Linux in Universities

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Linux in Universities

- Linux in the real world
- Poised to take the desktop
- The case for Linux in universities
- What should schools do about it?
- Building a better infrastructure with Linux
- Summary / Questions / Round Table

Linux in the real world

Universities prepare students for the real world, so let's look at how Linux is doing there:

- Linux runs 50%-80% of HPC clusters
- Linux runs 25% of New Servers
- Linux is OS of choice for new embedded systems
- Linux runs 2% of New Desktops

Linux runs 50%-80% of HPC clusters

Linux is cheap, reliable, easy to manage remotely, fast, and standards-compliant.

This makes it easy to build supercomputers from clusters of cheap PCs.

According to IDC,

Linux represented half of year 2000 revenue in the high performance computing market

87 of 100 clusters listed at the supercomputer database topclusters.org run Linux

Linux runs 25% of New Servers

According to a recent Morgan Stanley survey of CIOs, 29 percent of companies are now using Linux servers

Big companies -- IBM, Sun, HP, Dell, Red Hat, Suse, and Oracle -- are working hard to sell Linux servers.

IDC says the number of servers sold with Linux as the operating system grew 18% last year, and that by 2006, 26% of servers in operation will be running Linux.

Linux is OS of choice for new embedded systems

Linux is highly reliable and customizable, and is royalty-free -- which makes it ideal for embedded systems.

For example, the TiVo personal video recorder is controlled by Linux

A recent survey of embedded systems developers showed that Linux was the most popular choice for their next project, beating out both VxWorks and Windows

Linux runs 2% of New Desktops

IDC says Linux’s market share on the desktop has slowly increased every year since 1995 -- but is still only about 2% - 3%.

That’s hardly a dent in Microsoft’s monopoly.

Problem is, application vendors write programs for Windows, since that’s what everyone uses.

This Catch-22 is called "the applications barrier to entry" for new operating systems.

Poised to take the desktop

The numbers say Linux has failed on the desktop, but major events have conspired to prepare Linux for another leap forward:

- Computers getting cheaper
- Microsoft getting more expensive
- Free office software maturing
- Microsoft Alienating Businesses
- Governments want independence
- Linux vendors aiming for the desktop

It was a joke, but it’s not funny anymore:

"World domination. Fast." - Linus Torvalds, 1994

Computers are getting cheaper, but Windows is getting more expensive

- 1982: 4.77MHz 8 bit IBM PC $3000, DOS $5
- 2002: 1GHz PC $600, WinXP Home $100

Computer speeds increased 40%/year,
computer prices fell 8%/year,
but Microsoft OEM prices increased 15%/year

Windows now makes up 16% of the price of a computer

Free software maturing

High quality Free* software (and what it replaces):

- OpenOffice (Microsoft Office)
- Evolution (Outlook)
- Mozilla (Internet Explorer)
- Apache (IIS)
- PHP (ASP)
- OpenLDAP+Kerberos (ActiveDirectory)
- Linux + Wine (Windows itself)

(*Free = available under an Open Source license that lets users fix bugs in the software, and share it with other users for free)

Microsoft Alienating Businesses

US News and World Reports says:

"Chafing under the 'Microsoft tax' -- license fees collected each time they upgrade personal computers and server networks -- customers from the government of China to Europe's Ford Motor Co. division are switching to free software systems."

Bloor Research says:

"It looks as though the battle for the server market is being won by Linux... most Wall Street trading operations are converting to the open source operating system."

The Butler group predicts:

"Linux is expected to dominate the server market by 2009"

ZDNet says

58% of companies would switch to Linux on the desktop immediately -- if applications were available.

Governments Want Independence

Microsoft can disable Windows XP remotely!

Foreign governments hate this.

Governments would rather support local talent than send money to Redmond.

Linux is perceived as a local alternative.

Germany’s Interior Minister said moving to Linux would help cut costs and improve security in the nation’s computer networks.

"We are raising computer security by avoiding a monoculture..."

Government use of Linux will help drive improvements to Linux

Linux Vendors Aiming For Desktop

Every major Linux vendor (Red Hat, Suse, Mandrake, Debian) is now preparing for the desktop

Several new Linux vendors (Lycoris, Xandros, Lindows) are focusing solely on the desktop

Their goal: make Windows users comfortable, and give them easy access to thousands of Free software packages

Many vendors are including Codeweavers Crossover Wine, which runs Microsoft Word and Excel seamlessly and well

The case for Linux in universities

Linux's growing popularity in the real world means a growing need for Linux-savvy graduates, so universities should create Linux-based programming courses, right?

Yes, but the university should use Linux elsewhere, too, since:

- Linux costs less to acquire and run
- Linux eases software license management
- Linux is robust and secure
- Linux helps discourage piracy
- Free Software helps teach

Linux costs less to acquire and run

The Robert Frances Group says:

"The cost of running Linux is roughly 40% that of Microsoft Windows... Linux... also came out ahead of Windows in terms of administration costs, despite the fact that it’s less expensive to hire Windows system administrators."

According to TheOpenEnterprise.com,

81% of corporate IT departments believe that Open Source software such as Linux has lower TCO than proprietary software.

