Linux™ on the desktop: An Update -- Benefits, Issues, New Developments

by Keith Fish
Hewlett-Packard Company
Technical Computing Division
3404 E. Harmony Road
Fort Collins, CO 80528
Phone: 970.898.2134
Fax: 970.898.3002
Email: kaf@fc.hp.com

Abstract

This paper is a continuation of the Linux on the Desktop paper presented at HP World in September 1999. The focus of that paper was the tangible and intangible benefits and costs of Linux on the desktop, and where solutions existed or were emerging in the desktop space. Since then, there has been significant progress for Linux on laptops, and there has also been significant progress for Linux in the high-end technical desktop.

This paper will reiterate the benefits, costs, and solutions presented last fall, as well as attempt to describe key developments in the Linux "workstation" space while also assessing the benefits, costs, and issues of those developments.

The timing of the presentation versus paper deadline is such that the presentation (and session handouts) will contain up-to-date information that can not be committed to at the time of submitting the paper.

Introduction

Like its predecessor "Linux on the Desktop: What does it cost? Will it work for me?", this paper does not cover server deployment issues, nor does it cover integration issues in depth. Hence, we will not touch on issues associated with database applications, [networked] file systems and high-availability.

By the time this paper is presented, it is likely that new applications and runtime environments will be available for Linux, and existing applications will have improved. Thus, this paper does not discuss many applications by name; any that are discussed by are done for the purpose of example, and the application names may be registered trademarks of their respective software vendor. The author is not endorsing any applications and distributions that are discussed.

Linux Accolades

Two years ago if I were to mention "Linux" to computer-literate people, most would have said something to the effect of "What's that?" Today, those same people are at least aware of Linux, though they have various understandings of what Linux offers based on their involvement with Linux and the market hype surrounding Linux. Even so, all seem to understand one significant benefit that Linux affords is a choice for their [commodity] computer's operating environment – one that can not be easily squashed by marketing and advertising dollars. All seem to hope that this new choice will, in one way or another, precipitate improvements in the computer operating environments that they rely on.

Linux's long standing strengths has been realized with Internet Service Providers as Linux powers a high percentage of the servers used in ISP-like businesses. The understood benefits [of Linux for ISPs] are its initial cost, its robustness, its performance, its flexibility, and its ability to function very well in a resource-constrained system.

The recent announcement of the classes of Crusoe processors from Transmeta (the company that Linus Torvalds works for) is another confirmation that Linux is attractive for the low-end and embedded markets. The recent popularity of stock offerings for VA Linux Systems and Cobalt Networks Inc. show that investors believe that Linux has a future in the traditional and custom server solutions market. Another hurrah for Linux recently has been its success in the next-generation IA64 development and showcasing efforts.

Other positive activities surrounding Linux in the recent months include

- enhancements in HP, IBM, Linuxcare, RedHat, etc. support offerings
- the availability of Corel's Linux distribution for the masses
- TradeMark Computers impending Linux server products built on UltraSparc processors
- investments in or partnering with Linux distributors such as SuSe, Caldera, and TurboLinux
- more adoption and deployment of high-availability technologies around Linux-based clusters

Linux Desktop Critiques

The following statements are known critiques concerning the viability of Linux on the desktop:

- Linux distributions are largely based on open source software development, which is poor at addressing ease-of-use throughout the entire user experience.
- Linux-based solutions tend to enhance existing solutions rather than innovate new/better solutions to user problems. This marginal improvement will not be enough to cause users to want to switch from what they have already invested in.
- Linux has the perception of a hacker's operating system, and therefore it is not consumable by non-hackers.
- Nobody *owns* most of the components that make up a Linux operating environment so there is no one to hold accountable when there are problems.

Now, let us review some counters to these critiques:

- Linux distributions are paying more attention to the user experience. The recent advances in the desktop look-n-feel, installers and configuration utilities are some examples.
- Linux's reliability may be enough of an improvement to cause users to want to switch from less reliable operating environments.
- The recent ease-of-use improvements found in many Linux distributions are a testimony to the play that Linux is making to attract the non-hacker user.
- Linux operating environments offer the ability for the customer to have a great degree of control over their destiny, including more choices of providers for their hardware, software, custom tailoring, and support than is typically possible with other operating environments.

