

STOA

Science and Technology Options Assessment

The Secretariat

STOA annual lecture proposal:

The future of open source versus proprietary software - Long term threats, challenges and opportunities, for the ICT industry, the private and public sectors and the general public

The objective of this conference would be to allow industry representatives and key stakeholders supporting the development of "open source" and "proprietary" software to present their views on *"what are the long term prospects for open source versus proprietary software development, and in relation to this, what are the technological and economic potentials and impacts of the expected developments on the society as a whole"*

It is proposed that to invite **Linus Torvalds** from the **Linux Foundation** as the main speaker at this conference. However since the conference needs to present the views of the two "camps", each camp should be adequately represented. Therefore, the presence of a high-level **Microsoft representative is indispensable**. Speakers from **Apple, Oracle, IBM, Google** and **Ubuntu Canonical** are also strongly recommended since these companies are major players in the software industry. A balanced representation of the advocates of each camp is also essential to ensure adequate contradictory debate during the conference in the best interest of the success of the event.

It is unlikely that it is possible to attract enough participants within the EP for a conference on such a specialised subject. Therefore, it is recommended that STOA, at a very early stage of the planning process, secures an adequate level of participation by inviting target representatives from large ICT companies, major universities, as well as key stakeholders and experts from the private and public sectors. Securing an adequate participation at an early stage will also help to convince the speakers targeted to participate in the event.

This conference would touch indirectly upon several recent STOA projects such as:

- Cloud computing
- Security of e-government systems
- e-democracy
- projects related to protection of intellectual property rights and copyright
- etc ...

Brussels, 10 January 2012

Peter Ide-Kostic, STOA administrator

Annex 1: Background information on Linus Torvalds and the history of the creation of Linux (Source Wikipedia)

Annex 1: Background information on Linus Torvalds and the history of the creation of Linux (Source Wikipedia)

1	The creation of Linux	3
2	Linux development Chronology.....	4
3	Linus Torvalds Biography	5
4	Linus Torvald Worldwide recognition as an inovator.....	6
4.1	Academics	6
4.2	Industry	6
4.3	Media	6
4.4	Space	6
4.5	Literature	7
4.6	Patents	7
5	Controversy over Linux.....	7
5.1	Linux is obsolete.....	7
5.2	Samizdat	7
5.3	Competition from Microsoft	8
5.4	SCO.....	8
5.5	Trademark rights.....	9
6	Latest Linux Development.....	9
6.1	Linux Kernel.....	9
6.2	Linux Community.....	9
6.3	Open Source Development Lab and Linux Foundation	10
6.4	Companies.....	10

1 The creation of Linux

"Every motivation that makes a man do something can be classified under "survival", "social life" and "entertainment." As a result, progress is defined as reaching a higher category: not doing a thing merely for survival, but for social reasons, and then, even better, just for fun.

Linus Torvalds "



In 1991, in Helsinki, Linus Torvalds began a project that later became the Linux kernel. It was initially a terminal emulator, which Torvalds used to access the large UNIX servers of the university. He wrote the program specifically for the hardware he was using and independent of an operating system because he wanted to use the functions of his new PC with an 80386 processor. Development was done on MINIX using the GNU C compiler, which is still the

main choice for compiling Linux today (although the code can be built with other compilers, such as the [Intel C Compiler](#))

As Torvalds wrote in his book *Just for Fun*, he eventually realized that he had written an operating system kernel. On 25 August 1991, he announced this system in a [Usenet](#) posting to the [newsgroup](#) "comp.os.minix.":

" 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 portable (uses 386 task switching etc), and it probably never will support anything other than AT-harddisks, as that's all I have :-(.
—Linus Torvalds "***

2 Linux development Chronology

- 1983: Richard Stallman creates the GNU project with the goal of creating a free operating system.
- 1989: Richard Stallman writes the first version of the [GNU General Public License](#).
- 1991: The Linux kernel is publicly announced on 25 August by the 21 year old Finnish student Linus Benedict Torvalds
- 1992: The Linux kernel is relicensed under the GNU GPL. The first so called "Linux distributions" are created.
- 1993: Over 100 developers work on the Linux kernel. With their assistance the kernel is adapted to the GNU environment, which creates a large spectrum of application types for Linux. The oldest currently existing Linux distribution, [Slackware](#), is released for the first time. Later in the same year, the [Debian](#) project is established. Today it is the largest community distribution.
- 1994: In March Torvalds judges all components of the kernel to be fully matured: he releases version 1.0 of Linux. The [XFree86](#) project contributes a graphic user interface (GUI). In this year the companies [Red Hat](#) and [SUSE](#) publish version 1.0 of their Linux distributions.
- 1995: Linux is ported to the [DEC Alpha](#) and to the [Sun SPARC](#). Over the following years it is ported to an ever greater number of platforms.
- 1996: Version 2.0 of the Linux kernel is released. The kernel can now serve several processors at the same time, and thereby becomes a serious alternative for many companies.

