Linux Information Sheet

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This document provides basic information about the Linux operating system, including an explanation of Linux, a list of features, some requirements, and some resources.

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1 Introduction to Linux

Linux is a completely free reimplementation of the POSIX spec, with SYSV and BSD extensions (which means it looks like Unix, but does not come from the same source code base), which is available in both source code and binary form. It is copyrighted by Linus B. Torvalds (torvalds@kruuna.helsinki.fi) and other contributors, and is freely redistributable under the terms of the GNU Public License.

Linux is **not** public domain, nor is it 'shareware'. It is 'free' software, commonly called **freeware**, and you may give copies away, but you must also give the source with it or make it available in the same way. If you redistribute any modifications, you are legally bound to distribute the source for those modifications. See the GNU Public License for details. A copy is included with the Linux source, or you can get a copy via ftp from prep.ai.mit.edu in /pub/gnu/COPYING

Linux is still free as of version 1.0, and will continue to be. Because of the nature of the GNU copyright which Linux is subject to, it would be illegal for it to be made not free. Note carefully: it is perfectly legal to charge money for distributing Linux, so long as you also distribute the source code. This is a generalization; if you want the fine points, read the GPL.

Linux runs only on 386/486/Pentium machines with an ISA or EISA bus. MCA (IBM's proprietary bus) is not currently supported because there is little available documentation, although some patches are available for a few machines. VLB and PCI local busses are both supported, and the driver for the NCR SCSI chip that is used in many PCI machines is included in the latest development versions, and will be in Linux 1.2

There is a port in progress for multiple Motorola 680x0 platforms (currently running on some Amigas and Ataris), which now works quite well. It requires a 68020 with an MMU, a 68030, or a 68040, and also requires an FPU.

Ports to other machines, including ALPHA, MIPS, PowerPC, and PowerMAC, are under way and showing various amounts of progress. Don't hold your breath, but if you are interested and able to contribute, you may well find other developers who wish to work with you.

Linux is no longer considered to be in beta testing, as version 1.0 was released on March 14, 1994. There are still bugs in the system, and new bugs will creep up and be fixed as time goes on. Because Linux follows the "open development model", all new versions will be released to the public, whether or not they are considered "production quality". However, in order to help people tell whether they are getting a stable version or not, the following scheme has been implemented: Versions 1.x.y, where x is an even number, are stable versions, and only bug fixes will be applied as y is incremented. So from version 1.0.2 to 1.0.3, there were only bug fixes, and no new features. Versions 1.x.y, where x is an odd number, are beta-quality releases for developers only, and may be unstable and may crash, and are having new features added to them all the time.

From time to time, as the currect development kernel stabilizes, it will be frozen as the new "stable" kernel, and developement will continue on a new development version of the kernel.

Most versions of Linux, beta or not, are quite stable, and you can keep using those if they do what you need and you don't want to be on the bleeding edge. One site had a computer running version 0.97 patchlevel 1 (dating from the summer of 1992) for over 136 days without an error or crash. (It would have been longer if the backhoe operator hadn't mistaken a main power transformer for a dumpster...)

One thing to be aware of is that Linux is developed using an open and distributed model, instead of a closed and centralized model like much other software. This means that the current development version is always public (with up to a week or two's delay) so that anybody can use it. The result is that whenever a version with new functionality is released, it almost always contains bugs, but it also results in a very rapid development so that the bugs are found and corrected quickly, often in hours, as many people work to fix them.

In contrast, the closed and centralized model means that there is only one person or team working on the project, and they only release software that they think is working well. Often this leads to long intervals between releases, long waiting for bug fixes, and slower development. Of course, the latest release of such software to the public is often of higher quality, but the development speed is generally much slower.

As of November 12, 1994, the current stable version of Linux is 1.0.9, and the development version was 1.1.62 the last time I heard. Linux 1.2.0 is nearing release; 1.1.62 is part of a code freeze series of releases intended to shake out bugs.

