Linux distributions on PowerPC systems

POWER TO THE PENGUINS!

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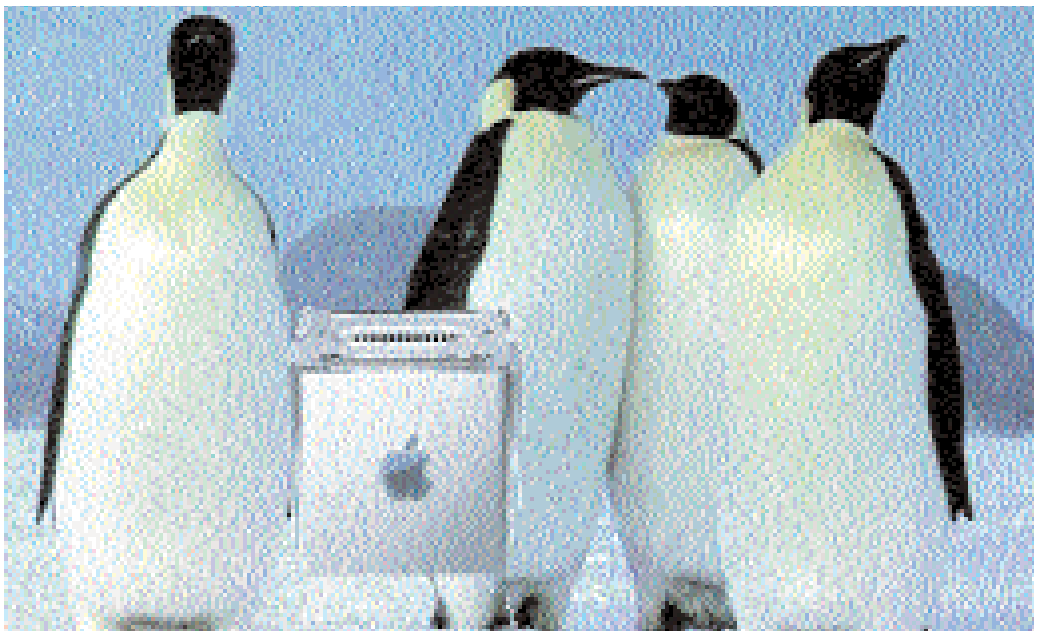
Owners of PowerPC systems are spoilt for choice. Linux is an interesting alternative to the operating system usually provided, whether it's AIX, BeOS or MacOS. We give an oyverview of the distributions available on the market and test their compatibility with various PowerPC systems.



A lot has been going on in the market for Linux distributions for PPC over the past few years. Besides SuSE – the newcomer to the PowerPC domain which, with SuSE Linux 7.0 PowerPC Edition, has now released its second PowerPC Linux version – we have tested LinuxPPC 2000, Yellow Dog Linux Champion Server 1.2 and Debian Potato for PowerPC. Red Hat and Mandrake don't yet offer versions for PowerPC-based systems.

Hardware

Support for PowerPC systems isn't totally straightforward for those offering Linux distributions. In the six years that have elapsed since the introduction of the PowerPC 601, many manufacturers have produced PPC-based systems. Most of those are no longer on the market. Apart from the well-known PowerMacs from Apple and diverse clones from Motorola, PowerComputing and UMAX, RS/6000 systems from IBM, PowerStack-, MTX- and MVME systems from Motorola, Escala- and Estrella-systems from Bull and the BeBox are equipped with PowerPC processors.

There are also some PowerPC-based cards for installation in Amiga computers. Support for at least five different bus systems (PCI, ISA, Microchannel, VME, Zorro-Bus), six processors (not including the embedded PowerPC processors), four different connection options for input devices like keyboards and mice (PS/2, ADB, USB, serial) and three different connection systems for mass storage (SCSI, IDE, FireWire) would be necessary in an ideal PowerPC Linux distribution. Let's get one thing out of the way – there's no such thing as a perfect distribution. But you didn't seriously expect one, did you?

