

Amateur Radio and Linux

Software Homebrewing is Here

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ABSTRACT

This paper is an introduction to Linux, a 32 bit, multi-tasking, multi-user, computer operating system. The paper emphasizes uses of Linux in amateur radio communication and software development. Included is a brief history and description of Linux, a list of amateur radio applications, and numerous sources for further investigation for readers wishing to implement Linux.

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INTRODUCTION

“Do you pine for the nice days of Minix-1.1, when men were men and wrote their own device drivers? Are you without a nice project and just dying to cut your teeth on an OS you can try to modify for your needs? Are you finding it frustrating when everything works on Minix? No more all-nighters to get a nifty program working? Then this post might be just for you?”

With that simple introduction on October 5, 1991, Linus Torvalds, a Finnish graduate student, announced to the world version 0.02 of Linux on the USENET newsgroup **comp.os.minix**. Linux is pronounced Lean-nucks, based on the Finnish pronunciation of Linus. Linux is a perfect platform for software development for amateur radio. It offers a plethora of freely distributed high quality software and a knowledgeable and helpful community of people (very much like the amateur radio community) ready, willing, and able to help; kind of like a ham’s “Elmer.” Although the original idea for Linux must go to Linus Torvalds, the kernel and copious other software are the result of an international collaboration of dedicated people.

No doubt the gamut of readers of this article range from those who use Linux on a daily basis at work and/or home, to those who have never heard of it. For those who fall into the latter category, Linux is a 32 bit, multi-tasking, multi-user, freely distributed UNIX-like operating system. Technically, Linux is only the kernel or core of the operating system, however, in general it represents all the software that normally comes with a complete distribution. Platforms upon which Linux runs include: DEC Alpha, Commodore AMIGA, Sun Sparc, MIPS, Atari ST, and Apple Macintosh. However, without a doubt, the 386, 486, and Pentium based systems are the most popular. Linux is not copyrighted and there is no AT&T code included (UNIX was born at AT&T). Linux is licensed under the Free Software Foundation’s General Public License which specifies, among other things, that the source code must be freely available. It is the inclusion of the source code that is perhaps most unique. If you ever wondered how an operating system, network, compiler, assembler, or editor works, it is all there for you to study and modify to your heart’s content.

There was a time when most amateur radio operators built all or part of their amateur radio station. I have built my share of transmitters, electronic keyers, RTTY widgets, antennas and more. The desire to build was based on the thrill of learning and building. In fact, I remember taking months to build a nifty gadget for the shack, using it for a week to see if it worked, and then returning to think of something else to build. I believe most of the amateur radio community feels the same way. However, homebrewing now includes software, and for that development, Linux is the perfect platform.

WHO IS IT FOR?

At the PACIFICON conference Bruce Perens, AB6YM, said “There’s a saying that marketing people have about programmers: ‘leave a programmer alone, and he’ll come up with the kind of product that only a programmer could love’. That’s what Unix is, and Linux too. Actually, other kinds of propeller-heads such as hardware designers, mathematicians, etc., have been known to be comfortable with Unix and Linux. But, why use an operating system that only a nerd could love? Well, you want them to write more software, don’t you? Unix and Linux are the most comfortable platforms for the development of sophisticated software that

communicates, controls hardware, does complicated math ... what I'm trying to say is that it's the best platform for developing the kinds of software that radio amateurs need."

Who is Linux for? Not for everyone is the simple answer. Linux and UNIX are industrial grade operating systems. They both support a wide variety of GUIs (Graphical User Interfaces), but they are predominately a CLI (Command Line Interface). They are powerful, but with power and flexibility comes some complexity. Matt Welsh begins his book (see references) with, "Before you looms one of the most complex and utterly intimidating systems ever written. Linux, the free UNIX clone for the personal computer, produced by a mishmash team of UNIX gurus, hackers, and the occasional loon. The system itself reflects this complex heritage, and although the development of Linux may appear to be a disorganized volunteer effort, the system is powerful, fast, and free. It is a true 32-bit operating system solution."

If Matt's introduction has not scared you, then a more humorous test to see if you are ready for Linux is included in Table 1. Since you probably already have the hardware, a personal computer, and Linux is free, you have nothing to loose and a whole lot to gain. UNIX and Linux experience on a resume never hurt anyone!