2 Linux Features

- multitasking: several programs running at once.
- multiuser: several users on the same machine at once (and NO two-user licenses!).
- runs in 386 protected mode.
- has memory protection between processes, so that one program can't bring the whole system down.
- demand loads executables: Linux only reads from disk those parts of a program that are actually used.
- shared copy-on-write pages among executables. This means that multiple process can use the same memory to run in. When one tries to write to that memory, that page (4KB piece of memory) is copied somewhere else. Copy-on-write has two benefits: increasing speed and decreasing memory use.
- virtual memory using paging (not swapping whole processes) to disk: to a separate partition or a file in the filesystem, or both, with the possibility of adding more swapping areas during runtime (yes, they're still called swapping areas). A total of 16 of these 128 MB swapping areas can be used at once, for a theoretical total of 2 GB of useable swap space.
- a unified memory pool for user programs and disk cache, so that all free memory can be used for caching, and the cache can be reduced when running large programs.
- dynamically linked shared libraries (DLL's), and static libraries too, of course.
- does core dumps for post-mortem analysis, allowing the use of a debugger on a program not only while it is running but also after it has crashed.
- mostly compatible with POSIX, System V, and BSD at the source level.
- through iBCS2-compliant emulation, mostly compatible with SCO, SVR3, and SVR4 at the binary level.

- all source code is available, including the whole kernel and all drivers, the development tools and all user programs; also, all of it is freely distributable. There are some commercial programs being provided for Linux now without source, but everything that has been free is still free.
- POSIX job control.
- pseudoterminals (pty's).
- 387-emulation in the kernel so that programs don't need to do their own math emulation. Every computer running Linux appears to have a math coprocessor. Of course, if your computer already contains an FPU, it will be used instead of the emulation, and you can even compile your own kernel with math emulation removed, for a small memory gain.
- support for many national or customized keyboards, and it is fairly easy to add new ones.
- multiple virtual consoles: several independent login sessions through the console, you switch by pressing a hot-key combination (not dependent on video hardware). These are dynamically allocated; you can use up to 64.
- Supports several common filesystems, including minix-1, Xenix, and all the system V filesystems, and has an advanced filesystem of its own, which offers filesystems of up to 4 TB, and names up to 255 characters long.
- transparent access to MS-DOS partitions (or OS/2 FAT partitions) via a special filesystem: you don't need any special commands to use the MS-DOS partition, it looks just like a normal Unix filesystem (except for funny restrictions on filenames, permissions, and so on). MS-DOS 6 compressed partitions do not work at this time, and are not expected to.
- special filesystem called UMSDOS which allows Linux to be installed on a DOS filesystem.
- read-only HPFS-2 support for OS/2 2.1
- CD-ROM filesystem which reads all standard formats of CD-ROMs.
- TCP/IP networking, including ftp, telnet, NFS, etc.

3 Hardware Issues

3.1 Minimal configuration

The following is probably the smallest possible configuration that Linux will work on: 386SX/16, 2 MB RAM, 1.44 MB or 1.2 MB floppy, any supported video card (+ keyboards, monitors, and so on of course). This should allow you to boot and test whether it works at all on the machine, but you won't be able to do anything useful.

In order to do something, you will want some hard disk space as well, 5 to 10 MB should suffice for a very minimal setup (with only the most important commands and perhaps one or two small applications installed, like, say, a terminal program). This is still very, very limited, and very uncomfortable, as it doesn't leave enough room to do just about anything, unless your applications are quite limited. It's generally not recommended for anything but testing if things work, and of course to be able to brag about small resource requirements.

3.2 Usable configuration

If you are going to run computationally intensive programs, such as gcc, X, and TeX, you will probably want a faster processor than a 386SX/16, but even that should suffice if you are patient.

In practice, you need at least 4 MB of RAM if you don't use X, and 8 MB if you do. Also, if you want to have several users at a time, or run several large programs (compilations for example) at a time, you may want more than 4 MB of memory. It will still work with a smaller amount of memory (should work even with 2 MB), but it will use virtual memory (using the hard drive as **slow** memory) and that will be so slow as to be unusable.

The amount of hard disk you need depends on what software you want to install. The normal basic set of Unix utilities, shells, and administrative programs should be comfortable in less than 10 MB, with a bit of room to spare for user files. For a more complete system, get Slackware, MCC, or (soon) Debian, and assume that you will need 60 to 200 MB, depending on what you choose to install and what distribution you get. Add whatever space you want to reserve for user files to these totals. With today's prices on hard drives, if you are buying a new system, it makes no sense to buy a drive that is too small. Get at least 200 MB, and you will not regret it.

Add more memory, more hard disk, a faster processor and other stuff depending on your needs, wishes and budget to go beyond the merely usable. In general, one big difference from DOS is that with Linux, adding memory makes a large difference, whereas with dos, extra memory doesn't make that much difference. This of course has something to do with DOS's 640KB limit.

