PACKET STATUS REGISTER

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In This Issue...

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PRESIDENT'S CORNER

by Andy Freeborn, NØCCZ

For the first time since February 1983 TAPR has a new President. Now if you looked at TAPR as a run-of-the-mill ham club you just might yawn at that statement. You shouldn't. Very few presidents of any type of ham club hang in there for five years or enjoy the stature to be repeatedly reelected.

Lyle Johnson, WA7GXD, your President for the last five years, is one of a rare breed of persons who is a highly skilled technician, possesses an intense dedication to the Amateur Radio Service and has been willing to put up with the routine mundane chores of running TAPR which is, in essence, a business.

He has done this, not for just a couple of years, but for FIVE years. He has done it while holding a full time job. He has done it while he and his wife Heather, N7DZU, have been raising a family of six children, the oldest now 16. Lyle, it seems, has packed a whole career into a five year period.

He has gone through the ups and downs of TAPR as its leader. Black Thursday in 1982, when it was discovered that all 174 of the TNC1 beta boards were defective, was a bad period. The long period just before the sale of the TNC2's, when TAPR was incredibly big bucks in debt certainly was a worrisome time. Whenever there was criticism of TAPR it was always Lyle that took the heat.

There were good times, too, as when Lyle accepted the Dayton HamVention first time award for Outstanding Technical Achievement on behalf of TAPR. August 21st 1985 was a great day! At 9 AM the TAPR office, manned by volunteers, started taking orders for the TNC2. Within hours the telephone company called to find out what in blazes we were doing. Hams were calling from all over the country to the single TAPR telephone and had put their system into gridlock. I guess one of his greatest periods must have been when he was able to start signing checks to pay off that debt.

Why would a man put himself through all of this? I think it was because Lyle Johnson wanted to contribute something to the hobby that he loves so much. If that was his motivation, he certainly succeeded.

Lest you think that this is an eulogy, be assured that Lyle is alive and well. Wild horses couldn't pull him away from the hobby (or TAPR). He is now devoting his time, freed of administrative burdens, to the much loved technical side of new and exciting TAPR development programs.

The entire world of amateur radio owes Lyle Johnson, WA7GXD, a huge debt of gratitude.

What an act to follow! Your Board of Directors, in their infinite wisdom, felt that it was time to keep the techies in the tech jobs and a non-techie in charge of TAPR's day to day operations. And that is why you see my name and call at the head of this column.

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President's Corner
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I am a 30 year Air Force retiree. I flew P-47's in WWII in Europe, was shot down on my 39th dive bombing mission in early 1945 and spent the balance of the war as a guest of der Fuehrer. I subsequently spent 20 of those AF years in Communications-Electronics organizations. I got my ham ticket in 1980, then bought a computer and saw the possibilities of the marriage of the two. In early 1982 I heard of a group in Tucson starting to DO something about it. I contacted them and have been associated with TAPR ever since. My wife of 45 years, Vernie, says that if she were a CB'er her handle would be Packet Radio Widow. Now you know more about me than you were ever going to ask.

As President of TAPR I pledge to the membership the best that I can do.

73, Andy - NØCCZ

DAYTON HAMVENTION: Packet Radio Activities

The Packet Forum Moderator for the 1988 HamVention is Bob Neben, K9BL. He reports that the planned schedule of events will be as follows:

Friday, 29 April, Room 3

1:00 "Packet Radio Introduction" by Dave Peterson, N7BHC.

2:00 "Level 1 Discussion - Modems" by Lyle Johnson, WA7GXD.

3:00 "Pacsat and DSP" by Bob McGuire, N4HY.

4:00 "Networking - How to get started" by Dave Toth, VE3GYQ and Chris Sullivan, VE3NRT.

Friday evening packet getogether dinner arrangements have not been made, but is assumed to be at McNasty's.

73 Bert N8NN @ N8NN -sk-

See You at the 1988 Dayton HamVention! TAPR will be represented at the AMSAT booth this year.

NON-TECH TOPICS

by Andy Freeborn NØCCZ

DSP Excitement

As the annual meeting progressed in February, and as more and more information concerning TAPR's Digital Signal Processing work was disclosed you could just feel the excitement building among the attendees. Several folks commented to me that the DSP work could result in an impact on amateur radio as significant as TAPR's TNC1 and TNC2 developments.

