Whetting your feet with JNOS…

By John Martin KF8KK 6/12/06
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Some Background…

While JNOS has been accurately described as the 'swiss army knife' of packet radio, it's roots are not quite so feature laden and the background design and operation of JNOS has evolved from a heritage borne of Unix hounds (some would say hackers) of the earliest days of the internet (back in the Arpanet/Darpanet days).

For those familiar with command line Unix, JNOS is a piece of cake. The rest of us may have trouble making full use of this 'swiss army knife' and settle for just a few of the possible uses that JNOS can be used for.

Thankfully, there's a guy in Winnipeg Canada, Maiko Langelaar, VE4KLM who is currently bringing the software up to date, fixing bugs, and adding features. His website is: http://www.langelaar.net/projects/JNOS2. Maiko is adding some Ginsu knife features, to transform JNOS into the packet version of a Leatherman tool.

For most of the packet networking tools, it's sad that 'software maintenance' is rare or has ceased. The brightest minds who developed our packet networking infrastructure during the 1980's have gone onto other things. We are very fortunate to have current progress in the world of JNOS, thanks to Maiko.

JNOS is based on the 'Network Operating System' [NOS] written by KA9Q back in the late 80's. This is the time when IBM8088 XT computers were all the rage, the Commodore VIC-20 and C64 were popular, etc.

At that time, if you wanted to network your [IBM] PC you had to buy expensive networking software. The original KA9Q 'NOS' (some referred to it as 'net') was revolutionary in that for the first time hams could experiment with using the burgeoning internet protocols of TCP/IP and UDP/IP over packet radio. The fact that the software would also act as a gateway to an Ethernet LAN was missed by most hams at the time since very few had the rare and expensive networking cards for their computers (A 3com netcard might command near $500 back then).

In the early days, all of the NOS derivatives (this includes KA9Q, and the later JNOS, XNOS, MFNOS, TNOS, etc) were written exclusively to run on DOS PC's. This meant they were limited in program size to fit within the 640k memory limitations imposed on all DOS run programs. Thankfully, JNOS has been ported over to run on Linux and avail itself of the more modern RAM available, and make use of commonly available networking devices.

The program was mostly written before the days of the graphical user interface, where anyone who used a computer was familiar with entering command line text commands. The authors of the 'nos-es' were particularly familiar with unix commands, since the internet was almost universally accessed using computers running various versions of the Unix operating system. This carries forth into the JNOS that we use today, and is mostly responsible for why it seems rather cryptic by our current standards.

What does JNOS bring to the table?

JNOS can be viewed as primarily a network and protocol gateway device with a 'bbs style' mailbox and mail forwarding capability. JNOS also provides functionality as both a file server, a Telnet gateway, and a linkable conference server.

Network/Protocol Gateway…

JNOS can communicate via multiple paths if desired. You can install as many TNC's as you can physically wire into your PC. You can also install multiple Ethernet network cards, and multiple modems if your needs require this.

JNOS can communicate via these ports using not only regular AX.25 packet protocol, but it can use the internet/Ethernet TCP/IP (and UDP/IP) protocols. JNOS is not limited to just those protocols. JNOS can communicate using the NetRom 'ISO Layer 3' protocol, PPP (point-to-point protocol), and SLIP (serial line interface protocol). Sadly, they left out IPX/SPX (Novell Netware), Appletalk, and Arcnet--- but, perhaps it's just as well.

The ability to speak in these different protocols makes the system most useful in the EmComm arena as it allows us to utilize the high speed internet where available, and the slower speed RF packet systems where needed.

Through JNOS and TheNet X1J nodes, actual TCP/IP packets can be transmitted across the ham radio RF and easily pass through a JNOS gateway to the internet. While the use of TCP/IP over the radio is currently a rarity, the ability to do so opens up another potential avenue we can use to assist the served agencies. The TCP/IP over RF that I am talking about is just the same TCP/IP that's on the internet, or in a typical LAN. The only difference is the speed.

JNOS BBS Mailbox

JNOS was not written from the start to be a full featured BBS like Msys or FBB, so when you compare it's BBS features it comes up a tad short.

On the other hand, JNOS does provide basic mail handling and forwarding. Of course, like the other BBS systems, the system operator has to manually setup the forwarding configuration for forwarding to occur. Few JNOS operators currently in Michigan (if any) have setup forwarding on their system. This is likely to change as more JNOS hamgates come on line.

JNOS makes it easy to send email to local users, or to anyone over the internet. Simply put the persons callsign, or an internet email address after the 'S' in the send message command and JNOS will act accordingly.

