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Towards A Higher Speed Radio Network In Northern California

Glenn Elmore N6GN

This article is to describe some of what is being done toward building a higher performance digital radio network in Northern California. It is also a call for involvement by those who are interested in using its fruits to benefit all of amateur radio.

Why Faster Packet?

Before getting into the details of our efforts to build a prototype higher speed network in Northern California, it may be good to ask why anyone would want one. For those of you familiar with existing amateur packet radio applications like keyboard to keyboard chats and BBS operation one answer is perhaps obvious. A better network would give better performance. Getting messages delivered to intended recipients in seconds instead of hours or days and having reliable low-delay connections to distant stations is attractive. Being able to scan and download messages and files without delay and greatly improving the connectivity within the BBS or DX spotting networks could make a big difference in their effectiveness.

However there are other reasons for desiring a highspeed network. With highspeed connectivity there is a whole world of new applications which might be used. Roundtable discussions, special interest groups, wide area game playing, FAX and certainly high performance emergency services are but a few. Shared information services like callsign, weather and general information databases become possible as well. Even digital audio and remote control of home stations could be supported. Imagine mobiling hundreds of miles from home and being able to access and control instruments and functions in your hamshack all from the touchtone pad of your HT through a voice repeater which is tied into a wide-area digital network. By accessing your home QTH it could be a fairly simple matter to control and have a voice synthesizer report back such things as "The cat's dish needs water" or "Hamshack light now off."

These sorts of applications are not necessarily too difficult in themselves but in order for many widespread amateurs to simultaneously use them and experience good performance considerable data speed or "bandwidth" and efficient hardware and protocols are required.

Although building this kind of infrastructure is difficult and requires a lot of coordination and cooperation, I believe it is not impossible and that the benefits to amateur radio could be enormous. Not only could our capabilites for emergency communications be greatly improved but the attractiveness of the hobby to "information age" individuals could greatly revitalize the hobby at the same time existing special interest uses could be encouraged.

In order to provide a foundation for some of these exiting applications we need both radios and digital hardware capable of much higher speeds which are distributed around the state and we also

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In This Issue

Editorial

Mike Chepponis, K3MC
Downlink Editor

Greetings again, and welcome aboard again for another stellar issue of the NCPA Downlink!

It's been a warm summer this year, and we're going to keep it hot! This issue contains quite a bit about the Physical Layer, the hardware stuff that lets us communicate. We start off with a bang with Glenn Elmore, N6GN, describing his Faster Packet in Northern California ideas, why they make sense, and he puts out a plea for all interested parties to help build this budding network.

We've got Barry McLarnon, VE3JF, giving us a great rundown of what's now available in medium- to high-speed packet. I think you'll be amazed at just how much stuff really is available right now! This is a list that Barry keeps updating, so if you have information on more products, Barry would like it if you'd drop him a line (VE3JF@VE3JF).

We've got some info from our friends in Japan. Yutaka Sakurai, JF1LZQ, brought me a beautiful circuit board for a device called a "TNC-Z. It's a TNC-2 style device but with greatly enhanced processing capability. It uses the Hitachi HD64180S Z-80 compatible Communications Processor IC. It has been tested running up to 2 MEGAbits per second when running over wires, and this circuit is being used in the 64 kilobit/sec radio modems that are running all around the Tokyo area. (I had the privilege to visit Japan and see this stuff working — it's VERY impressive!) They use modified 1.2 GHz radios; they install varactor modulators and pick off the IF and feed it to the standard Motorola FSK demodulator chip. They hope to make kits available, and I have suggested that they contact TAPR.

We have a debut column from our TCP/IP Guru (and NCPA Board Member) Larry, N6SLE. Larry has taken the Q&A style for this column, and we trust you'll find it enjoyable.

By the time you read this, the 12th ARRL Digital Communications Conference will be over. What this means is that you can call up the ARRL at 203/666-1541, ask for Publications, and order the Conference Proceedings! I would have to say if you are just the least bit interested in Packet Radio, then you owe it to yourself to get all of the back issues of the conferences, for it's a real wealth of information.

And we have our other usual pieces of juicy tidbits.

In the next issue, we'll be taking a bit of a retrospective on NTS and Packet. The article by Don NI6A was written in 1988 (ancient history from a packeteer's perspective!).

I hope I have a chance to meet a lot of you folks at Pacificon. NCPA is planning to have a booth there where we'll be signing up new members. Plus, naturally, NCPA will be putting on some tutorial and advanced sessions there. Stay tuned...and please tell a friend about NCPA! And don't forget, we're always searching the globe for great material for our beloved NCPA Downlink.

Vy 73,
Mike K3MC

The NCPA *Downlink*

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Equipment Options for Medium- to High-Speed Packet

Barry McLarnon, VE3JF

Last update: 2 July 1993

The purpose of the following is to summarize the hardware options available for constructing medium- to high-speed packet links. Thus far, only 9.6, 19.2, and 56 kbps are covered. This material is intended to be a useful reference, but I make no claims as to its accuracy or completeness. Many details concerning model numbers and prices are missing, and I have very little information concerning equipment sources outside North America. If you have corrections, or suggestions on additional information to include in this survey, please send them to:

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Note: unless otherwise noted, prices given are in $US.

Equipment for 9600 bps

9600 bps Modems

The K9NG modem was available for a number of years as a kit from TAPR. It set the "standard" for 9600 bps packet operation, but it has now been replaced by the G3RUH and new TAPR designs. Among the improvements provided by the newer designs is full-duplex capability. Even when full-duplex is not needed on the air, this is a great convenience for doing loopback testing of the modem. If you still have a K9NG modem lying around, though, don't hesitate to try it!

The G3RUH modem is available from several sources:

PacComm MC-NB96 internal modem card ($109)—fits on disconnect header of most TNCs.

PacComm EM-NB96 external modem ($175)—standalone version of above.

Kantronics DE9600 modem card, similar to the PacComm MC-NB96.

MFJ MFJ-9600 9600 bps modem card ($110), similar to the others.

The new 9600 bps TAPR modem kit ($70). The new design has all of the features of the G3RUH, plus a few enhancements. It is attractive for repeater use, since it includes provision on the board for bit regeneration/FIFO buffering ($10 extra for the parts). The first rev of the board in 1992 had a few problems, and some mods were needed for best performance. A new rev which incorporates the fixes became available in early 1993.

The G3RUH and TAPR modems can plug directly into a TNC modem disconnect header as a daughterboard, or be connected externally via a ribbon cable.

DRSI DPK-9600 ($250). This is a G3RUH-compatible modem and TNC-2 clone (10 MHz clock) housed in one box.

Data Interfaces for 9600 bps

For 9600 bps, the usual interface is a TNC. If you don't already have a TNC, it's worth considering a PC bus interface card like the PI or the PackeTwin. They are a better investment since they will not become obsolete if you upgrade to higher speeds than 9600. In fact, many people have reported results with TNCs that were much less than theoretical maximums, even at 9600 bps. The faster the TNC clock rate the better: 4.9MHz should be considered an absolute minimum.

Ottawa PI board ($120 US, $140 CDN). It provides a DMA port which handles 56 kbps with ease, even with a 4.77 MHz XT-class machine. All you need to add is the cable to the modem. The main limitation of the board is that it does not support full-duplex operation, but full-duplex operation is rare (especially amongst end users). The PI also supports a low-speed port (you provide the modem and radio). The board can be used with any version of KA9Q NOS.

Gracilis TWIN-1E PackeTwin card ($225). Like the PI, it provides a DMA port for the 56 kbps modem and an interrupt-driven port for lower-speed modems. The DMA port supports full-duplex operation. The Kantronics 9600 bps modem can be piggybacked on the card.

DRSI PCPA Type 1296 ($290). An interrupt-driven PC-plugin card with on-board 9600 bps and 1200 bps modems.

Radios for 9600 bps

A standard NBFM radio is typically used. To interface to the modem, the radio must have a direct FSK modulator, discriminator output, an IF with sufficient bandwidth and reasonable phase characteristics, and fast t/r switching. Some radios are usable with just a few modifications to bring out the required signals, others may need more extensive mods such as adding a varactor FM modulator, and still others are almost completely unusable due to their IF characteristics or slow t/r switching. There are a few radios designed specifically for digital service which require no mods:

2m

DRSI offers a "matched set" ($550) consisting of their DPK-9600 TNC/modem and a modified Alinco DR-1200T (20W, synthesized).

70cm

Tekk data radio ($190), 2W output, one channel, crystal controlled (430-450 MHz). Available from Gracilis and other sources. Gracilis has a package (TWIN-96E) consisting of the PackeTwin card, 9600 bps modem, and Tekk radio which lists at $520.

PacComm has two packages which contain the Tekk:

PacComm DT-NB96 ($369): Tekk radio and 9600 bps modem housed in one box.

PacComm IPR-NB96 ($499): Tekk radio, modem, and Tiny-2 MK-2 TNC housed in one box.

Kantronics D4-10 ($359), 10W output, two channel, crystal controlled (430-450 MHz). Can go to at least 19.2 kbps.

A large number of amateur VHF and UHF transceivers have been successfully used for 9600 bps work. Many commercial FM radios are also suitable; ironical-

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ly, the IF filters in these radios are typically "better" (narrower bandwidth, steeper skirts) than in amateur-grade equipment, which leads to inferior performance at 9600 bps (on the other hand, they also tend to have superior intermod immunity compared to amateur rigs). The IF stages of most receivers can be broadbanded successfully, but the degree of difficulty and expense involved varies considerably.

A good source of information on radio interfacing and other topics related to 9600 bps operation is the "9600 Baud Packet Handbook" by Mike Curtis, WD6EHR. Hard copies are distributed with the TAPR modem, and it can also be found in electronic form on some BBS's.

Summary: 9600 bps

The cost of getting something working at 9600 bps is highly variable. If you already had a TNC and a suitable .adio plus antenna, it could be as little as $70 or so (TAPR modem). On the other hand, you can get a "plug 'n play" package from Gracilis, consisting of a PackeTwin interface card, DE9600 modem (piggybacks on the PackeTwin), and Tekk radio, for about $500 — just add an antenna. You should seriously question spending this kind of money to get 9600 bps, when you could put together a 56 kbps setup for not much more money (but, admittedly, considerably more effort!).

