

# Client alternatives in schools – going forward

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## ABSTRACT

Since 2000 there has been a steady growth of municipalities, regions and countries deploying free software at schools. Big deployments are done in Spain, Germany and Brazil. Several projects are targeting schools with distributions such as Skolelinux[1], K12LTSP[2], Linux Educacional[3] and Edubuntu[4] targeting netbooks as One Laptop per Child[5] and Classmate PC[6]. I ask how the desktops are received so far and what can be improved with respect to educational use. We take a look at mEDUXa[7] on Canary Island and Sugar[8] from One Laptop per Child and ask how KDE[9] may improve the desktop tailored for use in education.

## GENERAL TERMS AND KEYWORDS

Management, Measurement, Performance, Design, Economics, Reliability, Human Factors, Standardization, Languages, Cross Desktop, Education, Schools, Free Software, Deployment.

## FREE SOFTWARE IDEALS FOR EDUCATION

Many of the most prominent free software promoters as Richard Stallman[10], John “Maddog” Hall[11] and Walter Bender[12] (from Sugar desktop environment) speak enthusiastically on the topic of using free software in education. Richard points out reasons that goes beyond license cost[13], which may be a disadvantage for proprietary software - a disadvantage that can be eliminated by donating copies of proprietary software to schools (Watch out!—a school that accepts this offer may have to pay for future upgrades.). “Free software permits students to learn how software works. When students reach their teens, some of them want to learn everything there is to know about their computer system and its software. That is the age when people who will be good programmers should learn it,” writes Richard Stallman in 2003.

Skolelinux is one project focusing on the learning aspect with free software in education. When I and Petter Reinholdtsen[14] started the Skolelinux project in 2001, they were motivated by the sad fact that most local schools only had old computers and a few applications running on Windows, and no money to upgrade. They found it frustrating that proprietary software prevented pupils from

learning technical, under-the-hood things by example - from source code written by expert programmers. I and Petter decided to stop talking and focused on simply get free software in use in at schools. They invited to a startup meeting in Oslo June 2, 2001[15], and now the project is a standard part of Debian Edu[16] aiming for its fourth release as we speak.

Since 2001 we have seen several free software projects targeting schools. Some has been successful as Debian Edu, K12LTSP, Edubuntu and Linux Educacional. Some has been restarted as the openSuSE Education[17]. Several Linux distros have not been able to make a second release, just stopping after the lead developer found something else to be interested in. Some has been merged upstream as LinEx[18] and Skolelinux which both are a part of Debian Edu, even if they've kept their separate brands for marketing reasons in different regions and countries.

## TO MANY ALTERNATIVES?

The latest two additions to the school desktop is Sugar Desktop Environment, which was influenced by the tailored Gnome[19] desktop for younger pupils at schools in Extremadura, Spain. The second one is the KDE Plasma Educational still[20] in development, heavily inspired by mEDUXa used at the Canary Islands in Spain since 2006.

All these distributions and desktop choices can make teachers and school leaders confused. The alternatives raise a lot of questions, where most of it may not be as confusing when choosing a Linux configuration made for schools. But I must convey two major warnings when approaching schools.

First, focus on computer use and user friendliness relevant for students and teachers. At the Open Minds conference in Indianapolis in USA, Vern Ceder[21] told an interesting story about getting help from Linux User Group (LUG) enthusiasts when introducing Linux to tracers. Vern works as a Director of Technology at Canterbury School at Fort Wayne. After a year of lobbying 3-4 years ago, he was finally able to persuasion teachers in trying out Linux in the classroom. To make a good introduction, he invited a local LUG enthusiast to show the beauty of Linux.

The Linux enthusiast immediately started the command shell, starting Apache[22], showing how that could serve web pages in a browser. After just two minutes, the teachers were lost. After 10 minutes Vern had to halt the presentation, showing what Linux could be used for students. By walking through the end-user friendly application OpenOffice[23], a free software video player and Firefox web browser with fully working Flash and Java, he was able to get the presentation on track. When adding a short walk through with the KDE Edu[24] applications and GCompris[25], and demonstrating that USB works flawlessly, Vern was able prevent a disaster. But the Linux deployment was delayed by 6 months.

