Digital Messaging for ARES®, a Progress Report

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Background

At the July 2003 meeting the ARRL Board resolved to establish an ad hoc committee of members to develop a comprehensive program to enhance the current ARES emergency communications capability to include rapid and accurate handling of long range (inter-state, national, and international) emergency communications. This led to the formation of the ARESCOM committee in September 2003.

At the July 2004 ARRL Board meeting the chairman of the ARRL ARESCOM committee presented the committee's final recommendations to the ARRL Board where it received unanimous acceptance[1,2]. This paper summarizes some of the committee's recommendations and the technical implications of implementing them.

ARESCOM Recommendations

The committee recommended a national organization for ARES and a national digital messaging network for ARES.

ARESCOM looked at the needs of typical ARES "customers" or "served agencies" and established the following requirements for an amateur radio based emergency messaging system.

- It must integrate with Internet messaging where Internet is available and provide a viable alternative to Internet messaging where Internet is not available.
- It must be able to use the served agency's existing email client systems such as Outlook, Eudora, Netscape, etc.
- It must use SMTP message format including multiple addresses and binary attachments.
- It must provide both local and global coverage.
- It must support tactical addressing of messages.
- It must support rapid mobile deployment without being dependent on local services.

Some early thought was given to developing a system that was totally independent of Internet on the theory that some major catastrophe might disable Internet on a global scale and that users might not be able to depend on it. With further reflection this was found to be less than practical on a global level but on a local level full inter-user messaging could be supported entirely by radio. The likelihood of Internet being down globally is fairly remote given the architecture of the network. An event such as a hurricane can disable

Internet locally or even regionally. So long as radio links can be established to a distant point where Internet is functional global service can be preserved while local service is provided with local radio links.

The ARES is there to serve the community of users in need of emergency communications. Since these users are not radio amateurs the messaging services provided must be offered in a way that they can easily use and that requires as little "retraining" as possible. For this reason more than any other it is important that the ARES system provide the user the option of using his existing email client program and simply interchange messages with the ARES system in the same way as messages are interchanged with the mail service of a normal Internet service provider.

Where services are so severely damaged that even a local LAN on a served agency's premises is not functional a temporary independent mobile service should be available.

Available Technology

The closest thing available in the amateur community today to meet these goals in the near term is the Winlink 2000 (WL2K) system. This system has been in service now for nearly five years providing messaging service, position reporting, and weather reporting and bulletins for hams in RVs, cruising boats, and others with no other access to Internet. It provides a good platform for the additional services required by ARES.

The existing WL2K system has been covered in previous papers and articles[3,4,5] so I will only touch on the high points here. Through the use of a central server WL2K provides messaging service between all WL2K users, with Internet messaging services, and with the packet network. Participating radio MBOs (PMBOs) throughout the world maintain a full time Internet connection with the central server (CMBO). By making a radio connection (HF or VHF) with any participating MBO an amateur operator can send or receive messages in near real time. The messages use an SMTP compatible format (with aggressive compression to limit air time) that supports multiple addresses and binary attachments.

Until recently, individual users accessed WL2K by direct radio connection to a PMBO using a client program (AirMail) or indirectly from a non-WL2K packet BBS that forwarded to a PMBO. New software has been fielded to expand the VHF access to WL2K using simple VHF/UHF nodes and AX.25 signaling (Telpac) and a gateway program that will interface one or more users' existing email client programs as

terminal points for messages (Paclink) via packet radio (and via HF if a future version).

AirMail is the program of choice for fast mobile deployment of a message service and it can reach PMBOs via HF or VHF as the circumstance requires. Local ARES managers will be encouraged to install PMBOs, Telpac nodes, and Paclink sites as fixed facility for instantly available emergency service.

Recent Developments

The most immediate critical need for ARES service is to provide a transparent link between served agencies' existing email clients and the radio network. This was solved by the development of Paclink. The initial Paclink design was presented at last year's DCC meeting. Field testing found a number of shortcomings in the implementation. In August 2004 a completely revised design was placed in service that provides a much better match to the need.

The most critical improvement was the use of tactical addressing to individual users while retaining a legal callsign over the supporting radio links. Paclink will support any number of served agency email clients, each with an assigned tactical address that can be reached from any radio user or from Internet. A single Paclink installation on a served agency's premises can keep the entire agency's message system alive with full interchange with other local agencies (assuming they also have Paclink installed) and the global Internet when local Internet service is no longer functional.