These points reinforce that Linux is not yet ready to go out and replace all Win* desktops in the home and in corporations. It will take some time for Linux-based solutions to gather the necessary applications and mind-share for such a feat.

Note that the critiques focus on the ease-of-use that is expected in the home PC environment, which is typically less of an issue in the commercial workstation environment. Therefore, it should be much easier for Linux desktops to be deployed today in what I will call the technical workstation space; that is, the space that requires moderate compute power, minimal downtime, configurability, has historically been Unix-centric and more recently populated with higher-end NT workstations. Linux also offers workstation users and their IT departments the ability to customize and support their environment as they choose, and does not lock them into a single vendor of either hardware nor (in theory) operating system software.

Linux Desktop Support

To get a feel for the breadth of hardware supported by Linux you can browse several "Linux hardware" web sites. Many card vendors and chip vendors are starting to notice Linux, and they are putting links to sites that contain drivers and support information for their products. Because Linux customers do not represent their primary business (according to their marketing folk), you will often have to search hard to discover whether or not Linux supports their card or chipset. Unlike most chip and board vendors' web sites, the following web sites are easy to browse for confirmation of hardware support:

- http://lhd.datapower.com/
- http://www.redhat.com/support/hardware/intel/61/rh6.1-hcl-i.ld.html
- http://bugzilla.redhat.com/certification/cert-report.php3?mod_class=1
- http://hp-linux.cern.ch/support/centp.php3

From such sites, it is evident that Linux drivers exist for most pieces and parts of popular IA32-based systems. The systems listed on the latter web site, ***LINUX SUPPORT FOR HP PC's,*** are desktop systems with mostly-commodity IA32-based components. Thus, Linux itself is fairly complete in what it is able to support in the IA32 hardware space. If you consider the plethora of other 3rd-party IO cards, it is likely that if enough people cared about using a card, then it is possible that it will be supported under Linux.

Application Survey for Linux

As part of an overview of the Desktop, Administration, Office Productivity, EDA, MDA (MCAD and MCAE), Scientific, Development, and Publishing application spaces, this next section will attempt to:

- List the flavors of applications supported on Linux in each space
- Subjectively judge the quantity and quality of applications in each space
- Subjectively judge ease of integration into an existing Unix workgroup

A few web sites that list applications for Linux include:

- Scientific Applications for Linux – http://SAL.KachinaTech.Com/
- Freshmeat (with Searching) – http://www.freshmeat.net/
- DaveCentral Shareware Archive – http://www.davecentral.com/

As with many applications and system software, you will not always find exactly what you are looking for, and at the price you want to pay. A relatively new venue is being deployed to address this kind of problem in an *open source* way. What follows are a few web sites that allow you to pursue getting the software you want at the (hopefully reasonable) price you want. Essentially, you create a specification for what you want and how much you will pay and post that on the web (i.e. an RFP). You then get back proposals and pick which one you want to go with. On some sites, there may be an intermediary that handles the negotiation, contract and financial logistics of the project for you for a fee.

- CoSource -- http://www.cosource.com/
- sourceXchange -- http://www.sourceexchange.com/
- The Free Software Bazaar -- http://visar.csustan.edu/bazaar/bazaar.html
- SourceForge – http://sourceforge.net/

Application Coverage

MCAD

- Drafting
- Modeling
- Renderers/Ray-Tracers
- "Software for CAD visualization professionals"

In this space we find few applications to choose from though the ones that are available may be inexpensive to obtain. As of this writing, there is one mainstream commercial Unix workstation application, as well as other commercial products which are competitors to popular PC CAD applications. I expect that the ISVs offering applications in this space will provide reasonable quality/support given the price they charge. Unix integration will depend on what you are already using, and how well the CAD interchange utilities (import/export filters) work.