3.3 Supported hardware

CPU:

Anything that runs 386 protected mode programs (all models of 386's 486's, and 586's should work; 286s don't work, and never will). Also, a version for the 680x0 CPU (for $x = 2$ with external MMU, 3, and 4) which runs on Amigas and Ataris is being developed, and can be found at tsx-11.mit.edu in the 680x directory. Ports are also being done to the PowerPC, Alpha/AXP, and MIPS architecture. More details are available elsewhere.

Architecture:

ISA or EISA bus. MCA (mostly true blue PS/2's) does not work, although a few brave souls are doing some work to help remedy this for a few machines). Local busses (VLB and PCI) work.

RAM:

Theoretically up to 1 GB. This has not been tested. Some people (including Linus) have noted that adding ram without adding more cache at the same time has slowed down their machine extremely, so if you add memory and find your machine slower, try adding more cache. Over 64MB will require a boot-time parameter, as the BIOS cannot report more than 64MB, because it is "broken as designed."

Data storage:

Generic AT drives (IDE, 16 bit HD controllers with MFM or RLL, or ESDI) are supported, as are SCSI hard disks and CD-ROMs, with a supported SCSI adaptor. Generic XT controllers (8 bit controllers with MFM or RLL) are also supported. Supported SCSI adaptors: Adaptec 1542, 1522, and 1740 in extended (not 1542 compatible) mode, Buslogic controllers via the Adaptek compatibility or with their own driver, Seagate ST-01 and ST-02, Future Domain TMC-88x series (or any board based on the TMC950 chip) and TMC1660/1680, Ultrastor 14F, 24F and 34F, and Western Digital wd7000. SCSI and some QIC-02 and QIC-80 tapes are also supported. Several CD-ROM devices are also supported, including Matsushita/Panasonic, Mitsumi, Sony, Soundblaster, Toshiba, and others. For exact models, check the hardware compatibility HOWTO.

Video:

VGA, EGA, CGA, or Hercules (and compatibles) work in text mode. For graphics and X, there is support for (at least) normal VGA, some super-VGA cards (most of the cards based on ET3000, ET4000, Paradise, and some Trident chipsets), S3 (except for Diamond Stealth cards, because the manufacturer won't tell how to program it), 8514/A, ATI MACH8, ATI MACH32, and hercules. (Linux uses the Xfree86 X server, so that determines what cards are supported.)

Networking:

Western Digital 80x3, ne1000, ne2000, 3com501 (not recommended), 3com503, 3com507, 3com509, 3com589 PCMCIA, Allied Telliesis AT1500, most LANCE boards, d-link pocket adaptors, PPP, SLIP, CSLIP, PLIP (Parallel Link IP), and more.

Other hardware:

SoundBlaster, ProAudio Spectrum 16, Gravis Ultrasound, AST Fourport cards (with 4 serial ports), several models of Boca serial boards, the Usenet Serial Card II, several flavours of bus mice (Microsoft, Logitech, PS/2).

4 An Incomplete List of Ported Programs and Other Software

Most of the common Unix tools and programs have been ported to Linux, including almost all of the GNU stuff and many X clients from various sources. Actually, ported is often too strong a word, since many programs compile out of the box without modifications, or only small modifications, because Linux tracks POSIX quite closely. Unfortunately, there are not very many end-user applications at this time. Nevertheless, here is an incomplete list of software that is known to work under Linux.

Basic Unix commands:

`ls`, `tr`, `sed`, `awk` and so on (you name it, Linux probably has it).

Development tools:

`gcc`, `gdb`, `make`, `bison`, `flex`, `perl`, `rcs`, `cvs`, `prof`.

Languages and Environments:

C, C++, Objective C, Modula-3, Modula-2, ADA, Pascal, Fortran, ML, scheme, Tcl/tk, Perl, Python, Common Lisp, and many others.

Graphical environments:

X11R5 (XFree86 2.x), X11R6 (XFree86 3.x), MGR.

Editors:

GNU Emacs, Lucid Emacs, MicroEmacs, `jove`, ez, `epoch`, `elvis` (GNU vi), `vim`, `vile`, `joe`, `pico`, `jed`.

Shells:

`bash` (POSIX sh-compatible), `zsh` (includes `ksh` compatiblity mode), `pdksh`, `tcsh`, `csh`, `rc`, `ash` (mostly sh-compatible shell used as `/bin/sh` by BSD), and many more.