Even for a passionate collector of computers it's hard to get hold of all the systems supported by the

various distributions for a test. Yet we did manage to drum up at least one example of each of the available computer platforms and to test the available distributions on them. All the tested models are listed in Table 1. A BeBox and an Amiga equipped with PowerPC were unfortunately not available.

Distributions

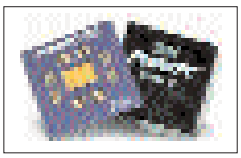
The various distributions came in a wide variety of packages. Yellow Dog came in a smart bag with room for CDs and documentation; SuSE 7.0 PowerPC Edition came in the usual SuSE carton; LinuxPPC 2000 sent CDs and the manual and Debian came direct from the ftp-server onto a blank CD.

Debian

The CD-ROMs with Debian 2.2 Potato for PowerPC are available commercially; for the sake of simplicity, though, I burned the ISO images direct from the ftp-server onto blank CDs. On the three CD images there are pretty well all the programs found in the x86 version of Debian, none of which resisted compilation onto PowerPC too strongly.

Boot support comes in the form of boot diskette images for CHRP-, PReP-, APUS- and Powermac systems. Macs can also be booted via *yaboot*. For BootX, unfortunately, there is no support to be found on the CDs. According to the PPC port websites Debian has so far been tested on very few systems. However, experience shows that a large number of systems can be made to run with a tolerable amount of time and effort. Otherwise Debian on PowerPC doesn't differ substantially from the x86-version (which of course is the whole idea).

The story of the porting of Debian to PowerPC is really interesting. It started at the 1997 Linux Congress in Würzburg (yes, like so many developments in the field of Linux, this one also began in Germany) where a generous benefactor gave the Debian project a Motorola StarMax 4000 (a Mac-compatible system by Motorola. The computer is still in use today by Martin "Joey" Schulze as an *automatic package build daemon*, that is, a machine which automatically constructs Debian packages for all new source files. So the origins of Debian for PowerPC lie in the first Linux version available for PowerMacs – the Developer Release of MkLinux from Apple. The poor Debian maintainers thus had to fight their way through all the ups and downs of PowerPC Linux development (glibc 1.99, compiler problems etc.).



The heart of the tested systems: PowerPC CPUs

Since BootX isn't supported, Debian is not a system for beginners – there isn't even a graphical installation tool available. But anyone used to Debian on the PC will very quickly get used to a PowerPC with Debian.

LinuxPPC 2000

LinuxPPC 2000 arrived on two CDs and with a manual of just under 130 pages. The manual was compiled from information taken from various FAQs and HOWTO documents which are mostly found at *http://www.linuxppc.org* . The manual, which has excellent screenshots, explains the installation mainly for Mac users, but isn't short of instructions for using ftp under MacOS. The Linux beginner is given a brief introduction to basic filesystem construction under Linux as well as the most important shell commands. For any more advanced help, though, go to the mailing lists at *http://lists.linuxppc.org* and a list of additional URLs. In the annexes to the manual there are instructions on the use of OpenFirmware, disk partitioning with pdisk and fdisk and installation on non-Apple PowerPCs (BeBox, CHRP and PReP-systems).

LinuxPPC 2000 can now be booted from the CD on PowerMacs. The system structure is Red Hat-based, but the installer takes the form of a Perl-Tk script (as an option a text-based installer is also available). Installation is done in several simple steps (making the filesystem, rough selection of the packages to be installed, setting the root password and starting the installation procedure), during which the complete installation environment is loaded on a RAM disk (including the framebuffer X-server). On PReP- and CHRP-systems a boot diskette must first be

Table 1: Tested models

Manufacturer	Model	Equipment
Apple	PowerMac G3 blue/white	G3/300, 192 MB RAM, 6 GB IDE
Apple	PowerMac G4	G4/400, 64 MB RAM, 10 GB IDE
Apple	PowerBook G3 "Wallstreet"	G3/250, 13.3" TFT, 96 MB RAM 10 GB IDE
IBM	RS/6000 B50	PPC604e/375, 1 GB RAM, 2x18 GB UW-SCSI
IBM	RS/6000 43P Model 120	PPC604/120, 48 MB RAM, 1 GB SCSI HD
Motorola	PowerStack	PPC604/120, 64 MB RAM, 2 GB SCSI HD
Motorola	MTX+	PPC604/400 MHz, 64 MB RAM, 4 GB SCSI HD
Motorola	MVME 2700	G3/367 MHz, 256 MB RAM, 2 GB SCSI HD

created for installation via *dd* or the DOS program rawrite.exe.

