LINUX HISTORY

This month sees the anniversary of Linux. It is 10 years old. It has come a long way since its inception and the rate of development is speeding up. Only a year ago Red Hat and SuSE 7 launched – just two years ago Mandrake 6.1 was launched. Here we take a look at the history of Linux as told by Linus. The full transcripts can be found on the Web at *www.li.org* or in Linus' book, Just for Fun.

```
From: torvalds@klaava.Helsinki.FI (Linus
Benedict Torvalds)

Newsgroups: comp.os.minix

Subject: Gcc-1.40 and a posix-question

Message-ID:
<1991Jul3.100050.9886@klaava.Helsinki.FI
>

Date: 3 Jul 91 10:00:50 GMT

Hello netlanders,

Due to a project I'm working on (in
minix), I'm interested in the posix
standard definition. Could somebody
please point me to a (preferably)
machine-readable format of the latest
posix rules? Ftp-sites would be nice.

Linus Torvalds
torvalds@kruuna.helsinki.fi

PS. Could someone please try to finger me
from overseas, as I've installed a
"changing .plan" (made by your's truly),
and I'm not certain it works from
outside? It should report a new .plan
every time.
```

Then, almost two months later, I actually had something working: I made sources for version 0.01 available on nic sometimes around this time. 0.01 sources weren't actually runnable: they were just a token gesture to arl who had probably started to despair about ever getting anything. This next post must have been from just a couple of weeks before that release.

```
From: torvalds@klaava.Helsinki.FI (Linus
Benedict Torvalds)

Newsgroups: comp.os.minix
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```
Subject: What would you like to see most
in minix?

Summary: small poll for my new operating
system

Message-ID:
<1991Aug25.205708.9541@klaava.Helsinki.F
I>

Date: 25 Aug 91 20:57:08 GMT

Organization: University of Helsinki

Hello everybody out there using minix -

I'm doing a (free) operating system (just
a hobby, won't be big and professional
like gnu) for 386(486) AT clones. This
has been brewing since april, and is
starting to get ready. I'd like any
feedback on things people like/dislike
in minix, as my OS resembles it somewhat
(same physical layout of the file-system
(due to practical reasons) among other
things).

I've currently ported bash(1.08) and
gcc(1.40), and things seem to work. This
implies that I'll get something
practical within a few months, and I'd
like to know what features most people
would want. Any suggestions are welcome,
but I won't promise I'll implement them
:-)

Linus (torvalds@kruuna.helsinki.fi)

PS. Yes - it's free of any minix code,
and it has a multi-threaded fs.

It is NOT protable (uses 386 task
switching etc), and it probably never
will support anything other than AT-
harddisks, as that's all I have :-(.
```

Judging from the post, 0.01 wasn't actually out yet, but it was close. I'd guess the first version went out in the middle of September '91. I got some responses to this (most by mail, which I haven't saved), and I even got a few mails asking to be beta-testers for Linux. After that just a few general answers to quesions on the Net:

```
From: torvalds@klaava.Helsinki.FI (Linus
Benedict Torvalds)
```

```
Newsgroups: comp.os.minix

Subject: Re: What would you like to see
most in minix?

Summary: yes - it's nonportable

Message-ID:
<1991Aug26.110602.19446@klaava.Helsinki.
FI>

Date: 26 Aug 91 11:06:02 GMT

Organization: University of Helsinki

In article
<1991Aug25.234450.22562@nntp.hut.fi>
jkp@cs.HUT.FI

(Jyrki Kuoppala) writes:

> [re: my post about my new OS]

>

>Tell us more! Does it need a MMU?

Yes, it needs a MMU (sorry everybody),
and it specifically needs a 386/486 MMU
(see later).

>

>PS. Yes - it's free of any minix code,
and it has a multi-threaded fs.

>>It is NOT protable (uses 386 task
switching etc)

>

>How much of it is in C? What
difficulties will there be in porting?

>Nobody will believe you about non-
portability ;-), and I for one would

>like to port it to my Amiga (Mach needs
a MMU and Minix is not free).
```

Simply, I'd say that porting is impossible. It's mostly in C, but most people wouldn't call what I write C. It uses every conceivable feature of the 386 I could find, as it was also a project to teach me about the 386. As already mentioned, it uses a MMU, for both paging (not to disk yet) and segmentation. It's the segmentation that makes it really 386 dependent (every task has a 64Mb segment for code & data - max 64 tasks in 4Gb.