TAPR Office Change

In an effort to conserve our resources for ongoing digital development work the TAPR Board of Directors voted to close its present office/warehouse arrangement. The only difference that the membership will observe is a change in office telephone number and P.O. Box address. The office will be located in one of the rooms in the home of our employee, Cris. You will still hear her pleasant voice when the phone is answered. We are able to make this change because the company that has been doing kit assembly for us will also take on some of the functions that required only a small part of the warehouse that we are leaving.

TNC1 Ver 4 Firmware

It is time to put to rest the matter of Version 4 firmware for the TNC1. The Board of Directors has concluded that existing firmware is adequate and that further expenditures of funds or technical talent, in view of the benefits to be obtained, is unwarranted.

What's a TAPR?

Old time packeteers (of at least a couple of years) will recall when the terms TAPR and TNC were almost interchangeable. Since that time the explosive growth of packet radio has brought multi thousands of new packeteers onto the scene. When you ask someone if he is a member of TAPR and he says "What's that?", take the time to explain to him the origin of his TNC2 clone. Be sure to stress that it came from within the amateur community, not industry.

Thanks Terry

The Board of Directors, by unanimous resolution, extended its heartfelt thanks to Terry Price, N6HBB, for the great job she did as Treasurer of TAPR. Terry set up accounting procedures and then prepared quarterly reports for the BoD that are second to none for this type of organization.

Hello, Secretary/Treasurer Scott

Scott Loftesness, W3VS, the editor of the PSR which you are reading is the new Secretary/Treasurer for TAPR. Scott is taking over a big job from Terry. In addition to his regular job he is also Sysop of HamNet on CompuServe. It seems that folks like Scott, who continually do more than should be expected of them, just keep doing more and more. I am just mighty happy for TAPR that Scott is there.

Our Membership Rolls

TAPR membership has dropped consistently since the introduction of the TNC2. We feel that some of this is due to a relatively low TAPR profile in the recent past (see also What's a TAPR? above). We'll be instituting several new procedures soon to reverse this trend. Included will be membership renewal reminders and a new membership drive program.

Membership Dues and Publication Costs

The Board of Directors has directed the Executive Committee to review the costs of publishing the PSR, the member dues structure and related costs. More on this next issue.

Be sure to note TAPR's new telephone number on the cover of this issue. The phone number change was required as part of the office changes recently implemented in Tucson. You'll still find TAPR's Office Manager, Cris, awaiting your call!

TAPR's new office telephone number is 602-323-1710

HARDWARE HAPPENINGS

by Lyle Johnson, WA7GXD

Old readers of PSR (or, perhaps I should say, "readers of early issues of PSR...") will recognize this column. It has been out of print in PSR for several years due to my authoring other columns.

Fortunately for all of us, Andy Freeborn is now writing the President's Corner.

Unfortunately, you're not completely rid of me as I plan to keep my finger in the pie by dabbling in various projects and generally stirring things up!

I hope to use this column as a means of disseminating technical information on the hardware aspects of TAPR-sanctioned and -funded projects in which I am involved. In this respect, it may resemble some of the Beginner's Corner articles I have written in the past.

As in earlier years, I also hope to break down some of the major projects into a sort of block diagram discussion, highlighting features and explaining some of the reasons behind design decisions that ultimately affect packet operators and network users.

The big project that will affect you first is the Digital Signal Processor (DSP) initial project, currently dubbed DSP-1. As has been mentioned in recent issues of PSR by Bob McGwier, DSP techniques will allow us to build configurable modems and other analog/digital devices which combinehigh performance with reasonable cost.

A suite of three projects is currently envisioned.

DSP-1 will likely be a standalone device capable of working with most TNCs as an external modem. It appears that it may include an 8088-class general purpose processor to allow it to function as a TNC on its own, as well as operate numerous other modes. If it does include a TNC function, the hope is that it will be capable of really high speed operation, perhaps using a full duplex HDLC port with direct-memory access (DMA) circuitry for performance.