Equipment for 19.2 kbps

Until recently, operation at 19.2 kbps had not received much attention. A major reason for this is that binary FSK at 19.2 kbps cannot be accommodated by the IF stages of NBFM receivers, nor is it compatible with the 20 or 25 kHz channel spacing used for FM in the amateur VHF/UHF bands. On the other hand, it makes relatively poor use of the 100 kHz channels typically allocated for "wideband" digital modes. However, interest in 19.2 kbps operation has been spurred by the appearance of the Kantronics D4-10 radio. Since it contains a varactor modulator, plus a data slicer following the discriminator, it can be operated in "raw FSK" mode at 19.2 kbps without additional modem hardware. All that is needed in addition to the radio is the computer interface. A "souped-up" TNC might work fairly well, but one of the PC DMA interface boards (or maybe a DataEngine) would be better. Running "modemless" FSK entails some loss of performance, most notably from the lack of data scrambling, which results in more jitter in the recovered clock signal and thus higher bit error rates.

Kantronics also offers a 19.2 kbps modem, similar to the DE9600. The performance difference between the "bare bones" D4-10 radios and that which you could realize with the more sophisticated modem has not, to my knowledge, been quantified. The GRAPES modem (see below) could also be run at 19.2 kbps, but it would not be compatible with the Kantronics equipment (and why would you want to throttle back a modem that can do 56 kbps and more, to only 19.2?).

Some experiences with using the D4-10's at 19.2 kbps, using Ottawa PI cards and DataEngines as interfaces, appear in an article by John Ackermann AG9V in the 11th ARRL Computer Networking Conference Proceedings.

Equipment for 56 kbps

56 kbps Modem

GRAPES (WA4DSY) modem, $250 in kit form. You also need to provide a box for it, plus a few interconnecting cables and connectors. It requires +/-5V power (about 0.5A @ +5V, 0.1A @ -5V). This is an RF modem with input and output (about 1 mW) in the 28-30 MHz band, designed for use in the bands above 220 MHz (occupied bandwidth is about 70 kHz at 56 kbps), using standard receive and transmit converters. The receive and transmit portions of the modem are separately crystal-controlled, and it can run full-duplex. It is not limited to 56 kbps — with suitable modifications, it can be made to work at 128 kbps or more.

Data Interface for 56 kbps

Ottawa PI card ($120) Gracilis PackeTwin card ($225)

Both of these cards (see descriptions above) will handle 56 kbps with ease.

Kantronics Data Engine (need price info). This is essentially a higher-speed TNC with two HDLC ports that can reportedly run at 56 kbps, and an RS-232 port that can run at up to 19.2 kbps. The standard firmware is G8BPQ, but there is now also a port of JNOS (JNOS40) by WG7J available. The DE appears to be more useful as a small standalone packet switch then as an interface for end users.

Gracilis PackeTen (~$1500?). This is a full-blown packet switch that runs a custom version of KA9Q NOS. It is available in both standalone and PC bus versions. If you need more than two high-speed ports (more than one, if you need full-duplex), then this is really the only choice.

RF Equipment for 56 kbps

The RF equipment required depends on whether the links are half- or full-duplex. There are three basic configurations in use:

- Half-duplex point-to-point links

An example is the Georgia backbone network. The usual RF equipment is a Microwave Modules (220, 430 MHz) or Sinclabs (220 MHz) transverter.

- Full-duplex point-to-point links

Full duplex operation is significantly more complicated, but it is also highly desirable if you want to maximize the throughput of a backbone link. The GRAPES modem is inherently full-duplex, so it is only necessary to provide separate RF up- and down-converters. The two channels may be in-band or cross-band, using either separate antennas or duplexers. The only full-duplex point-to-point link I'm aware of is in Chicago — it uses PackeTen switches and operates in-band in the 70 cm band.

- Multiple-access networks with full-duplex repeater

In this case, an in-band or cross-band 56 kbps repeater provides hidden transmitter-free access to a channel (or rather, a pair of channels) by multiple 56 kbps stations. This might just be a LAN for the power users, but it also is an attractive means of linking a number of network nodes together, with less complexity than multiple point-to-point links (see the 10th ARRL Computer Networking Conference proceedings for more details). As in the preceding case, separate receive and transmit converters are used, usually

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with separate antennas (in principle, a transverter with "split" frequency operation could be used, but such things are hard to come by). The stations in this network do not require full-duplex computer interfaces, but since the RF portions have full-duplex capability, it allows smaller txdelays to be used than in the half-duplex case. It also allows users to observe the quality of their signals coming back from the repeater.

The first 56 kbps full-duplex repeater went on the air in Ottawa in January 1990. The repeater is cross-band (220.55 MHz in, 433.55 MHz out), so users must up-convert the modem's 28-30 MHz IF output to 220 MHz, and down-convert 432 MHz to the 28-30 MHz IF input.

220 MHz

Transverters and up-converters

Sinclabs ST220-28 transverter ($329 CDN), 15W output. Sinclabs has recently withdrawn from this business, but transverters may still be available from Bob Morton, VE3BFM (Maple Leaf Communications).

Microwave Modules MMT220/28S transverter, 10W output. Not readily available new, but watch for used ones on the market.

SSB Electronic TV 28-220/01 transverter ($380), 100 mW output. These units have no T/R switching, so that would have to be added externally for single-channel half-duplex operation. On the other hand, there are separate local oscillators provided for the receive and transmit converters, so this looks like a good choice for in-band full-duplex or half-duplex split operation.

Hamtronics XV4 transmit converter (kit, $79), 0.5 - 1W output. The cheapest alternative, and the power level is adequate if you aren't too far from the repeater and have a reasonable transmitting antenna. But you do need to find someone with a spectrum analyzer to get it tuned up properly, and some people have had problems taming this unit.

Down-converters

Microwave Modules MMc220 (price/availability unknown), 2.8 dB NF.

Advanced Receiver Research (model no., other details unknown). This unit is in the $100 range and of high quality, but it really needs a front-end preamp. We use one of these converters on the Ottawa 56kb repeater, along with an ARR preamp. ARR may be no longer producing the converters.

Antennas

You might get by with omni antennas, but multipath can cause poor performance even when signal levels are high. Small yagis provide more margin and help discriminate against multipath. A typical example is the Cushcraft A220-7 7-element yagi (about $50).

430 MHz

Transverters and up-converters

Down East Microwave DEM432 no-tune transverter, 50-100mW output. This is a 3-board set, available in several forms, and there is an optional power amplifier that provides 15W output. The local oscillator board normally has a single oscillator for standard half-duplex operation, but a second oscillator can be added on the board for half-duplex split or full-duplex operation. Some options and prices:

DEM432B assembled and tested unit, including case, $275

DEM432B DUAL as above, but set up for dual frequencies, $300

DEM432K basic kit (no case or connectors), $155.

Second LO kit, $8

432PA 15W PA, assembled and tested, $180

432PACK 15W PA complete kit, $135

432PAK 15W PA basic kit (no case, connectors or heat sink), $75

Enclosure to house both DEM432K and 432PA, $25

DEM432-15S complete 15W dual-frequency transverter, $395

Microwave Modules MMT432/28S transverter, 10W output. Not readily available new, but quite a few used ones on the market.

SSB Electronic TV 28-432 transverter ($310), 100mW output. These units have no T/R switching, so that would have to be added externally for single-channel half-duplex operation. On the other hand, there are separate local oscillators provided for the receive and transmit converters, so this looks like a good choice for in-band full-duplex or half-duplex split operation.

Hamtronics XV4 transmit converter (kit, $79), 0.5 - 1W output. The 432 Mhz version of the unit described above.

Down-converters

Hamtronics ($49/$69/$99 for basic kit/kit with box/wired & tested). Quality of this unit is uncertain.

Microwave Modules MMc435.2 ($115). Current availability unknown.

SSB Electronic K7001-10 ($180). High quality, with a price to match.

There are other sources for units in the $100-$150 range, such as Lunar.

1.2 GHz

Equipment for operation of the GRAPES modem at 1.2 GHz and the other bands above 450 MHz is a problem, due to the scarcity of converters which have input/output at 28 MHz, not to mention reasonable power output.

Transverters and up-converters

SHF-1240(K) "No-tune" transverter board ($149 kit, $189 assembled, from Down East Microwave): 144 MHz IF (10 mW drive required), 10 mW output. Also required is the separate SHF-LO local oscillator board ($50 kit, less crystal; $85 assembled). A complete transverter (transverter board, LO board, IF PIN diode switch, packaged in a metal box) is available for $265. Note that no RF switching is included, so if you wanted to run half-duplex, a suitable RF T/R switch or a circulator would be needed. NF of the down-converter is in the 4-5 dB range. Due to the 144 MHz IF, a separate 28 MHz to 144 MHz conversion stage would be needed.

SSB Electronic USM-3 transmit converter ($210). 1W out (20 mW in). Requires external LO source (10 mW). Although normally used with 144 MHz IF, it reportedly can be tuned for 28-30 MHz IF input. Housed in a metal box with BNC connectors.

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need a physical network which ties them all together so that they can be fully utilized. In such a case, the whole is greater than the sum of the parts. It becomes a distributed resource which can do more than the individual radio links or individual users might do by themselves. Individuals or groups in one area with, say, equipment specialized for weather information and a database might record and share that with a much wider community on a realtime basis. Amateur seismologists might find themselves able to quickly and automatically report the occurance and amplitude of an earthquake and together to quickly pinpoint the epicenter in order to alert the general community of emergency needs. With a high performance wide-area network this capability might even include detecting and locating an earthquake before it occurs which could make protective measures possible. The potential uses for a wide area amateur network seem nearly endless and await amateurs applying their interest and craft to be discovered.

A Little History

Like many of you reading this, I entered amateur packet radio on VHF with a 1200 bps modem/TNC using an existing vhf transceiver and discovered it to be exciting and have a lot of potential. Since I already had a home computer, entering packet radio was pretty inexpensive. Also like many of you, I discovered that the actual user throughput was a lot lower than the 1200 bps/150 characters per second speed of the radio channel. On some connections, it was less than one thousandth of this. Because I have enjoyed building and experimenting with amateur RF and microwave I started investigating what was needed to make things work better. About this time I also discovered amateur networking in the form of TCP/IP. Since I was also able to experience a highspeed wide area network, the "Internet," at my work I had a taste of some of the possibilities.

Putting some of this together and joining with N3EUA, KA9Q, K3MC, and N6RCE we discussed and presented some of our thoughts about higher speed amateur networking in the 8th ARRL Computer Networking Conference in 1989.