The UK's premier provider of LiNUX IT solutions

Founded in 1998 iTS-LiNUX quickly established itself in the expanding market.

iTS-LiNUX has become noted for its cost-conscious, innovative and creative solutions, acquiring clients such as Banks and other financial institutions, The Economist Group, Crewe Alexandra Football Club, utility companies, manufacturing and engineering companies, ISP's and Internet organisations

Local Government and Educational establishments, e-commerce companies and many many "bricks and mortar" SMEs.

When asked about their level of current success, Matthew Clarke (Managing Director) replied "Naturally part of our success is due to the growth of the Linux market in the UK as a whole, but as we've not, until recently, been in a position to expand by acquisition, we have had to focus our efforts on working harder and producing better results for our clients." he went on to say "We are fortunate

to have great staff at iTS-LiNUX people who are prepared to put in the time and effort to ensure that the job is done right, and if its never been done before they will invent ways to get the job done, in fact, according to IBM's own engineers, our CTO Andy Roffe, was the first person ever to get Lotus Notes running on Linux, and they still aren't sure how he did it."

iTS-LiNUX in association with IBM and Trustix recently announced the Goldbox as the total IT solution for SMEs

iTS-LiNUX have become the prime distributor for the much admired Trustix range of firewalls and secure server management tools.

The future looks promising indeed for iTS-LiNUX "We have made significant strides over the past 12 months, and are now looking to expand rapidly, taking on many more clients, and much larger projects."

Anybody who needs more than 64Mb/task - tough cookies). It also uses every feature of gcc I could find, specifically the __asm__ directive, so that I wouldn't need so much assembly language objects.

Some of my "C"-files (specifically mm.c) are almost as much assembler as C. It would be "interesting" even to port it to another compiler (though why anybody would want to use anything other than gcc is a mystery).

Note: linux has in fact gotten more portable with newer versions: there was a lot more assembly in the early versions. It has in fact been ported to other architectures by now. In Jan 92 things had moved on with a

```
From: torvalds@klaava.Helsinki.FI (Linus Benedict Torvalds)

Newsgroups: comp.os.minix

Subject: Free minix-like kernel sources for 386-AT

Message-ID: <1991Oct5.054106.4647@klaava.Helsinki.FI>

Date: 5 Oct 91 05:41:06 GMT

Organization: University of Helsinki

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 a 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 :-)

As I mentioned a month(?) ago, I'm working on a free version of
a minix-lookalike for AT-386 computers.  It has finally reached
the stage where it's even usable (though may not be depending
on what you want), and I am willing to put out the sources for
wider distribution.  It is just version 0.02 (+1 (very small)
patch already), but I've successfully run bash/gcc/gnu-
make/gnu-sed/compress etc under it.

Sources for this pet project of mine can be found at
nic.funet.fi (128.214.6.100) in the directory /pub/OS/Linux.
The directory also contains some README-file and a couple of
binaries to work under linux (bash, update and gcc, what more
can you ask for :-).  Full kernel source is provided, as no
minix code has been used.  Library sources are only partially
free, so that cannot be distributed currently.  The system is
able to compile "as-is" and has been known to work.  Heh.

Sources to the binaries (bash and gcc) can be found at the same
place in /pub/gnu.

ALERT! WARNING! NOTE! These sources still need minix-386 to be
compiled (and gcc-1.40, possibly 1.37.1, haven't tested), and
you need minix to set it up if you want to run it, so it is not
yet a standalone system for those of you without minix. I'm
working on it. You also need to be something of a hacker to set
it up (?), so for those hoping for an alternative to minix-386,
please ignore me. It is currently meant for hackers interested
in operating systems and 386's with access to minix.

The system needs an AT-compatible harddisk (IDE is fine) and
EGA/VGA. If you are still interested, please ftp the
README/RELNOTES, and/or mail me for additional info.

I can (well, almost) hear you asking yourselves "why?".  Hurd
will be out in a year (or two, or next month, who knows), and
I've already got minix.  This is a program for hackers by a
hacker.  I've enjoyed doing it, and somebody might enjoy
looking at it and even modifying it for their own needs.  It is
still small enough to understand, use and modify, and I'm
looking forward to any comments you might have.

I'm also interested in hearing from anybody who has written any
of the utilities/library functions for minix. If your efforts
are freely distributable (under copyright or even public
domain), I'd like to hear from you, so I can add them to the
system. I'm using Earl Chews estdio right now (thanks for a
nice and working system Earl), and similar works will be very
wellcome. Your (C)'s will of course be left intact. Drop me a
line if you are willing to let me use your code.

        Linus

PS. to PHIL NELSON! I'm unable to get through to you, and keep
getting "forward error - strawberry unknown domain" or
something.
```

newsgroup alt.os.linux but a message from Prof Andy Tanenbaum (AST) (wrote Minix) on