WHAT'S AVAILABLE

Just about everything you can imagine for serious software development is available for Linux. But that is only part of the story. The fact that it all comes with source code and the enthusiastic support of authors and users worldwide means you can probably get an answer to your question within hours, and that includes 3 AM. Much of the documentation for Linux comes from the Linux Documentation Project (LDP) in the form of HOWTOs. These documents typically range from 10-50 pages and provide in-depth information on a particular subject. There are currently 50+ HOWTOs to aid the user with Ethernet, XFree86, sound, video, networking, and more. For the amateur radio community, there are two in particular, a HAM and AX.25 HOWTO. Table 2 is based on the HAM HOWTO and includes a summary of the software available for amateur radio. This document and other HOWTOs can be obtained from <http://sunsite.unc.edu/mdw/HOWTO> and other mirror sites.

However, the purpose of this paper and Linux is not to get you started assembling a computer system based completely on applications that you can download. The purpose and subtitle of the article reflects my desire to inform the amateur radio community of an operating system (OS) that is the experimenter's dream. Here is your chance to learn C, C++, Perl, awk, Smalltalk, Tcl/Tk, Fortran, Python, shell scripts, networking, real-time systems, and more. It is a chance to put together a TCP/IP packet network that cannot be duplicated on any other platform. The reason for this is that the packet radio protocol is now built right into the kernel. Linux is the only operating system in the world that can boast standard and native support for amateur radio protocols. In fact, packet radio uses the same interface as the Internet. Therefore any program which you use on the Internet can also be used as a packet radio program. For example, your favorite Internet programs such as: Netscape, Mosaic, telnet, and ftp will work and not care, or know, that the medium they are using is packet radio.

GETTING STARTED

Table 3 shows the hardware for a comfortable system upon which to install Linux. I want to emphasize the word comfortable, since you can get away with a lot less, especially hard

drive space. However, most readers are not going to give up DOS or Windows 3.x right away, (this might eventually happen, however), therefore you will want to make a partition on the hard disk for your DOS environment and another for Linux. One of the great benefits of Linux is that you don't have to give up anything you currently use. If you fear that Linux means leaving your current OS behind, fear not, Linux offers emulations for DOS, SVR3 Unix, SVR4 Unix, Macintosh and even older computers such as the Apple II and Commodore 64. For those of you who like GUIs, Linux has many to choose from. There are several versions of X Windows to choose from including: twm, fvwm, and others. X Windows is a very powerful interface which allows great configuration flexibility.

Regarding file formats, as you survey the various distributions you will come across the terms "a.out" and "ELF" (Executable and Linking Format). Both are binary formats, the former being used for many years but now falling into disuse due to the advantages of ELF. The Linux community currently supports both formats during the current transition period. All of the distributions listed in Table 4 support ELF.

During the installation of Linux you will be asked questions about your system's hardware configuration. Chances are you are using standard port assignments and addresses and the installation will go smoothly, but you should have your documentation handy just in case. For example, you might need to know your serial and parallel port's I/O memory locations, and the IRQ (interrupt) addresses for devices (e.g., serial ports, sound cards, SCSI ports, video card, etc.). If you are not sure, most of the scripts have a default value to suggest, in most cases you can't go too far astray sticking to the defaults in lieu of first hand knowledge. Unless you have done something strange with your hardware configuration, the defaults should work fine.

Although I said that everything for Linux is free and can be downloaded from the Internet, I would not advise that for anyone, including a UNIX guru. A small Linux installation can consist of a thousand or more files easily consuming 50+ MB of space. A complete installation which includes source code, copious documentation, computer languages and examples, and the X Window system can easily take up much more (e.g. 500+ MB). For this reason downloading is not practical. Fortunately, there are many CD-ROM publishers that include a complete distribution of Linux along with excellent installation software.

There is a lot more to Linux than the kernel. There are editors, compilers, linkers, assemblers, and utilities to name a few. In fact, in most distributions you will get several of each. For example, I have at least 6 different editors, although I use only one (emacs). For this reason it is not unusual for a distribution to consist of 2 or 3 CD-ROMs. In fact, Matt Welsh's book (see references), can be purchased separately or with a 5 CD-ROM Linux distribution. The prices for all of the distributions are reasonable and well worth it.

Another reason for using CD-ROMs is to take advantage of the "installation scripts" that accompany the distributions, some of which provide a graphical user interface. These installation scripts will walk you through the installation process asking you questions about your system. Don't worry that you will be shielded from knowing exactly what is going on during the installation, there will be plenty of time for you to explore Linux later.