Paclink was developed using the Microsoft .NET development system using the VB.NET language. This is the first of the suite of Winlink programs to use this development system and it has proved to be an outstanding choice. Code can be developed and debugged very rapidly and in the least possible keyboard time for the volunteer developers. The resulting runtime code is fast and efficient and is compatible with the vast majority of installed PCs.

Future Development

WL2K as it stands has some shortcomings that need to be resolved to achieve everything required of the ARES. The WL2K development team is actively working to make the necessary improvements.

The central message server represents a potential single point of failure for the system. Although there is a backup system in another distant location it requires manual intervention to bring it on line and there is the potential for some message loss in the process. A

new server design is underway that will provide real time mirroring using geographically dispersed multiple servers.

The PMBOs can operate independently of Internet but without an Internet connection to the CMBO traffic cannot be exchanged with other PMBOs or Internet mail services. A new PMBO design is in the works that supports a fallback to an HF radio channel for sustaining a path through another PMBO to a CMBO.

With these two major enhancements to the existing system it becomes possible to provide SMTP messaging through significantly sized regions where the Internet has been disrupted - a primary ARES goal.

Appendix A

From the ARRL Letter, Vol. 23, No. 29, July 23, 2004:

ARESCOM PLAN TO ENHANCE EMERGENCY COMMUNICATION CAPABILITY

The ARRL Board of Directors has adopted a resolution encouraging further development and expansion of an inaugural network to enhance the emergency communications capability of the Amateur Radio Emergency Service (ARES). The action came during the Board's meeting July 16-17. The Board had charged an ad hoc committee, dubbed "ARESCOM," with developing an augmented ARES telecommunications system that would include rapid and accurate handling of long-range emergency communications. ARESCOM recommended deployment of a digital e-mail system based on Winlink 2000 software. The Board encouraged the deployment of e-mail via Amateur Radio--"as exemplified by Winlink 2000"--to meet the needs of served agencies and others involved in providing disaster communications.

"The digital network will provide a value-added service for ARES and will continue to be viewed very positively by our served agencies," the committee said in its report to the Board. "This allows ARES to be viewed as modern and necessary instead of antiquated and invasive."

The committee, chaired by Great Lakes Division Vice-Director Dick Mondro, W8FQT, said situations arise when ARES must "pass message traffic across the nation quickly and accurately." It also said the need for such a nationwide ARES capability is likely to increase in light of the ARRL's Citizen Corps partnership with the Department of Homeland Security.

Winlink 2000--a worldwide Amateur Radio digital radio e-mail system--already is widely used by the blue water boating and recreational

vehicle communities. Members of the ARRL Programs and Services Committee witnessed a Winlink 2000 demonstration at ARRL Headquarters the day before the board meeting.

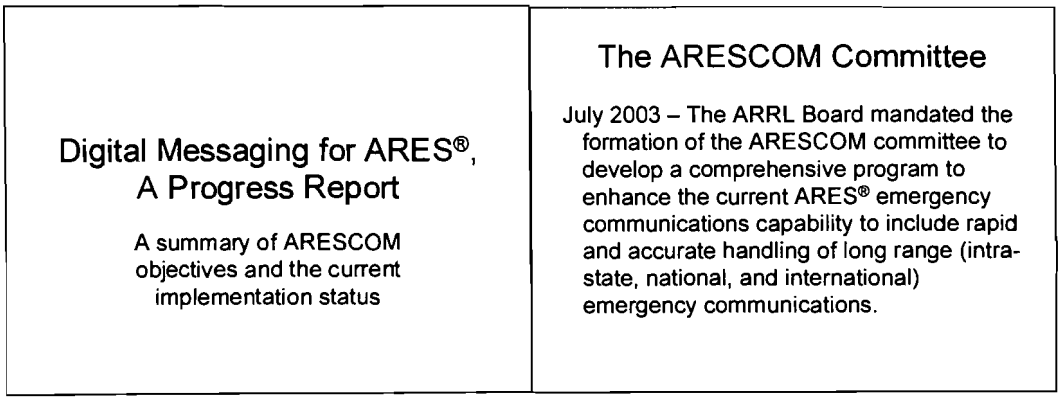
The ARRL Board extended the committee's charter until its January 2005 meeting so ARESCOM can complete an implementation plan that ensures that ARES has "the prominent role" in managing the national network and that ARES officials and appropriate ARRL Headquarters staffers have a chance to critique the network's operation to ensure it meets the requirements of ARES and its served agencies.