"Linux is Obsolete" started a flame war. The flame war got quite heated at times

with supporters for both sides eventually agreeing to disagree.

```
From: ast@cs.vu.nl (Andy Tanenbaum)

Newsgroups: comp.os.minix

Subject: LINUX is obsolete

Date: 29 Jan 92 12:12:50 GMT

Organization: Fac. Wiskunde & Informatica, Vrije Universiteit,
Amsterdam

I was in the U.S. for a couple of weeks, so I haven't commented
much on LINUX (not that I would have said much had I been
around), but for what  it is worth, I have a couple of comments
now.

As most of you know, for me MINIX is a hobby, something that I

do in the evening when I get bored writing books and there are
no major wars, revolutions, or senate hearings being televised
live on CNN.  My real job is a professor and researcher in the
area of operating systems.

As a result of my occupation, I think I know a bit about where
operating are going in the next decade or so.  Two aspects stand
out:

1. MICROKERNEL VS MONOLITHIC SYSTEM

Most older operating systems are monolithic, that is, the whole
operating system is a single a.out file that runs in 'kernel
mode.'  This binary contains the process management, memory
management, file system and the rest. Examples of such systems
are UNIX, MS-DOS, VMS, MVS, OS/360,  MULTICS, and many more.
```

First Started : October 1999

Distributions Used: Debian, FreeBSD

Specialist Area: Information Technology Management.

Current Perspective :

Wired 4 Life was established to actively promote Open Source and GPL based software. Realising that many businesses are seeing increasing costs in software purchases despite continuing reductions in the cost of hardware. To compensate Wired 4 Life is encouraging businesses to implement Open Source and GPL applications, utilising shared file services such as Samba, internal and external E-mail through the many varieties of mail applications and providing Internet access and firewalls, using tools commonly distributed with Linux and FreeBSD. Much of Wired 4 Lifes' business arrives via referral or word of mouth which is a testament to Wired 4 Lifes commitment to customer satisfaction.

Future Predictions.

A business' core function should not be to continually support costly software and hardware upgrades required by commercially driven products. In adopting Open Source software and building on that philosophy, a business can drive development of more reliable applications whilst maintaining control over their own internal processes. Sharing the cost of software development means new applications can be born and common standards will be built upon which no single entity can control. Open Source is returning control to the consumer.

Growth Areas:

Many customers are realising that developing intranet applications using Open Source products allows costs of projects to be spread out amongst the Open Source community. Making the source „Open‰ means ensuring that they are not railroaded into a technology driven product.

The alternative is a microkernel-based system, in which most of the OS runs as separate processes, mostly outside the kernel. They communicate by message passing. The kernel's job is to handle the message passing, interrupt handling, low-level process management, and possibly the I/O. Examples of this design are the RC4000, Amoeba, Chorus, Mach, and the not-yet-released Windows/NT.

While I could go into a long story here about the relative merits of the two designs, suffice it to say that among the people who actually design operating systems, the debate is essentially over. Microkernels have won. The only real argument for monolithic systems was performance, and there is now enough evidence showing that microkernel systems can be just as fast as monolithic systems (e.g., Rick Rashid has published papers comparing Mach 3.0 to monolithic systems) that it is now all over but the shoutin`.

MINIX is a microkernel-based system. The file system and memory management are separate processes, running outside the kernel. The I/O drivers are also separate processes (in the kernel, but only because the brain-dead nature of the Intel CPUs makes that difficult to do otherwise). LINUX is a monolithic style system. This is a giant step back into the 1970s. That is like taking an existing, working C program and rewriting it in BASIC. To me, writing a monolithic system in 1991 is a truly poor idea.

2. PORTABILITY

Once upon a time there was the 4004 CPU. When it grew up it became an 8008. Then it underwent plastic surgery and became the 8080. It begat the 8086, which begat the 8088, which begat the 80286, which begat the 80386, which begat the 80486, and so on unto the N-th generation. In the meantime, RISC chips happened, and some of them are running at over 100 MIPS. Speeds of 200 MIPS and more are likely in the coming years. These things are not going to suddenly vanish. What is going to happen is that they will gradually take over from the 80x86 line. They will run old MS-DOS programs by interpreting the 80386 in software. (I even wrote my own IBM PC simulator in C, which you can get by FTP from ftp.cs.vu.nl = 192.31.231.42 in dir minix/simulator.) I think it is a gross error to design an OS for any specific architecture, since that is not going to be around all that long. MINIX was designed to be reasonably portable, and has been ported from the Intel line to the 680x0 (Atari, Amiga, Macintosh), SPARC, and NS32016. LINUX is tied fairly closely to the 80x86. Not the way to go.