Secondly, there are several stories about choosing Linux-distros, and the choice between a GNOME or KDE desktop. This easily leads to uncertainty, and may be the same as telling schools to choose Windows. Some Linux enthusiast recommend Fedora, others Edubuntu. Schools can use Skolelinux, but the computer staff are running RedHat[26] on the servers, suggesting that this may be the right choice for the schools. Then the KDE and Gnome desktop ballot starts. Be certain, a Windows positive computer staffs can easily revoke any decision of using free software. They think they know what's needed in schools, recommending "one" system. They conveniently forgets that Microsoft has launched 6 different Windows versions the last 10 years[27]. Several such Windows versions already runs on the different computers at schools, bought the last 10-12 years. Maintenance of such variety of Windows versions cost considerable more than just maintaining a couple Windows "versions". Not to forget the schools just got 10-20 percent of the maintenance budget compared to the municipality staff.

Which such diversity in computers and little money for maintenance, a Linux distro for schools is the answer. Schools can keep their equipment twice as long than proprietary software allows, and they got the benefit of centralized operated Linux system with free software.

Remember most teachers don't have personal experience in using computer as a natural part of their teaching. They may meet parents expecting their kids to use MS Office[28], since they've heard that's mandatory in the workplace. Because of that I'll walk through opportunities and threats when introducing or broadening the use of free software in education.

### **FOCUS ON PRACTICAL USE!**

The ideal for using free software in schools is permitting students to learn how software works. User surveys shows that most students and teachers cares of three things.

First are that software can be used without problems when used on a computer at their school or at home. This means that things they've used to with Windows must work flawlessly on Linux. Support for Microsoft documents (god

forbid) are mandatory. Java, Flash videos, other proprietary format[29] and USB memory sticks should work without a hitch.

Secondly teachers and students mostly care about freedom 0 and 2 when using free software. They want to copy and run their software for any purpose on any machine. It's important that students can use same software at home as they use at schools.

Third teacher and students expects more from a computer system at schools than that software and web sites works flawlessly. They expect that the software can be used for teaching, as a natural part of the different subjects. I've added four use cases which are relevant when introducing free software to schools:

**1 Use case:** The class aims to learn more about the different regions in their country. The class is divided into 14 groups. There are two pupils in each group. The groups are assigned on region in the country each, where each group will present facts from their region to the other students. Each group presentation will take around 3-4 minutes.

The students collects facts, figures and pictures from different Internet sites. Each group compile a presentation of their region in OpenOffice. Then each group are presenting their region on their classroom white board. This is done easily since the presentation are collected in Moodle Learning Management System[30], which makes the slides easy accessible from the web browser on the presentation PC connected to the video projector.

**Technology in use:** Linux desktop, web browser, office suite, Learning Management System

**2 Use case:** The class will present their wildlife observations from their field trip to the nearby lake. Each pupil has to take pictures of ordinary plants and waterside animals using their mobile camera. After the trip, the student add their pictures to an web map of the beach they visited. They also add facts to what the animals eat, living condition for grass etc.

**Technology in use:** Mobile phone camera with USB connection, Linux desktop, web browser

**3 Use case:** Try to make a song you like without copying a MIDI-file[31] or using a music sheet.

**Technology in use:** A synthesizer connected to a Rosegarden music composition and editing application on a Linux laptop.

**4 Use case:** Let the students change the desktop and spell checker to French in their French class, instead of their native desktop. When being a native English or Norwegian speaker, switching language on a Linux desktop or in the office suite is really easy with built in spell checking supporting many languages.