Linux eases license management

Microsoft offers huge educational discounts -- but not on the right to use Windows

Microsoft recently reminded UCLA and other colleges they MUST purchase PCs with Windows preloaded, regardless of any deal with Microsoft

The LAUSD was fined $300,000 for not being able to prove they had the right licenses

Free software, on the other hand, is free to use, customize, and distribute, forever. No need for complicated bookkeeping!

Linux is robust and secure

Gartner says:

"Due to legacy code and resistance to cultural change, Microsoft will not deliver necessary security ... before 2004".

TechWeb says:

"IT pros navigating a minefield of insecure software and systems are finding safe ground in Linux. That’s because the open-source operating system -- in part due to its very openness -- has become a model of security.

IBM says:

"The retail sector is interested in Linux because of its stability and security, rather than the fact that it is free."

Linux helps discourage piracy

40% of students surveyed at two public universities admitted to having pirated computer software.

Universities could help fight piracy by encouraging the use of Free software like OpenOffice, The GIMP, or Linux instead of proprietary software like Microsoft Office, Photoshop, or Windows.

Then students could install the software anywhere, anytime without violating copyright laws.

Free Software helps teach

Jeff Williams of Concordia University says exposing students to alternate office software packages helps teach concepts rather than just applications

John Howland of Trinity University says Open Source software is good for computer science courses because it lets students read and understand the source code for great software

Western Carolina University uses a Linux server to provide a uniform programming environment for an unlimited number of high school students -- without worrying about client access licenses

What should schools do about it?

The abrupt increase in popularity of Linux and Free software in general means universities can and should:

- Monitor the state of Linux closely
- Include Linux in strategic plans
- Begin supporting Linux on the desktop
- Use OpenOffice for universal access
- Begin migrating servers to Linux
- Use Linux to build better infrastructure

Monitor the state of Linux closely

For concise weekly analysis, read Linux Weekly News (lwn.net)

Example item from LWN:

A recent MITRE study on Free and Open Source software said

"FOSS plays a more critical role in the DoD than has generally been recognized... banning FOSS would have immediate, broad, and strongly negative impacts on the ability of [the DoD] to defend against cyberattacks."

Include Linux in strategic plans

Because Free software like Linux has so many advantages for universities, strategic plans and policy documents should specifically recommend its use.

University policy should state that software should be chosen on a value-for-money basis. Free software like Linux should not be discriminated against.

Master plans for information infrastructure should encourage the use of Free software like Linux to promote security, flexibility, and vendor independence.

Begin supporting Linux on the desktop

Faculty and students are already using Linux, but many university IT departments only support Windows

First step: start supporting Free software that runs on Windows (e.g. OpenOffice, Mozilla)

Second step: start supporting that same software on Linux

Third step: start supporting Linux itself

Use OpenOffice for universal access

One school standardized on OpenOffice, and sends OpenOffice CD-ROMs to students before they first come to school, so they can get their laptops prepared -- regardless of whether they run Windows or Linux.

You just can’t do that with Microsoft Office.

Free software means no barriers - the software is always there for everyone

Begin migrating servers to Linux

Software for Unix simply runs on Linux without change, thanks to the POSIX standard

That means you can use Linux to run Unix software on IBM mainframes, and oddly enough, many businesses are!

But it also means it’s easy to migrate from expensive RISC systems from Sun to fast, inexpensive servers from IBM, HP, and Dell

Building a better infrastructure with Linux

- User directory and authentication
- File services
- Zero-Administration Workstations
- One Administrator per 1000 PCs?

User directory and authentication

Universities want to move all services to the web, which means they need a universal way of checking usernames and passwords

UC Berkeley is using LDAP and Kerberos to implement CalNet, which is used to grant access to many services -- even student elections

Unlike PKI, Kerberos+OpenLDAP is free and ready to roll out, and username/password is more familiar and convenient than certificates.

Many universities are using this combination.

File services

Users should have access to their files no matter what computer they log into -- no matter what operating system it's running.

OpenAFS is Free software for Windows, MacOSX, Linux, and Unix that lets users do just that, securely and conveniently.

Universities using OpenAFS + Kerberos for universal file access include:

Arizona State, Dartmouth, Duke, Michigan, MIT, MSU, NCSU, NJIT, Notre Dame, Rose-Hullman, RPI, Stanford, UCSC, ...

Zero-Administration Workstations

The universal cure for PC problems: reboot!
If that doesn't work: reinstall!

Why not reinstall every time you reboot?
Or run without a hard drive, and never install!
Then every workstation is identical, and needs no configuration.

750MHz 128MB PCs with 17" monitor: $250
Boot server: $500
Total cost for lab: $300/seat

Net booting is insecure. Use local boot server!

One Administrator per 1000 PCs?

Boot servers for workstation clusters can be read-only mirrors of a central master

A single administrator can update a thousand PCs just by putting new files on the master

AFS is good at handling replication.

rsync could also be used

Use encryption to secure communications between boot servers and central master!

Summary

Free software has achieved critical mass

Universities should prepare themselves and their students for a world in which Linux coexists with Windows

Universities should use Linux and other Free software to improve their infrastructure

Questions / Round Table

Slides at www.kegel.com/linux/edu

Round Table discussion with Red Hat
6-8PM, 12 November 2002
room 202, Taper Hall of Humanities
Details:
www.lalugs.org/roundtable.html

Questions?