Don`t get me wrong, I am not unhappy with LINUX. It will get all the people who want to turn MINIX in BSD UNIX off my back. But in all honesty, I would suggest that people who want a **MODERN** "free" OS look around for a microkernel-based, portable OS, like maybe GNU or something like that.

Andy Tanenbaum (ast@cs.vu.nl)

P.S. Just as a random aside, Amoeba has a UNIX emulator (running in user space), but it is far from complete. If there are any people who would like to work on that, please let me know. To run Amoeba you need a few 386s, one of which needs 16M, and all of which need the WD Ethernet card.#

eoff (end of flame fest :-)

Niels

From: dingbat@diku.dk (Niels Skov Olsen)

Newsgroups: comp.os.minix

Subject: Re: 1.6.17 summary and why I think AST is right.

Date: 10 Feb 92 17:33:39 GMT

Organization: Department of Computer Science, U of Copenhagen michael@gandalf.informatik.rwth-aachen.de (Michael Haardt) writes:

>Stop flaming, MINIX and Linux are two different systems with different purposes.

>One is a teaching tool (and a good one I think), the other is real UNIX for real hackers.

Hear, hear! And now Linux articles in alt.os.linux (or comp.os.misc if your site don't receive alt.*) and Minix articles here.

Professor Tanenbaum eventually released MINIX as public domain with the source and various versions exist supporting hardware from Ataris to SPARC stations.

With hindsight it is easy to look at the arguements of Microkernel and Monolithic systems, but at the time it seemed to be a major problem. AST jokingly awarded Linus two F grades for poor design.

Releases happened fast with some just weeks apart. New features and support was growing. Finally in March 92 the version number jumped from 0.12 to 0.95 as it was almost a full release. It then took until 13/3/94 for 1.0 to hit the world. Version 2.0 hit in June 96 and 2.4 finally in January 2001. On the CD you will find a copy of 0.01 just for fun.

The listing of kernel revisions is held at *http://www.memalpha.cx/Linux/Kernel/Master.html*

The beginnings of the GPL and the GNU project go back further than 10 years to January 1984 and the story of how Richard Stallman developed the project after the IT industry changed to proprietary software is a very important one. It can be found at *http://www.gnu.org/gnu/the-gnu-project.html*

Although we always use the term Linux, most of the time we are refering to GNU/Linux as we are including other components with the kernel.

So where does this leave us. Well after 10 years we have an OS that competes on the world market (As I write MacDonalds have announced 4000 stores are to change to Linux). The OS runs on lots of differing architecture using preemptive multitasking supporting multi users. The IT industry is starting to understand Open Source and the desktop is becoming fun. In the next 10 years your guess is probably better than mine. Will the Internet be even more pervasive? Just how fast can machines go? Problems ahead do exist such as software patent law and governmental control, but I still predict an Open Source world will eventually dominate.

Celebrating 10 years of Linux

Roger Whittaker
SuSE Linux Ltd

The old saying about how 'mighty oaks from tiny acorns grow' was never more appropriate than in the case of Linux. We have certainly come a long way since that famous email (August 25th 1991) which could be considered the first announcement of Linux and which began as follows.

Hello everybody out there using minix - I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) AT clones. This has been brewing since april, and is starting to get ready. I'd like any feedback on things people like/dislike in minix, as my OS resembles it somewhat (same physical layout of the filesystem (due to practical reasons) among other things) [...]

What began as 'just a hobby' has become extremely big and very professional. There is indeed much to celebrate: far too much to mention here. But in particular this is a good time to remember the phenomenal work done in those earliest days by Linux Torvalds as he slipped from computer to bed and back hardly noticing whether it was day or night. It is also a good time to celebrate the extraordinary prescience and foresight of his decision to make the code available under the GPL which allowed the open-source development model to work its magic.

Speaking personally, the excitement and fascination of exploring Linux led me to make a complete career change and join SuSE, the oldest existing Linux company. SuSE began in 1992 and started distributing Linux in the following year: originally a localised version of Slackware for the German market, but very soon a distribution in its own right with an international presence.

