

# History of Linux

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## a. In The Beginning

It was 1991, and the ruthless agonies of the cold war was gradually coming to an end. There was an air of peace and tranquility that prevailed in the horizon. In the field of computing, a great future seemed to be in the offing, as powerful hardware pushed the limits of the computers beyond what anyone expected.

But still, something was missing.

And it was the none other than the Operating Systems, where a great void seemed to have appeared.

For one thing, DOS was still reigning supreme in its vast empire of personal computers. Bought by Bill Gates from a Seattle hacker for \$50,000, the bare bones operating system had sneaked into every corner of the world by virtue of a clever marketing strategy. PC users had no other choice. Apple Macs were better, but with astronomical prices that nobody could afford, they remained a horizon away from the eager millions.

The other dedicated camp of computing was the Unix world. But Unix itself was far more expensive. In quest of big money, the Unix vendors priced it high enough to ensure small PC users stayed away from it. The source code of Unix, once taught in universities courtesy of Bell Labs, was now cautiously guarded and not published publicly. To add to the frustration of PC users worldwide, the big players in the software market failed to provide an efficient solution to this problem.

A solution seemed to appear in form of MINIX. It was written from scratch by [Andrew S. Tanenbaum](#), a [US-born Dutch professor](#) who wanted to teach his students the inner workings of a real operating system. It was designed to run on the Intel 8086 microprocessors that had flooded the world market.

As an operating system, MINIX was not a superb one. But it had the advantage that the source code was available. Anyone who happened to get the book 'Operating System' by Tanenbaum could get hold of the 12,000 lines of code, written in C and assembly language. For the first time, an aspiring programmer or hacker could read the source codes of the operating system, which to that time the software vendors had guarded vigorously. A superb author, Tanenbaum captivated the brightest minds of computer science with the elaborate and immaculately lively discussion of the art of creating a working operating system. Students of Computer Science all over the world poured over the book, reading through the codes to understand the very system that runs their computer.

And one of them was Linus Torvalds.

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## b. New Baby in the Horizon

In 1991, [Linus Benedict Torvalds](#) was a second year student of Computer Science at the [University of Helsinki](#) and a self-taught [hacker](#). The 21 year old sandy haired soft-spoken Finn loved to tinker with the power of the computers and the limits to which the system can be pushed. But all that was lacking was an operating system that could meet the demands of the professionals. MINIX was good, but still it was simply an operating system for the students, designed as a teaching tool rather than an industry strength one.

At that time, programmers worldwide were greatly inspired by the [GNU project](#) by [Richard Stallman](#), a software movement to provide free and quality software. Revered as a cult hero in the realm of computing, Stallman started his awesome career in the famous [Artificial Intelligence Laboratory at MIT](#), and during the mid and late seventies, created the [emacs editor](#). In the early eighties, commercial software companies lured away much of the brilliant programmers of the AI lab, and negotiated stringent [nondisclosure agreements](#) to protect their secrets. But Stallman had a different vision. His idea was that unlike other products, software should be free from restrictions against copying or modification in order to make better and efficient computer programs. With his famous [1985 manifesto that declared the beginnings of the GNU project](#), he started a movement to create and distribute softwares that conveyed his philosophy (Incidentally, the name GNU is a recursive acronym which actually stands for 'GNU is Not Unix'). But to achieve this dream of ultimately creating a free operating system, he needed to create the tools first. So, beginning in 1984, Stallman started writing the [GNU C Compiler\(GCC\)](#), an amazing feat for an individual programmer. With his legendary technical wizardry, he alone outclassed entire groups of programmers from commercial software vendors in creating GCC, considered as one of the most efficient and robust compilers ever created.

By 1991, the GNU project created a lot of the tools. The much awaited Gnu C compiler was available by then, but there was still no operating system. Even [MINIX](#) had to be licensed. Work was going the [GNU kernel HURD](#), but that was not supposed to come out within a few years.

That was too much of a delay for Linus.