About this same time Kevin Rowett, N6RCE, and I designed, built and published a high speed and inexpensive 10 GHz data link article in Ham Radio Magazine and then also in the ARRL CNC proceedings and the ARRL Handbook. I designed and built the radio side and Kevin adapted an old IBM PCLAN computer networking card to control the radios. As much as anything, I wrote the article as a "teaser" to show that effective highspeed digital radios need not be expensive.

Conventional AX.25 packet radio has grown out of non-radio or "wireline" protocols and hardware. However, this environment doesn't really adapt well to a wireless or radio environment. Many amateurs have been frustrated with the relatively poor performance of 1200 bps amateur packet and have desired to simply "have faster radios". Unfortunately, this does not solve the problem. Why this is true, and a way to to build an amateur radio network which is efficient along with a supporting link layer protocol, Hubmaster, were the subjects of two of our papers in the 9th ARRL CNC. Also, a single faster radio link doesn't create a network. The original 1 Mbps microwave link we published has been sitting idle on the bench for this reason. Even though it provides fast information flow across a single radio path, it doesn't do much toward furthering an amateur network. The realities of most amateur's QTHs and antenna constraints also make this solution impractical.

After recognizing some of the physical fundamentals which control information transfer over radio along with the economic issues of amateur radio we set out to build a small prototype of what we had discussed in the papers. Neither "turning up the speed" nor building a lowcost radio was enough. We needed lowcost, highspeed user (individual) connection along with efficient wide area information communication. All this had to be done in an amateur radio context.

Interestingly, one of the biggest stumbling blocks has consistently been the lack of lowcost digital hardware capable of manipulating highspeed streams of data in and out of radios, computers and application devices. The original 10 GHz hardware was designed for 2 Mbps and could almost operate at Ethernet speed of 10 MBps but was actually operated at only 1 Mbps due to the lack a lowcost digital controller.

Between us, and with counsel from Ed Satterthwaite, N6PLO, we set out to build about a dozen radios and digital controllers in order to produce a small but functional prototype network in Northern California. This quantity was all we felt our personal radio budgets could allow.

By late 1991 I had designed and built half a dozen 10 watt, 256 Kbps digital radios which operate on 904.5 MHz. Kevin had built "MIO," a digital controller which could run either stand-alone or be plugged into an IBM personal computer and handle the highspeed data streams from the radios and deliver it rapidly to the computer. In addition to the board, Kevin and Stu Phillips, N6TTO, developed a very complete software development environment around the Borland IDE complete with remote debugging capability (described in Dr. Dobb's Magazine). A description of this and additional information is published in the 10th (1991) ARRL CNC proceedings.

Where We Are Now

Although the hardware was "done" (with a few corrections of course) and a half dozen set of radios and controllers were built, there were and still are software problems. The radios proved to be quite labor intensive to build and cost/performance probably exceeds what is required for low-level end-user operation. We determined to use the existing hardware first to build a backbone rather than to use it for end-user connection and development of the Hubmaster protocol. Therefore, I built two complete hilltop "nodes"; rackmounted radios, filters, power supplies and antennas which were installed on Sonoma Mountain, east of Petaluma in Sonoma County and Black Mountain, which overlooks the bay area from above Los Alto Hills. These sites are in range of one another and have been operating in "beacon" mode at half speed, 128 Kbps, sending data and IDing on both packet and CW for almost a year now. However, subtle software problems have kept receive data from being properly delivered to the host computer and prevented two-way data flow.

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Signal strenths and quality are excellent, packets from the mountaintops are reliably received and delivered (via DMA) to shared memory but not usually reported to the on-board cpu.

About the time that these first two hilltops nodes were put into operation, N6RCE's found his time for amateur radio swallowed up in work. During a good part of the last year, 60+ hour weeks have dominated and amateur radio network progress has been pretty stagnant. So far, no one else with software and hardware skills and equipment has stepped in to fill the gap.

In early June of 1993, N6RCE, N6PLO, Weo Moerner, WN6I sysop and benefactor of the SanJose TCP/IP switch and N6GN met. As a group we decided that in order not to further waste the radio hardware, to either get MIO working or temporarily replace it with something else by mid-August of 1993. Since that meeting it has become apparant that replacing the MIO controllers with modified commercial TNCs is the only viable solution.

I have recently purchased and examined a sample of MFJ1270B and Pac-Comm Tiny 2 TNCs with the 10 MHz high speed option for use as a controller for hilltop sites as well as proposed valley terminus sites. While only five radios are completely built up, I have another half dozen very nearly completed once suitable backbone node locations and sponsers are identified.

Even with the 10 MHz option, it appears that the TNCs reliably operate only to 38.4 Kbps. Actual throughput is considerably less than this and seems to be limited by the TNC CPU capability rather than by radio speed. With a TNC software change proposed by Mike Chepponis, K3MC, it may be possible to improve this considerably. In any case, operating at only one tenth of the radio's capability is preferrable to not operating at all.

Help is Needed

We are now seeking to "turn on" the backbone from valley floor sites between Sonoma and Santa Clara Counties. In addition to the existing two hilltops we hope to increase the backbone to cover into the Sacramento Valley and up to part of the Northern California coast perhaps as far as Fort Bragg.

In order to do this, we need help. We need local sponsers in each community, including those containing the nodes already installed, to install and maintain the hilltop and terminal sites. Because this is a backbone, it is important that there be only a few terminal nodes at low levels which provide user access. Although the backbone may run with 38-128 Kbps channel speeds, we are presently sharing a common channel and additional terminal locations effectively divide the channel capacity. Our desire is that user and application access to the backbone be made on other channels in each locale. Additionally, there are in total only about a dozen radios and due to the large effort it takes to build them and difficulty of "teaching" the process, building more is not being considered at this time, even though I have additional unloaded boards.

To gain the maximum benefit for the Northern California amateur radio community, we desire to use all of these radios in the most efficient way; as backbone nodes from high level sites carefully selected to provide excellent performance. Additional sites are yet to be selected and whether a SF Bay Area to LA connection is worth pursuing or whether extensions to the backbone solely within the northern part of the state make the most sense is open for discussion. I suspect a lot will depend upon who steps forward to sponser sites.

All hardware and interface connections for a hilltop site is documented. Antennas used so far have all been home constructed. Construction plans are available. Commercial antennas are available and may be purchased if preferred. A single interface board needs to be constructed to go between the TNC and the radio, which need to be purchased, . I may have a circuit board available for this, depending upon time availability. A TNC and 12 volt power supply needs to be purchased for each site unless power is otherwise available. Having emergency 12 VDC at about .5A is a very strong desire since the backbone could be most important during emergencies which cause failure of commercial power sources. For any radio I provide, I'm only asking to have parts cost returned. This is about the same as the cost of a new 2M transceiver.

I hope to have sponsers for each hilltop and terminus of the backbone. I intend that the capability of the backbone be available to all applications, keyboard-keyboard, BBS and other existing applications as well as future ones. How this is ensured is beyond my control but I hope that Norcal amateurs will rise to the occasion.

My present efforts are going into a much lower cost and producible design which integrates a digital controller. This is called "layer 3 TNC" and incoroporates direct conversion and spread spectrum to provide very low cost and at the same time alleviate multipath propagation problems which become significant at higher data speeds. This radio is intended to work at both high level backbone sites as well as low level user/end locations. This is not likely to be in "finished form" very soon but it is where I hope to be able to focus my attention as soon as the existing hardware is fully deployed.

If you or your group (especially) are interested in using a backbone of the sort described above, please contact me by BBS, email or conventional mail before the end of August 1993. I will collect responses and call a meeting to provide information and enable coordination of further effort.

Thank you for your interest. I look forward to hearing from individuals and especially groups who might be interested in meeting soon for planning and sponsoring a site. I may be reached at

N6GN @ K3MC amateur BBS
glenn@SantaRosa.ampr.org
glenne@sr.hp.com (Internet)

EOF

Proposed Rule Change

Message Forwarding Systems in the Amateur Service

FEDERAL COMMUNICATIONS COMMISSION
47 CFR Part 97
[PR Docket No. 93-85; FCC 93-154].
Message Forwarding Systems in the Amateur Service
ACTION: Proposed rule.

Summary

This action proposes to amend the rules for the amateur service by modifying the Commission's compliance policy for stations participating in message forwarding and voice repeater systems. This action addresses six petitions for rulemaking concerning amateur stations participating in message forwarding systems. The petitioners indicate that 97.103(a) of the Commission's rules, 47 CFR 97.103(a), hampers unnecessarily the operation of high speed message forwarding systems and repeaters. They claim that the potential for transmitting large numbers of messages in these systems cannot be achieved because this section does not distinguish between the responsibilities of the station originating and those only forwarding or repeating violative communications. The effect of the proposed rule would be to hold the licensee and control operator of the station originating the message and the control operator of the first forwarding station accountable for communications transmitted within a message forwarding system.

Dates

Comments must be filed on or before July 1, 1993. Reply comments must be filed on or before August 1, 1993.

Addresses

Federal Communications Commission
1919 M Street, NW.
Washington, DC 20554.

For Further Information Contact

William T. Cross, Federal Communications Commission, Private Radio Bureau, Personal Radio Branch, Washington, DC 20554, (202) 632-4964.

Supplementary Information

The Commission's Notice of Proposed Rule Making, adopted March 18, 1993, and released March 29, 1993, is available for inspection and copying during normal business hours in the FCC Dockets Branch (room 239) 1919 M Street, NW., Washington, DC. The complete text of this Notice of Proposed Rule Making, including the proposed rule amendments, may also be purchased from the Commission's copy contractor, International Transcription Service, (202) 857-3800, 2100 M Street, NW., suite 140, Washington, DC 20037.

Summary of Notice of Proposed Rulemaking

1. This action proposes to amend the rules for the amateur service by modifying the Commission's compliance policy for stations participating in message forwarding and voice repeater systems. The proposed rules are set forth at the end of this document.

2. The proposal contained herein has been analyzed with respect to the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 et seq., and found to contain no new or modified form, information collection and/or record keeping, labeling, disclosure, or record retention requirements and will not increase or decrease burden hours imposed on the public.

3. This is a non-restricted notice and comment rule making proceeding. See 1.1206(a) of the Commission's Rules, 47 CFR 1.1206(a), for provisions governing permissible ex parte contacts.

4. In accordance with Section 605 of the Regulatory Flexibility Act of 1980, 5 U.S.C. 605, the Commission certifies that these rule changes would not if promulgated, have a significant economic impact on a substantial number of small entities. The Amateur Radio Service may not currently be used to transmit any communication to facilitate the business or commercial affairs of any party. See 47 CFR 97.113(a).