Linux has changed the world of computing: the power of the open source method has ensured that. 'World domination' has not arrived (yet), but no-one in the industry whichever side they are on can possibly ignore it.
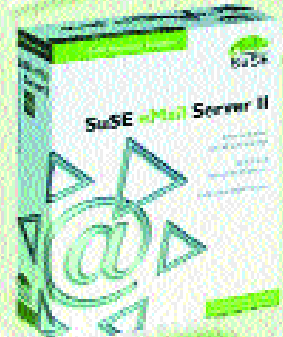
Yes, there is indeed plenty to celebrate.

Major developments in the last two years.

January, 1999

Samba 2.0 is released.
Kernel 2.2.0 is released
Blackdown's JDK 1.2

February, 1999

Brave Gnu World starts.
Kernel 2.2.1 released.
Lyx 1.0.0 is released.
Linux-Mandrake 5.3 is released.
KDE 1.1 is released.
Samba 2.0.2
SuSE 6.0 released.
Glibc 2.1 is released.

March, 1999

Gnome 1.0 is released.
Kernel 2.2.3 is released.
Debian 2.1 is released.

April, 1999

Caldera OpenLinux 2.2 is released.
SuSE 6.1 is released.
Python 1.5.2 is released.
KDE 1.1.1 beta is released.
Red Hat 6.0 is released.

May, 1999

Definite Linux 6.0 is released.
Tcl 8.1 is released.
KDE 1.1.1 is released.
Kernel 2.2.8 comes out, and 2.3.0.
Slackware 4.0 is released.
Corel's WordPerfect for Linux.
Linux-Mandrake 6.0 is released.

June, 1999

LinuxPPC 5.0 is released.
PostgreSQL v6.5 is released.
TurboLinux Workstation 3.6 is released.
Qt 2.0 is released.
Sun releases the JDK 1.2.2.

July, 1999

Midgard 1.1 is released.
Oracle releases Oracle8i for Linux.
IBM released DB2 for Linux.

August, 1999

Stable kernel 2.2.11 is released.
Definite Linux 6.1 is released.
Midgard 1.2 is released.

September, 1999

Zope 2.0 is released.
Bind 8.2 is released.
Caldera OpenLinux 2.3 is released.
GnuPG 1.0 is released.
Debian 2.1r3 is released.
Development kernel 2.3.18 is released.
KDE 1.1.2 is released.
Linux-Mandrake 6.1 is released.

October, 1999

Definite Linux 7.0 is released.
Red Hat Linux 6.1 is released.
IBM announces their JVM for the JDK 1.1.8.

November, 1999

Slackware 7 is released.
Reiserfs with journaling is released.
Kondara MNU/Linux 1.0 is released.
Corel launches its Linux distribution.
SuSE 6.3 is announced.
Mozilla Milestone 11 is released.
Real-time Linux 2.0 is released.

December, 1999

Linux kernel 2.3.30 is released.
SuSE 6.3 starts shipping.
Zope 2.1.1 is released.
Bastille Linux 1.0.0 is released.
Development kernel 2.3.33 is released.
Debian 2.1r4 is released.
Storm Linux 2000 is released.
Mozilla M12 is released.

January, 2000

SGI make OpenGL open source license.
Mozilla M13 is released.
Linux-Mandrake 7.0 is released.

February, 2000

IBM's Journaled File System released as GPL.
OpenSSH 1.2.2 is released.
Hard Hat Linux 1.0 is released.
BlackCat Linux 1.0 is released.
TurboLinux 6.0 released.

March, 2000

Helix Gnome started.
XFree86 4.0 is released.
Trustix 1.0, is released.
Chinese Penguin64 is released.
Red Hat 6.2 is released.
FreeBSD 4.0 is released.
Perl v5.6.0 is released.

April, 2000

Corel Word Perfect Office 2000 released.
Gimp 1.1.20 is released.
Samba 2.0.7 is released.
Vine Linux 2.0 is released.
Plamo Linux 2.0 is released.
Applixware 5.0 is announced.
Mozilla M15 is released.
Qt 2.1 is released.
Netscape 6 preview release 1.
IBM introduces DB2 Universal Database V7.
Trustix Secure Linux 1.0 is released.

May, 2000

IBM announces that Linux for its
S/390 mainframe.
PostgreSQL 7.0 is released.

June, 2000

Slackware 7.1 is released.
MySQL now under the GPL.
Bastille Linux 1.1 is released.
BlueCat Linux release 2.0.
Linux-Mandrake 7.1 is released.