Recently, a feature was added to JNOS (still under development) that allows for the JNOS BBS to send and receive emails via the Winlink2000 system. This shows great promise as being a real boon to JNOS users as currently they cannot receive email replies from the internet. Nearly all JNOS system operators disable inbound email due to the avalanche of spam that quickly appears if they open up their server for that. Internet email via Winlink2000 is likely to be the future of JNOS internet email, at least for inbound email (outbound can still go whichever way it can). **[We can do both in NYC – N2NOV]**

JNOS stores messages in 'areas'. Each user has an area assigned to their callsign. The system operator can create special areas of the BBS to store messages pertaining to specialized topics. By way of these 'areas', the JNOS BBS can be used to store pertinent information in a manner that can be logically sorted and retrieved by users without having to wade through every message on the system.

JNOS as a file server..

JNOS also allows for users to download and upload files to the hard drive of the server. This can be done via commands within the BBS, or via regular internet FTP via the TCP/IP protocol from either the internet, or stations running TCP/IP over RF.

The JNOS FTP server has the same functionality of most other commonly used FTP servers.

The only caveat in using the JNOS server for downloading/uploading files is that if used via the RF, the time it takes to transfer a file at 1200 baud can be daunting unless the file is rather small.

The file server method of storing information on the JNOS server is an alternate to storing the information as messages in one of the sectioned 'areas' of the BBS.

JNOS as a Telnet Gateway

The JNOS BBS also allows the user to gateway through the internet using the TELNET command to remotely log onto other systems, ham radio or otherwise.

For those of us not familiar with Telnet, it's an internet protocol which allows you to log into a remote computer and get their command prompt. For most JNOS users, this allows you to log into another JNOS system in some other area and get access to that systems commands and RF ports just as if it was your local system.

It is via this Telnet mode that a user can easily setup a wormhole on demand to RF packet across the state, nation, or even internationally. A station can connect to their local JNOS node via RF, Telnet to a distant JNOS hamgate and then connect out on RF from there. Once the connection is made, their traffic will pass just like any other packet connection.

The JNOS Converse 'chat room' server…

On systems configured for the Converse mode, users can enter into any of thousands of multi-user 'chat rooms'. These provide text chat much like the common messenger programs popular on the internet currently. JNOS allows you to connect these converse rooms together with those on other JNOS systems. This networking of converse servers can make the converse mode extremely useful during an event, allowing not just for communications locally, but for regional and state authorities to monitor the traffic and communicate when necessary.

In Michigan, we have standardized the 'channel' numbers (chat rooms are called channels in JNOS) to correspond with the Michigan county numbers. 45 being Leelanau county.
[14736 in NYC – N2NOV]

By standardizing the numbers, if an event were to happen in Leelanau and the state EOC wanted to join in the local converse traffic of the event, they would know to go to 'channel 45'.

JNOS as a NetRom node…

NetRom and TheNet (X1J) are what's called 'ISO Level 3 network nodes', and are operationally identical (so much so, the company that authored NetRom alleges copyright infringement by the freeware TheNet authors). I will use the term 'NetRom', but only for simplification, as 'TheNet' operates synonymously.

The term ISO Level 3 is covered in APPENDIX A and is beyond the scope of this presentation. Why you would want to install a NetRom node (and how) is in APPENDIX B.

NetRom nodes broadcast the list of nodes that they hear. These 'node broadcasts' are heard by the other nodes and automatically routing tables are built by the nodes.

In an area with multiple NetRom nodes, each node will present the user with the nodes that are available by any of the NetRom nodes in the area.

The user does not have to know anything about how his data gets to any of the nodes, the routing is done automatically by NetRom and often traverses numerous nodes and gateways along the way.

> *An example would be the occasional appearance of the SSM (VE3SSM in Sault St Marie) node in the 145.07 node broadcasts of BEN11 (wl0OK-7 in Empire). A user can connect to the BEN11 node and then issue the 'C SSM' command and eventually find themselves connected to the VE3SSM station in the Soo.*

> *The amazing thing that the user would be unaware of is the path their packet took to get to the Soo. BEN11 would connect via the serial port on it's TNC to the BEN12 node which would then transmit the packet on 433.125mhz to the KKBBS JNOS node, which would then gateway the packet out on 145.09 to VE3SSM! Yes, this does work, I've verified it— but there must be band enhancement for SSM to reach Empire.*

NetRoms ability to provide automatic packet routing enables the system to provide much needed assistance to users who would otherwise have difficulty in setting up a long or complicated route.

