PACKET STATUS REGISTER ™

President's Corner

A Different Way to Think About TAPR

By John Ackermann, N8UR, n8ur@tapr.org

Something clicked for me while I was behind the counter at the TAPR Hamvention booth, watching the intense discussion going on around the Gnuradio/USRP part of the table.

For those of you who don't know, Gnuradio is a software project led by Eric Blossom, K7GNU, and Matt Ettus, N2MJI. It's aimed at creating the building blocks for software-defined radio running on a PC. Using the Gnuradio tools, you can write the code for a complete receiver in perhaps 100 lines of code.

The USRP is a hardware project developed and sold by Matt. It's an external board that talks to the PC via USB and contains high-speed analog-to-digital and digital-to-analog converters, as well as glue logic. It has room for up to four daughterboards that provide the RF front-end. The USRP can be the foundation of a complete radio system and was designed to work with Gnuradio.

As I saw the interest that Matt and Eric had created, I thought back to a couple of years ago when Gerald Youngblood, now K5SDR, but then AC5OG, had his very first SDR-1000 software-defined radio boards in that same spot at our booth.

And I thought back even further, more than ten years, to when Bob Bruninga, WB4APR, and the Sproul brothers, Mark, KB2ICI, and Keith, WU2Z, were showing off their fledging APRS software at an earlier version of the TAPR booth.

The lightbulb that went on for me is that while TAPR has had more than a few products of its own to be proud of, perhaps our biggest impact since the TNC-2 has been through our role as a technology incubator. Even though the APRS software, the SDR-1000, Gnuradio, and the USRP weren't TAPR products, we were there to support those innovators and watch as they went on to make a big impact in the ham

radio world and beyond.

Now, taking that role doesn't put money in our bank account. But I think it is absolutely the right thing to do and I think everyone involved with TAPR, whether as officer, volunteer, or member, should be very proud of the role we've taken to support of new technology, whether it's sold by us or by someone else.

The Worldwide Workbench

I wrote previously about how Mario, DL5MLO/KC5WHE, developed a *Linux* version of the TAPR/Ten-Tec Vector Network Analyzer software without ever having seen the hardware. It's an amazing story of how the Internet has enabled hams to work together across continents the way we used to work together across town.

I'd like to expand on this idea of long-distance collaboration; it doesn't have to be as extreme as Mario's case to be effective.

Without many of us realizing it, the Internet has really changed the way we can work on technology projects. In the old days, your local radio club was the main source of feedback and inspiration. If you were lucky, you might run into someone on the air who knew about that roadblock that was stumping you, but finding specialized knowledge was like searching for a needle in a haystack. I remember writing to

the ARRL's technical service for simple circuit advice, simply because I couldn't find the answer locally (and they were very helpful).

Today, search engines like Google and the widespread use of specialized mailing lists have created an incredible ability to dig for information. I've seen a couple of great examples in my own work recently.

I'm working on my first TAPR project (more on that in the next *PSR!*), and as we usually do, we set up a mailing list at **www.tapr.org** for beta testers and others interested in the project. I was able to use that list to get input on what features people wanted in this product, and as a result, I was able to make significant design changes to meet those needs. That may not seem too sexy ~ some people call it "market research" ~ but it was sure a lot easier than standing out on the corner with a survey form!

After finalizing the circuit, I was able to send the schematic and PCB layout files to the group and got excellent feedback from people much more knowledgeable about RF design than I. In fact, I completely redesigned the board as a result of that input and it's now a much better board than my first attempt. My on-line helpers ranged from being on the other side of town, to the other side of the country, to the other side of the Atlantic.

In another example of long-distance collaboration, TAPR VP Steve Bible, N7HPR, has been working with Luis Cupido, CT1DMK, to do a TAPR version of Luis' "Reflock II" universal frequency control. I don't think Steve and Luis have ever met in person or even talked on the phone, but they worked closely as a team to create a great product, using e-mail to send schematics, spectrum analyzer captures, and other data back and forth, as well as just talk things through.

We've been using e-mail and the web so long now that most of us no longer see how they have changed things. They make it possible for us to have a "Worldwide Workbench" that multiplies our individual capabilities. If you have a project you'd like to work on, but don't have quite enough background or information to pull it off, don't give up ~ use the web, scout for mailing lists or newsgroups where you might find help. You'll be amazed at the resources that are there for the taking.

It's DCC Time!

We're just about a month away from this year's Digital Communications Conference, to be held in Santa Ana, CA, September 23-25. Registration and hotel rates go up after August 31, so make your plans now. See you there!