July, 2000

StarOffice is to be released under the GPL.
Red Hat release Source Navigator under GPL.
e-smith server 4.0 is released.

August, 2000

Debian 2.2 is released.
IBM release the Andrew Filesystem (AFS)
under the IBM Public License.
XEmacs/GTK is released.
LinuxPrinting.org, started.
Blue Cat Linux 3.0 is released.
SuSE 7.0 is released.

September, 2000

Qt library released under the GPL.
Python 1.6 and 2.0b1 are released.
RSA encryption algorithm made public domain.
SmoothWall released.
Red Hat 7 is released.

October, 2000

SAP release its database under the GPL.
The StarOffice source released.
Turbolinux Workstation Pro 6.1.
Python 2.0 is released.
KDE 2.0 is released.
Linux-Mandrake 7.2 is released.

November, 2000

Debian 2.2r1 is released.
Netscape 6 is released.
Red Hat 7 on the Alpha is released.
SuSE Linux 7.0 for the Alpha is released.
Trustix Secure Linux 1.2 is released.

December, 2000

Bruce Perens moves to HP.
Conectiva 6.0 is released.
Debian 2.2r2 is released.
OpenBSD 2.8 is released.
Mailman 2.0 is released.
The source to Solaris 8 is released.
NetBSD 1.5 is released.
Mozilla 0.6 is released.

January 2001

2.4.0 Kernel is released.
SuSE 7.1 is released.

February 2001

KDE 2.1 is out

March 2001

Progeny Debian RC1

April 2001

RedHat 7.1 released.
Mandrake 8.0 released.

May 2001

Eazel closes

June 2001

SuSE 7.2 released
Caldera OpenLinux Workstation 3.1
Caldera OpenLinux Server 3.1

July 2001

Dmitry Sklyarov is arrested.

The Master of One,
The Jack of Many

"So, you've good uptime"?

"Yes. A number of our shared servers have been running without reboot for over a year"

"Excellent. And logging, good bandwidth, free support..?"

"Yes, and more."

"Sounds great. And ASP scripting? My site runs from an Access Database."

"Erm..."

Hereafter, if the sales call is to a technically "agnostic" hosting provider, it's a one-way trip to the clutches of its NT department, where the notion of 300+ days of uptime is as absurd as the eventual site defacement is inevitable. Some providers, however, aren't willing to be the Jack of all trades. The proprietorially-wedded customer is asked to be "always right" elsewhere.

The Positive Internet Company (http://www.positive-internet.com/), based in London, gives just this dogged message to prospective customers, and the reactions range from incredulity ("I thought Bill Gates invented the Internet!") to interest ("There are genuine alternatives to being a Microsoft serf?").

Positive's choice to use just GNU/Linux and associated Free software in its hosting and dedicated service provision has its basis in efficiency, flexibility and even morality:
"We install and run facilities managed servers for very big household names. The notion of doing this without compiling afresh from the source code is alien: almost a dereliction of duty!" says Andrew Och, an engineer at the Company. He continues: "From our shared hosting right up to our renowned Enterprise Max dedicated server, customers are delighted with the reliable flexibility on offer in the Free software ecosystem. And we're delighted that it lets us run rings around the competition!"

With PHP, Perl, MySQL, Python, Java servlets and JSP, customers kick the ASP habit quickly, particularly with Positive's enthusiastic support team on hand.

Och chuckles, "I sometimes hope Microsoft continue their successful marketing, because it means we always have the secret of a GNU/Linux based system up our sleeve: digital magic to a jaded MS veteran". But, with every passing Code Red incident, the trend towards GNU/Linux is unstoppable; increasingly, when a customer's Access/ASP question is replied in the negative, 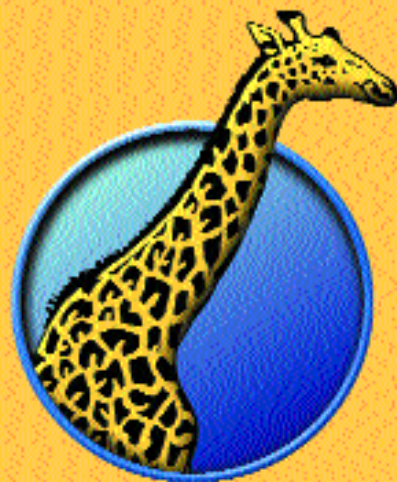the retort is "Thank heavens - where do I sign up?"