Another source for information is your local bookstore. Go to the computer section and chances are you will be surprised at the number of books devoted to Linux. I counted over a dozen during a recent visit, and there are many more that can help you during installation, configuration, networking, and more.

Last, and certainly not least, the World Wide Web is a great source of information. I have included a list of key web sites to visit in the references. Of particular interest to amateur radio operators is Bruce Peren's **Linux for Hams** homepage shown in Figure 1.

CONCLUSION

Most every amateur radio operator has been asked, "What is amateur radio?" There are a variety of answers and none are incorrect. For me, amateur radio is the thrill and excitement of experimentation, both software and hardware.

If you need to write a letter, do your taxes, develop a spreadsheet, there are computer systems that do that, and do it very well. They give you the power to be your best and concentrate on the task at hand. For software development however, you can't beat Linux. Where else can you get the complete source code for a C++ compiler, an operating system, and the support of hundreds of thousands of users worldwide?

REFERENCES

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6. Welsh, Matt, "Linux Installation and Getting Started," Specialized Systems Consultants, Seattle, WA, 1994, ISBN 0-916151-77-8.
7. Yggdrasil Computing, "The Linux Bible," Yggdrasil Computing Incorporated, San Jose, CA, 1995, ISBN 1-883601-10-X.
8. Linux newsgroups:
 - comp.os.linux
 - comp.os.linux.advocacy
 - comp.os.linux.announce
 - comp.os.linux.answers
 - comp.os.linux.development
 - comp.os.linux.development.apps
 - comp.os.linux.development.system
 - comp.os.linux.hardware
 - comp.os.linux.m68k
 - comp.os.linux.misc
 - comp.os.linux.networking
 - comp.os.linux.setup
 - comp.os.linux.x
9. Linux general information web sites:
 - <http://sunsite.unc.edu/mdw/linux.html>
 - http://www.redhat.com/lg/gazette_toc.html
 - <http://www.geog.ubc.ca/sparclinux.html>
10. Linux and amateur radio web sites:
 - <http://www.rahul.net/perens/LinuxForHams/>
 - <http://sunsite.unc.edu/mdw/HOWTO/HAM-HOWTO.html>
 - <http://www.Hams.com/perens/HamRadio/LinuxAndAmateurRadio.html>
 - <http://www.inx.de/~wahlm/>
 - <http://hppool0.rz.hu-berlin.de/~h0187akk/>
 - <http://www.qualcomm.com/~rparry/xnet.html>

Ten ways to tell if Linux is for you:

1. you don't own "DOS for DUMMIES"
2. you don't hate typing
3. you don't mind reading manuals
4. you don't like going to bed before midnight
5. you don't own "Internet for Idiots"
6. you do like learning
7. you do like challenges
8. you do like to build
9. you do like to experiment
10. you can stop the VCR from blinking 12:00

TABLE 1

A humorous checklist to aid you in making the decision to use Linux. However, like all humor, there is always an element of truth.

- Packet Radio
 - JNOS
 - TNOS
 - NOARY Packet BBS for UN*X
 - LBBS - Linux BBS message gateway
 - MBL/RLI message to NNTP and email converter.
 - Packet Cluster Node software
 - Single floppy disk AX.25 router.
 - DPTNT Terminal and BBS package.
 - IPIP encapsulation daemon.
 - AXIP encapsulation daemon.
 - Ping-Pong Convers Server
 - RSPF Daemon
 - Michael Westfall's TTYLINK Daemon
 - Craig Small's TTYLINK Daemon
- Morse Code
 - GW4PTS Morse trainer.
 - morse (aka superiormorse)
- AMTOR Software
- PACTOR Software
- Slow Scan Television Software
- Facsimile Software
- Design and Construction Software
 - Software Oscilloscope
 - Printed Circuit Board design tool
 - Chipmunk circuit design and simulation tool
 - irsim
 - Spice vers. 3f4
 - svgafft - Spectrum Analyser
 - Audio Spectrum Analyser
 - ObjectProDSP
- Training/Educational Software
- Miscellaneous Software
 - Linux for HAMS CD-ROM
 - SunClock
 - Xearth

TABLE 2

Here is a partial list of amateur radio Linux software taken from the HAM HOWTO documentation written by Terry Dawson, VK2KTJ. The entire HOWTO is available at: <http://sunsite.unc.edu/mdw/HOWTO/HAM-HOWTO.html>.