5. This Notice of Proposed Rulemaking and the proposed rule amendments are issued under the authority of sections 4(i), 303(b), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 303(b), (g), and (r).

6. A copy of this Notice of Proposed Rulemaking will be forwarded to the Chief Counsel for Advocacy of the Small Business Administration.

List of Subjects in 47 CFR Part 97

Compliance policy, Packet networks, Radio, Repeaters.

Federal Communications Commission.

Donna R. Searcy, Secretary.

Proposed Rule Changes

Part 97 of chapter I of title 47 of the Code of Federal Regulations is proposed to be amended as follows:

PART 97-AMATEUR RADIO SERVICE

1. The authority citation for part 97 would continue to read as follows:

Authority: 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303. Interpret or apply 48 Stat. 1064-1068, 1081-1105, as amended; 47 U.S.C. 151-155, 301-609, unless otherwise noted.

2. Section 97.3 would be amended by redesignating paragraphs (a)(28) through (a)(44) as paragraphs (a)(29) through (a)(45), respectively, adding a new paragraph (a)(28), and revising newly redesignated paragraph (a)(36) to read as follows:

97.3 Definitions.

*(a) * * * (28) Message forwarding system. A group of amateur stations participating in a voluntary, cooperative, interactive arrangement where communications are sent from the control operator of an originating station to the control operator of one or more destination stations by one or more forwarding stations. * * * * **
(36) Repeater. An amateur station that instantaneously

*retransmits on a different channel the angle-modulated phone or image emission transmission of another amateur station. * * * * **

3. Section 97.109(e) would be revised to read as follows:

*97.109 Station control. * * * * * (e) No station may be automatically controlled while transmitting third party communications, except a station participating as a forwarding station in a message forwarding system.*

4. Section 97.205 would be amended by adding new paragraph (g) to read as follows:

*97.205 Repeater station. * * * * * (g) The control operator of a repeater is not accountable for violative communications that the repeater retransmits inadvertently.*

5. Subpart C of part 97 would be amended by adding new 97.217 to read as follows:

97.217 Message forwarding system.

(a) Any amateur station may participate in a message forwarding system, subject to the privileges of the class of operator license held. (b) The control operator of the station originating a message and the control operator of the first station retransmitting that message are accountable for violative communications that are transmitted in a message forwarding system. The control operators of other stations inadvertently retransmitting violative communications in a message forwarding system are not accountable for the violative communications. EOF

Equipment Options for Medium- to High-Speed Packet

Continued from page 5

Down-converters

SSB Electronic UEK-3 receive converter ($200). 2.2 dB NF, 20 dB conversion gain. The nominal LO frequency is 1152 MHz, for conversion of the 1296-1298 range to 144-146 MHz. An LO output port is provided for driving the USM-3 transmit converter. Housed in a metal box with BNC connectors.

Power amplifiers

Pauldon (kit, $165): 18W out for 1W in.

Down East Microwave 2318PAM ($205): 18W out for 1W in. Also available in kit form.

SSB Electronic PA 2310 ($250): 10W out for 0.5W in (a 20W out version is $300).

Antennas

Although loop yagis are commonly used at 1.2 GHz ($89 kit, $109 assembled for the 45-element loop yagi from Down East Microwave), a better choice for linking would probably be the Tonna 23-element yagi (about $70).

Other Considerations (applies to all bands)

The receive converters have very broad front ends, and some additional bandpass filtering will often be needed. A single cavity (or helical resonator frontend filter, in the case of separate receive converters) should do the trick in most cases. There is also a design available for a homebrew 28-30 MHz bandpass filter for the modem front end. This might eliminate the need for a front-end filter, but it depends on your receiving environment.

56 kbps Summary

The cost of a 56 kbps station is a bit hard to pin down, given all the variables. As an example, we'll consider a station for the Ottawa 56kb LAN. The modem kit and a PI board will set you back about $370. The rest depends on the choice of rf stuff. The total will vary from about $500 to $800. The "low road" is using the Hamtronics kits and scrounging up things such as boxes for them and the modem, homebrewing the antennas, etc. The "high road" is buying higher-quality assembled and tested gear, such as the Sinclabs transverter and the MM receive converter. If you can find some good used gear, the total should be closer to $650. Getting on 56 kbps is certainly a more challenging project than plug 'n play 9600, but the rewards are greater too.

Sources

Down East Microwave
RR 1, Box 2310
Troy, ME 04987
207-948-3741 Fax: 948-5157

DRSI (Digtal Radio Systems Inc)
2065 Range Road
Clearwater, FL 34625
813-461-0204 Fax: 447-4369

Gracilis Inc
623 Palace Street
Aurora, IL
708-801-8800 Fax: 844-0183
Email: info@gracilis.com

GRAPES Inc.
P.O. Box 871
Alpharetta, GA 30239-0871
Email: dug@kd4nc.atl.ga.us

Kantronics
1202 E. 23rd Street
Lawrence, KS 66046
913-842-7745 Fax: 842-2021
BBS: 842-4678

Maple Leaf Communications
(Bob Morton, VE3BFM)
R.R. 1
Everett, ON, Canada L0M 1J0
705-435-0689

MFJ Enterprises Inc
PO Box 494
Mississippi State, MS 39762
Order: 800-647-1800
Technical info: 800-647-8324
Fax: 601-323-6551

Ottawa Amateur Radio Club
Packet Working Group
P.O. Box 8873
Ottawa, ON, Canada K1G 3J2
Email: bm@hydra.carleton.ca

PacComm Packet Radio Systems Inc
4413 N. Hesperides Street
Tampa, FL 33614-7618
813-874-2980 Fax: 872-8696

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NOSintro Availablilty

Jim Chesner N9GBH

CAPRA - the Chicago Area Packet Radio Association has arranged to obtain a supply of Ian Wade, G3NRW's new TCP/IP primer: "NOSintro." Reviews of this book have been quite good.

This 356 page book is a hands-on tutorial with documentation regarding TCP/IP and NOS software version of this international standard as implemented for use with amateur packet radio operations.

An earlier posting listed all of the 35 chapters of the book which outline the basics and more advanced topics of TCP/IP; there are 6 Appendices with additional reference materials and information. The book has over 80 detailed diagrams with "countless examples of commands and screen displays."

We expect to receive the books and mail them prior to the end of March, 1993. In the event that this is not possible due to unforseen circumstances, we will notify you if we expect delays beyond April 15, 1993.

The books will be shipped via U.S. Postal Service's 2nd Day Priority Mail service upon receipt here in suburban Chicago.

Ian Wade, the author, has given us a discount for our quantity purchase. The cost to you will be $22.50 which is slightly under the total cost which you would have were ordering directly from the publisher in the U.K. *(Editor's note: This is cheaper than the ARRL price.)*

This is NOT a money making undertaking on the part of our group. Many of us are active on TCP/IP and feel that this is a way to increase the awareness of and technical expertise of others who may be interested in or who are currently using the protocol in amateur radio circles.

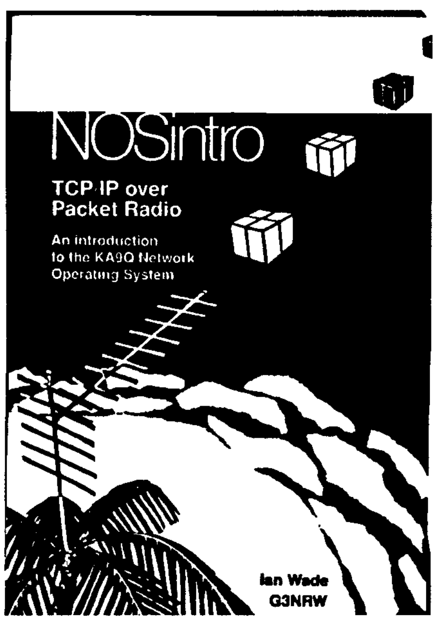
Send your complete mailing address, a telephone number at which you can be reached should there be a problem, and a check/money order made out to CAPRA in the amount of $22.50. Mail it to:

CAPRA
Post Office Box 8251
Rolling Meadows, Illinois 60008

Please: no requests for information, orders, etc., via amateur packet radio resources.

73 de Jim, N9GBH
CAPRA - Vice President
jchesner@holonet.net
70040.125@compuserve.com
(708) 253-0046

EOF



What's Inside

1 Intro to NOSintro
2 NOSview
3 The Ground Rules
4 NOS in a Nutshell
5 Let's Meet the Locals
6 The TNC Revisited
7 A Peek at Protocols
8 Names, Domains and Addresses
9 Client/Server
10 Hands On - Hardware Checkout
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12 NOS File Compendium
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14 The NOS Command Set
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16 The ftpusers File
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18 NOS BBS - The Big Picture
19 Setting up the NOS BBS
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23 Forwarding SMTP Mail
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26 AX.25 Routing
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28 IP Routing
29 NET/ROM Routing
30 Going Live: Preparing the Files
31 Hands On - AX.25
32 Hands On - NET/ROM
33 Hands On - Ping and Hop
34 Hands On - DNS System
35 Trailing Flag

Appendices
1 Where to get the Software
2 NOS Command Set Reference
3 NOS Control Files
4 Character Codes
5 IP Address Coordinators
6 References

- 356 pages, copiously illustrated with over 80 detailed diagrams.
- Examples of commands and screen displays.
- Full listings of all the control files needed for NOS.
- Specifically written for DOS, but applicable to Amiga, Atari, Mac, Unix, VMS and Archimedes implementations of NOS.

Thoughts about the Inter-BBS Link between Oregon and San Francisco

Robert S. Leonard KD6DG

The link between the San Francisco Bay Area and South-Central Oregon needs an upgrade. The following paragraphs describe the present state of affairs -- as I see them -- and then outline a plan for improvement. I consider this outline as a starting point for discussions to develop a plan that can be implemented. This scheme would initially serve to strengthen the system by providing alternative routes, but will have the possibility to be extended and up-graded to form a central California backbone.

Background

The present route starts north from Kregor Peak in the Bay Area via St. John Mountain to the Redding BBS. From Redding it goes to Hatchet Mtn. northeast of Redding, to Hamaker Mtn. on the California-Oregon border, and to Klamath Falls, Oregon, where traffic enters the Oregon network.