Theoretically, there is a way to configure a JNOS hamgate to share NetRom routes with another JNOS system via a tunnel across the internet. I have not verified this, as outside of D7W (northwest lower MI) the configuration of NetRom by JNOS system operators is not yet a common reality. In time, this functionality may become real, and then simple commands to a NetRom or JNOS node could connect you to packet anywhere across the state, using RF when available, and Internet when not. I hope this is not a vaporware feature, as it could be handy.

JNOS Extras…
In addition to the commonly used features of JNOS above are the following (which may or may not be configured on your local JNOS hamgate):

SMTP server….
This is the very same SMTP server that you'll recall when you setup your internet email. Microsoft Outlook or Outlook Express, or similar internet email client programs can connect up to a JNOS server for the sending of email. As long as you have a TCP/IP path from your computer to the JNOS server (either via the LAN or RF) you can send you email via JNOS.

POP3 server…
Similar to the SMTP server, the POP3 server will work just fine with your Microsoft Outlook email client for your retrieval of mail from JNOS. Just like with SMTP, if you have a TCP/IP path to the JNOS machine, you can retrieve your email or packet mail for viewing in Outlook or any other internet email software.

Web server… (yea… plain old http!—view with your web browser)
JNOS can be setup to serve up web pages! While JNOS does not provide the capabilities to run CGI scripts, it can serve up pages via the LAN, Internet or even RF to be viewed on your regular web browser.

Proxy server…
JNOS hamgates can be setup as proxy servers, routing TCP/IP packets destined for one port to another.

NNTP News Server or Reader
You can serve up newsgroups to your area with your JNOS hamgate, or download newsgroups and have them appear in your BBS as an 'area' so that local users can view the messages.

APRS Igate…
The latest versions of JNOS (JNOS2 by VE4KLM) contain a mode where the JNOS hamgate can be setup to gateway APRS data to and from the internet.

This mode can have some interesting possible implementations dealing with possibly a gateway from the regular packet side of JNOS to and from the 'text mode' available to APRS users. Since this mode is new, useful applications for it are still as yet developing. (possibly allowing a regular packet equipped EOC to communicate to search and rescue APRS stations without having to switch over to the APRS channel directly).

Conclusion…

JNOS is a very useful tool in packet networking. Sadly, it's **not** a simple system to install and can test the knowledge and patience of even third echelon IT professionals. Once properly configured, it is easy to see how it has garnered the 'Swiss Army Knife' moniker, making it well worth the effort to setup.

Finally, when it comes to hooking up the TNC to the radio, please visit http://www.febo.com/packet/layer-one/ for some useful advice on setting up the audio for the best reliability and packet connectivity.

Our Statewide Digital Radio Group website is at:
http://www.mi-drg.org/ with plenty of information available to view.

I've been keeping some packet ramblings that might be useful at:
http://www.legitimate.org/iook/packet/

Thanks and 73

John Martin KF8KK

APPENDIX A:

ISO/OSI LAYERS and what they mean to you and me.

The International Standards Organization, a group of really smart people, decided to define a 'STACK' of 'LAYERS' that would describe a very flexible system for computer networking and call it the 'Open Systems Interconnection'. [If you've ever heard reference to a 'TCP/IP stack'--- this is it!]

These layers allow data to traverse a computer network in such a way that computer networking software was modularized, allowing for sections of the standards to change without having to toss out the whole system. Being the rapid pace of networking advances over the past 30 years, this model has served us all very well. Software authors can concentrate on the special needs of one portion of the overall ultimate networked system, without having to reinvent everything with each new software product produced, or whenever a bug is fixed.

LAYER 1 ---- Physical

This is the physical network card and wires in your wired Ethernet LAN. It's the radio and RF path in your wifi LAN. It's also your packet TNC, radio and RF path in ham packet radio. Layer 1 deals with such things as the 'MAC address' of your network card (that's the unique factory-coded address of each individual networking device). For hams, Layer 1 is where your ham callsign is inserted into the system. For those watching TCP/IP in action, Layer 1 information appears in the ARP (Address Resolution Protocol) tables. ARP tables correlate specific network devices (be they network cards, wifi transceivers, or individual hams) to Layer 2 or 3 addresses.

LAYER 2 ---- Data Link Level

This is where we first start to see packets of data. Your standard packet radio, AX.25 connection is considered 'layer 2' by the gurus (layer 1 being the physical gear associated with your callsign).

LAYER 3 ---- NETWORK level

This is where the IP in TCP/IP comes in. It's also where NetRom packets reside (NetRom packets reside atop layer 2 AX.25 packets). It is here where routing from one machine (or 'node' if you think of each device on a network as a 'node') to another is performed. The common 'IP address' (192.168.1.1, etc) resides at this level.