We were amused by the following sentence in the manual: "If you chose to install KDE instead of GNOME, you'll have the GNOME desktop. This works very much like GNOME, but looks slightly different". Hmmm.

The future of LinuxPPC?

Shortly before finishing this article we were informed that a new Beta version of LinuxPPC was available: LinuxPPC 2000 Q3. Along with this announcement LinuxPPC.com published a statement that Q3 would be the last LinuxPPC release and after that they will be concentrating on other areas of business, whatever that might mean. So there's still something to look forward to.

SuSE Linux 7.0

SuSE's PowerPC Edition is the latest representative of PowerPC Linux distributions. Following 6.4, this is SuSE's second PowerPC release

IBMs B50s can easily be stacked into a cluster system

and is supplied along with a manual of the usual SuSE quality having some 530 pages. The manual is – as to be expected – the x86 version adapted for PowerPC. For newcomers, the section on the preparations for installation on various PowerPC-based systems is, in our opinion, a bit brief – a little over half a page in each case for installation on CHRP- and Motorola PReP-systems respectively would surely save a few questions to the hotline (which by the way is available free for 60 days with the PowerPC version).

Incidentally, there is no distinction between "Professional" and "Personal" versions in the PowerPC edition. The PowerPC version is similar (apart from unavailable commercial packages, which unfortunately includes StarOffice) to the x86 version. A few additional programs, such as perhaps the virtual MacOS machine *mol* (Mac On Linux) are also provided.

Installation of SuSE is generally accomplished using *yast2*, which normally runs on a framebuffer-based X-server. Users familiar with SuSE on other systems are going to feel right at home. Our PowerBook G3 Wallstreet acted (while equipped with SuSE 7.0 PowerPC Edition Release Candidate 5) as presentation computer and applications server for a web server training course. Booting of the system can be done on Macs either using *BootX* or *yaboot*, so beginners aren't encumbered with the cryptic OpenFirmware. The CD is also bootable on PreP-systems like the Motorola MTX, but for CHRP-systems like the RS/6000 B50 a boot diskette needs to be created.

The installation of SuSE went smoothly, quickly and simply on all the machines tested. The only problem which arose was that the Matrox Millennium PCI-graphics card integrated in the Motorola MTX+ would only run unaccelerated. Otherwise the automatic hardware recognition functioned impeccably. But there is still one problem with PCMCIA cards. More on that later.

SuSE gives the positive impression that they have gone to the trouble of getting all possible drivers (mostly for PCI cards) on PowerPCs to co-operate. So for example diverse PCI-ISDN cards, Ethernet cards and a BT848 framegrabber card all run under SuSE 7.0. Unlike SuSE 6.4 there is even an accelerated X-server. With SuSE one can safely presume that installation on a Mac will be no more difficult than on a PC.

Yellow Dog Linux

With Yellowdog Linux Champion Server Version 1.2 TerraSoft Solutions has released the third version of its Linux distribution for PowerPC systems. The marketing department at

Yellow Dog Linux is inventively packaged

TerraSoft has dreamt up a real plus for this distribution: YDL comes in a chic black and yellow bag which contains a ring binder holding the 80 page documentation and three CD-ROMs.

Yellow Dog has gone to a lot of trouble to give a clear description of the options for booting using OpenFirmware. Despite the manual which has been kept really short (despite a lot of very sparsely-printed pages) there is room for such details. In other words, you'll learn something!

Yellow Dog's installer is text-based and familiar from older versions of Red Hat Linux. The whole thing is Red Hat 6.2-based. Given today's penchant for graphical installers this looks a bit antiquated, but it doesn't impair the functionality. Quite the contrary: if you have a serial console there is no need to mess around with sparsely documented parameters to configure it (text-based installation is an option, though, for all the distributions presented here). Both *BootX* and *yaboot* can be used for booting on Macs.