The segment between Kregor Peak and St. John Mtn. went down in Jan. 1992 and has been irregularly up and down since. The site on St. John Mtn. is quite remote and can only be serviced in the summer because snow prevents access in the winter.

The segment between Hatchet Mtn. and Hamaker Mtn. seems to have a history of marginal performance. At one time it was operating on 440 MHz and was so unsatisfactory it was changed to the 220 MHz band. A brief analysis of the path shows that it is not line-of-site. That is, there are mountains in the way of a direct path. Propagation is probably via a scatter path off the side of Mt. Shasta which lies somewhat off to the west of the direct path and is clearly visible from both sites. Added to this, the equipment on Hamaker Mtn. was removed late in the fall of 1992; the packet group in Klamath Falls is currently trying to arrange for equipment to re-establish this site.

Despite the negatives described above, these routes have provided many years of service. While I am proposing alternate routes, I believe that the present routes should remain and be improved, if possible, to introduce some redundancy into the network to provide enhanced reliability.

Improvement Plan

In looking for alternate routes for the BBS forwarding network, I considered the following points: unobstructed paths; year round accessibility; interconnectivity of nodes to provide routes around failed links; and a path structure that could be easily up-graded to provide enhanced performance. Therefore, I made an effort to plan the entire system to operate in the 400 MHz band where wider bandwidth channels are possible.

New Route Layout

The conceptual layout of the new sites was based on a study of maps and calculations of propagation paths, NOT on availability or visits to confirm their suitability. The following specific sites named are therefore only examples to be used in discussion of the overall concepts.

The new route in this conceptual layout would roughly follow Interstate 5. It would start at a node in the Oregon network southwest of Ashland, Oregon, on Soda Mtn. and run down Shasta Valley to Mt. Bradley, near Dunsmuir. The next node would be on Round Mtn, southwest of Red Bluff; this node would feed Redding and connect to the next node on Wolf Mtn., near Grass Valley. A final link would connect Wolf Mtn. to Kregor Peak.

The following is a plan to implement the new routes in several stages as resources become available. The initial phase would be done without regard to any hidden transmitter problems and would provide a complete alternate path between Kregor and Redding. It requires putting simple nodes on Wolf Mtn and Round Mtn operating on 443.41 MHz and a port on the Redding BBS on 443.41 MHz.

The first upgrade would be to solve the hidden transmitter problem by moving the Wolf-to-Round Mtn link to another frequency. This could be done by going to another band or by using another frequency in the 400 MHz band offset at least 5 MHZ from 443.41 MHz with suitable filters. The Wolf-Kregor link could stay on the present St. John-Kregor frequency of 443.41 MHz as all three sites are in clear view of each other. The Redding- Round Mtn link should probably be moved slightly to avoid occasional interference -- say to 443.45 MHz (the frequency of the old Hatchet to Hamaker link). The Redding-Hatchet path could also be moved to this frequency to fix the hidden transmitter problem in the Redding-Hatchet-Hamaker triad.

The second upgrade would add a site on Bradley operating on 443.45 MHz to Round Mtn and 223.48 MHz to Soda. This would cause a hidden transmitter problem on 223.48 MHz.

The third upgrade would replace the 223.48 MHz Bradley-Soda link with another 400 MHz band frequency offset from 443.45 MHz by roughly 5 MHz to solve the hidden transmitter problem.

This initial configuration and three upgrades would provide a much more robust network with two interconnected routes to each BBS. The new routes would all be in the 400 MHz band, but the entire network would still only operate at 1200 baud.

Future upgrades

A recent article by John Ackerman, AG9V, described a 19.2kB network that was built in Miami Valley, Ohio. The Ohio network uses Kantronics model D4-10 radios and G8BPQ node software with shorter links than those described above; fortunately, California has higher mountains on each side of the valley making the longer paths possible. Ackerman's most important criteria was to have unobstructed paths.

A major upgrade to the proposed Northern California network would be to make the route from Soda to Bradley to Round Mtn to Wolf Mtn to Kregor a 19.2 kB backbone with user feeds like the Round Mtn to Redding link. This system would have backup links via the existing network at whatever speed is available. With any future plan like this in mind, it is very important that any new equipment

Continued on page 12

President's Letter

Bob Arasmith, N0ARY
NCPA President

About 3 years ago, a non-ham friend of mine ask me what I thought about packet radio. My thoughtful response was probably something incoherent...

I was rather embarrassed to admit that I had no idea what he was talking about, especially since my career is designing computer hardware and software! Well, I decided that afternoon that I was going to at least start to figure out what this "packet stuff" was.

So, I went down to the local ham store, bought a TNC, rushed home, built a cable, and hooked it up to my radio and computer.

And then I thought: Now what?

It was clear that I was not going to become packet literate by throwing money at the problem, just buying equipment. So I spent the next 2 days searching for the right people to help get me started.

Fortunately, I was active in a repeater club and found an "Elmer" there to take me under his wing and teach me the basics of this stuff called "Packet Radio."

I am sure you have all had similar experiences when you first decided to venture into the digital realm. Sure, there was excellent information available, but to get to it required that you already be operating packet! (The basic chicken and the egg problem, I'd say!) Luckily, one day, I happened across an incredible newsletter at a local ham store: in fact, it was this very publication, our own Downlink! In its 20 pages were answers to most of my questions.

So, I see education as being my goal for the NCPA in the coming year. And it is a task that can engage all of us. It isn't just Larry's packet tutorials, the Pacificon talks, or even the Downlink. We need to each get involved in any way possible to further the hobby. Talk packet up at your club meetings, offer to help new guys setup their equipment, or give a demonstration of your station. Each of us is an expert in at least a portion of this hobby, so, please, share that knowledge!

As you become more involved, consider becoming more involved in the NCPA. We have meetings quarterly that are open to the public. They are called "Board Meetings" but don't let this fool you. If you have questions, complaints or just want to BS about packet you are more than welcome! Watch your local BBS for meeting notices. The next meeting is September 19th, and Pacificon will probably be the major topic. Hope to see you there!

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ARRL Digital Conference Announcement

Brian A. Lantz KO4KS

This year's Digital Conference (formerly the Computer Networking Conference) will be in Tampa Florida. The Conference will be hosted by the Tampa Local Area Network (TPALAN). The date of the Conference is September 11, 1993. The Conference will be held at the University of South Florida.

The deadline for conference papers has already passed.

For family members that AREN'T attending the Conference, the Museum of Science and Industry is adjacent to the University, Busch Gardens is only minutes away, and a major shopping district (with a large mall) is right there.

Well, there they are.... the sketchy and TENTATIVE details. Mark your calendars. If you have any questions, send me a note.

Hope you can come!

73 from Brian A. Lantz, TPALAN President
KO4KS@KO4KS.#TPAFL.FL.USA.NA
Internet: brianlantz@delphi.com
Ampmet: ko4ks@ko4ks.ampr.org

Thoughts about the Inter-BBS Link between Oregon and San Francisco

Continued from page 11

needed to build the initial configuration should be selected to be used in a future, more advanced, network.

Far-out ideas

It is interesting to speculate on future extensions of the 19.2kB backbone, such as from Kregor up the San Joaquin Valley to connect to southern California, to the satellite gateway stations, or over the Sierras to Reno.

Summary

I believe a plan like the one described here would improve the inter-BBS network running up the Central Valley of California between San Francisco and the Oregon border. Starting modestly and proceeding through a few upgrades, a complete, robust, low speed network could be effected. By exercising care in selecting equipments to implement the initial phase, the network could be upgraded readily to a 19.2kB backbone.

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LA/Chicago Wormhole

Donald Lemke WB9MJN

Hi, I helped set up the LA / Chicago wormhole, building the Chicago side RF link. At present, the RF link is a 1.2 gig 9600 baud radio channel, using No-Tune transverters, and DVR2-2s. Altho we started with back to back NETROM TNC 2 nodes, the configuration has changed. At present the WORM node (wb6wey-7) is running G8BPQ code, and has ports on the LA 6 meter backbone (4800 / K9NG), 2 meter Simi Valley Lan Channel, and a port for each of the three wormhole links (Chicago (Naperville, IL), St Louis, and New Jersey (Secaucus)).

Recently, the port to Naperville , IL was converted to a KISS link, over the commercial wire. The TNC2 NETROM at Naperville could not deal with the additional node load of the new NJ links. It would operate very slugisly, and stop working for many minutes at a time. So, we converted the TNC2 to a KISS TNC, and WB6WEY had its ports upgraded to use 16550 SIO chips. The Simi Valley, CA LAN port, and 6 meter / 4800 baud port were switched to KISS at WORM:WB6WEY-7, shortly after the improvement gained by switching to KISS was apparent. This change gives a few more years of service to our TNC2 based hardware in the Naperville office of the wormhole sponsor. We converted the TNC2 to 19.2 Kb on the Rs232 port, which goes thru the local statistical multiplexer, a 56 KB data wire, and the sponsors headquarters site statistical multiplexer, to get to the WORM node. Thru this arrangement, WORM can send packets right to the ILNAP:K9VXW-1 PacketTEN node, over 1.2 Ghz, at 9600 baud in Naperville, here.

We are using 1.2 Ghz because of the noisy office enviorment, and because 440 is used at K9VXW-1 site already. Using 440 would create a hidden station situation, and retard thruput. I beleive this is how the St Louis link is done , however, on 440/9600 with Kantronics D4-10s. The hidden station problem has been noted howerver, and they live with it.

An added advantage to the KISS changeover, is that someday with either newer G8BPQ or NOS software on the WORM site, we will be able to send IP packets right from K9VXW-1 to WB6WEY-7, without the need to gateway thru NETROM.

73, Don.
wb9mjn@wb9mjn.ampr.org
wb9mjn%wb9mjn.ampr.org@wb9us.bradley.edu
WB9MJN@N9HSI.IL.USA.NA

EOF

TCP/IP Questions and Answers

Larry Renslow, N6SLE
(a.k.a. "The TCP/IP Answer Man")

What is TCP/IP?

It's a protocol (a set of rules) governing communication between computers. That is, TCP/IP is a way of getting computers to talk to each other. TCP/IP is a somewhat more sophisticated protocol than the AX.25 protocol used in amateur radio's pbbs network. This means that TCP/IP will support a wider variety of activities than will the AX.25 protocol. Perhaps the most important feature of TCP/IP is that it's geared toward a peer network rather than the hierarchical network used by the pbbs system.

What is NOS?