- 386 machine or better
- 8MB RAM (more is better)
- 250MB hard drive (SCSI, IDE, etc.)
- Floppy Drive (1.44 MB High Density)
- CD-ROM (any speed, SCSI, IDE, etc.)
- Video card supported by Linux
- Mouse (3 button type preferred)

TABLE 3

Linux runs on many platforms, however, for most hams the platform of choice is the PC. Shown here is a good hardware configuration for Linux software development.

Debian	http://www.debian.org	n/a
Craftworks	http://www.craftwork.com	\$89.95
Linux Universe	http://www.springer-ny.com/samples/linux/linux.html	\$34.95
Red Hat	http://www.redhat.com	\$49.95
Slackware	http://www.cdrom.com/titles/slackware.html	\$39.95
Yggdrasil	http://www.yggdrasil.com	\$39.95

TABLE 4

Shown here is a list of popular Linux distributions. Although you can download everything on these CD-ROMs for free from the Internet, using a CD-ROM for installation is preferred. The time saved is well worth the price.

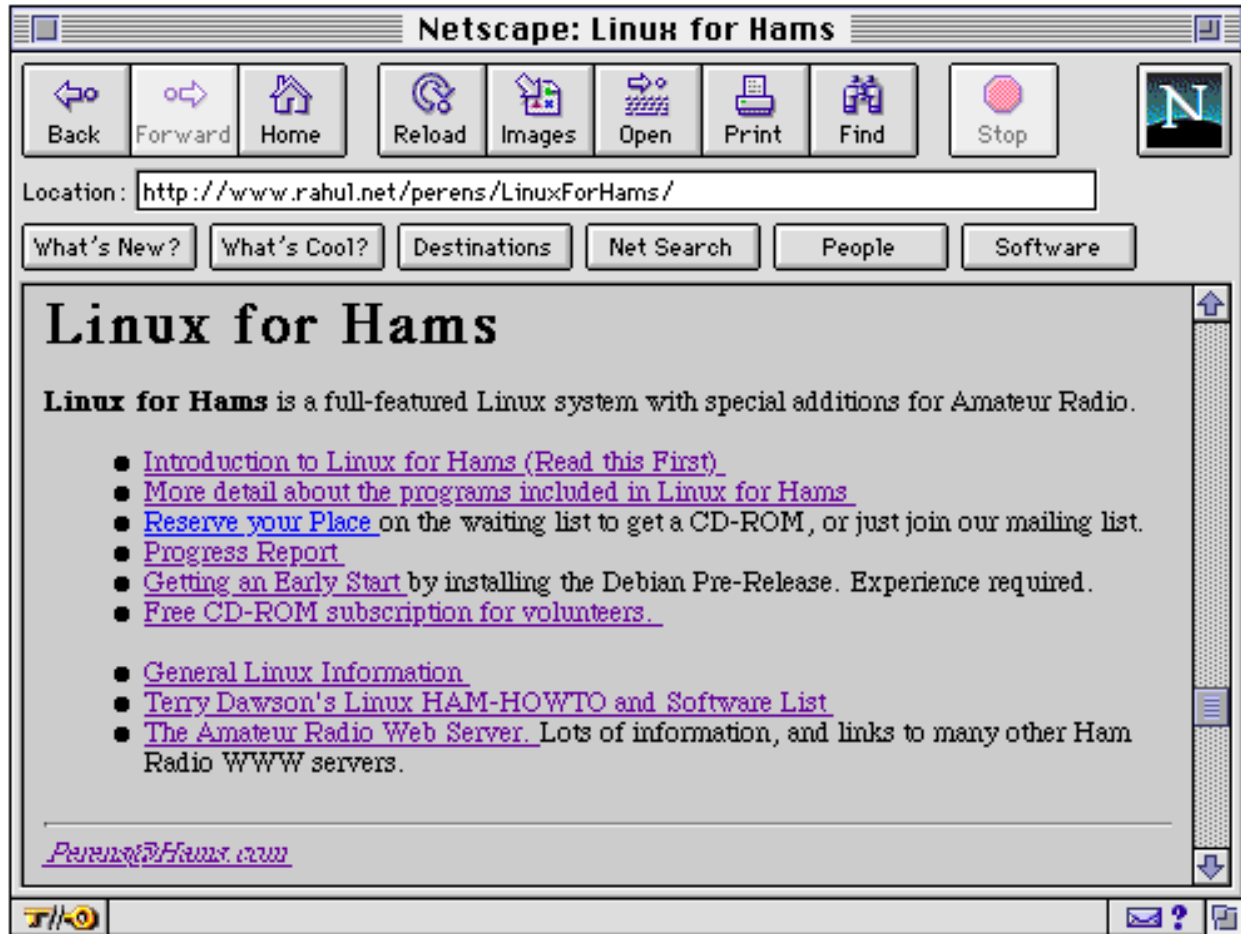
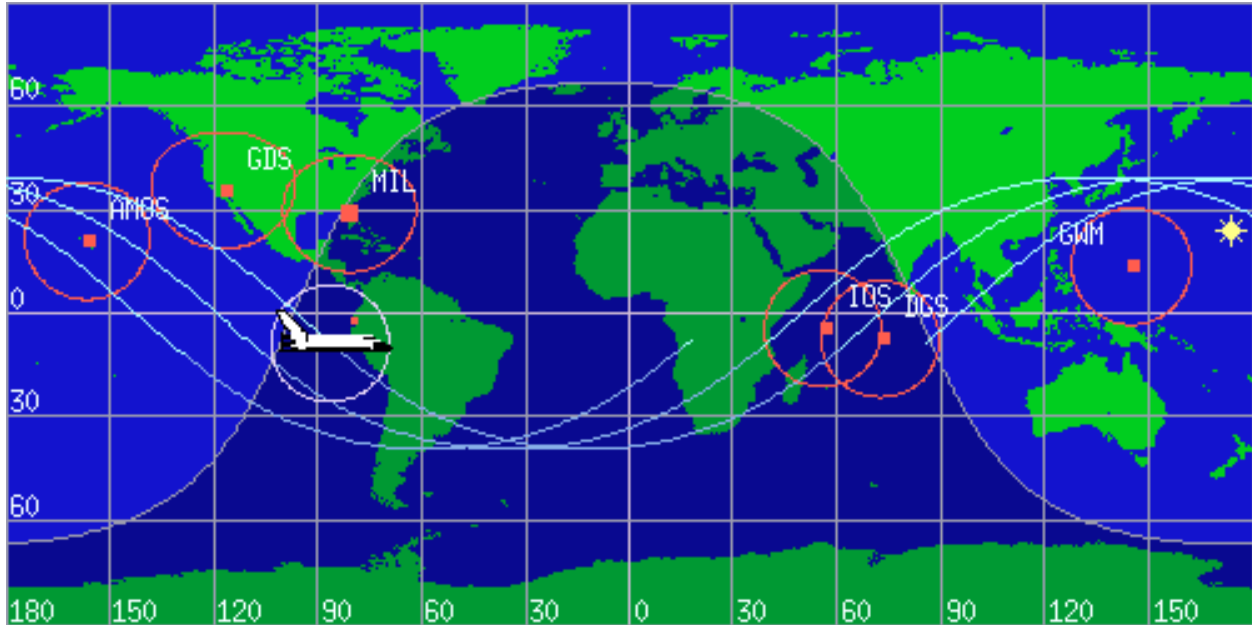