###

Election of TAPR Board of Directors

The following three TAPR members have agreed to run for the three available positions on the TAPR Board of Directors: Steve Bible, N7HPR, Stan Horzepa, WA1LOU, and Darryl Smith, VK2DTS. Board members serve three-year terms.

This year, there are three ways to vote:

- Online at **www.tapr.org/ballot**
- Mail in a printed copy of the ballot from **www.tapr.org/ballot**
- Mail in the ballot printed below.

Mail-in ballots go to TAPR, PO Box 852754, Richardson, TX 75085-2754

Online voting begins on September 1. The deadline for all balloting is September 14.

2005 Ballot for TAPR Board of Directors

Deadline for all balloting is September 14.

Vote for three (maximum):

☐ Steve Bible, N7HPR

☐ Stan Horzepa, WA1LOU

☐ Darryl Smith, VK2DTS

☐ Write-in candidate: _____

☐ Write-in candidate: _____

☐ Write-in candidate: _____

Your TAPR membership number*: _____

Last four digits of your telephone number: _____

*If you don't know your membership number, contact the TAPR office via **www.tapr.org/inforequest**, phone 972-671-TAPR (8277), fax 972-671-8716, or mail TAPR, PO Box 852754, Richardson, TX 75085-2754. Office Hours: (US Central Time zone) 0900-1700 Monday – Friday.

Steven Bible, N7HPR

Steve has been involved with amateur digital communications since 1985. He began work with TAPR in 1995 serving as board member and presently serves as vice president. Steve enjoys the research and development side of the Amateur Radio hobby. He has been involved in the development of several TAPR kits helping bring them to the amateur population. The TAC-2, DGPSIB, PIC-E, T-238, to name only a few. Steve has lectured extensively at clubs and hamfests on spread spectrum and software radio helping amateurs begin experimentation and exploration of these technologies.

Steve resides in Chandler, AZ and works as a Principal Applications Engineer for Microchip Technology Inc.

Stan Horzepa, WA1LOU

Born 1951, Waterbury, CT

BA, University of Connecticut (1973); JD, Western New England College (1977)

Senior Technical Writer at CCOR, Inc.

Resides on Compounce Mountain, Wolcott, CT

Married with child plus 5 cats, 2 dogs, and 1 fish

Amateur Extra Class, first licensed in 1969 (WN1LOU)

TAPR member since 1985

TAPR *Packet Status Register* editor since 2002

TAPR SIG administrator of APRSNEWS, APRSSAT, APRSSIG, APRSSPEC, HTAPRS

APRS QSY Committee, 1997-98

APRS Working Group, secretary

ARRL Life Member

ARRL headquarters staff, 1977-1979

QST contributing editor, 1979 to present (FM/RPT, On Line, Packet Perspective, Digital Dimension), ARRLWeb contributing editor, 2000 to present (Surfin')

Author: *Your Gateway to Packet Radio* (ARRL, 1987, 1989), *Practical Packet Radio* (ARRL 1995), *Getting on Track with APRS* (ARRL 1996), *APRS: Tracks, Maps and Mobiles* (ARRL 1999), *APRS: Moving Hams on Radio and the Internet* (ARRL, 2004), *The ARRL Operating Manual* (ARRL, 1980, 1985, 1987, 1991, 1995, 1997, 2000)

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Darryl Smith is a 35-year-old Electrical Engineer, based in Sydney, Australia. He has been licensed asVK2TDS since 1993, when he gained his license in order to experiment with packet radio. For his Electrical Engineering thesis, he investigated spread spectrum data communications - with the work now available via the TAPR WWW site.

Professionally Darryl has been working in the electricity generation industry for 12 years, doing a cadetship with the state owned electricity generator. Since graduation he has worked as an electrical plant owner in a large coal power station, and more recently working in the IT group managing drawings within the organization.

Darryl owns and operates Radioactive Networks, an engineering consulting company specializing in mobile data and GPS tracking technology.

Darryl has been a member of TAPR since 1997. He presented a paper in the 1997 DCC, and has written a number of papers since then. Darryl has been an active member of the APRS community for a number of years and has been heavily involved in setting up the Australian and New Zealand APRS networks.

###

Evolution of TAPR/TEN-TEC RF Vector Network Analyzer

By Tom Salvetti, KC3NF, Tsalvetti@cs.com

It all started with an e-mail to TAPR from Tom McDermott, N5EG, in the fall of 2003. Tom and a friend, Karl Ireland, conceived and built an incredibly unique piece of test equipment, humbly dubbed the "Vector Network Analyzer" or "VNA" for short.