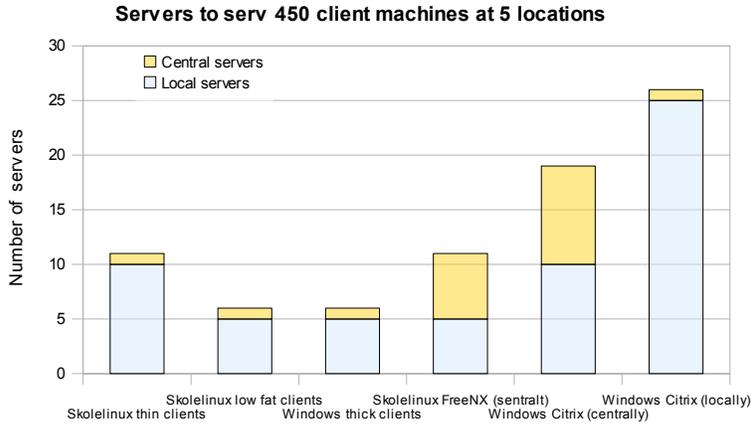


Figure 1: Number of servers needed with different client types

**Technology in use:** Both native and foreign languages are already installed by default in the most used Linux distributions made for education. If your language is left out, it's easily installable.

**Sharing content**

Projects as Linux Educacional in Brazil, LinEx in Extremadura and Skolelinux in Rheinland-Pfalz[32] all got an extensive content offer to their schools.

- Linux Educational are shipping videos and scanned books as a part of the school server. In addition there are made pedagogic Flash applications.
- LinEx in Extremadura got comprehensive documentation and teaching material for use with Squeak when teaching math and natural science. The LinEx project also made material for helping students to use the Linux destkop, e-mail, web browser and other applications.
- Skolelinux in Germany have invited many teachers to make lections and teaching material for selected educational software.
- I also recommend www.lektion.se in Sweden. They got tons of teaching material made by thousands of teachers. As we speak around 190 000 teachers are sharing material between them self.

In Norway paper textbooks are replaced by digital content online, cause of lower prices.

**CENTRALIZED MAINTENANCE**

There is extensive use of LTSP[33] clients on Linux installations at schools. Today LTSP supports both thin clients and low fat (diskless) clients. In addition schools and provide FreeNX clients for remote desktops. There are also ways to easily connect laptops and netbooks to a school network.

Schools' resources for computer maintenance and upkeep

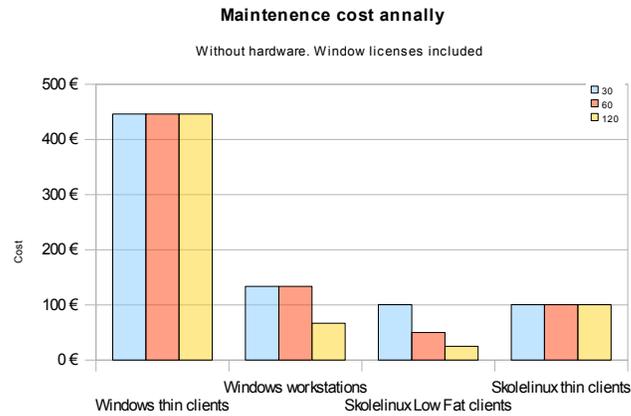


Figure 2: Maintenance cost decided by number of clients and type

might not be more than one fifth compared to what's usual with ordinary office PC's. They may got a teacher who has 4-8 hours a week for maintaining 50 to 100 client machines and a server at a school with 320 students and teachers. Every client PC are used by four-five different users a day.

Many municipalities and regions do centralized maintenance of their schools' Linux network. With centralized maintenance, it's easier to support the schools with appropriate knowledge in network administration and second and third line support. A local teacher can do first line support.

The operational cost is deeply connected to the number of servers, the number of client hard drives to maintain and the number of concurrent users. When running 450 client machines at 5 schools, software has to be maintained on 450 client machines and 6 servers. This does not taking into account that two Windows servers are recommended at each location to handle dhcp fail-over and software distribution. When running Low Fat[34] LTSP clients, only 6 servers needs to software, user and configuration maintenance.

Reducing the number of disks and machines to maintain actively gives huge effect on operational cost, as this market prices from 2005 shows:

Since Low Fat clients needs less servers and are stateless, even if software are running locally on each machine. This gives the lowest cost and best cost performance ratio compared to any configuration. Similar effects can be achieved by imaging techniques with laptops.