In August 25, 1991 the historic post was sent to the MINIX news group by Linus

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From: torvalds@klaava.Helsinki.FI (Linus Benedict Torvalds)  
Newsgroups: comp.os.minix  
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.FI>  
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 :-).

As it is apparent from the posting, Linus himself didn't believe that his creation was going to be big enough to change computing forever. Linux version 0.01 was released by mid September 1991, and was put on the net. Enthusiasm gathered around this new kid on the block, and codes were downloaded, tested, tweaked, and returned to Linus. 0.02 came on October 5th, along with this famous declaration from Linus:

From: torvalds@kruuna.helsinki.fi (Linus Benedict Torvalds)

Newsgroups: comp.os.minix

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

Message-ID: <1991Oct5.054106.4647@kruuna.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.

Linux version 0.03 came in a few weeks. By December came version 0.10. Still Linux was little more than in skeletal form. It had only support for AT hard disks, had no login (booted directly to bash). version 0.11 was much better with support for multilingual keyboards, floppy disk drivers, support for [VGA](#), [EGA](#), [Hercules](#) etc. The version numbers went directly from 0.12 to 0.95 and 0.96 and

so on. Soon the code went worldwide via ftp sites at Finland and elsewhere.

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### c. Confrontation & Development



Soon Linus faced some confrontation from none other than [Andrew Tanenbaum](#), the great teacher who wrote MINIX. In a post to Linus, Tanenbaum commented:

" I still maintain the point that designing a monolithic kernel in 1991 is a fundamental error. Be thankful you are not my student. You would not get a high grade for such a design :-)"  
(Andrew Tanenbaum to Linus Torvalds)

Linus later admitted that it was the worst point of his development of Linux. Tanenbaum was certainly the famous professor, and anything he said certainly mattered. But he was wrong with Linux, for Linus was one stubborn guy who won't admit defeat.

Tanenbaum also remarked that : "Linux is obsolete".

Now was the turn for the new Linux generation. Backed by the strong Linux community, Linus gave a reply to Tanenbaum which seems to be most fitting:

Your job is being a professor and researcher: That's one hell of a good excuse for some of the brain-damages of minix.  
(Linus Torvalds to Andrew Tanenbaum)

And work went on. Soon more than a hundred people joined the Linux camp. Then thousands. Then hundreds of thousands. This was no longer a hackers toy. Powered by a plethora of programs from the GNU project, Linux was ready for the actual showdown. It was licensed under [GNU General Public License](#), thus ensuring that the source codes will be free for all to copy, study and to change. Students and computer programmers grabbed it.

Soon, commercial vendors moved in. Linux itself was, and is free. What the vendors did was to compile up various software and gather them in a distributable format, more like the other operating systems with which people were more familiar. [Red Hat](#) ,[Caldera](#), [Debian](#), and some other companies gained substantial amount of response from the users worldwide. With the new Graphical User Interfaces (like [X-windows](#), [KDE](#), [GNOME](#)) the Linux distributions became very popular.

Meanwhile, there were amazing things happening with Linux. Besides the PC, Linux was ported to many different platforms. Linux was tweaked to run 3Com's handheld [PalmPilot](#) computer. Clustering technology enabled large number of Linux machines to be combined into a single computing entity, a [parallel](#)

computer. In April 1996, researchers at Los Alamos National Laboratory used Linux to run 68 PCs as a single parallel processing machine to simulate atomic shock waves. But unlike other Supercomputers costing a fortune, it was rather cheap. The do-it-yourself supercomputer cost only \$152,000, including labor (connecting the 68 PCs with cables)-about one tenth the price of a comparable commercial machine. It reached a peak speed of 19 billion calculations per second, making it the 315th most powerful supercomputer in the world. And it was a robust one too. Three months later it still didn't have to be rebooted.



The best thing about Linux today is the fanatic following it commands. Whenever a new piece of hardware is out, the Linux kernel is tweaked to take advantage of it. For example, within weeks after the introduction of Intel Xeon® Microprocessor, Linux kernel was tweaked and was ready for it. It has also been adapted for use in Alpha, Mac, PowerPC, and even for palmtops, a feat which is hardly matched by any other operating system. And it continues its journey into the new millennium, with the same enthusiasm that started one fine day back in 1991.