Let's put in perspective what this idea represents to Amateur Radio experimenters. Most of us can only dream of owning a conventional bench-top network analyzer. Even a used model typically sells for $5000 and up. Tom and Karl designed a standalone board to do the actual measurements and then created software that runs on your personal computer to replace the rest of the computational horsepower and displays of a conventional network analyzer. Now we've got something we hams can afford for our own workshop! More on that to come; let's get back to the history.

Revision 1 was already up and running when Tom contacted TAPR. As has been TAPR's tradition with other technical innovations, Tom hoped they would be interested in "kitting" the VNA to make it more readily available to hams. It didn't take long for TAPR to join forces with Tom.

Additional development work followed, resulting in Revision 2. Then the decision was made that TAPR fund the building of ten beta units. The call went out and ten intrepid experimenters stepped up to the task.

There was one particular mechanical hurdle to overcome. The VNA circuit design was state-of-the-art and included the use of eight fine pitch SMD ICs. Soldering surface mount ICs is challenging enough, but hand soldering fine pitch parts moves into a world of its own! Steve Bible, N7HPR, stepped forward to solve this one and installed the fine pitch parts on all ten boards. The beta team then assembled the balance of their individual boards laying down the remaining 130 components, connectors, etc. Certainly noteworthy in the kit environment and to the credit of everyone involved, all ten were brought to life successfully.

Coincidentally, Tom had submitted an article to QEX for consideration about the same time as he made the initial contacts with TAPR. QEX accepted and published in the July/August 2004 issue. The VNA article was so well received that Tom and Karl were awarded the 2004 Doug DeMaw, W1FB, Technical Excellence Award for outstanding technical article in QST or QEX.

As beta testing moved forward, feedback, and suggestions started to flow. All the while, Tom continued development of the PC software. A number of hardware improvements were identified and incorporated, with the VNA now called Revision 3.

It was time for the May 2004 Dayton Hamvention. The VNA was shown and

demonstrated. Everyone involved realized the challenge of making a kit readily available to the rest of the hobby. Steve had labored through mounting the fine pitch parts on ten boards, but no one expected him to scale up to larger quantities. Then Steve came up with an idea. How about TAPR partnering with a manufacturer that would provide factory built models? While still there at Dayton, Steve approached Gary Barbour, AC4DL, Vice President of TEN-TEC.

Discussions began in earnest between TAPR and TEN-TEC and an agreement was reached soon after. Members will recognize that TAPR has licensed product designs to other firms a number of times throughout its history, but there is one aspect of the VNA program that breaks new ground. The VNA will be co-branded TAPR and TEN-TEC providing TAPR with continuing recognition of their role in the project. TAPR will also receive royalties on the sale of every unit. This helps support TAPR's fundamental mission to provide leadership and resources to radio amateurs for the purpose of advancing the art of radio.

TEN-TEC recently finished building a small production run. These units are now out in the hands of beta testers. Model 6000 TAPR/TEN-TEC RF Vector Network Analyzer should be available for shipment to customers in September. Designed for testing up to 100 MHz, the unit connects to your PC via USB and the software runs on *Windows*-based systems. *Linux* fans will be pleased to learn that Mario Lorenz, DL5MLO, has already developed a *Linux* port and tested it extensively.

The VNA sells for $655, which includes a set of testing and calibration accessories: 1 and 3-meter cables, 10 and 30-db attenuators, 50-ohm load, shorted connector, and barrel connector. Interested hams are encouraged to visit the TAPR or TEN-TEC web sites to learn more.

###

Wanted: Unpopulated DSP-93 PC Board (The DSP Engine Board)

We have a couple of DSP-93s here in OZ-land and one of them will simply not work. All our attempts to diagnose the problem have been unsuccessful and we now believe that moving all the components to a new unpopulated board is the only way out. For this reason, we seek a bare DSP Engine board. If you have one, please contact me. A partly or fully populated board will also be of interest.