**Reduced hardware spec and power**

Standard power consumption on an office computer with CRT screen is around 250 Watt. It may seems to be a reasonable number, but when cramping in 20-30 computers in a classroom we are talking about 5000 Watt. Adding 30 active kids, we are talking about a huge stove installed in the classroom, which can make it extremely hot on sunny

day with 25-27 degree Celsius. Finding ways to decrease power consumption are of great importance, or else the schools has to beef up their cooling system, costing more than the computer hardware.

Today it's easy to find low powered machines which easy to run as Low Fat client's with 1,6 GHz processor, 1 GB RAM and a small swap disk. Such machine may not use more than 20 Watt reducing the power consumption with 80%. Introducing One Laptop Per Child or ARM-based netbooks may reduce power consumption to 2-5 Watt.

Linux also needs considerable less memory to run the latest and greatest software. You can run a modern Linux desktop with on 800 MHz processor and 1 GB RAM. Especially Firefox and OpenOffice needs considerable with memory, which increases the memory usage. Today there are no widely adopted Webkit based browser which could replace Firefox and reduce the memory footprint. The same goes for OpenOffice. Addressing memory use is of great importance cause of the cost, not only for educational desktops.

#### **SOCIAL DESKTOPS, NETBOOKS AND REVERSED MOORE'S LAW[35]**

There were five major concepts that Skolelinux, mEDUXa, LinEx One Laptop per Child bough to the table.

- A complete computer network for the schools, centrally maintainable with an operational concept and digital user profiles made for the school budget
- A selection of free software suited for schools, running on a free operating system in permitting students to learn how software works.
- A tailored desktop for different age groups, making it easy to start using free software letting the dekstop "grow" when the kids are growing.
- A social desktop where students easily exchange drawings, music and text with their class mates.
- Reversed mores law, using hardware with reduces specifications, innovative mesh network and LCD screen for a new kind of use cases.

#### **NEXT STEPS?**

There are several interesting observations from schools today. First more and more kids got a mobile phone. Such device can be really effective when having a decent camera, as we saw exemplified at use case #2 with the field trip. Lets connect our mobile phones with our desktop.

Second the "reversed" Moore's law will continue. It's expected that phones should run more features and services. It's expected that a Linux desktop and free software can run smoothly on 700-1000 MHz ARM-based devices with 512 MB or 1 GB RAM and limited solid-state drives.

Third making applications context sensitive by adapting to different form factors, positioning and angels (with accelerators and/or positioning (GPS))

At last extending the social desktop. Making a Netbook/MID desktop with everything from news at my fingertip to exchange a picture with a friend, content and other things. This includes connecting the Linux desktop to anything from PIM-data, Bluetooth services and your friends or class mates.

#### **ACKNOWLEDGMENTS**

This article had not been possible to write without The Norwegian Ministry of Education and Research. They founded research on experiences with centralized maintained free software solutions in schools. The educational agency of Oslo, the capital city of Norway. The municipalities of Nittedal, Hurum, Narvik and Kongsvinger. The administrative centers of Akershus, and Møre og Romsdal.

In addition to Norwegian educational authorizes great help on facts and background are provided by: Jose L. Redrejo Rodriguez at the LinEx project in Extremadura. Agustín Benito Bethencourt from the mEDUXa, the Kubuntu/Debian based Linux distribution tailored for Canary Islands school. Peter Senna Tschudin Product Manager for Linux Educational 2.0 for Brazilian schools. Walter Bender from the Sugar Desktop project and Jim Gettys from One Laptop per Child. Paul Nelson and Eric Harrison from the K12LTSP project. Vern Ceder, the Director of Technology at Canterbury School at Fort Wayne. I will thank Jim McQuillan, Scott Balneaves and Otavio Salvador for their exellent work with Linux Terminal Project. Canonicals sponsorship for remaking LTSP, making it easy to integrate and deploy with different GNU/Linux distributions. Canonicals sponsorship for LTSP helped including full support for diskless Low Fat clients.