Telecommunication:

Taylor (BNU-compatible) UUCP, SLIP, CSLIP, PPP, `kermit`, `szrz`, `minicom`, `pcomm`, `xcomm`, `term` (runs multiple shells, redirects network activity, and allows remote X, all over one modem line), Seyon (popular X-windows communications program), and several fax and voice-mail (using ZyXEL modems) packages are available. Of course, remote serial logins are supported.

News and mail:

C-news, `innd`, `trn`, `nn`, `tin`, `smail`, `elm`, `mh`, `pine`.

Textprocessing:

TeX, `groff`, `doc`, `ez`, and Linuxdoc-SGML.

Games:

Nethack, several Muds and X games, and lots of others. One of those games is looking through all the games available at tsx-11 and sunsite.

Suites:

AUIS, the Andrew User Interface System. ez is part of this suite.

All of these programs (and this isn't even a hundredth of what is available) are freely available.

5 Who uses Linux?

Linux is freely available, and no one is required to register their copies with any central authority, so it is difficult to know how many people use Linux. Several businesses are now surviving solely on selling and supporting Linux, and very few Linux users use those businesses, relatively speaking, and the Linux newsgroups are some of the most heavily read on the internet, so the number is likely in the hundreds of thousands, but hard numbers are hard to come by. However, one brave soul, Harald T. Alvestrand, has decided to try, and asks that if you use Linux, you send a message to linux-counter@uninett.no with one of the following subjects: "I use Linux at home", "I use Linux at work", or "I use Linux at home and at work". He is also counting votes of "I don't use Linux", for some reason. He posts his counts to comp.os.linux.misc.

6 Getting Linux

6.1 Anonymous FTP

Matt Welsh has released a new version of his Installation and Getting Started guide, version 2.1.1. Also, the Linux documentation project (the LDP) has put out several other books in various states of completion, and these are available at sunsite.unc.edu:/pub/Linux/docs/LDP. Stay tuned to comp.os.linux.announce.

At least the following anonymous ftp sites carry Linux.

```
Textual name                   Numeric address  Linux directory
=============================  ===============  ===============
tsx-11.mit.edu                 18.172.1.2       /pub/linux
sunsite.unc.edu                152.2.22.81      /pub/Linux
ftp.funet.fi                   128.214.248.6    /pub/OS/Linux
net.tamu.edu                   128.194.177.1    /pub/linux
ftp.mcc.ac.uk                  130.88.203.12    /pub/linux
src.doc.ic.ac.uk               146.169.2.1      /packages/linux
fgb1.fgb.mw.tu-muenchen.de     129.187.200.1    /pub/linux
ftp.informatik.tu-muenchen.de  131.159.0.110    /pub/comp/os/linux
ftp.dfv.rwth-aachen.de         137.226.4.111    /pub/linux
ftp.informatik.rwth-aachen.de  137.226.225.3    /pub/Linux
ftp.Germany.EU.net             192.76.144.75    /pub/os/Linux
ftp.ibp.fr                     132.227.60.2     /pub/linux
kirk.bond.edu.au               131.244.1.1      /pub/OS/Linux
ftp.uu.net                     137.39.1.9       /systems/unix/linux
wuarchive.wustl.edu            128.252.135.4    mirrors/linux
ftp.win.tue.nl                 131.155.70.100   /pub/linux
ftp.stack.urc.tue.nl           131.155.2.71     /pub/linux
srawgw.sra.co.jp               133.137.4.3      /pub/os/linux
cair.kaist.ac.kr                                /pub/Linux
ftp.denet.dk                   129.142.6.74     /pub/OS/linux
NCTUCCCA.edu.tw                140.111.1.10     /Operating-Systems/Linux
nic.switch.ch                  130.59.1.40      /mirror/linux
monu1.monash.edu.au            130.194.1.101    /pub/linux
cnuce_arch.cnr.it              131.114.1.10     /pub/Linux
```

tsx-11.mit.edu and fgb1.fgb.mw.tu-muenchen.de are the official sites for Linux' GCC. Some sites mirror other sites. Please use the site closest (network-wise) to you whenever possible.

At least sunsite.unc.edu and ftp.informatik.tu-muenchen.de offer ftpmail services. Mail ftpmail@sunsite.unc.edu or ftp@informatik.tu-muenchen.de for help.

If you are lost, try looking at sunsite.unc.edu:/pub/Linux/distributions/, where several distributions are offered. Slackware is well-tested, being one of the most popular Linux distributions.