As for Linus, he remains a simple man. Unlike Bill Gates, he is not a billionaire. Having completed studies, he moved to USA and landed a job at Transmeta Corporation. After conducting a top-secret research and development project, Transmeta launched the Crusoe™ processor. Linus was an active member of the research team. Recently married to Tove, he is the proud father of a girl, Patricia

Miranda Torvalds. But he remains as the world's most favorite and most famous programmer to this date. Revered by Computer communities worldwide, Linus is by far the most popular programmer on this planet.

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#### d. After a Decade: Linux Today

Proving all the warning and prophecies of the skeptics wrong, Linux has completed a decade of development. Today, Linux is one of the fastest growing operating systems in the history. From a few dedicated fanatics in 1991-92 to millions of general users at present, it is certainly a remarkable journey. The big businesses have 'discovered' Linux, and have poured millions of dollars into the development effort, denouncing the anti-business myth of the open-source movement. IBM corp. once considered the archenemy of open-source hacker community, has come forward with a huge fund for development of open source Linux based solutions. But what's really amazing is the continuously increasing band of developers spread throughout the world who work with a fervent zeal to improve upon the features of Linux. The development effort is not, as many closed-sourced advocates accuse, totally engulfed with chaos. A well designed development model supervised by some maintainers is adopted. Along with this, there are thousands of developers working to port various applications to Linux.

Commercial enterprises are no longer wary of Linux. With a large number of vendors providing support for Linux based products, it is no longer a 'do-at-your-own-risk' thing to use Linux at the office. As for reliability, Linux certainly proved it during the nasty attacks of the CIH virus in 1999 and the love bug a year later, during which Linux based machines proved to be immune to the damages caused by these otherwise quite simple computer viruses. Linux start-ups like Red Hat received a cordial response as they went public. And even after the dot-com bust of the recent years, these companies continue to thrive and grow. With this added confidence, many large and small businesses have adopted Linux based servers and workstations as an integral part of their offices.

#### **Rise of the Desktop Linux**

What is the biggest complain against Linux? Perhaps in the past, it was the text based interface which scared off many people from using it. 'Text mode gives total control', some dedicated hackers and heavy users may explain. But for the millions of ordinary people, it also means a lot of effort towards learning the system. The existing X-Windows system and the window managers were not up to the general computer users' expectation. Exactly this argument had always been put forward by dedicated followers of the [Windows\(TM\)](#) camp. But things began to change in the last couple of years. The advent of professional looking desktop environments like KDE (K Desktop Environment) and GNOME completed the picture. The recent versions of these desktop environment have changed the general perception about the 'user friendliness' of Linux to a great extent. Though hard-core users grumble about the loss of purity of the hacker-culture, this great change in the mindset of the common users has increased the popularity of Linux.

## Linux in the Developing World

Perhaps the greatest change is the spread of Linux to the developing world. In the days before Linux, [developing countries](#) were way behind in the field of computing. The cost of hardware fell down, but the cost of software was a huge burden to the cash-strapped computer enthusiasts of the [Third World](#) countries. In desperation, people resorted to piracy [[copyright infringement](#)] of almost all sorts of software products. This resulted in widespread piracy, amounting to billions of dollars. But then again, the pricetag of most of the commercial products were far beyond the reaches of the people in developing countries. For example, a typical operating system product costs at least US \$100 or more. But in countries with per capita incomes of about US\$200-300, that is a huge amount.

The rise of Linux and other related open source product has changed it all. Since Linux can be scaled to run in almost computer with very few resources, it has become a suitable alternative for low budget computer users. Old, ancient 486/Pentium 1 computers that has become a part of history in the developed world are still used in developing countries. And Linux has enabled to unleash the full potential of these computers. The use of open source software has also proliferated, since the price of software is a big question. In countries of Asia, Africa and Latin America, Linux has appeared as a way out for the masses of computer enthusiasts. And a testament to the true global nature of Linux, local customizations were made in obscure parts of the world. The Linux documentation now includes documents written in almost all the major languages...and also many minor ones, for example, Vietnamese.