Not to forget. There has been countless teachers and software developers included in both the user community of free software in education and software developers. Names as Anne-Marie Mahfouf from KDE Edu, Bruno Coudoin from GCompris and Kurt Gramlich from Skolelinux in Germany should be mentioned.

#### **REFERENCES**

- 1.Skolelinux is a GNU/Linux distribution for educational use on laptops and pc's, in schools tailored for central maintenance at municipality, region or state level. Skolelinux is a part of the Debian Edu together with GNU/LinEx
- 2.K12LTSP is a GNU/Linux project for schools based on a modification to the Centos operating system with the the Linux Terminal Server Project (LTSP) integrated into it.
- 3.Linux Educacional is a Debian based distribution made

for Brazilian schools. GNU/Linux is already deployed on more than 43.000 computer labs used by more than 30 million students in Brazilian schools

4. Edubuntu, also known as Ubuntu Education Edition, is an official derivative of the Ubuntu designed for classrooms and schools
5. One Laptop per Child is an inexpensive sub netbook for school children in the developing world
6. Classmate PC is Intel's entry into the market for low-cost sub netbooks for children in the developing world.
7. mEDUXa is a Kubuntu based GNU/Linux distro for schools in the Canary Islands
8. Sugar Desktop is the desktop environment originally developed for the One Laptop per Child.
9. Suggested KDE improvements for education: <http://techbase.kde.org/Projects/Plasma/Education>
10. Richard Stallman pioneered the concept of free software and copyleft in 1983
11. John "Maddog" Hall is the Executive Director of Linux International
12. Walter Bender is the former president of OLPC Software and Content, now president for Sugar Labs
13. Why schools should exclusively use free software, by Richard Stallman: <http://www.gnu.org/philosophy/schools.html>
14. Petter Reinholdtsen is the co-founder of Skolelinux
15. Debian Edu is the project which makes Skolelinux
16. Oslo, June 2, 2001 was the first project meeting for Skolelinux. <http://en.wikipedia.org/wiki/Skolelinux>
17. openSUSE Education is an add-on to openSUSE for education
18. LinEx is a Debian Edu based GNU/Linux distribution
19. GNOME is a desktop environment software for computers running Linux and Unix-like operating systems
20. KDE Plasma Educational is an educational desktop for

KDE still under development

21. Vern Ceder, the Director of Technology at Canterbury School at Fort Wayne. [http://www.k12tsp.org/mediawiki/index.php/Dealing\\_With\\_Uncooperative\\_Tech\\_Staff](http://www.k12tsp.org/mediawiki/index.php/Dealing_With_Uncooperative_Tech_Staff)
22. Apache is an Internet web server.
23. OpenOffice is a free software cross platform office suite
24. KDE Edu are a collection of more than 20 applications for educational use
25. GNOME is a desktop environment software for computers running Linux and Unix-like operating systems
26. RedHat is a GNU/Linux distribution sold commercially
27. Windows versions last 10 years: [http://en.wikipedia.org/wiki/History\\_of\\_Microsoft\\_Windows](http://en.wikipedia.org/wiki/History_of_Microsoft_Windows)
28. MS Office is a proprietary office suite for Windows and Mac
29. Proprietary video formats are formats where the license holder has exclusive control over the technology where they may exclude others from using the format: [http://en.wikipedia.org/wiki/Proprietary\\_format](http://en.wikipedia.org/wiki/Proprietary_format)
30. Learning Management System is software for delivering, tracking and managing training/education.
31. MIDI-file is Musical Instrument Digital Interface file for electronic musical instruments
32. Rheinland-Pfalz is one of the 16 German federal states
33. LTSP Linux Terminal Server Project: <http://www.ltsp.org/>
34. Low Fat clients or Diskless workstations are Hybrid Clients storing software and files centrally, where software is run locally on each client: [http://en.wikipedia.org/wiki/Hybrid\\_client](http://en.wikipedia.org/wiki/Hybrid_client)
35. Moore's Law describes a long-term trend in the history of computing hardware with doubling of transistors approximately every two years: [http://en.wikipedia.org/wiki/Moore%27s\\_law](http://en.wikipedia.org/wiki/Moore%27s_law)