FIGURE 1

This is the Linux for Hams homepage maintained by Bruce Perens, AB6YM. There you will find information on application programs specifically for Linux and amateur radio. Links include the Linux HAM-HOWTO written by Terry Dawson, VK2KTJ. A CD-ROM is currently being developed that will include a Linux distribution along with amateur radio programs. There is even a link to *Elmers*, a volunteer who is prepared to aid you in getting setup. The URL for this page is: <http://www.rahul.net/perens/LinuxForHams/>.

**FIGURE 2**

Shown here is one of the SatTrack windows written by Manfred Bester, DL5KR. SatTrack is a satellite orbit prediction and real-time tracking program with X Window System color graphics displays. It has been written in the C language and runs on UNIX and Linux systems, using only basic X11 and X11 Toolkit functions for the graphics displays. The program not only displays in real-time where a number of satellites are, but is also capable of controlling suitable ground station equipment, like antennas or optical telescopes, radio communications hardware or other sensors. An autotrack mode can track any number of satellites and switches automatically between them as they rise and set. Predictions of passes of satellites over specified ground stations can be run off either interactively or in batch mode. The page is located at: <http://www.primenet.com/~bester/bts.html>.

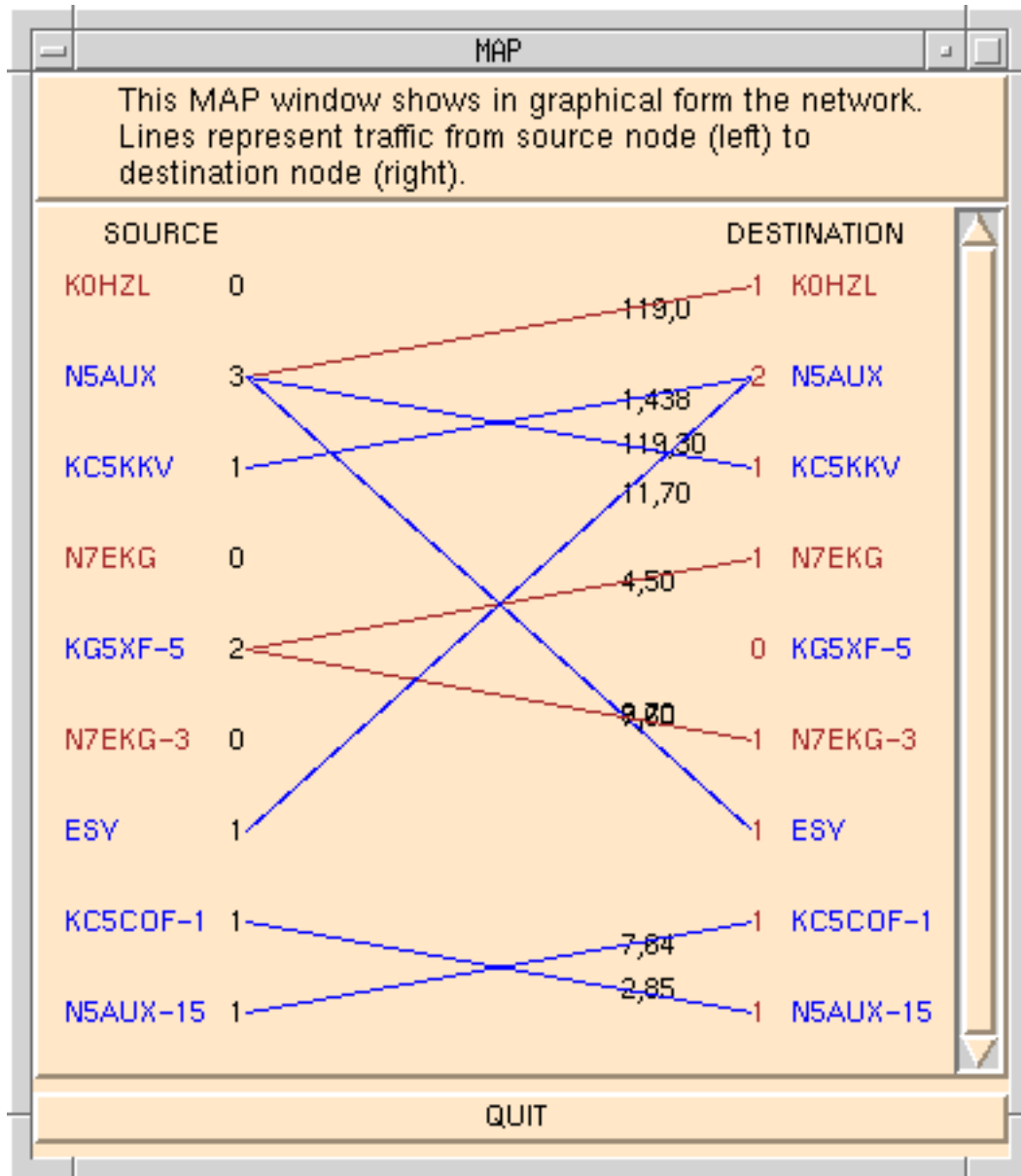


FIGURE 3

XNET, written by Richard Parry, W9IF, is a network analyzer designed specifically to monitor AX.25 packet radio networks. It will collect and display network data allowing the user to understand network traffic and channel utilization. XNET was written in Tcl/Tk and provides many features that are useful to both the casual packet user and the packet radio BBS sysop wishing to better understand the network. The XNET home page is: <http://www.qualcomm.com/~rparry/xnet.html>.