NOS (or Net) is the TCP/IP based computer program written by KA9Q, Phil Karn. KA9Q's NOS and variants by PA0GRI, WG7J, and others, are the programs used to operate packet stations on the TCP/IP network, which is known as the Amateur Packet Radio Net, or AmprNet for short.

What is INTERNET and how does packet fit in?

Internet is a network of networks. More exactly, it's a landline network linking together thousands of government, commercial, and academic networks. AmprNet is part of all that; a part of the Internet. The IP addresses used in AmprNet are Internet addresses. (IP means Internet Protocol. The IP address is used throughout Internet for routing packets.) AmprNet access to the rest of Internet is through "gateways," stations set up to relay packets and messages between AmprNet and the rest of Internet.

Can all of the above interact with our pbbs network?

Some few AmprNet stations provide a message gateway between the pbbs network and the AmprNet. K3MC in Santa Clara is one.

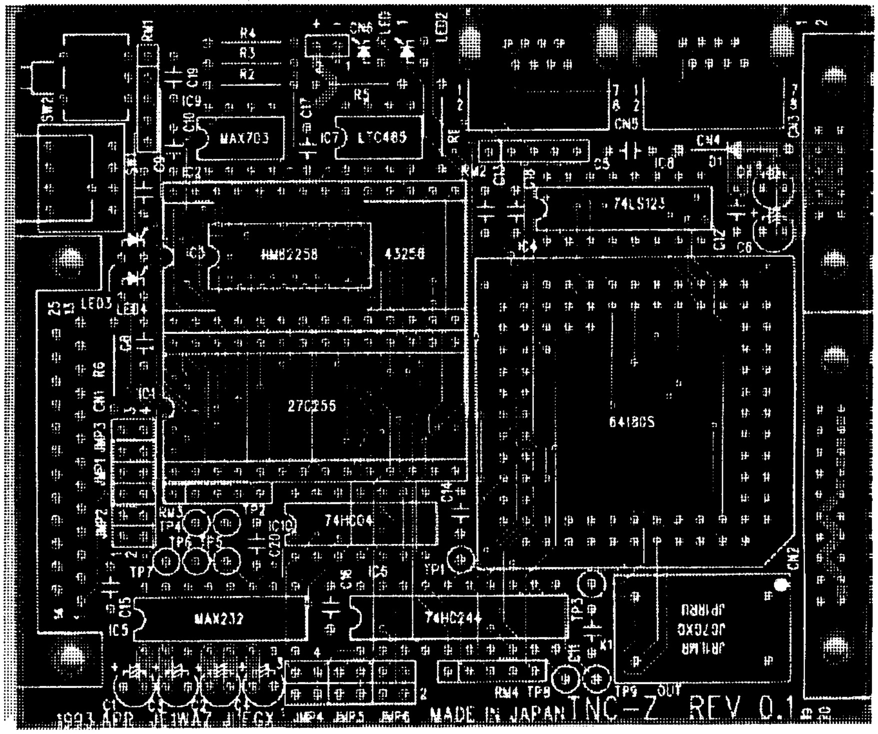
Is TCP/IP worth getting involved in?

You may like the all-stations-are-equal nature of AmprNet; all-stations-are-equal is what is meant by "peer network." You may like the links with Internet. You may like being part of the development of new technology. If you like doing for yourself, rather than having someone else provide services for you, you'll probably like AmprNet.

Next issue:
More about TCP/IP's peer network

Recent Packet Radio Advances in Japan

Ryuji Suzuki, JF7WEX.
Packet Radio User's Group, PRUG



TNC

We have a type of TNC named "TNC-Z", developed by Masaaki YONEZAWA (JE1WAZ), using HD64180S (Hitachi), dedicated to kiss-mode.

It can handle up to 2Mbps differntial Manchester symbol (and NRZ/NRZI) at radio port. Because it aims to be used for multi mode of radio, only a outer MODEM is available. *(Editor's Note: This TNC has been tested to 2 Mbps over a wire link so far.)*

PCB and diagram of TNC-Z have already distributed. Size of PCB is 4"x 3-3/8".

NOTE: Schematics and PCB Layout are provided in this issue! FSK

We have already experimented 64Kbps at 1200MHz for several times. At that time, a pair of IC-1200s are used for full-duplex. (It is hard to use the rig as both TX and RX concurrently.)

The modulation was done directly at the VCO of the TX-RIG, (Because of the PLL and not scrambling, we decided to use that approch) and a small external circuit, using MC-3356P(Motorola), which converts IF of IC-1200 (136MHz) down to 10.7MHz, filters it, and shapes the detected signal, then demodulates it.

The book "High-speed Packet TNC" which describes V.27ter, V.29, 64Kbps FSK, and already distributed PCB has been published with genny.or.jp, but, unfortunately, only a Japanese edition is available. The RF part was further improved to be an independent component, separate from the up-converter. The circuit and PCB, MC-2833P (Motorola) is the TX-part, the same 3356P added local oscillator (crystal controlled) and RF amp is the RX part.

This also includes PTT (RTS) control and a voltage regulator, developed by me. This RF PCB will be available soon. Size of this PCB is 4-3/4" x 3". No filter was used in the experiments because the digital filter did not arrive in time. Now, some prototypes have already built and evaluated.

All digital filters had developed by Shin'ichi KANNO, JN1JDZ. He is selecting from among them and turning it to practical use. Ordering its PCB is in progress. PSK (being planned out.) Some kinds of suitable chips, dedicated to demodulate QPSK, are supplied for consumer products. One kind is for NICAM, about 750Kbps. (728Kbps or 768Kbps??)

Another is for also PCM audio channels of satelite broadcasting, 2.048Mbps. I found chips supplied from Toshiba for each use, and from Micronas (Finnish company) for NICAM. The problem still lies in the modulating. I know some groups using looking-up EPROM and D/A, and of the existence of variously applicable chips, useful for this purpose, from RF Micro Devices. I think demodulator must be composed cheaply and simply, but the modulator must be constructed. In the case of using the RF-2802 or 2402, containing 90 degrees hybrid phase splitter and two balanced mixers, it is easy to do so. And the catalog says "Low Cost." I am interested in using them. Has anyone used them? How much did it cost? Protocol and software?

We are simultaneously reserching broadcasting-type protocol for scattering USENET compatible news, ampmet-JA, over radio.

Currently, the Terokoya system, used with TCP/IP, spreads USENET-compatible newsgroups via email messages all over Japan.

Flash!
More TNC-Z news from Japan

We got some new results of connection test for TNC and some computers.

MAC ---TNC-Z---------TNC-Z ------PC
38.4kbps 64kbps 9.6kbps

It works fine. FTP ok.

AT ------TNC-Z---------TNC-Z ----- AT
38.4kbps 64kbps 38.4kbps

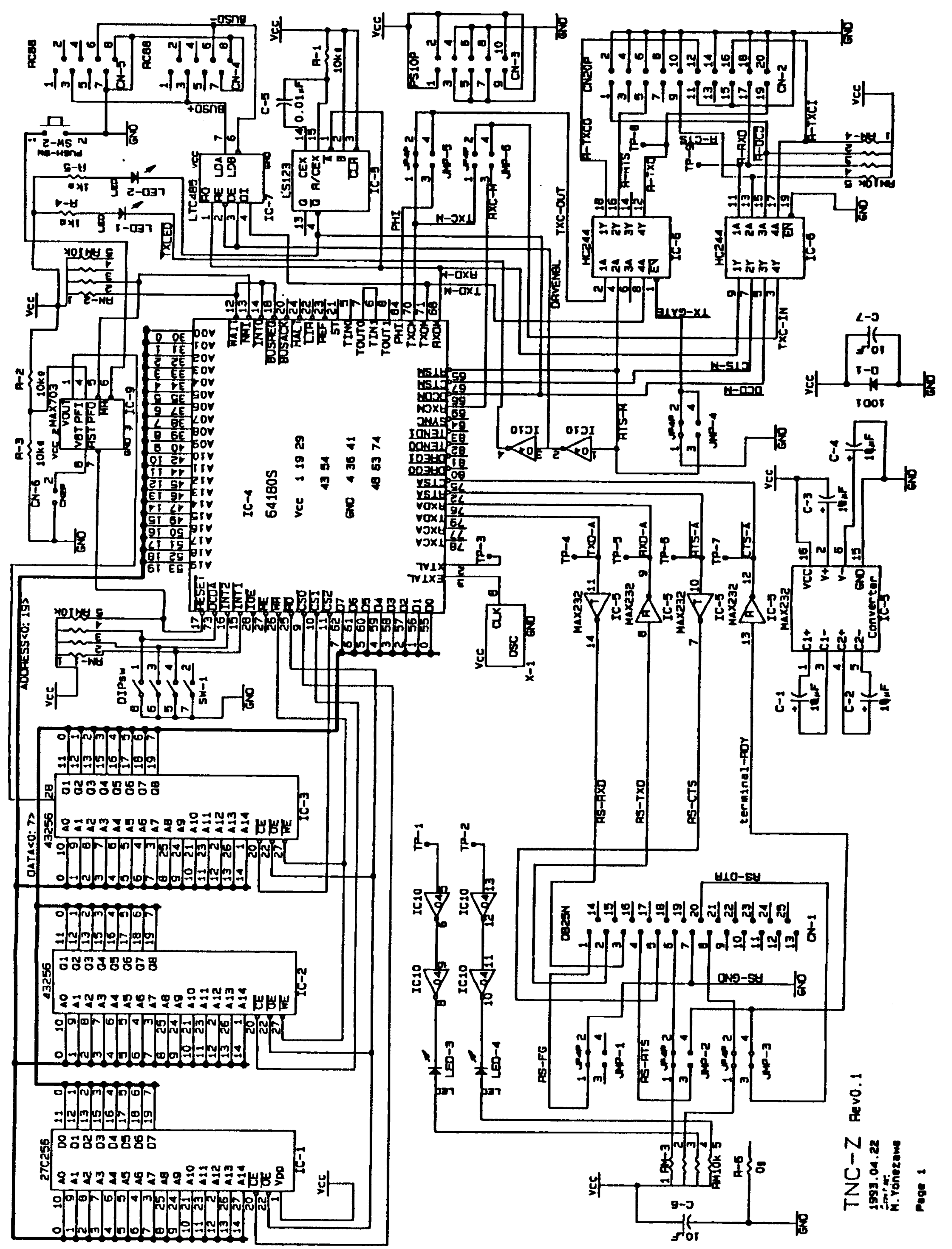
Works fine. FTP throughput is 2000chr/sec. (File size is 10kbyte.)