The DSP portion will prpbably be based on a Texas Instruments TMS320C15 DSP chip. With proper software, it should be capable of providing solid performance as a several-hundred bits-per-second (bps) HF modem, as a PSK satellite and terrestrial modem, hopefully as a "K9NG-compatible" 9600 bps FSK modem, as an MSK modem, as a 2400 bps QPSK modem, and as a normal 300 and 1200 baud FSK modem.

In addition, it should be possible to configure it to do a good job demodulating WEFAX and satellite weather transmissions, as well as a multi-grey scale SSTV modem. Then, of course, there's CW, digital voice, and any number of other possibilities.

Software development can be done for it with the Delanco-Spry Model 10 DSP board for the IBM PC. Support for downloading code into DSP-1 will also be provided via a serial port, so anyone can write code for the unit. Hopefully, updated modems can be distributed via your local packet BBS!

It is still too early to give any price or availability estimates, other than to say that design work is proceeding along and prototype units may be in the hands of a few coders and testers by Summer.

In the next issue, I hope to break down the design of DSP-1 in some detail for you.

As good as the TMS32010 is for many amateur applications, there are some applications that simply require more horsepower, more memory or more resolution than DSP-1 can provide.

For this reason, it may be possible to configure the unit to support a pair of DSP processor boards. A more powerful processor board,perhaps based on the TMS320C25 or the Motorola DSP56001, will likely be designed for the DSP-1 after the initial configuration is debugged, placed in service and had a reasonable demand generated for it.

Finally, the DSP-1 project will probably emerge as a joint venture of AMSAT and TAPR, combining the resources from both organizations and benefitting both through kit sales and, hopefully, OEM arrangements similar to that of the TNC 2. The TNC 2 OEM agreements have proven very successful for TAPR, the manufacturers and the Amateur community.

Until next time, keep those bits flying!

TAPR to Coordinate Group Purchase of PS-186 kits.

TAPR is in the process of organizing a group purchase of bare boards and hard to find components for the PS-186 packet switch in order to make this new technology available to the advanced experimenter for software and network development.

The PS-186 is a 5-port high speed (>1Mbit/sec) packet switch that was designed by WB6HHV, KA6IQA, & N6NKF. The card is described in detail in the ARRL 6th Networking Conference Proceedings. Briefly, the PS-186 is built around an 8 MHz 80186 processor and up to a 1 megabyte of memory. I/O support is provided by two 8530 SCC chips which are interfaced with DMA. This provides 4 HDLC/ASYNC/SYNC ports, the fifth port is ASYNC only. Also provided are an SCSI port (for disk or multi-board interface), a real time clock, a watchdog timer, and a remote reset circuit.

Advanced Electronic Applications (AEA) has acquired the rights to produce the card commercially. TAPR is organizing a group purchase of bare PCBs and the necessary PALs directly from AEA.

The kit will include an electrically tested 6 layer PCB, programmed PALs, difficult to find LSI components, and a documentation package. A complete list of the parts is included in the documentation. The package will not contain any of the readily available components such as connectors, LEDs, resistors, or commonly available chips.

Continued on page 7

APPLIED DIGITAL SIGNAL PROCESSING: The Telebit Trailblazer Modem

By Michael Ballard, UNIX Program Manager, Telebit Corp.

[Editor's Note: This article provides some interesting background on real-world uses of digital signal processing technology. It was ported here from Usenet.]

I would like to provide some background for Unix users considering the use of Telebit's TrailBlazer Plus high speed dialup modem. I served as project manager and principal programmer for Telebit's protocol support developement. The UUCP "g", Kermit, Xmodem and Ymodem protocols are directly supported in the TrailBlazer modem's firmware. Peter Honeyman, co-developer of ATT's HoneyDanBer/BNU UUCP, coded those portions of the TrailBlazer firmware which support the "g" protocol.

The Telebit modem employs a patented multicarrier modulation scheme coined DAMQAM (Dynamically Adaptive Multicarrier Quadrature Amplitude Modulation). A CRC-16 based sliding window protocol with selective retransmission runs on top of this modulation scheme insuring data integrity across the phone line. This telephone line protocol is known as the Packetized Ensemble Protocol or PEP. PEP is the trademark by which all modems employing this technique can be recognized.