Apart from the IBM models B50 and F50 (in single-processor configuration) only systems from

Apple are supported. This brings us almost as far as the current Apple hardware development. The new Apple computers G4-Cube and the multiprocessor G4 systems are not in fact officially supported, but according to a statement from TerraSoft they should work (for the SMP-G4 computer there is an experimental kernel).

Problems

There were amazingly few problems: we expected a lot worse. On a machine that isn't officially supported like an IBM RS/6000 43P Model 120 the distributions could be installed using tricks and boot

Unlike the B50, the IBM RS/6000 43P Model 120 is a workstation class computer

diskettes. An X-server, though, could only be made to run using very obscure kernel patches. On "mainstream systems" like modern iMacs, PowerMacs, PowerBooks and IBM's B50 there are no problems, but special cases like Motorola's MTX+ or the BeBox need a bit more care. We were unable to get a current machine from the Bull company in time for the test. Many of Bull's machines, though, are compatible with IBM's RS/6000 systems (for example 43P Model 140 and 150 respectively).

That doesn't mean there can't be problems with somewhat more exotic hardware. We had a chance to try out a Lucent Wavelan network card in the Wallstreet Powerbook with SuSE Linux 7.0 installed. In the lower PCMCIA slot the card was recognised by the *cardmgr*, but then the *syslog* recorded a terse "card initialisation failed". There wasn't enough time to determine the cause. The behaviour in the upper PCMCIA slot was worse – the Powerbook repeatedly crashed without comment.

Unfortunately, unlike x86 users, you'll have to forgo ReiserFS support and the use of StarOffice. Whether ReiserFS will ever run on non-x86 systems is written in the stars. As alternatives, hopefully in the not too distant future, there will be IBM's JFS and SGI's XFS – at least JFS is tested explicitly with respect to PowerPC compatibility. Work is already proceeding apace on porting OpenOffice to LinuxPPC.

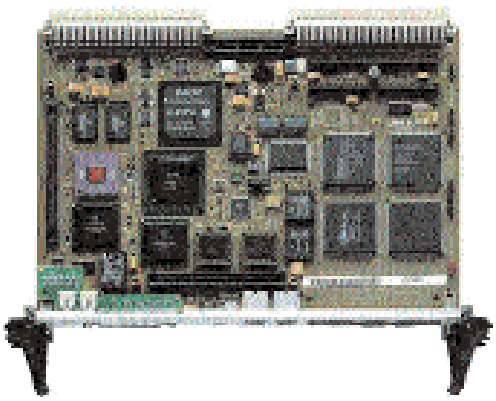
Support for older machines such as NuBus-based Macs or Microchannel-based RS/6000s is and remains a problem. Much of the documentation is now no longer available. A few of these machines are based, not on PowerPC processors but on the old POWER chipset from IBM. And yet, as one more or less expects with Linux, support for some of these "old dears" is being worked on by experienced Linux hackers. The fact that this is very time-consuming is something that will be understood by anyone who has ever tried to get Linux to run on an undocumented machine.

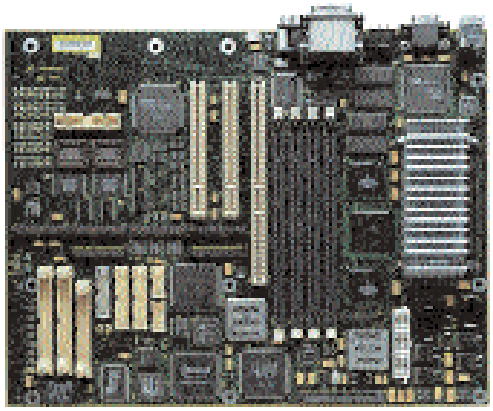
Something we were unable to test due to the lack of peripherals is support for FireWire devices. Rudimentary driver support for the TI chipset used in all new PowerMacs does however exist in current 2.4.0-test kernel versions, so there should be no obstacle to providing complete support in the next PowerPC Linux versions. It was encouraging that many non-Apple USB devices worked anyway, such as a Logitech 3-button USB mouse with scroll wheel or a KeySpan USB PDA-Adapter.