A two-part series appearing in the August and September 2004 issues of QST, "Winlink for ARES," by ARRL South Texas Section Emergency Coordinator Jerry Reimer, KK5CA, outlines an enhanced ARES network that would include e-mail capability over HF links.

References:

1. http://www.arrl.org/news/stories/2004/07/20/2/?nc=1, "ARESCOM Plan to Enhance Emergency Communication Capability"
2. Reimer, Jerry, KK5CA, "Winlink for ARES", QST August 2004, Page 82
3. Muething, Rick, KN6KB, "Telpac - Winlink 2000's New Telnet Packet Bridge", QST, October 2003, Page 39
4. Muething, Rick, KN6KB, "Telpac and Paclink - Streamlined AX.25 Packet Radio Server and Client for a Full Service Ham Radio Messaging Network", DCC, September 2003
5. Poor, Victor, W5SMM, "Introduction to Winlink 2000", QST, June 2002, Page 31
6. Muething, Rick, KN6KB; Kessler, Hans, N8PGR; Waterman, Steve, K4CJX; Poor, Victor, W5SMM, "Winlink 2000 - A Global Ham Message Transfer and Delivery Network", DCC, September 2000

Presentation Visuals:



The ARESCOM Committee

- September 2003 – The committee was appointed by ARRL President, Jim Haynie, W5JSP
- July 2004 – The committee's recommendations were presented and accepted by the ARRL Board. The committee was directed to continue its work to help facilitate its recommendations.

ARESCOM Recommendations

- Build a nationwide ARES organization and a national digital messaging network.
- Provide messaging services that meet the needs of the ARES Service Agencies.

ARESCOM Recommendations

- Interface with and use Internet when and where it is available – be ready with radio where it is not.
- Work with served agency email clients and networks.
- Use SMTP compatible message format including multiple addresses and binary attachments.

ARESCOM Recommendations

The new system must . . .

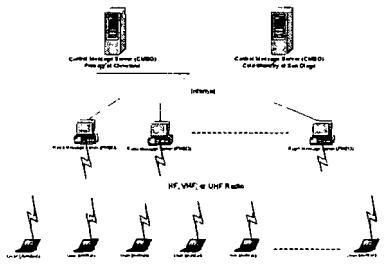
- Provide local and global service
- Provide tactical message addressing
- Be able to provide fast mobile deployment without dependence on any local service

Available Technology

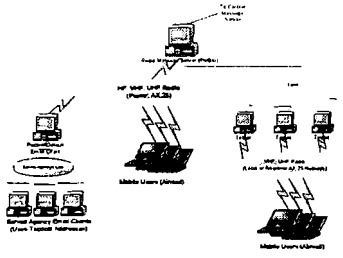
The Winlink 2000 system consisting of:

- Central Message Server (CMBO)
- Regional Radio Message Servers (PMBO)
- Telpac VHF/UHF Packet Nodes
- Paclink, a gateway between served agency email clients and the radio-based services

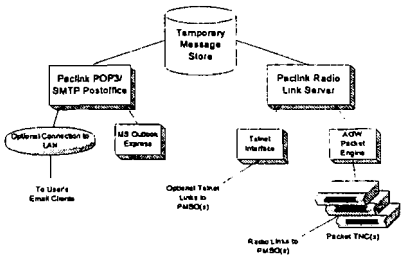
Traditional Winlink 2000



Expanded Winlink 2000 Facilities



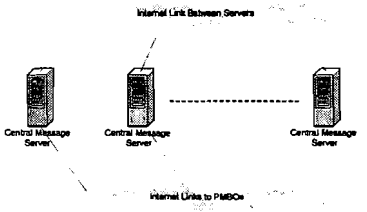
Paclink



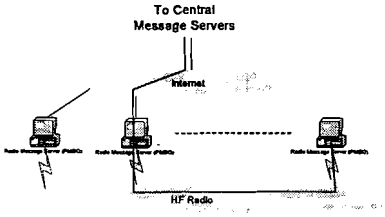
Future Winlink 2000 Enhancements

- Geographically dispersed mirrored central message servers
- HF backup for CMBO/PMBO Internet links
- HF backup for Paclink sites

Mirrored Central Message Servers



HF Backup To PMBO Internet Links



HF Backup to Paclink VHF/UHF Links