The Implications of Traditional Operating Practices for Amateur Packet Network Design

Gwyn Reedy, W1BEL

The Florida Amateur Digital Communications Association

Overview

Amateur packet network design relies heavily upon equipment and procedures developed for commercial service. This paper urges network designers to examine the anticipated uses of the network by amateurs, and modify commercial practice to accommodate the existing amateur population.

High Frequencies

The HF bands are generally characterized by long distance propagation which varies greatly by time of day, season, and sunspot cycle. Atmospheric noise is often severe. Tradition and the density of the user population prevent official channelization. (The variable nature of propagation would cause poor utilization of any strictly channelized frequency.) Standard operating frequencies for RTTY, slow scan TV, and other specialized modes approach a channel concept, and net operation is a method of channel allocation on a temporal basis. Only goodwill and general knowledge of those frequencies restrict interference. The lack of channelization makes possible the excitement and spontaneity of random operation which characterizes the HF bands. The practices of calling CQ or tuning for the calls of others enhance the variety of contacts which are possible. Many time-honored amateur activities such as DX chasing, contests, certificate seeking, and just plain "listening to the band" have flourished in the HF environment. However, point-to-point communication beyond daytime groundwave propagation distances on a reliable basis requires periodic frequency changes to compensate for changing propagation conditions. Even stations with power levels well beyond amateur levels must vary frequency in that fashion. Adaptive HF equipment exists that will determine and use the optimum frequency, but in general considerable operator skill and attention are required to optimize circuit throughput.

Very High Frequencies and Above

Operation on the bands above HF was little different from HF operation prior to the introduction of commercial FM equipment and procedures (and remains so on non-FM portions of the bands). Effective communication beyond the local line of sight area requires knowledge of propagation modes and current conditions. A smaller population of users and reduced propagation distances, combined with generous frequency allocations, reduces the chances of random contacts. Much activity is prearranged, but activities such as DXing, contesting, etc. flourish. Reliable point-to-point contact is easier to establish than on HF, using propagation modes which are line of sight or otherwise not dependent on the state of current band conditions.

The extreme popularity of FM operation on VHF is due to a number of factors. Improved audio fidelity, ease of tuning and extension of coverage by repeaters are some of the obvious ones. Amateur operating procedures have been modified to suit the mode, and are considerably different from those described previously. Calling CQ is discouraged (but has been replaced by the abhorrent practice of calling "QRZ" the repeater). Much less random communication takes place and while DXing repeaters is fun, it is considered poor form in populous areas. Many amateurs have adopted a 'home repeater' which they monitor regularly. This provides a high probability of making contact with a particular station if his 'home repeater' is accessed. I believe this ability to easily contact a desired station is one of the major factors in the popularity of FM operation, especially for base station operations.

Message System and Telephone Bulletin Board Operation

Many persons, including amateurs, that have personal computers are active in computer communication activities. The popular mode of contact for these hobbyists for computer to computer communication is the landline. (The voice call is certainly the most common means of telecommunications, but hams and computerists enjoy using their 'special equipment'), The natural two party limitation of conventional telephone connections and the single user capability of most personal computers have made the computer bulletin board system (BBS) a very popular method for non-real-time communication among multiple participants. It allows a person to leave messages or

computer files for another without regard to the availability of the receiver at the time of transmission. This same type Of capability has been implemented on the amateur bands by RTTY, ASCII, and AMTOR mailboxes or message system operations (MSO). The capabilities of many of these RF accessed systems are limited by the transmission speed of the mode used, interference on the designated frequencies, and the restrictions of the character set used.

Commercial Networks

The hardwired networks of terminals that communicate with host computers in commercial installations have provided amateurs with the hardware and link level protocols needed for packet networking. The environment on a hardwired terminal network is fairly constant with a known quantity and location of terminals. Communication connectivity is assured within the limits of the cable medium. All devices on the cable can hear all other devices, given that some time lags will require compensation. Thus each terminal may be assigned a fixed unique identifier which will be known by the host. All terminals are assumed to be available whenever the system is operational.

Packet Radio Networks

Several factors in amateur packet networks are significantly different from commercial networks: The unpredictable propagation of the RF environment, the sporadic nature of amateur operation, and the uses amateurs will make of the network.

In an RF environment all transmitters able to participate in a local network may not be able to hear each other. In addition amateur stations participate on a voluntary basis and cannot be assumed to be part of the network at any given time. As a result, if network connectivity is to be held at a high level, adaptive routing must be employed. This consideration is being satisfied in the level 3 and higher protocols now being developed by amateur network designers.

The factors I want to emphasize are those based on the possible uses of the packet network by amateurs. Commercial network users send messages or electronic mail to other network users. The addressee's identification is normally known by the sender, or his identity code can be found in a directory of some sort. There may be a general 'broadcast' facility which allows addressing all users or some subset of all users. Those modes of operation will be very useful to amateur network users. There will be great utility in sending out a message addressed to another amateur by callsign (and perhaps some other routing informabion) and having the message delivered automatically and rapidly to the recipient, or at least held in his local area until he activates his equipment. But over and above the tremendous value of that capability, there are many enjoyable, traditional things that amateurs want to do that have no commercial equivalent. Chasing DX, participating in contests, earning certificates, and listening to activity in other parts of the network are some examples.

Chasing DX on a packet network makes no sense, you say? DXing Digipeaters is good sport in Florida already, and just look at the way the Doctor DX game is gaining popularity. Surely if people can enjoy working DX with a computer program they will enjoy digital contacts with distant stations on a packet network. Contests? Last Spring the first contest was held using OSCAR 10, a shared, limited resource system. By all reports it was a success and did not adversely affect 'normal" operation.

Specific Activities That Should Be Accommodated On a Packet Network

I believe the following activities should be among those supported (in approximately this order of importance):

1. Network control and monitoring functions.
2. Remote computer access/operation.
3. Message/Mail delivery (short length).
4. File transfers (long length messages).
5. Remote access of network user and function directories.
6. Directional beaconing (broadcasting to a specific location).
7. Monitoring network traffic at a remote location.

The last three activities allow users to find out who is on the network and perhaps make a connection. These activities allow the network to support traditional amateur operating practice while giving priority to the dedicated information transfer functions that only the network can provide.

How might these capabilities be used by amateurs? Here are a few examples. A vistor in Florida for the winter wants to contact anyone in his hometown in the north. He may place a directed beacon (CQ) on the network that will be seen only by members of his home LAN. Similarly, he may enable a network process that will forward to his station any traffic addressed to his station on the hometown LAN. He may choose to monitor some portion of the activity in that LAN or any other LAN of his choosing. Limitations will have to be applied in this instance to reduce the load on network resources that would occur if all activity on a LAN were monitored. A desirable capability that substitutes processor loading for network loading would be

monitoring distant locations based on a keyword list. Only traffic bearing certain keywords (including callsigns) and related traffic would be forwarded to the monitoring station. Working network DX or earning the "Worked All LANS" award are procedural activities which become possible through directed beaconing and directed monitoring.

Summary

Packet radio is an exciting new mode of communication that is gaining immense popularity. It builds on the popularity of FM operation by providing a high (and growing) probability of automatic message delivery. It combines the pleasures and advantages of both computer and radio communication hobbies. Its appeal and usefulness can be enhanced for many amateurs if network design provides the capacity and facilities for random operation in somewhat traditional amateur fashion.