- 1998: Many major companies such as IBM, Compaq and Oracle announce their support for Linux. In addition a group of programmers begins developing the graphic user interface KDE.
- 1999: A group of developers begin work on the graphic environment GNOME, which should become a free replacement for KDE, which depended on the then proprietary Qt toolkit. During the year IBM announces an extensive project for the support of Linux.
- 2004: The XFree86 team splits up and joins with the existing X Window standards body to form the X.Org Foundation, which results in a substantially faster development of the X Window Server for Linux.
- 2005: The project openSUSE begins a free distribution from Novell's community. Also the project OpenOffice.org introduces version 2.0 that now supports OASIS OpenDocument standards in October.
- 2006: Oracle releases its own distribution of Red Hat. Novell and Microsoft announce a cooperation for a better interoperability.
- 2007: Dell starts distributing laptops with Ubuntu pre-installed in them.
- 2011: Version 3.0 of the Linux kernel is released

3 Linus Torvalds Biography

Torvalds was born in Helsinki, Finland. He is the son of journalists Anna and Nils Torvalds, and the grandson of poet Ole Torvalds. Both of his parents were campus radicals at the University of Helsinki in the 1960s. His family belongs to the Swedish-speaking minority (5.5%) of Finland's population. Torvalds attended the University of Helsinki between 1988 and 1996, graduating with a master's degree in computer science from NODES research group. His academic career was interrupted after his first year of study when he joined the Finnish Army, selecting the 11-month officer training program to fulfill the mandatory military service of Finland. In the army he holds the rank of second lieutenant, with the role of a ballistic calculation officer. In 1990, he resumed his university studies, and was exposed to UNIX for the first time, in the form of a DEC MicroVAX running ULTRIX. His M.Sc. thesis was titled Linux: A Portable Operating System.

His interest in computers began with a Commodore VIC-20. After the VIC-20 he purchased a Sinclair QL, which he modified extensively, especially its operating system. He programmed an assembly language and a text editor for the QL, as well as a few games. He is known to have written a Pac-Man clone named Cool Man. On January 5, 1991 he purchased an Intel 80386-based IBM PC and spent a month playing the game Prince of Persia before receiving his MINIX copy, which in turn enabled him to begin work on Linux.

After a visit to Transmeta in late 1996, Torvalds accepted a position at the company in California, where he would work from February 1997 to June 2003. He then moved to the Open Source Development Labs, which has since merged with the Free Standards Group to become the Linux Foundation, under whose auspices he continues to work. In June 2004, Torvalds and his family moved to Portland, Oregon, to be closer to the OSDL's Beaverton, Oregon-based headquarters

From 1997 to 1999, he was involved in 86open helping to choose the standard binary format for Linux and Unix. In 1999, he was named to the MIT Technology Review TR100 as one of the top 100 innovators in the world under the age of 35.

Red Hat and VA Linux, both leading developers of Linux-based software, presented Torvalds with stock options in gratitude for his creation. In 1999, both companies went public and Torvalds' share value temporarily shot up to roughly \$20 million.

His personal mascot is a penguin nicknamed Tux, which has been widely adopted by the Linux community as the mascot of the Linux kernel.

Although Torvalds believes "open source is the only right way to do software", he also has said that he uses the "best tool for the job", even if that includes proprietary software.

4 Linus Torvald Worldwide recognition as an inovator

4.1 Academics

In 1997, Torvalds received his Master degree (Laudatur Grade) from Department of Computer Science, University of Helsinki. Two years later he received honorary doctor status at Stockholm University, and in 2000 he received the same honor from his *alma mater*.

In August 2005, Torvalds received the Vollum Award from Reed College.