Best 73 de Bent, OZ6BL, e-mail **oz6bl@amsat.org**

###

Product Review: Garmin GPS18 PC GPS Receiver

By Guy Story, KC5GOI, kc5goi@kc5goi.net

This May I was given an opportunity to test out a new Garmin GPS receiver called the GPS18PC. It is a new version of what has been referred to as Garmin's Hockey Puck receivers. The older Garmin 30 was one of their first. To demonstrate how technology has changed, the Garmin GPS 30 was an eight-channel receiver but was serial in how it track satellites instead of parallel, as are most receivers today. At the time that was the technology and it worked ok. Acquisition times were slower and receiver sensitivity was lacking in comparison to today. The GPS 18 is a 12-channel, parallel receiver. This allows for monitoring of multiple GPS satellites at a single time. The receiver sensitivity improvements allow a receiver to achieve a lock much quicker.

The Garmin GPS18 is actually a family of receivers. There are the 18PC, 18USB and the 18 LVC (includes the LVC-5M and the 18-5Hz). First, a word of caution. The 18USB is just that, a USB device. It only sends out Garmin proprietary sentences. I am not aware of any of the APRS programs that can use the Garmin sentences in the same fashion as the NMEA sentences. This is great if you are using mapping software standalone but not for APRS.

First the pluses and some differences between the rest of the receivers. I have tested the 18 PC version and was very impressed. The 18 PC has an adaptor to plug into a cigarette lighter adapter in your vehicle and a female db9 to connect to the PC. The cigarette lighter adapter has a

voltage regulator in it and measures 11.5 centimeters in length. It does give you the pilot light LED to let you know it is on. The data and power connections are each 80 cm in length. The overall length is 2.1 meters. The actual receiver section is 6.5 cm in diameter. A 1 PPS output is not provided. The receiver pulls 50mA at 13.8 VDC.

The GPS 18 LVC family has a single cable assembly coming from the receiver. First word of caution is that there is no voltage regulation. You will need to provide regulated 5 VDC. The 18LVC has a 3-meter cable; the LVC-5m and 18-5Hz have 5-meter long cables. The receivers pull 60 mA @ 5.0 VDC. I personally find these attributes to be an advantage. The unfinished pigtail and need for regulated voltage make them ideal for placement with a Tiny Track, MIC-E or PIC-E kits. All 3 can provide the current required to drives the LVC receivers. The 18 LVC and 18-5 Hz are the only receivers in the family to give you 1 PPS outputs. This is not critical for APRS but needs to be looked at if you want a timing solution. For more differences on the LVC receivers, please visit **www.garmin.com/manuals/425_TechnicalSpecification.pdf**.

I did some playing with and actual APRS use with the 18PC. First thing that I found was my Kenwood D700 and D7A(G) were happy with the 18PC. I did not have to alter any settings on the receiver. The 18PC does have the ability to output the newer 2.3 version of NEMA 0183 but I did not test the compatibility since version 2.0

works just fine. I moved onto connecting the 18PC to a Kantronics KPC3 (not a plus version). You do have to use a null modem if you connect to the DB25 of the Kantronics TNCs, but that is normal. Using the same configuration I used with my Garmin GPSMap76, the tracker took off like a charm. I test with *WinAPRS, APRS+* and *UIView* with the same performance results I see with my II+ and GPSMap 76.

I found that acquisition times were very close to the times given in the documentation. If I left the receiver off overnight, it would take typically 10 seconds to find itself. If left off over a week, a little over a minute was typical. Again, similar to my GPSMap76 but better than my II+. All the receivers in the GPS 18 family make use of WAAS corrections. If you wish to turn it off, you just download the software from Garmin and make whatever changes you need. This includes enabling the 2.3 version of the NEMA protocol.

Overall I am happy with the Garmin 18PC. It does not get more plug and play than this. If you are going to move your receiver between applications on occasion, the 18PC is the way to go. The built in magnet will keep the receiver on your roof at highway speeds. The low profile is a big bonus. If you are looking for a receiver and do not require a display, I would recommend the Garmin GPS18.

###

Eliminating Source Routing from APRS, Part 3

By Pete Loveall, AE5PL, pete@ae5pl.net

The NSR (No-Source-Routing) algorithm appears to have stabilized with input from a number of people over the past six months. Suggestions incorporated into the algorithm were verified to adhere to the NSR concept of no user-defined paths. Suggestions not incorporated usually tried to provide "limited" source routing. As has been shown, any introduction of source routing into the algorithm opens the network to breakage and therefore the NSR algorithm would bring no benefit to the amateur community if those suggestions were implemented.

First, here is the algorithm as shown at **www.aprs-is.net**:

1. The digipeater repeats any packets it sees from a station on its "must digipeat" list. This allows specific remote stations to make it into the "metro" LAN as deemed proper by the digipeater sysop. The digipeater will modify the path by simply appending its call with the H-bit set after the "ok" list digipeater call plus any path defined by the sysop.