6.2 Other methods of obtaining Linux

There are many BBS's that have Linux files. A list of them is occasionally posted to comp.os.linux.announce. Ask friends and user groups, or order one of the commmercial distributions. A list of these is contained in the Linux distribution HOWTO, available as sunsite.unc.edu:/pub/Linux/docs/HOWTO/distribution-HOWTO, and posted regularily to the comp.os.linux.announce newsgroup.

7 Getting started

As mentioned at the beginning, Linux is not centrally administered. Because of this, there is no "official" release that one could point at, and say "That's Linux." Instead, there are various "distributions," which are more or less complete collections of software configured and packaged so that they can be used to install a Linux system.

The first thing you should do is to get and read the list of Frequently Asked Questions (FAQ) from one of the FTP sites, or by using the normal Usenet FAQ archives (e.g. rtfm.mit.edu). This document has plenty of instructions on what to do to get started, what files you need, and how to solve most of the common problems (during installation or otherwise).

8 Legal Status of Linux

Although Linux is supplied with the complete source code, it is copyrighted software, not public domain. However, it is available for free under the GNU Public License. See the GPL for more information. The programs that run under Linux each have their own copyright, although many of them use the GPL as well. X uses the MIT X copyright, and some utilities are under the BSD copyright. In any case, all of the software on the FTP site is freely distributable (or else it shouldn't be there).

9 News About Linux

A new magazine called Linux Journal was recently launched. It includes articles intended for almost all skill levels, and is intended to be helpful to all Linux users. Subscriptions are $19 in the U.S., $24 in Canada and Mexico, and $29 elsewhere, payable in US currency. Subscription inquiries can be sent via email to subs@ssc.com or faxed to (U.S.) 1-206-527-2806 or mailed to Linux Journal, PO Box 85867, Seattle, WA 98145-1867 USA. **Please do not send credit card numbers via email; the internet is not secure, and it is entirely possible that a technologically adept thief may steal your credit card number and cost you a large sum of money if you do.**

There are several Usenet newsgroups for Linux discussion, and also several mailing lists. See the Linux FAQ for more information about the mailing lists (you should be able to find the FAQ either in the newsgroup or on the FTP sites).

The newsgroup comp.os.linux.announce is a moderated newsgroup for announcements about Linux (new programs, bug fixes, etc).

The newsgroup comp.os.linux.admin is an unmoderated newsgroup for discussion of administration of Linux systems.

The newsgroup comp.os.linux.development is an unmoderated newsgroup specifically for discussion of Linux **kernel** development. The only application development questions that should be discussed here are those that are intimately associated with the kernel. All other development questions are probably generic Unix development questions and should be directed to a comp.unix group instead.

The newsgroup comp.os.linux.help is an unmoderated newsgroup for any Linux questions that don't belong anywhere else.

The newsgroup comp.os.linux.misc is the replacement for comp.os.linux, and is meant for any discussion that doesn't belong elsewhere.

In general, **do not** crosspost between the Linux newsgroups. The **only** crossposting that is appropriate is an occasional posting between one unmoderated group and comp.os.linux.announce. The whole point of splitting comp.os.linux into many groups is to reduce traffic in each. Those that do not follow this rule will be flamed without mercy...

For the current status of the Linux kernel and a summary of the most recent versions, `finger torvalds@kruuna.helsinki.fi`

Linux is on the Web (WWW, W3, whatever...) The URL is http://sunsite.unc.edu/mdw/linux.html

10 The Future

Now that Linux 1.0 has been released, work is already in progress on several enhancements. Disk access speedups, TTY improvements, and many more things are being worked on. Linux 1.0 is not the end of Linux, nor is it even very important; it is mostly intended to provide a stable version that people can use without being afraid that they are using beta software, and that can be standardized on to some extent.

Linux 1.2 is nearing release. It should be very similar to 1.1.62, which is a code freeze release intended to shake out bugs remaining in the 1.1 series. For those interested in what will happen with the new development series, 1.3, Linus has promised quotas and the PC speaker sound driver. Significant networking improvements will also debut in 1.3. Stay tuned!

There is plenty of code left to write, and even more documentation. Please join the DOC channel of the mailing list if you would like to contribute to the documentation.

11 This document

This document is maintained by Michael K. Johnson, johnsonm@nigel.vnet.net. Please mail me with any comments, no matter how small. I can't do a good job of maintaining this document without your help. A more-or-less current copy of this document can always be found as tsx-11.mit.edu:/pub/linux/docs/INFO-SHEET, and a PostScript version can be found as INFO-SHEET.ps, in the same directory.

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