4.2 Industry

In 1998 Torvalds received an EFF Pioneer Award. In 2000 he was awarded the Lovelace Medal from the British Computer Society. In 2001, he shared the Takeda Award for Social/Economic Well-Being with Richard Stallman and Ken Sakamura. In 2008, he was inducted into the Hall of Fellows of the Computer History Museum in Mountain View, California. He was awarded the C&C Prize by the NEC Corporation in 2010 for "contributions to the advancement of the information technology industry, education, research, and the improvement of our lives".

4.3 Media

Time magazine has recognized Torvalds multiple times:

- In 2000, he was 17th in their Time 100: The Most Important People of the Century Poll.
- In 2004, he was named one of the most influential people in the world
- In 2006, the magazine's Europe edition named him one of the revolutionary heroes of the past 60 years.

InfoWorld presented him with the 2000 Award for Industry Achievement. In 2005 Torvalds appeared as one of "the best managers" in a survey by BusinessWeek. In 2006, Business 2.0 magazine named him one of "10 people who don't matter" because the growth of Linux has shrunk Torvalds' individual impact.

In summer 2004, viewers of YLE (the Finnish Broadcasting Company) placed Torvalds 16th in the network's 100 Greatest Finns. In 2010, as part of a series called The Britannica Guide to the World's Most Influential People, Torvalds was listed among The 100 Most Influential Inventors of All Time (ISBN 9781615300037).

4.4 Space

In 1996, an asteroid (9793 Torvalds) was named after him.

4.5 Literature

The 1999 novel *Cryptonomicon* by [Neal Stephenson](#) features several characters who use "Finux", a Unix-like operating system developed in Finland.

4.6 Patents

As of March 2011, Linus has been granted 35 patents worldwide (application and granted patents).

5 Controversy over Linux

Linux has been surrounded by controversy repeatedly since its inception.

5.1 Linux is obsolete

In 1992 [Andrew S. Tanenbaum](#), recognized computer scientist and author of the [Minix microkernel](#) system, wrote a Usenet article on the newsgroup comp.os.minix with the title "Linux is obsolete", which marked the beginning of a famous debate about the structure of the then-recent Linux kernel. Among the most significant criticisms were that:

- The kernel was [monolithic](#) and thus old-fashioned.
- The lack of [portability](#), due to the use of exclusive features of the Intel 386 processor. "Writing a new operating system that is closely tied to any particular piece of hardware, especially a weird one like the Intel line, is basically wrong."
- There was no strict control of the source code by any individual person.
- Linux employed a set of features which were useless (Tanenbaum believed that multithreaded [file systems](#) were simply a "performance hack").

Tanenbaum's prediction that Linux would become outdated within a few years and replaced by [GNU Hurd](#) (which he considered to be more modern) proved incorrect. Linux has been ported to all major platforms and its open development model has led to an exemplary pace of development. In contrast, GNU Hurd has not yet reached the level of stability that would allow it to be used on a production server. His dismissal of the Intel line of 386 processors as 'weird' has also proven short-sighted, as the [x86](#) series of processors and the [Intel Corporation](#) would later become near ubiquitous in personal computers.

5.2 Samizdat

In his unpublished book *Samizdat*, [Kenneth Brown](#) claims that Torvalds illegally copied code from MINIX. These claims have been refuted by Tanenbaum:

He [Kenneth Brown] wanted to go on about the ownership issue, but he was also trying to avoid telling me what his real purpose was, so he didn't phrase his questions very well. Finally he asked me if I thought Linus wrote Linux. I said that to the best of my knowledge, Linus wrote the whole kernel himself, but after it was released, other people began improving the kernel, which was very primitive initially, and adding new software to the system--essentially the same development model as MINIX. Then he began to focus on this, with questions like: "Didn't he steal pieces of MINIX without permission." I told him that MINIX had clearly had a huge influence on Linux in many ways, from the layout of the file system to the names in the source tree, but I didn't think Linus had used any of my code.

The book's claims, methodology and references were seriously questioned and in the end it was never released and was delisted from the distributor's site.

5.3 Competition from Microsoft

Although Torvalds has said that Microsoft's feeling threatened by Linux in the past was of no consequence to him, the Microsoft and Linux camps had a number of antagonistic interactions between 1997 and 2001. This became quite clear for the first time in 1998, when the first Halloween document was brought to light by Eric S. Raymond. This was a short essay by a Microsoft developer that sought to lay out the threats posed to Microsoft by free software and identified strategies to counter these perceived threats. However the Free Software Foundation issued a statement that Microsoft's production of proprietary software is bad for software users because it denies users "their rightful freedom."