2. The digipeater repeats everything it sees directly (no digipeated packets), stripping the entire path away and replacing it with just the digipeater's callsign with the H-bit set plus any path defined by the sysop.

3. The digipeater repeats any packets it sees last digipeated by a digipeater on its "ok" list unless it sees that it has been digipeated by a digipeater on

its "exclude" list. This allows remote areas to make it into the "metro" LAN as deemed proper by the digipeater sysop. The digipeater will modify the path by simply appending its call with the H-bit set after the "ok" list digipeater call plus any path defined by the sysop.

RELAY can be on the "ok" list allowing people to set up low-level RELAY alias digipeaters. Packets with RELAY in the path would only be digipeated if RELAY is in the first position and no place else.

The digipeater does full dupe checking (CRC or checksum) based on from call, unproto (not including the SSIS), I field length, and I field data. The digipeater will not digipeat any packet where its callsign appears before or including the call with the H-bit set in the path. The depth of this dupe check would only need to be about 30 packets long.

It is important to note that the only part of the algorithm that is directly related to APRS is the dupe check algorithm (accounting for the sparsely implemented SSID routing on the unproto destination field). The NSR algorithm is a digipeater implementation for the AX.25 UI protocol. APRS also makes use of the AX.25 UI protocol and this is why APRS has been referenced in the title.

Why do we need a new digipeater algorithm for the AX.25 UI protocol? Because the current digipeater

mechanism is broken and has been proven over the years to simply not work for communications of more than one or two hops. It is interesting to note that the authors of the AX.25 protocol foresaw this (from the APRS 2.0 specification) **"It is anticipated that multiple-repeater operation is a temporary method of interconnecting stations over large distances until such time that a layer 3 protocol is in use. Once this layer 3 protocol becomes operational, repeater chaining should be phased out."** The current AX.25 specification (2.1) restricts digipeating to two hops. Yet many in the APRS world are against stabilizing the network by mandatory digipeater reductions. Why? Let's take a look at their reasons and how the NSR algorithm actually provides better network performance and stability.

1. "Only the user knows where their packets should go."

This is a holdover from 30 years of failed networking attempts by the amateur community. When AX.25 was introduced, amateurs immediately tried to use the digipeater fields to allow the user to define their own paths. This required the individual user to know the network topology which most did not. It also attempted to use a very bandwidth restricted RF channel for multiple repeats of the same packet. This caused excessive collisions and relatively

unusable, isolated networks. Even so, all the "fixes" relied on various methods of digipeating on the same bandwidth restricted channel which eventually caused their failure.

2. "The problems with digipeaters in the past were because those were using a connected protocol."

The problems seen in the past are being seen today on the unconnected APRS network. The type of protocol doesn't obfuscate the fact that multiple repeats of packets on a bandwidth restricted channel increases collisions and decreases network reliability and usability.

3. "This is amateur radio and I don't want my packets to go via non-RF means."

Amateur radio has been using non-RF backbones since the 1950's (at least). This doesn't make the RF network any less amateur radio. And, it doesn't make communicating between RF networks any less amateur radio, especially if you do not know how your communication is being routed.

The NSR algorithm accounts for the fact that the primary RF channel is bandwidth restricted and being competed for by multiple stations. As such, it looks at each area defined by the digipeater sysops as a local area network (LAN). As with any LAN network design, interconnection of the LAN's is done using a separate wide area network (WAN), not by trying to adapt multiple, disparate LAN's to

adhere to a common communications medium. Why a separate WAN? To eliminate or reduce collisions on the LAN thereby increasing the usability and performance of each individual LAN.

In the APRS world, gateways have been developed which provide filtered connectivity between the LAN's. This connectivity is primarily, but not exclusively, via the Internet. The need for the "filtered" connectivity is because there is over 10 times the bandwidth used on the WAN backbone than is available on the individual LAN's.

4. "We need to change our routing in an emergency."

The only group that might want to change their routing (and the only group that should control such routing changes) is the group at the center of the emergency. This should be done by that emergency group coordinating with the digipeater sysop, not by trying to change radio configurations of all the users during the actual emergency. This is simply common sense and known to all those trained in emergency communications: KISS "Don't try changing configurations across multiple devices during an emergency." The NSR algorithm allows for the minimum number of devices to be changed to achieve an altered network topology so the participants can concentrate on the emergency, not configuring their radios.