It competes [with] the finest analog telephone-line modem.

M.Yonezawa (Designer, TNC-Z)

(Editor's Note: The "64kbps" connection is the Japanese 64 kilobit/sec RF 1.2 GHz Modem.)

EOF


TNC-Z Rev0.1
1993.04.22
M.Yonezawa
Page 1
64180S
27C256
43256
MAX232
HC244
LTC485
LS123
MAX703
DB25N

Northern California Packet Band Plan

50 MHz

51.12	SOCAL backbone
51.14	Experimental
51.16	Keyboard to Keyboard
51.18	Experimental

144 MHz

144.91	Keyboard to Keyboard
144.93	LAN[1]
144.95	DX Cluster
144.97	LAN
144.99	LAN
145.01	Keyboard to Keyboard
145.03	Keyboard to Keyboard
145.05	Keyboard to Keyboard
145.07	LAN
145.09	LAN
145.71	9600 bps
145.73	LAN
145.75	TCP/IP
145.77	DX Cluster
145.79	LAN
146.58	DX Cluster

[1]Some TCP/IP in Sacramento grandfathered

220 MHz

223.54	Node uplink (East Bay)[1]
223.56	Node uplink (East Bay)
223.58	Node uplink ("Other")[2]
223.60	Node uplink (Sacramento Valley)
223.62	Node uplink (South Bay)
223.64	TCP/IP
223.66	Keyboard to Keyboard
223.68	LAN
223.70	Node uplink (Monterey Bay)
223.72	Node uplink (North Bay)
223.74	DX Backbone

[1]To move to .56 when SOCAL coordinates

[2]TCP/IP interlink (Sacramento) Not to interfere with node uplink.

440 MHz

441.50	All

Packet channels below 440MHz are available, but must be coordinated on a case-by-case basis as auxiliary allocations in conjunction with NARCC. Contact WD6CMU for details.

900 MHz

903.500	1 Mhz wide - TCP/IP
904.500	1 Mhz wide - TCP/IP
915.500	1 Mhz wide - Experimental
916.100	200 Khz Wide - Experimental
916.300	200 Khz Wide - Experimental
916.500	200 Khz Wide - Experimental
916.650	100 Khz Wide - Experimental
916.750	100 Khz Wide - Experimental
916.810	20 Khz Wide - Experimental
916.830	20 Khz Wide - Experimental
916.850	20 Khz Wide - Experimental
916.870	20 Khz Wide - Experimental
916.890	20 Khz Wide - Experimental
916.910	20 Khz Wide - Experimental
916.930	20 Khz Wide - Experimental
916.950	20 Khz Wide - Experimental
916.970	20 Khz Wide - Experimental
916.990	20 Khz Wide - BBS links (Contra Costa County only)

900 MHz activity is on a non-interference basis to vehicle locator service. 900 MHz is not considered suitable for omindirectional systems, use for point-to-point links only.

1296 MHz

1248.500	1 Mhz wide - Full duplex with 1299.500 Experimental
1249.000 to 1249.450	Unchannelized - Experimental
1249.500	100 Khz wide - Experimental
1249.600	100 Khz wide - Experimental
1249.700	100 Khz wide - Full duplex with 1299.700 Experimental
1249.800	100 Khz wide - Full duplex with 1299.800 Experimental
1249.870	20 Khz wide - Experimental
1249.890	20 Khz wide - Experimental
1249.910	20 Khz wide - Full duplex with 1299.910 Experimental
1249.930	20 Khz wide - Full duplex with 1299.930 Experimental
1249.950	20 Khz wide - Full duplex with 1299.950 Experimental
1249.970	20 Khz wide - Full duplex with 1299.970 Experimental
1249.990	20 Khz wide - Full duplex with 1299.990 Experimental
1250.500	1 Mhz wide - Experimental
1251.500	1 Mhz wide - Experimental
1297.000 to 1298.000	Unchannelized - Experimental
1298.500	1 Mhz wide - Full duplex with 1299.500
1299.000 to 1299.450	Unchannelized - Experimental
1299.500	100 Khz wide - Experimental
1299.600	100 Khz wide - Experimental
1299.700	100 Khz wide - Full duplex with 1249.700 Experimental
1299.800	100 Khz wide - Full duplex with 1249.800 Experimental
1299.870	20 Khz wide - Experimental
1299.890	20 Khz wide - DX Packet Cluster users
1299.910	20 Khz wide - Full duplex with 1249.910 Experimental
1299.930	20 Khz wide - Full duplex with 1249.930 Experimental
1299.950	20 Khz wide - Full duplex with 1249.950 Experimental
1299.970	20 Khz wide - Full duplex with 1249.970 Experimental
1299.990	20 Khz wide - Full duplex with 1249.990 Experimental

Northern California Packet Band Plan

Continued from previous page

Definitions

Experimental — Anything goes except full service BBS or any 24 Hr/Day services (nodes, gateways, etc). This is where you can come and test new gear, programs, etc. These channels may be reassigned in the near future so no permanent activities please.

Backbone, Uplink, Interlink — No uncoordinated stations. These channels are for specific purposes as defined by the NCPA and affiliated groups. This is where the various BBS, nodes, and clusters interlink and are very high usage channels. Please use the normal 2 meter entry points of the network you want to access rather than these channels.

Keyboard to Keyboard — Anything but full service BBS, TCP/IP, or DX Cluster. Primarily chat channels. These are also the primary emergency channels. Some existing BBS systems (eg. WA6RDH) were grandfathered.

A gray area is "Personal BBS." A PBBS is one with a small number of users (rule-of-thumb: five or less). A PBBS should not be attracting general users thru beacons, etc. Bulletins should be confined to local information and not duplicate the general bulletins send to the community. That's the job of a full service BBS and we have lots of them in Northern California to use.

LAN — Local Area Network. Anything except TCP/IP and DX Cluster is tolerated. Please avoid placing high level digipeaters or nodes on these channels since they are "local." A low-level node that links into a backbone on another frequency is the preferred implementation.

TCP/IP — Stations using TCP/IP protocol on top of AX.25. Some AX.25 tolerated to communicate to TCP/IP stations if p-persistance access method used.

DX Cluster — Northern California DX spotting network. No other activity should be on these channels.

9600 Bps — Stations using 9600 Bps with direct FSK (G3RUH, TAPR, etc.) modems.

Procedure for changes

Users should contact either the frequency coordinator or the NCPA board. The frequency coordinator will then present the requests to the board at the next meeting along with suggested assignments. The NCPA board elected by you, the packet user, makes all assignments!

Electronic mail is preferred.

Note: NCPA does not coordinate individual stations, nodes, etc. The only station coordination is done by KA6EYH for bulletin board systems.

Where to Find a BBS

N0ARY-1	Sunnyvale	144.93
KE6BX	Hollister	144.93
KJ6FY-1	Benicia	144.93
KI6YK	Danville	144.93
WD6CMU	Richmond	144.97
N6EEG	Berkeley	144.97
WA6EWV-1	S. Lake Tahoe	144.97
KD6JZZ-2	Sonora	144.97
K6LY	Monterey	144.97
N6LDL	Los Gatos	144.97, 145.71[1]
KI6WE	Pleasant Hill	144.97
KD6XZ-1	Sacramento	144.97, 441.50
AA4RE-1	Gilroy	144.99
W6SF	Stockton	144.99
KA6FUB	Martinez	144.99, 441.50
KE6LW-1	Yuba City	145.99, 441.50
W6PW-3	San Francisco	144.99
WA6RDH	Dixon	145.01, 441.50
KG6EE	Santa Cruz	145.07
KI6EH	Santa Cruz	145.07
KA6EYH	Pacifica	145.07
N6IIU-1	Palo Alto	145.07, 223.56
KM6PX	Carmichael	145.07, 441.50
N6ECP	Redding	145.09
KB6IRS	Soquel	145.09
N6IYA-2	Felton	145.09
K3MC	Fremont	145.75[2]
WA6NWE-1	North Highlands	145.09, 441.50, 144.93[2]
WA6YHJ-1	Livermore	145.09
WX3K	Rohnert Park	145.73
W8GEC	Boulder Creek	145.73
WA6HAM	Pittsburg	145.73
KA6JLT-2	Menlo Park	145.73, 145.71[1]
KC6PJW	Cotati	145.73
AA6QR	Orinda	145.73
KB6MER	San Jose	145.73
W6CUS-1	Richmond	145.79
N6MPW	Ben Lomond	144.79
N6QMY-1	Fremont	145.79, 441.50
K7WWA	Willits	145.79

[1] 9600 baud port
[2] TCP/IP port

NCXPN Meeting Minutes

Brad Watson, WA6AEO
NCXPN Coordinator

Items discussed at the August 7, 1993 NCXPN (Sysop) meeting at Lawrence Livermore Lab visitor's center:

WA6AEO : A little discussion about NCWP.

Resolution : NCWP is working well. It benefits our users, whether it be by querying NCWP, or having the information collected and disseminated to all of the BBSs. The NCWP will continue as it has.

KM6PX : Discussion of some sort of standardization of distribution designators. Maybe even the possibility of spear-heading a drive to standardize the rest of the USofA. This would include hierarchical designators.

Resolution : While it would be nice to have more standardization, it would be very difficult to attain any greater level than we have now. Since KM6PX was not at the meeting, this item was not discussed any further.

WB9LOZ : Clarification of what NCXPN is. It was originally supposed to encompass all AX.25 packet operations - BBSs, DXPSN, nodes, and TCP/IP - but has become just a meeting of BBSs sysops. Is NCXPN just a BBS sysop group now, or is this just a segment of it?

Resolution : NCXPN is primarily the organization representing Northern CA BBS Sysops and the nodes and network surrounding the Backbone and 220 LANs.

WA6AEO : SJV.

Resolution : Considerable discussion about what happened with the EBAY/SJV link. It was noted that EBAY and K6RAU were not able to agree technically on the configuration of the link. The Sonora BBS group were there, and there is some possibility that the central valley link will be restored through them in the future.

WA6AEO : New BBS Coordinator. "BBS Coordination Package".

Resolution : Roy KA6EYH will be taking over the BBS Coordinator position. He will be getting the materials for the position from K6RAU. The job will continue as before, with the "Coordination Package" being given out to new candidates by KA6EYH. He will begin in his new position very shortly, with the monthly BBS lists to resume soon.