This technique (DAMQAM) divides the voice bandwidth into 511 individual channels each capable of passing 2, 4, or 6 bits per baud based on the measured characteristics of the individual frequencies associated with each channel. On a typical phone connection, the modem uses a subset of about 400 of those channels.

Each time the modem connects to a circuit established on the dialup Public Switched Telephone Network (PSTN), the TrailBlazer measures the quality of the connection, and determines the usable subset of the 511 carriers. The aggregate sum of bits modulated on this subset of carriers multiplied times the baud rate yields a bit per second rate that on a local telephone connection (i.e. round trip through your local telco) is 18031 bps. This 18031 bps is then reduced by about 20% to allow for the CRC overhead, to about 14400 bps of data throughput.

Long distance line quality varies with location and carrier, but you can expect this number to be in the 10000 to 17000 bps range under most conditions domestically. By choosing a high quality long distance carrier, you will ensure the best throughput overall.

The modem operates at 7.35 and 88.26 baud, transparently changing baud rates to accomodate the pace and quantity of data traffic. When in "interactive mode" the modem sends data using 11 msec packets (which run at 88.26 baud). Each packet contains 15 bytes of data. In "file transfer mode" the modem uses 136 msec packets (that transfer at 7.35 baud) that contain 256 bytes of data. The TrailBlazer decides which packet size to use on an ongoing dynamic basis. No intervention from the user is required.

At lower speeds, such as 300, 1200, and 2400 bps, the TrailBlazer provides emulation (performed in the DSP section, not by a "chip" modem) to support these standards. The 300 bps standard is called Bell 103C. At 1200 bps, two standards exist, Bell 212A and CCITT V.22. Both are supported. At 2400 bps, the standard is called CCITT V.22 bis. These speeds are all available with or without MNP Class 3 Error Correction.

The TrailBlazer employs a Motorola 68000 and a Texas Instuments TMS32010 digital signal processor to accomplish this performance. Because of this substantial computer horsepower (about 7.5 MIPS), the TrailBlazer is really a communications processor, rather than a conventional modem.

The software defined architecture produces a flexible product platform that allows broad feature development capabilities while allowing the product's installed base to benefit from those developments by installing upgrade EPROM sets.

All four protocols (Kermit, Xmodem/Ymodem, UUCP), V.22bis support, MNP at low speeds, multiple releases to improve the interactive performance (earlier TrailBlazers utilized only one baud rate), a multitude of RS-232 behavior related features, leased line capabilities, remote command processor access, echo suppressor compensation, increased data rates, and a myriad of user requested features have found their way into current production modems and are available to earlier revisioned modems via the EPROM uprgrade kits.

PEP modems provide a full duplex serial interface to an attached computer, however they employ a half duplex implementation on the telephone line. Telebit refers to this half duplex technique as "Adaptive Duplex". As the name implies, the ownership of the line (i.e. the ability to transmit) adapts to the quantity of data available to send at any single moment. Maximum efficiency is achieved by sending data in a nonstop data stream at 19.2Kbps relying on serial interface flow control to moderate the data flow into and out of the modem.

This allows the maximum amount of data to be available every time a transmitting modem takes ownership of the line. In this way the modem, not the DTE, controls the line turnarounds. The protocol provides a ceiling at about 3k of sent data before a transmitting modem must give up its turn and allow the other modem an opportunity to send. A continuous 19.2Kbps data flow into the modem is required to ensure that there is always 3k of data to send each time a transmitting modem takes its turn. The serial interface speed must exceed the telephone line speed, potentially 18,031 bps, or the maximum efficiency of the modems can not be reached).

UUCP's "g" protocol behavior on dialup lines was a clear contradiction of the desired behavior with the PEP protocol. "g" sends 3 small data packets at time and then waits for the remote UUCP to ACK or NAK their receipt. The resulting throughput

when using UUCP and "g" with the TrailBlazer was only a little better than a standard 1200 bps modem. This was unacceptable.

What did we do about it?
The TrailBlazer can be configured to "spoof" the protocol by setting a register (S111) to one of several values. The spoof can support four different protocols: UUCP "g", Xmodem, Ymodem, and Kermit.

"Spoof" means to fool the various protocols into thinking that they are getting their acknowledgment packets from the remote computer, when in reality they are getting them from the modem.