5. "I want to check into a net in a different LAN."

This is done without configuration changes by simply messaging the net control. The NSR digipeaters and the gateways take care of _all_ the routing issues.

So where does this leave the NSR algorithm? It leaves it as the only solution today, which guarantees a more stable, usable network than that which is currently implemented. Digipeater authors worldwide are implementing it. We hope that Kantronics and IW3FQG recognize the value and simplicity of the algorithm and implement it in their respective digipeater ROM's.

As stated above, the NSR algorithm is an AX.25 UI digipeater implementation, not an APRS digipeater implementation. It was a mistake for a non-link level protocol to try and dictate how the link-level protocol should behave. With the advent of the APRS gateway, layer 3 routing is available essentially available to APRS. The NSR algorithm makes the link-level protocol a true layer 2 protocol with no veiled attempts at making it a partial layer 3 protocol. With the modifications to the algorithm made over the last six months, the NSR algorithm can be put in place within the current network architecture and immediately start bringing benefits to the APRS community.

###

T238+ - A Second Generation Weather Station

By Will Beals, N0XGA, will@beals5.com

The original T238 design has gone through two production runs. Rather than a third identical run, the team requested the design be optimized more for its target use, and the T238+ was born.

The T238s main electronics consisted of a micro, an LCD panel, RS232 drivers, and support electronics for the 1-Wire® interface and switches. The support electronics included all the needed circuitry for code development as well. The T238 takes the raw data from the various supported weather sensors, converts the raw data to meaningful measurements and send the weather data in APRS® or Peet® format to a TNC for transmission.

The T238+ started with the original design, removed the explicit debug support (more on this later), two of the three serial port headers, and added a daughter card that is capable of driving a radio directly instead of relying on a TNC. The size of the main board layout was reduced to the same size as the LCD module to make assemblies much easier. There will still be only one code base for the T238 and T238+; release will operate on either platform.

While the explicit debugger support was removed from the T238+, code development is still possible. By cutting two traces and installing a debug header and different frequency crystal oscillator, the full code development features of the T238 can be restored.

The MX-614-based modem board operates much like other small standalone APRS devices. It does not operate as a full-function TNC, but rather allows the T238+ to send data if the channel is clear. Circuitry for receive is included and while it is "just a matter of software" to enable receive features, it is not envisioned at this time.

The two main challenges with the T238+ were the compact board designs and the modem software support. Noise susceptibility was one of the weaker points of the T238, so in addition to reducing the are of the T238 to less than half it's original size, I wanted as close to a full ground plane as possible on the solder side of the board. Further complicating things were no flexibility in pin choices to keep backward-compatibility with the T238. The ground plane remained solid except for nine traces that needed to be routed on the ground plane. An additional eight short lines were purposely routed on the bottom to facilitate cutting for debug modes and potential swizzling of the 1-Wire connector signals. The free CIRCAD98 for Windows tools proved to be a great toolset for schematics, layout, and rules checking between the two. Through both sets of board spins, there were no errors due to layout problems. I highly recommend these tools. Lots of help from TAPR in general and John Koster in particular also helped!

Software development for the T238+ was the other big challenge. The challenge came from an unexpected place however. The single biggest problem was finding sufficient documentation on how to format an APRS packet for transmission. The AX.25 specification is fairly complete save one critical area, how to generate the Frame Check Sequence or FCS, a form of CRC. The AX.25 specification referred only to an ISO 3309 specification that was not publicly available and had also been superseded by another specification. Other public domain references to algorithms called out in that specification were for different size CRCs. I spent weeks trying to search for information before giving up and resorting to a more direct approach—I analyzed someone else's APRS source code and copied it! I hasten to add it was with the author's permission after he also admitted he was not able to follow

any published specifications and got his code working by trial and error.

Since getting the code working, I have reverse-engineered the algorithm to the point where I was able to regenerate the FCS calculating it a byte at a time instead of a bit at a time; something not possible unless you really understand the algorithm. I have written up all these experiences in an article intended for a DCC where I explain the entire process from starting with an ASCII message (an APRS packet), adding headers, footers, calculating the FCS, bit stuffing, and finally tone generated as a result. My intention is this will be a fairly stand-alone explanation requiring very little external references to understand the complete process. The paper is mostly written save some sorely needed flow diagrams for the FCS.

My prototype T238+ weather station has been on the air for almost six months now and TAPR has just started selling the kids after an extended beta test run. A critical requirement for the station is that it be extremely reliable as several of them are located at very remote sites. Save some lockups on the early code, most of the early issues appear to have been related to external hardware issues.