LAYER 4 --- TRANSPORT level

This is where the TCP or UDP in TCP/IP comes in. [similarly the IPX in IPX/SPX for those familiar with Novell Netware networking]. TCP and UDP bring at their level items called 'ports'. Anyone who has gone through the hazing of setting up Echolink through a router has seen 'ports'. TCP port 5200, and UDP ports 5199 and 5198 need to be passed along to the particular computer running Echolink.

You can look at these 'ports' as if they were a socket panel on the side of your computer with special sockets with unique pin configurations for each different type of program your computer runs. A socket with two vertical pins would connect to the email receiving program. A socket with three horizontal pins would connect to your web browser. A socket with sixteen oval pins (that's socket 5200) is meant to connect to Echolink.

LAYER 5 --- SESSION level

This level is setup so that if you have four web browser windows open at the same time, the data from each particular web page can go to the desired browser window. It's like having an automatic 'cube tap' available on that socket panel mentioned above in layer 4. Of course, you can have multiple sessions for any of the sockets.

LAYER 6 --- PRESENTATION level
This is the actual data as it is piped into the back side of your actual software.

LAYER 7 --- APPLICATION level
This is the program that generates or receives the data. It's 'Internet Explorer' or 'Outlook'. It's also the mailbox/bbs in JNOS, or the 'Yahoo Messenger' program.

> The way to look at it is much like what happens when you place your hand written letter **(layer 7)** into an envelope **(layer 6)**, then place that envelope in the mailbox **(layer 5)**, then the postman takes that letter and puts it into a big bin at the local post office **(layer 4)**. The letter then goes to a regional mail processing plant **(layer 3)** and gets routed across the country via a USPS TRUCK **(layer 2)**. The truck travels across the Interstate Highway System **(layer 1)** and then reaches the regional mail processing plant near the destination **(layer 3)** and then continues back UP through the layers on the other side.

Useful links:

http://en.wikipedia.org/wiki/OSI_model

http://www.uwsg.iu.edu/usail/network/nfs/network_layers.html

http://www.uwsg.iu.edu/usail/network/nfs/network_layers.html

APPENDIX B: NETROM/THENET the how and why to bother.

The why…
Just like a Kantronics KA node, a NetRom node will provide the packet connection with the more reliable 'hop by hop acknowledgements' as opposed to the 'end to end acknowledgements' that's used when using the 'digipeater' mode in creating a long distance packet connection.

While the documentation for recent Kantronics TNC's describe a means to setup their KA nodes to use the Kantronics 'K-net' mode, which purports to provide node broadcasts that are similar to and compatible with NetRom, I have not personally seen any KA nodes setup in this manner. Hopefully, this functionality can be verified and simple instructions on how to enable it made available to our group. If this mode is NOT in reality what the manual eludes it to be (and we've all come across vaporware at one time or another), then NetRom with it's automatic routing features would be a dramatic improvement over the Knet/KAnode systems.

Even with Knet functioning as it should (with NetRom interoperability and automatic routing) the ability of a TheNet X1J (NetRom) node to route TCP/IP radio traffic through the node is a feature that could prove invaluable as our packet network evolves.

With TCP/IP being routed through the node, it is then possible for users and JNOS hamgates to make use of RF paths to route certain forms of data that would otherwise be limited to the internet side.

Of course, at present, the use of TCP/IP over RF packet is almost nonexistent. The future, however, may be different as software development for TCP/IP applications is quite active these days. How important this functionality is in a particular area will vary.

The how…
The most popular way to setup a NetRom node is really to setup a TheNet X1J node, which is the freeware functional equivalent. I'm not certain if you could still purchase a Software2000 created NetRom eprom.

TheNet (and NetRom) are pieces of software that are placed onto an eprom chip by an eprom 'burner' and then placed into a 'TAPR TNC-2 or similar' TNC in place of the factory eprom program chip.

There are a couple of small wire jumpers that need to be added to the TNC along with the chip swap. The modification is not difficult for someone used to working with the innards of electronic gear, but it would be a daunting task for someone without experience on the technical side.

The TNC's that are commonly used for making a TheNet node are:
PacComm Tiny2 (currently available for sale by PacComm)
MFJ 1270 / 1270B / 1270C / 1274
TAPR TNC2
AEA PK96
PacComm Spirit2

TheNet information can be had at the following websites:
http://www.vectorbd.com/bfd/thenet/index.html
http://www.packetradio.com/packetnodes.html
http://www.legitimate.org/iook/packet/JNOS/thenet-ops-1.htm