KM6PX : What to do about ELAS @ ALLUS, ALL @ ALLUS (with a for sale in the title), etc. It won't be long before we're back in the same boat unless we take a stand and publish it. This one's gonna be difficult.

Resolution : The current policy of holding SALE@ALLUS, or @ALLUS with SALE in the subject stands. We have to do something to control the nonsense, this is the minimum. If the local Sysop wants, add ELAS@ALLUS and the like to the hold/reject list.

N6VZT : Limiting lengths when users do LIST commands. Or forcing pauses should help "share" channels more effectively.

Resolution : It is up to the local Sysop to limit this sort of thing so that his operation does not cause undue interference, and so that he is a "good neighbor".

WA6AEO : Status of State OES link to southern CA.

Resolution : Several things are happening. State OES is getting their satellite TCP/IP link to the south going, with help from the Sacramento ham TCP/IP people. There will be a way for Amateur traffic to use this link at some point, BBS messages included. It is a possibility that access to this link for our network will be beefed up, with State OES having direct connectivity rather than being indirectly connected to us. It is also possible that a LL type of link using a State satellite phone system can be used. All of these possibilities are being explored. It is expected it will be some time yet before any of this is ready for use.

WB9LOZ : Is the "5 days is old" policy for bulletins working out to be the right duration?

Resolution : During times of low bulletin numbers, 5 days may be a little short. However, when bulletins are heavy this seems to be a very good number. Policy will remain to hold/reject bulletins older than 5 days from their origination.

KM6PX : Does coordination of a digital freq. include increased baud rates on user ports? (In other words, can I run 2400 baud packet simultaneously with my 1200 baud on my VHF port without prior authorization?).

Resolution : Use of LAN channels for higher baud rates should be no problem, as long as DCD is activated and the appropriate transmission control protocols are observed. Here again, the important thing is to be a "good neighbor" on your frequency. If there is no interference to other users, it will be permitted by this group.

WA6AEO : 2M forwarding. Responses from N6IYA, AA4RE, and K3MC as discussed at the last meeting. Further discussion of NCXPN policy on this matter.

Resolution : No action will be taken at this time. This group recognizes that there are several instances of interference to users by 2M forwarding. The NCXPN considers this sort of interference unfortunate, and notes that we have been trying to get ALL forwarding off of 2M for years. WB9LOZ will contact AA4RE and attempt to alleviate interference to his users. We will hold our next meeting in San Jose, we hope that N6IYA and AA4RE will attend so that we can all discuss what's been happening and come to some consensus. This issue will be taken up again at that time.

WB9LOZ : Status of WA6HAM-10 430 node on Crystal Peak.

Resolution : The node is on the air, but is not being used. It continues to be available if any of the parties in the south bay would like to make use of it.

WB9LOZ : Status of full duplex 6 meter Central Coast link.

Resolution : Little to nothing is known of this.

WD6CMU : "Spoofing" other user's calls (a la KB2NYG) and what to do about it.

Resolution : This does not appear to be a big problem locally. Sysops should deal with it as they see fit.

WD6CMU : Plan to port N0ARY's BBS code to run on PCs. I am looking for possible beta test sites. Minimums for beta systems are a 386 processor, 4MB memory and about 40-60MB of hard disk, to be re-partitioned for use with the Linux operating system.

Resolution : If interested, contact WD6CMU @ WD6CMU. EOF

> Your home electrical system is basically a bunch of wires that bring electricity into your home and take if back out before it has a chance to kill you. This is called a "circuit." The most common home electrical problem is when the circuit is broken by a "circuit breaker"; this causes the electricity to back up in one of the wires until it bursts out of an outlet in the form of sparks, which can damage your carpet. The best way to avoid broken circuits is to change your fuses regularly.
>
> Another common problem is that the lights flicker. This sometimes means that your electrical system is inadequate, but more often it means that your home is possessed by demons, in which case you'll need to get a caulking gun and some caulking. If you're not sure whether your house is possessed, see "The Amityville Horror," a fine documentary film based on an actual book. Or call in a licensed electrician, who is trained to spot the signs of demonic possession, such as blood coming down the stairs, enormous cats on the dinette table, etc.
>
> — Dave Barry, "The Taming of the Screw"

NCPA Board Meeting Minutes

The NCPA Board of Directors meeting took place in Pleasant Hill on June 6, 1993. The meeting started at 10:10. Those attending:

WA6HAM, WA6AEO, AB6DI, KD6KDQ, KA6EYH, KD6BNG, N6SLE KA6FUB, WB6YRU, N0ARY, N6UNE, KE6LW, WA6ZTY, WB6QVU KC6ZKM, WA0YQM, N0DHS, N6FRI, W6QJM, WU7Q, N6QMY, WB9LOZ

1. Meeting was called to order by Larry (WB9LOZ).

2. Elections President: N0ARY Vice President: KA6EYH Treasurer: WA6HAM Secretary: KD6BLK Editor: K3MC Frequency Coordinator: WD6CMU

3. Backbone Brad (WA6AEO) is still working with Stan Harder on the OES proposal. We will continue to have redundent paths in any case.

4. Tresurers report Steve (WA6HAM) identified some problems with our current bank and account. He is working to resolve these and get the books back in order. Our current account has a service charge. Steve is going to look into getting this charge removed. The board also approved the purchase of a rubber stamp.

5. Board members There were 4 open spots on the board in addition to the elected board positions. These additional postions are to allow the board to appoint people to give a better representation of all the digital modes. The positions. These additional postions are to allow the board to appoint people to give a better representation of all the digital modes. The following individuals were added to the board:

W6RGG, DX spotting; WA6AEO, OES; KE6LW

6. Incorporation Larry (WB9LOZ) and Gary (WB6YRU) will investigate the advantages of an association as opposed to an incorporation.

7. Booklets Dave (W0RNL) is going to investigate getting our books published.

8. Bandplan Review WA6RDH will no longer have a listing in the bbs section of our bandplan. Dennis (WA6RDH) is no longer accepting new users.

223.40 is used in southern CA and should not be used here.

Eric (WD6CMU) and Bob (N6FRI) will be reviewing the 1.2Ghz bandplan to make sure the current allocations make sense. They will also be working on cleaning up the 430 bandplan as well.

9. Membership meeting Bob (N0ARY) presented some complaints from attendies of the general membership meeting. It was suggested that we have a program as part of the meeting rather than the business format we now have. We will work on this for next year.

10. Pacificon Larry (WB9LOZ) is pulling together speakers and programs for Pacificon. We have time slots reserved.

The next board meeting was scheduled for Sept 19, 1993 at 10:00.

EOF

NCPA Directors

Eric Williams, WD6CMU
WD6CMU@WD6CMU
510-237-9909

Larry Kenney, WB9LOZ
WB9LOZ @ W6PW
415-821-2666

Bob Arasmith, N0ARY
N0ARY@N0ARY
408-749-0501

Bob Vallio, W6RGG
W6RGG@N6QMY
510-537-6704

George Fisk, K6TAM
K6TAM @ KI6EH
408-722-2060

Lawrence Renslow, N6SLE
N6SLE @ KI6YK
510-846-1947

Barry Barnes, KE6LW
KE6LW @ KE6LW
916-673-3282

Chris Musselman, AB6DI
AB6DI @ N0ARY
510-581-2981

Caroline Guay, KD6KQW
KD6KQW @ N6EEG
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Brad Watson, WA6AEO
WA6AEO@WA6AEO
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NCPA General Meeting Minutes

NCPA General Membership meeting 5/8/93 The meetings was called to order by Eric, WD6CMU, at 12:22. It was held at the Sunnyvale Public Safety building.

Eric, WD6CMU, explained the charter of the NCPA and described the elected positions.

The archiving of the Downlink at ucsd.edu was discussed. Apparently the last issues have not been getting to the archives.

The following people were elected to the NCPA board for the coming year: WD6CMU, N0ARY, WB9LOZ, K6TAM, AB6DI, N6SLE, KD6KQW

Next years plans - 1) get the "Intro to packet" and "TCP/IP" books published. The current problem is in getting them printed at a resonable cost.

2) frequency coordination of the lower 430 band.

Nationwide band plan - N6HM brought up the idea of trying to establish a nationwide bandplan to aid those that travel into other areas of the country. WD6CMU indicated that this would be very difficult to accompish. Each area has it's own needs and frequecies set aside for those needs.

219 band plan - There has been much talk about the amateur community getting back the 219-220 band for digital use. To date no coordination efforts have started.

Board member terms - WA6ZTY suggested that board terms be 2 years and be staggered. This would have to be a by-law change and to date hasn't been a problem. This will be discussed at the board meeting.

High speed packet - KC6AND discussed his plans for a 2mb data link operating in the 10Ghz band. He is targeting 4 to 5 months to have a functioning system. Estimated costs of a station would be about $1000 (radio,ant,pc).

Thanks to Howard, N6HM, and Lynn Brown of Sunnyvale Public Safety for the meeting facilities.

EOF

NCPA Officers

President:
Bob Arasmith, N0ARY
N0ARY @ N0ARY

Vice-President:
Bob Wysling, KA6EYH
KA6EYH @ KA6EYH

Secretary:
Lisa Smith, KD6BLK
KD6BLK @ N0ARY

Treasurer:
Steve Overacker, WA6HAM
WA6HAM @ WA6HAM

Newsletter Editor:
Mike Chepponis, K3MC
K3MC @ K3MC

Frequency Coordinator:
Eric Williams, WD6CMU
WD6CMU @ WD6CMU

What is NCPA?

NCPA, the Northern California Packet Association, is an organization formed to foster the Digital Communications modes of Amateur Radio. So far, we have defined our goals as:

- Education
- Coordination

Education means making information available about various Digital modes, and this newsletter is but one part of that education process.

Coordination activities include frequency coordination (NCPA is recognized by NARCC as the official packet radio frequency coordinator) as well as coordinating people and their various uses of packet radio, be they DX Cluster, BBS, TCP/IP, keyboard-to-keyboard, NET/ROM, Traffic/NTS, Emergency uses of packet, or even experimenting with new frontiers of various digital modes.

We in NCPA believe that the next revolution in Ham Radio will come about in Digital Communications Technology, and in the beneficial coordination among all users of ham Digital Communications Technologies.

We invite you to join NCPA! Become part of the most dynamic group of packet folks in Northern California!

NCPA *Downlink*

Northern California Packet Association
PO Box 61716
Sunnyvale, CA 94088-1761 Downlink

First Class Mail