Conclusion

Linux distributions for PowerPC-systems now have something for everyone. For the beginner who is entering unknown territory with Linux we can unreservedly recommend SuSE Linux 7.0 PowerPC Edition. The little bugs from version 6.4 have been exterminated and the system gives a very good and reliable impression. Due to the fact that SuSE has put a great deal of work into driver and platform support, it is usable for migrants from the x86-domain with old hardware. Also, SuSE comes with a huge range of packages, so users will be saved the trouble of compiling the software. Nice work, SuSE!

For migrants from Red Hat-based systems, both LinuxPPC and Yellow Dog Linux should be considered. Both are derived from Red Hat and it's easy to get to grips with them. The graphical

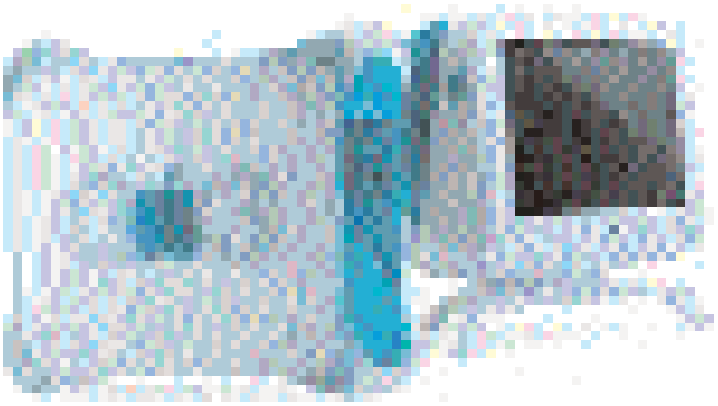




[left]
Motorola's VME PowerPC board is a good basis for process control andtelco system

[right]
The Motorola MTX mainboard series is mostly intended for industrial applications.

Apple G4 desktop computer: power inside, art design outside



The desktop version of the Apple G3 series – shown here in classic blue

installer makes LinuxPPC easier to install for not quite so experienced users. Otherwise there isn't much difference between these two distributions.

Finally, Debian on PowerPC is just what the professional user has been waiting for. Anyone wanting to use robust PowerPC hardware who at the same time cannot do without the Debian environment will like this distribution. A bit of up-to-date information on the hardware supported wouldn't go amiss on the websites. However, it's understandable that the maintainers of a free distribution would prefer tinkering with the software to updating websites.

A Motorola MVME2700 VME bus system provided for testing was left out of this test due to lack of time. A few distributions also support some other PowerPC systems – for example certain CompactPCI boards – and there is also support from Motorola for the more common systems based on PowerPC (and x86). This interesting field will also be the subject of a further article.

Wishes

It would be nice if all the improvements (which are at present found somewhere in some kernel versions) find their way into kernel 2.4 for PowerPC. Support for Macs is naturally the best (because of the number of installed systems) but the owners of PReP-, CHRP- and other PowerPC systems should be treated to something more than just a few little lines on their special hardware configuration.

It would also be nice if system manufacturers released the specifications to Linux developers as far as possible before the system is launched onto the market. That way, developers don't have to read out everything from the Darwin source code from Apple. Despite this, the PowerPC Linux developers nevertheless managed, four hours before the announcement of the Public Beta of MacOS X by Steve Jobs at the MacWorld Expo in Paris (the first operating system version from Apple to support several processors apart from AIX on Apple workgroup server) to present a functioning Linux kernel for the new multiprocessor G4 system.

Last but not least, it would be nice to have a truly affordable, modular PowerPC system, which in the manner of PCs made for ordinary users can easily be put together and expanded with standard components. It should have a 700 MHz or faster G4+ processor and the whole thing should sell at normal PC prices. This should all have long since been possible, but all earlier announcements failed to materialise, including unfortunately the POP reference design from IBM.