MCAE

- Analysis
- Simulation
- Pre- or Post-processes Visualization

In this space we find many open source and shareware applications, and more recently a fair number of commercial applications supported on Linux. Linux's clustering capabilities and reliability enable it to attractively address technical compute farm solutions in this space. In addition, the [pending] addition of OpenGL and HOOPS graphics runtime environments will allow the data visualization to also take place on Linux systems. I expect the commercial ISVs to provide good quality/support for their applications on Linux. Unix integration should be relatively easy.

EDA

- design
- verification
- simulation
- clusters

There are several (inexpensive) open source tools available, as well as several expensive commercial Unix mainstream choices available. Many applications are intended for compute farms, though they will work on stand-alone systems, also. I expect good quality/support for these tools, probably proportional to what you pay for them. These should integrate well given that most interchange formats in the EDA space are fairly standardized and given that Linux plays well on any existing network.

Electronic Publishing

- ghostscript
- acroread
- Software for film and video professionals
- WYSIWYG publishing
- wysiwyg HTML editors, HTML content creation tools
- GIMP (Photoshop-like) and other image-processing packages
- myriad of display and filter tools
- drawing packages
- mpeg players
- scanner software (including OCR)

This application space offers several reasonable choices and, proportional to the price of support, I expect reasonable quality/support for most of the applications offered. More commercial applications are being added, the most recent as of this writing was in the Digital Content Creation space. Integration will depend on what you are already using, and how well the interchange utilities (import/export filters) work. The integration problem should be helped by the fact that most of the applications support most of the popular audio/visual media file formats.

Office Productivity/Communications

- Word Processors
- Spread Sheets
- Presentation Packages
- Calendar
- Email clients and transports
- Intranet calendaring and scheduling
- Meeting synchronization
- FAX, VoiceMail
- Network chat
- Display sharing over LAN
- Voice over LAN
- Netscape Communicator

There are several good choices of applications in this space, and I expect them to come with good quality/support. Some of the powerful office applications are free for non-commercial use; more specifically, some are free for personal use *only*. For commercial use they are priced within reason. Integration into a Unix-centric environment should be relatively easy. There may be some issues with proprietary document formats (e.g. latest Microsoft application file formats), especially in an NT-centric environment.

Desktop

- Window Managers
- Desktop Environments
- Traditional Unix-desktop runtime (OpenGL, CDE, Motif)

There are many good choices of applications and helper applications in this space. Many have no licensing costs and all should have reasonable quality/support through a Linux distributor. Because this was considered an obvious weakness for Linux relative to Win*, development in this space has been fast and furious. If you do not have time to help this cause, you should resist using beta versions before they have had some mileage on them after being declared stable.

Other applications in this space follow along the paths of the commercial Unix environment and, as expected, there is a licensing cost. Again, these products are usually relatively leading edge, very robust, and come with good quality/support. Integration into an existing Unix-centric environment should be relatively easy as these applications are starting to superset the protocols of commercial Unix equivalents.

Scientific

- mathematical computation/solving
- chemistry/molecular modeling
- [GIS] mapping software

There is a lot of homegrown code in this application space, and just about all of that code should port relatively easily. The only issue I can think of might be with the no-cost versions of the Fortran compilers; a commercial (usually costly) version might be required, especially if recent versions of Fortran are needed. There are many good choices of applications from the research arena, and I expect reasonable quality/support for some applications. It is possible that some research codes have been orphaned and such codes would no longer receive any support.

Development Environment

- BASIC
- C, C++
- Java 2D, 3D
- Lisp
- Python
- TCL/TK
- X11R6, LessTif, Motif
- Debuggers (with or without GUIs)
- Fortran77, 90
- Pascal
- Cobal85
- (Networked) Source Control
- Many various GUI-based text editors
- Cross-compilation environments
- Data CD burning

There are many excellent choices in this application space including some very powerful development suites that integrate many of these tools into a nicely packaged environment. I expect very good quality/support for most applications, especially the commercial applications, in this space. Integration should be easy.

Shells and Scripting

- Bourne shell
- C shell
- K shell
- Bourne-again shell
- ash, zsh, and other specialized shells
- awk
- perl
- Python
- tclsh

This application space offers excellent choices with reasonable quality/support. Integration should be very easy into a Unix-centric environment.