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W1FB Technical Excellence Award

Three radio amateurs were honored as recipients of the 2004 Doug DeMaw, W1FB, Technical Excellence Award. Created to honor the late Doug DeMaw, W1FB—one of the most widely published technical authors in Amateur Radio history—the award is bestowed upon the author or authors of the best *QST* or *QEX* technical article during the prior year, as judged by the ARRL Technical Advisor group. DeMaw was the ARRL Technical Department Manager and Senior Technical Editor from 1970 to 1983.

For the best of 2004, the voting ended in a tie between the collaboration of Tom McDermott, N5EG, and Karl Ireland for their article "A Low-Cost 100 MHz Vector Network Analyzer with USB Interface," in July/August *QEX*, and Jack Belrose, VE2CV, for his article "On the Quest for an Ideal Antenna Tuner," in October *QST*. Accordingly, the ARRL bestowed the Technical Excellence Award on both articles and their authors.

An ARRL Life Member, McDermott has been licensed for 35 years. He's a member of the IEEE and holds a bachelor's in electrical engineering. His Amateur Radio interests lie in HF digital communications, hardware and software design, and an occasional HF contest. As part of the Texas Packet Radio Society, he designed the hardware and some of the protocols for the TexNet packet switching network, and has been involved in numerous TAPR projects. He has written a textbook on wireless communications, and holds eight patents. McDermott currently serves as chief technical officer at Chiaro Networks.

Ireland graduated from Ohio Institute of Technology and has worked as a broadcast engineer for KNUS, KVIL and WBEN. He designed high-speed VCXOs and receivers for fiber optics systems at Alcatel/Rockwell International, earning three patents in phase-locked loops and lock-and-acquisition circuits. Ireland is currently employed at Austin Instrument Systems, where he works on satellite systems.

The DeMaw Award consists of an engraved nine-inch pewter cup.

From ARRLWeb, **www.arrl.org**

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Packet Radio Telnet Nodes:

Using NOS Software as a Possible Solution

By Maiko Langelaar, VE4KLM, http://www.langelaar.net

With the recent surge (it seems) of packet radio telnet nodes for use in emergency and welfare communications, one solution has perhaps not got the attention it deserves – *NOS* (*Network Operating System*), also known as *JNOS, MFNOS, TNOS, WAMPES,* and other derivatives of the original KA9Q *Network Operating System* (*NOS*). Despite the fact that it has been around for more than 15 years, and labeled obsolete by many, it is still a decent solution for those seeking an alternative to the *Windows* based systems out there, since *NOS* runs in both *DOS* and *Linux* environments. For purposes of this article, all of the *NOS* variants will be treated the same, since fundamentally they are all capable of serving as telnet nodes and e-mail portals for that matter.

NOS goes back to the *DOS* days, and is a single monolithic application that had it's own IP stack, complete with services like email, ftp, dns, http, pop, smtp, and others. It allowed *DOS* users to have a complete TCP/IP system on a pathetic little 386, and share it with the rest of the IP network. You ran a *DOS* packet driver (TSR) for your network card, and then ran *NOS* on top of that. Your *NOS* on *DOS* (no pun intended) box served your LAN with all the services you needed. Then the variants appeared, allowing people with packet radio equipment to access these same services over RF. Further more, the *NOS* systems allowed the packet radio user to interface with systems on the network side, in essence providing a network gateway service, now more commonly known as an internet gateway. Years later, some of the *NOS* variants were ported to the Linux environment.

From a systems integrator point of view, I see *NOS* as a flexible solution - integrating the world of packet and HF digital radio with the internet (or with just a local LAN for that matter), and vice versa.

It's important to note that *NOS* is a standalone system, and does not need an IP network to function. It's perfectly fine on it's own, without the Internet or a LAN to connect to. But it serves well as an Internet gateway if that is what one is looking for.

If you want to provide emergency email or telnet services for packet radio users in your area, please consider looking at NOS as a possible solution for your needs. Just google "JNOS 2.0" or "MFNOS" or "TNOS" or "WAMPES."

The *JNOS* 2.0 variant is maintained by myself, and is based on the *JNOS* 1.11f distribution last maintained by James Dugal, N5KNX. I hope this article peaks your curiosity or at least renews an old interest you may have once had with the *NOS* software.

