The American Radio Relay League

The American Radio Relay League, Inc, is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimenta-tion, for the establishment of networks to provide communications in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

ARRL is an incorporated association without capital stock chartered under the laws of the state of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, whose voting members are elected every three years by the general membership. The officers are elected or appointed by the Directors. The League is noncommercial, and no one who could gain financially from the shaping of its affairs is eligible for membership on its Board.

"Of, by, and for the radio amateur," ARRL numbers within its ranks the vast majority of active amateurs in the nation and has a proud history of achievement as the standard-bearer in amateur affairs.

A *bona fide* interest in Amateur Radio is the only essential qualification of membership; an Amateur Radio license is not a prerequisite, although full voting membership is granted only to licensed amateurs in the US.

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The purpose of *QEX* is to:

1) provide a medium for the exchange of ideas and information among Amateur Radio experimenters,

2) document advanced technical work in the Amateur Radio field, and

3) support efforts to advance the state of the Amateur Radio art.

All correspondence concerning *QEX* should be addressed to the American Radio Relay League, 225 Main Street, Newington, CT 06111 USA. Envelopes containing manuscripts and letters for publication in *QEX* should be marked Editor, *QEX*.

Both theoretical and practical technical articles are welcomed. Manuscripts should be submitted in word-processor format, if possible. We can redraw any figures as long as their content is clear. Photos should be glossy, color or black-and-white prints of at least the size they are to appear in *QEX* or high-resolution digital images (300 dots per inch or higher at the printed size). Further information for authors can be found on the Web at **www.arrl.org/qex/** or by e-mail to **qex@arrl.org**.

Any opinions expressed in *QEX* are those of the authors, not necessarily those of the Editor or the League. While we strive to ensure all material is technically correct, authors are expected to defend their own assertions. Products mentioned are included for your information only; no endorsement is implied. Readers are cautioned to verify the availability of products before sending money to vendors.

Raymond Mack, W5IFS

Empirical Outlook

Your regular editor, Larry Wolfgang, WR1B, is tied up with the 100th anniversary of Boy Scouting at the National Jamboree as one of many representing Amateur Radio. It is quite an honor. I am filling in for him this issue.

Bringing Digital Radio to Amateur Radio

Those of us who are Baby Boomers started in electronics before many people knew what digital electronics meant. Electronics meant military communications and radar, TV and radio, and telephones. Car phones and calling internationally were things only the rich or businesses could afford. Computers were expensive, big, and incomprehensible. Our children grew up in a more or less completely digital world, talking around the world essentially for free (10 cents per minute to call Paris, France and 11 cents per minute to call Paris, TX on a wireless phone) and having computers at their fingertips. It has been a struggle with that perspective to interest young people in radio. We may have come full circle now that significant amounts of digital operation involves radio in some form. One of the goals for those of us working on high speed multi-media (HSMM) is to provide a means for young people to combine computers and radio as either a hobby or a vocation.

Multiple groups of amateurs in Austin are working together to implement a mesh network of HSMM nodes. Think of this as similar to the D-Star network, but operating at a much higher data rate. The groups in Austin include ARES, Roadrunner Microwave Group, Texas Emergency Management, and Red Cross. There is also a fair amount of work being done in Dallas and Plano. Glenn Currie, KD5MFW, gave a presentation to a standing room only group at the Austin Summerfest this past Saturday, so interest is growing significantly. The group doing the heavy lifting of developing software and hardware has been very busy over the past year.

The original motivation for putting together the mesh node system was to develop a system that amateurs can deploy in a disaster area to provide modern communications capabilities. Operations in the aftermath of Hurricane Katrina and Hurricane Ike indicated that amateurs would need to provide even more than just voice communications. Amateurs are using the mesh concept to build a network where each node has the intelligence to automatically connect with all other compatible nodes that it can "see". The network is self configuring, so you don't need to know more than how to hook a CAT-5 cable from your computer to the HSMM node. WiFi, on the other hand, builds a system that connects two nodes at a time and requires significant understanding of networking to connect wireless access points (nodes) into a working network. The goal in Austin is to create a mesh network that connects all of the local hospitals to the Red Cross and the state emergency management center. Individual amateur stations are also part of the network to provide redundant means of entry and exit from the local network to the outside world just as would occur during a real disaster. One application is creating gateways between the mesh network and the Internet.

A "killer application" and instructions suitable for "ordinary" amateurs were two major pieces missing from the puzzle until recently. It appears that one killer application for HSMM mesh networks may be voice over IP. The group has developed software and hardware that allow a PC and mesh node to implement a private business exchange (PBX) with multiple phone connections. Work is continuing on the PBX applications. A second killer application may come from being able to connect smart phones like Android and iPhone to the mesh network. There was enthusiastic interest from young people at Summerfest for this application. The group has also made significant progress in developing useful instructions for those of us who are barely able to spell "PC". Jim Kinter, K5KTF, has put together a Web site (**hsmm-mesh.org**) that captures all of the information currently available. It has links to external information on the Linksys routers that are modified to become a HSMM mesh node as well as documentation on how to convert a router to a mesh node. The Web site is also the starting point for you to contact the folks working on the hardware and software if you wish to contribute to the effort.

If you understand networking, integrating applications on a PC, and can put that information on paper so others can understand it, your talents are definitely needed. If you have the connections to convince Broadcom that it is a civic benefit to assist with technical information on the BCM5232, your talents are needed.

The Roadrunner Microwave Group has members who are looking at ways to implement long haul circuits to connect geographically separated mesh networks. The goal is to connect mesh networks in all the major metropolitan areas as well as smaller areas such as Kerrville, Bastrop, and Corpus Christi. Ideas for methods are always welcomed. Part of that effort is to identify alternate 802.11 hardware that has technical support from the manufacturer, so we can avoid the problems of not knowing what is really inside the Broadcom IC.

There are any number of activities that will help with the process of turning mesh networks into a robust emergency tool as well as a source of recreational enjoyment. There is a need for software folks to help with the development of the node firmware. There is also a need for folks who understand the PC part of the software equation to help with ideas for new killer applications. One of the most important things you can do is to get a node on the air and start using the system. It's no fun talking to yourself!

It is interesting that the concept of a mesh network is a modern embodiment of the original purpose of the ARRL: it is an Amateur Radio relay network.