Competition entered a new phase in the beginning of 2004, when Microsoft published results from customer case studies evaluating the use of Windows vs. Linux under the name "Get the Facts" on its own web page. Based on inquiries, research analysts, and some Microsoft sponsored investigations, the case studies claimed that enterprise use of Linux on servers compared unfavorably to the use of Windows in terms of reliability, security, and total cost of ownership.

In response, commercial Linux distributors produced their own studies, surveys and testimonials to counter Microsoft's campaign. Novell's web-based campaign at the end of 2004 was entitled "Unbending the truth" and sought to outline the advantages as well as dispelling the widely publicized legal liabilities of Linux deployment (particularly in light of the SCO v IBM case). Novell particularly referenced the Microsoft studies in many points. IBM also published a series of studies under the title "The Linux at IBM competitive advantage" to again parry Microsoft's campaign. Red Hat had a campaign called "Truth Happens" aimed at letting the performance of the product speak for itself, rather than advertising the product by studies.

In the autumn of 2006, Novell and Microsoft announced an agreement to co-operate on software interoperability and patent protection. This included an agreement that customers of either Novell or Microsoft may not be sued by the other company for patent infringement. This patent protection was also expanded to non-free software developers. The last part was criticized because it only included non-commercial developers.

In July 2009, Microsoft submitted 22,000 lines of source code to the Linux kernel under the GPLv2 license, which were subsequently accepted. Although this has been referred to as "an historic move" and as a possible bellwether of an improvement in Microsoft's corporate attitudes toward Linux and open-source software, the decision was not altogether altruistic, as it promised to lead to significant competitive advantages for Microsoft and avoided legal action against Microsoft. Microsoft was actually compelled to make the code contribution when Vyatta principal engineer and Linux contributor Stephen Hemminger discovered that Microsoft had incorporated a Hyper-V network driver, with GPL-licensed open source components, statically linked to closed-source binaries in contravention of the GPL licence. Microsoft contributed the drivers to rectify the licence violation, although the company attempted to portray it as a charitable act, rather than one to avoid legal action against it. In the past Microsoft had termed Linux a "cancer" and "communist".

5.4 SCO

In March 2003, the SCO Group accused IBM of violating their copyright on UNIX by transferring code from UNIX to Linux. SCO claims ownership of the copyrights on UNIX and a lawsuit was filed against IBM. Red Hat has countersued and SCO has since filed other related lawsuits. At the same time as their lawsuit, SCO began selling Linux licenses to users who did not want to risk a possible complaint on the part of SCO. Since Novell also claims the copyrights to UNIX, it filed suit against SCO.

SCO has since filed for bankruptcy.

5.5 Trademark rights

In 1994 and 1995, several people from different countries attempted to register the name "Linux" as a trademark. Thereupon requests for royalty payments were issued to several Linux companies, a step with which many developers and users of Linux did not agree. Linus Torvalds clamped down on these companies with help from Linux International and was granted the trademark to the name, which he transferred to Linux International. Protection of the trademark was later administered by a dedicated foundation, the non-profit Linux Mark Institute. In 2000, Linus Torvalds specified the basic rules for the assignment of the licenses. This means that anyone who offers a product or a service with the name *Linux* must possess a license for it, which can be obtained through a unique purchase.

In June 2005, a new controversy developed over the use of royalties generated from the use of the Linux trademark. The Linux Mark Institute, which represents Linus Torvalds' rights, announced a price increase from 500 to 5,000 dollars for the use of the name. This step was justified as being needed to cover the rising costs of trademark protection.

In response to this increase, the community became displeased, which is why Linus Torvalds made an announcement on 21 August 2005, in order to dissolve the misunderstandings. In an e-mail he described the current situation as well as the background in detail and also dealt with the question of who had to pay license costs:

[...] And let's repeat: somebody who doesn't want to protect that name would never do this. You can call anything "MyLinux", but the downside is that you may have somebody else who did protect himself come along and send you a cease-and-desist letter. Or, if the name ends up showing up in a trademark search that LMI needs to do every once in a while just to protect the trademark (another legal requirement for trademarks), LMI itself might have to send you a cease-and-desist-or-sublicense it letter.