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BWRIE

By John Blowsky, KB2SCS, kb2scs@optonline.net

Back in 2001, I created a system that I called Both Way Radio Internet Email (BWRIE, for short). This system makes it possible for the user to send and receive Internet e-mail.

I have just updated *BWRIE*, so you no longer have to install *Pegasus Mail*. The older version of *BWRIE* used *Pegasus Mail* as its POP3 client. Now *BWRIE* has its own built in POP3 client.

BWRIE is freeware. There is no charge to use *BWRIE*. You can find *BWRIE* at **www.qsl.net/kb2scs**.

Why Was BWRIE Created?

I created *BWRIE* to fill the perceived need of being able to receive and send Internet e-mails from inside a disaster area. I did not design *BWRIE* to be run on a daily basis. Rather, its strength lies in the fact that it is a dedicated system, i.e., a system designed to do one thing and to do that one thing very well. As a result, *BWRIE* is very easy to setup and has a very small learning curve.

BWRIE consists of two plain vanilla AX25 packet radio stations. One named "Receive" and the other named "Send."

The Receive station consists of:

1) PC capable of running *Windows 98* or better

2) TNC

3) Transceiver

4) Internet connection (full-time or dial-up, either will work)

5) *BWRIE* software that I named *Receive*.

Another name for the Receive station would be "Internet Gateway."

The Send station consists of:

1) PC capable of running *Windows 98* or better

2) TNC

3) Transceiver

4) *BWRIE* software that I named *Send*.

Let us say that a hurricane has devastated Suffolk County, Long Island, NY. Let also say that this hurricane did very little damage to Connecticut. The Town of Islip (NY) EOC has given you the task of sending and receiving Internet e-mail in and out of stricken Suffolk County.

Since *BWRIE* is come as you are, you simply take your laptop and your AX.25 packet radio station to the Islip EOC. Note: using *BWRIE* does not require a connection to the Islip EOC local area network. Once your station is set up, you find a repeater in Connecticut, and transmit a CQ. Since the hams in Connecticut know about the disaster in Suffolk County, finding someone willing to help should not be a problem.

Since Connecticut has little damage from the hurricane, the Internet in Connecticut is working fine. The ham that you contact in Connecticut from the comfort of his/her own home, downloads *BWRIE* and installs it on his/her PC. *BWRIE* has a very easy setup program so the installation of *BWRIE* is a snap.

BWRIE also has an integrated Windows Help system; so learning how to use *BWRIE* is not a problem. The ham in Connecticut only has to run *Receive*, so he/she only has to learn about *Receive*. There is no need for interaction between *Receive* and a host of other programs.

Through the repeater, the ham in Connecticut tells you the call sign and SSID that he/she will be using with *BWRIE*. You agree on a VHF or UHF band and a packet frequency to use.

That is all there is to it. After establishing a connection via RF between the Islip EOC and the Connecticut station, Internet e-mail will be able to go in and out of stricken Suffolk County. For the ham in Connecticut, *BWRIE* from this point is automatic. The ham in stricken Suffolk County is the one who causes all the RF transmissions from the *Receive* station in Connecticut. This means no worries about a non-ham causing a transmitter to key up.

The From addresses of the e-mail that *Receive* sends out to the Internet are formatted with the sender's first and last name and the e-mail address of the *Receive* station.

For example, the *Receive* station in Connecticut has the following e-mail address: **Super@myisp.com**. The *Send* station sends an e-mail to *Receive* that is from John Doe.

The From e-mail address that *Receive* will send out would be John Doe (**Super@myisp.com**). At the end of the e-mail, *Receive* adds the following lines:

"This message was sent via Amateur Radio. If you would like to learn more about Amateur Radio then please check out the following URL: **www.arrl.org**

"If you would like to send a reply to this message. Then please click on the 'REPLY' button on your e-mail program. Note: Your Reply will be sent via Amateur Radio. No attachments. No HTML. No business communications. No foul language. Also please no long quotes of original message. Except for the quotes the above are rules of the FCC. Please adhere to these rules. The Amateur Radio operators License is at stake."

The reply e-mail would go to **Super@myis.com**. This works out well since that is the e-mail address of our *Receive* station. *Send* will see a listing of the Internet e-mails that *Receive* receives. This above reply e-mail will be one of them. The operator of *Send* can request this e-mail from *Receive* and *Receive* will send this e-mail via packet radio to *Send*.

If you would like a more detailed description of *BWRIE*, then please go to www.tapr.org and find my paper that is in the 2001 DCC proceedings. The title of the paper is "BWRIE.'

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