## From Desktop to SuperComputing

When Linux was first envisaged by Linus Torvalds, it was just another hackers hobby. But from the humble Intel 386 machine of Linus that ran the first kernel, Linux has come a long way. Its most notable use now is in the field of massively parallel supercomputing clusters. Let us see a few examples:

### The TeraGrid

In August 2001, BBC reported that the US Government was planning to build what would be a mega computer, capable of performing over 13 trillion calculations per second (13.6 TeraFLOPS). The project, called [Tera grid](#) would consist of a connected network of 4 US supercomputing centers. The four labs that are collaborating to create the Teragrid are: ***National Center for Supercomputing Applications at the University of Illinois(NCSA), San Diego Supercomputer Center (SDSC) at the University of California Argonne National Laboratory in Chicago; California Institute of Technology in Pasadena.*** At each of these centers, there would be a supercomputer. In total, there would be more than 3000 processors running in parallel to create the Teragrid. The main technology behind this massive computer would be clustering: the technology of binding together many low performance/cost processors to create a single computing environment.

Dubbed as the Distributed Terascale Facility, the Teragrid will combine enough computing power to facilitate the solution of complex mathematical and

simulation problems, ranging from Astronomy and Cancer Research to Weather Forecasting. Equipped with a 600 Terabyte storage space, the Teragrid would be so powerful that it would take a human working on a calculator 10 million years to do what the Teragrid can do in only 1 second. The amazing thing is that this massively parallel Mega Computer will be powered by Linux. Each of the 4 sites will operate a Linux cluster, and connected by means of a 40 Gigabit/sec dedicated optical network.

Using Linux as the base system, the makers of Teragrid have saved millions of dollars, utilizing the clustering technology developed worldwide by the dedicated followers of open source movement.

### **Evolocity at Lawrence Livermore National Lab**

In July 2002, it was reported that Linux NetworX, a California based company, began work on [Evolocity](#), a very powerful Linux based cluster supercomputer for the [Lawrence Livermore National Laboratory](#) (LLNL), California, USA. This awesome cluster would consist of 962 nodes running on a total of 1920 Intel 2.4 GHz Xeon processors. With 4 GB of DDR SDRAM Memory and 120 GB of Hard Disk space at each node, the supercomputer cluster would run at a maximum speed of 9.2 TeraFLOPS (FLOating Operations Per Second), bringing it among the world's top five fastest supercomputers. With mass-produced off-the-shelf technology, this supercomputer will surely bring an air of change in the LLNL, where once massive Cray supercomputers reigned supreme.

### **The Journey Continues**

The journey of Linux from a hacking project to globalization has been more like an evolutionary experience. The GNU Project, started in the early 1980's by Richard Stallman, laid the foundation for the development of open source software. Prof. Andrew Tanenbaum's Personal Computer operating system Minix brought the study of operating systems from a theoretical basis to a practical one. And finally, Linus Torvald's endless enthusiasm for perfection gave birth to Linux. Throughout the last couple of years, hundreds of thousands of people forming global community nurtured it and brought it to its glorious place in the annals of the computer revolution. Today Linux is not just another student's hacking project, it is a worldwide phenomenon bringing together huge companies like IBM and the countless millions of people throughout the world in the spirit of the open source software movement. In the history of computing, it will forever remain as one of the most amazing endeavors of human achievement.

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#### **e. Tux the penguin: Linux's Dear Logo**

The logo of Linux is a penguin. Unlike other commercial products of computer operating systems, Linux doesn't have a formidable serious looking symbol. Rather Tux, as the penguin is lovingly called, symbolizes the care-free attitude of the total movement. This cute logo has a very interesting history. As put forward by Linus, initially no logo was selected for Linux. Once Linus went to the southern hemisphere on a vacation. There he encountered a penguin, not unlike

the current logo of Linux. As he tried to pat it, the penguin bit his hand. This amusing incident led to the selection of a penguin as the logo of Linux sometime later.