Too beautifull to be a mere reference system: Apple's Powerbook G3

Table 3: Information on porting

System	URL
MicroChannel RS/6000-systems	
Motorola MVME-systems	*http://www.vmelinux.org*
Amiga PPC	*http://www.debian.org/ports/powerpc/inst/apus*
Motorola MBX	*http://www.debian.org/ports/powerpc/inst/mbx*

Unsupported systems

Owners of systems that aren't officially supported should not give up hope. For a few systems there are unofficial patches. For others, ports are being worked on. The installation of Linux on these systems, though, requires a bit of work and know-how. Information on various unofficial patches and ports can be found in Table 3.

Thank you ...

Anyone who might now be thinking, the test that this splendid horde of PowerPC systems would make a very nice Beowulf cluster must be informed that this is sadly not the case. A few of the computers unfortunately had to go back to their owners. For this reason, our special thanks to Apple Computer, AID Computers and IBM, which provided the test systems. ■

The author

Michael Engel has been working for several years now with RISC processors and Linux. His most recent interests encompass embedded Linux and especially use for Linux in mobile devices.

URLs

[1] Linux CD-Images (among others, from Debian PPC): ftp.debian.org
[2] Debian for PowerPC: http://www.debian.org/ports/powerpc/
[3] LinuxPPC: http://www.linuxppc.com
[4] SuSE PowerPC Edition: http://www.suse.de/uk/produkte/susesoft/ppc/index.html
[5] Yellow Dog Linux: http://www.yellowdoglinux.com
[6] LinuxPPC Q3 Beta: ftp://ftp.linuxppc.com/linuxppc-halloween/install/updates/upgrade
[7] Yellow Dog SMP-Kernel: FTP-Server for Yellow Dog SMP-Kernel

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Table 2: Overview of PowerPC distributions

Distribution	SuSE Linux 7.0 PowerPC Edition	Yellow Dog Linux Champion Server 1.1	LinuxPPC 2000	Debian Potato for PowerPC
URLs	http://www.suse.de/uk	http://www.yellowdoglinux.com	http://www.linuxppc.com	http://www.debian.org
Package includes:	5 CDs Manual (approx. 530 pp.) Tux plug Geeko sticker	3 CDs manual (approx. 130 S.) YellowDog bag	2 CDs	rmanual (approx. 100 pp.) T-shirt 3 CDs
Reference source	SuSE GmbH	J. F. Lehmanns	J. F. Lehmanns	ftp.debian.org and mirrors, CD-Set von J. F. Lehmanns
Support	60 days installation support (telephone)	(for extra charge and via website)	30 days installation support	(e-mail)
Installation	X-based (Yast 2)	text-based	X-based	text-based
Kernel	2.2.16	2.2.15	2.2.14	2.2.15 + 2.2.17
glibc-Version	2.1.3	2.1.3	2.1.3	2.1.3
graphical interfaces	KDE (2.0 available as update), GNOME	KDE, GNOME	KDE, GNOME	GNOME (KDE as update)
Hardware-Support	first value: Manufacturer's specification / (optional) second value: tested * = functions, + = functions, but not supported, - = not tested / does not funct			
PowerMac 6100/7100/8100	-	-	-	-
PM 4400, 72xx, 7300, 7500, 7600, 8500, 8600, 9500, 9600	*	*	*	*
PM 5400, 5500, 6360, 6400, 6500	*	*	*	-
PM G3	*	*	*	-
PM G3 b&w, G3, iMac, iBook	* / *	* / *	* / *	- / *
PowerBook 2400, 3400	*	*	*	-
PowerBook G3	* / *	* / *	* / *	- / *
20th Anniversary Mac	*	*	*	-
PowerMac G4 Cube	-	-	-	-
PowerMac G4 SMP	-	-	-	-
Performa 52xx, 53xx, 62xx, 63xx (except 6360)	-	-	-	-
IBM RS/6000 B50	* / *	* / *	- / *	- / *
IBM RS/6000 43P 120	-	-	- / * (no X)	-
IBM RS/6000 43P 133,150	*	*	-	-
IBM MicroChannel	-	-	-	-
Motorola PowerStack (II)	- / *	-	*	-
Motorola MTX, MTX+	* / *	- / -	- / -	- / *
Motorola MVME	- /	-	-	-
BeBox	-	-	*	-
Amiga PPC	-	-	-	*