At which point you either rename it to something else, or you sublicense it. See? It's all about whether you need the protection or not, not about whether LMI wants the money or not.

[...] Finally, just to make it clear: not only do I not get a cent of the trademark money, but even LMI (who actually administers the mark) has so far historically always lost money on it. That's not a way to sustain a trademark, so they're trying to at least become self-sufficient, but so far I can tell that lawyers fees to give that protection that commercial companies want have been higher than the license fees. Even pro bono lawyers charge for the time of their costs and paralegals etc.

—Linus Torvalds

The Linux Mark Institute has since begun to offer a free, perpetual worldwide sublicense.

6 Latest Linux Development

6.1 Linux Kernel

There are many other well-known maintainers for the Linux kernel beside Torvalds such as Alan Cox and Marcelo Tosatti. Cox maintained version 2.2 of the kernel until it was discontinued at the end of 2003. Likewise, Tosatti maintained version 2.4 of the kernel until the middle of 2006. Andrew Morton steers the development and administration of the 2.6 kernel, which was released on 18 December 2003 in its first stable incarnation. Also the older branches are still constantly improved.

6.2 Linux Community

The largest part of the work on Linux is performed by the community: the thousands of programmers around the world that use Linux and send their suggested

improvements to the maintainers. Various companies have also helped not only with the development of the Kernels, but also with the writing of the body of auxiliary software, which is distributed with Linux.

It is released both by organized projects such as Debian, and by projects connected directly with companies such as Fedora and openSUSE. The members of the respective projects meet at various conferences and fairs, in order to exchange ideas. One of the largest of these fairs is the LinuxTag in Germany (currently in Berlin), where about 10,000 people assemble annually, in order to discuss Linux and the projects associated with it.

6.3 Open Source Development Lab and Linux Foundation

The Open Source Development Lab (OSDL) was created in the year 2000, and is an independent nonprofit organization which pursues the goal of optimizing Linux for employment in data centers and in the carrier range. It served as sponsored working premises for Linus Torvalds and also for Andrew Morton (until the middle of 2006 when Morton transferred to Google). Torvalds works full-time on behalf of OSDL, developing the Linux Kernels.

On January 22, 2007, OSDL and the Free Standards Group merged to form The Linux Foundation, narrowing their respective focuses to that of promoting GNU/Linux in competition with Microsoft Windows.

The **Linux Foundation (LF)** is a non-profit technology consortium chartered to foster the growth of Linux, the founding members are:

1. Platinum Members (7), who each donate US\$500,000 annually, incl. (listed alphabetically) Fujitsu Ltd, Hitachi Ltd, Intel Corp., IBM Corp., NEC Corp., Oracle Corp., and Qualcomm Innovation Center Inc.
2. Gold Members (12), who each donate US\$100,000 annually, incl. (listed alphabetically) Advanced Micro Devices Inc., China Mobile Ltd, Cisco Systems Inc., Electronics and Telecommunications Research Inst., Google Inc., Hewlett-Packard Development Co. LP, Motorola Solutions Inc., NetApp Inc., Nokia Oyj., Novell Inc., Panasonic Corp., and Toyota Motor Corp.
3. Silver Members (78), who each donate US\$5,000-20,000 (scaling with number of employees) annually, e.g. (listed alphabetically) Adobe Systems Inc., ARM Holdings PLC, Broadcom Corp., Canonical Ltd, Dell Inc., DreamWorks Animation LLC, EMC Corp., Huawei Technologies Co. Ltd, LG Electronics Inc., MIPS Technologies Inc., Protecode Inc., Red Hat Inc., Renesas Electronics Corp., Samsung Electronics Co. Ltd, Siemens AG, Sony Corp., Texas Instruments Inc., Toshiba Corp., VMware Inc., et al

6.4 Companies

Despite being open-source, a few companies profit from Linux. These companies, most of which are also members of the Open Source Development Lab, invest substantial resources into the advancement and development of Linux, in order to make it suited for various application areas. This includes hardware donations for driver developers, cash donations for people who develop Linux software, and the employment of Linux programmers at the company. Some examples are IBM and HP, which use Linux on their own servers, and Red Hat, which maintains its own distribution. Likewise Nokia supports Linux by the development and LGPL licensing of Qt, which makes the development of KDE possible, and by employing some of the X and KDE developers.