All of these protocols are what are commonly referred to as "send and wait" protocols. This type of protocol builds a packet in computer A, sends it out through the modems, where it is received by computer B. Next, computer B looks at the packet to determine whether or not it arrived intact. If it did, it sends an ACK (acknowledgement) packet back to computer A. If it did not arrive intact, it sends a NAK (non-acknowledgement) packet. In either case, computer A can't send the next packet out until it gets the ACK from the first packet. This is slow!

Since our modems are error-free between the modems, the only place data could get "broken" is between the modems and their respective computers. Let me draw the connection diagram below:

```
Ca <=> Ta <-> Tb <=> Cb

Ca = Computer A
Cb = Computer B
Ta = Telebit Modem A
Tb = Telebit Modem B

=== RS-232 Cable
--- Phone Line
```

When we are running our protocol support, we look at the packet coming from Ca. Ta checks the packet for validity and sends the ACK or NAK.Ca can begin building the next packet immediatly upon receipt of Ta's ACK. This results in Ca building and sending packets as fast as it can.. Many packets are now forwarded to Tb. Tb now delivers the packets to Cb, observing the rules of the protocol. Tb will deliver the next packet or retransmit the previous packet based on the ACK or NAK received from Cb. Cb ACKs and NAKs are then thrown away so as not to return to Ca.

Protocol support can be configured to run in parallel with data compression enabled. The real world result of this is to increase protocol transfers from 2-3 Kbps to 10-19.2 Kbps.

This covers most of the commonly asked questions about the TrailBlazer. If any of the above information is unclear, or you have questions regarding other aspects of modem technology or performance, send mail to:

Richard Siegel
Senior Systems Engineer
Telebit Corporation
ARPA: telebit!modems@ames.ARPA
UUCP:
{uunet,ames,hoptoad}!telebit!modems

TAPR AT DAYTON

TAPR will once again be officially represented at the Dayton Hamvention. We will be sharing a booth through the courtesy of AMSAT. There will be a limited number of PSK modems available for sale, and orders may be placed for additional items, such as the K9NG 9600 baud modems.

We hope that this booth, as well as a booth in the courtesy area, manned by the OHIO PACKET RADIO COUNCIL, will serve as rallying points for packet get-togethers.

Of course, no TAPR/Packet gathering would be complete without a trip to a Malibu raceway, and tentative plans include a trip to the Miamisburg track on Saturday nite. There will be a packet "dinner"/get-together, likely at the now-famous McNasty's (famous only because of our 2 previous bashes! ...

So, be there, or be square! Packet Pete Eaton and Dr. Death (AKA VE3GYQ) will be leading an all-star cast in manning the booth!!!

DIGITAL SIGNAL PROCESSING: Book Recommendation

[Editor's Note: The following message is from the HamNet Forum on CompuServe.]

#: 70570 S5/Amateur Satellites
23-Feb-88 07:53:50
Sb: #70474-#DSP and WEFAX I
Fm: Bill Coleman AA4LR 76067,2327
To: Bill Bard 75366,2557 (X)

I just found a great book on DSP. "Designing Digital Filters" by Charles S. Williams. Prentice-Hall 1986. ISBN 0-13-201856-X. This book is for "the rest of us" who are mathematical wizzos. All that is required is a working knowledge of trigonomitry and calculus. The book even contains a review of complex numbers and an introduction to analog filters. All notational conventions are thoroughly explained before they are used, and the book introduces each new concept with a easy-to-understand example.

The book starts with an overview of the impetus around designing digital filters, discusses the issues associated with digital filtering (aliasing, quantization). The next chapter reviews the mathematical concepts of frequency response. The next two chapters discuss the design and implementation of nonrecursive filters, then two chapters on recursive filters. The final two chapters talk of polynomial modeling of digital signals and the DFT and FFT.

An excellent book for those of us who are not EEs, nor Math majors. In all, a very readable book!

73, Bill

About your membership...

PSR is one of the major benefits of membership in TAPR. If you find PSR of value, please remember to check the mailing label on this issue for your membership expiration date. TAPR does not send you any other notice of membership expiration.

If you want to continue to receive PSR uninterrupted, please check your membership expiration NOW!

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