System Administration

- GUI-based single system control tools
- GUI-based networked system monitoring/control tools
- traditional Unix backup tools and open source backup tools
- commercial backup products

There are some good choices of applications in this space, most having good quality/support. Integration should be easy into a Unix-centric environment. Linux, like UNIX, is truly multi-user and, hence, it provides complete remote administration capabilities.

Icing on the cake

- Audio CD players/burners, and audio mixers
- music publishing and MIDI applications
- artistic applications
- emulators for DOS, WIN32, and NT virtual machine
- games

You may get what you pay for here. Many of the bonus applications are often leading edge, beta, and open source projects. With respect to *open source software* projects, you should be aware that you often get much more than what you pay for. This is especially true if you consider the quality, capabilities, and support of the resulting application(s). Be mindful, however, that for such projects you do not want to be a very large leech that kills its host -- a symbiotic relationship is much better for all involved.

Some of the emulators have been around for years, others are relatively new, and some are still in development. Many of the emulators have one goal in mind -- allow the user to run the productivity application on Linux that they ran on their PC before they switched to Linux.

Let us delve into a few 'emulators' to see the kinds of alternatives you have for enabling mass-market productivity applications atop Linux. The first alternative, VMWare, provides a thin software layer that allows multiple guest operating systems to run concurrently on a single standard PC running Linux natively.

Stated Benefits (with my parenthetical comments):

- run Windows software or other applications simultaneously with Linux
- run at close to native performance (depends on IO versus memory)
- a standard Linux application that provides a virtual windows platform
- can develop and test for multiple platforms concurrently
- can add new OSs without repartitioning disk (but requires *lots* of disk space)
- concurrent environments can share files via virtual network (need multiple IP addresses)
- Run new (untested) OS or applications in a secure sandbox
- can run a virtual machine in an X window (some performance degradation)
- hot key to switch environments
- run multi-bootable OS without reconfiguring

Issues with this technology (my opinions, not validated):

- some performance degradation for IO and graphics
- some versioning issues for XFree86 Xserver though XFree86 has tried to accommodate VMWare's needs
- potential lack of support for accelerated Xservers and their respective graphics devices
- potentially a bigger lag in support for new graphics devices
- *not clear about if or when this product will handle more advanced desktops (higher resolutions, accelerated OpenGL, Direct3D, etc.)*

For more information on VMWare, see http://www.vmware.com/

The next alternative is GraphOn's Bridges technology that will allow the Linux desktop to get at web-enabled Win32 applications being served up by an NT/Win2K server. For more information, see http://www.graphon.com/.

The third alternative is Win4Lin, and is similar to VMWare but it is more constrained because it can only run DOS-based OSs such as DOS, Win95, and Win98. Win4Lin has been expected for several months, but as of this writing there have not yet been any betas available to test. The company responsible for this product, TreLOS, has apparently been going through some reorganization that has slowed their product development and delivery considerably. For more information on Win4Lin, see http://www.trelos.com/.

The fourth alternative is VNC – an open source alternative that has been around for years. VNC runs a server on an NT desktop, and serves the desktop to a Linux system. From the Linux system, you then manipulate the NT desktop and run your Win32 applications remotely. For more information, see http://www.orl.co.uk/vnc.

WHAT'S THE COST?

For a server-centric comparison of the costs of WindowsNT versus Unix (Linux), I thought that the white-paper at http://unix-vs-nt.org/kirch/ did a reasonable job of assessing tradeoffs. The cost issues discussed below are focussed on the desktop space.

OBVIOUS…

- **Distribution**: The cost of an actual distribution is very low. Once the CDs are obtained (typically ranging from $10 to $200 depending on documentation and support included), you can use these CDs to install or upgrade as many systems as you want.

- **Win32 Applications**: If you need a commercial emulator to run Win32-only applications, or client software to catch such applications that are served up, you may have to add another several hundred US dollars per seat to your up-front and support costs.

- **System Administrator Training**: The learning curve and training for IT people on Linux should be very low if they already have commercial Unix experience. Experienced Unix administrators can probably self-train by reading a book and playing around with one or two distributions. They can also consider one of the many 4-day Linux 'certification' courses available. If your IT people are only trained on NT, then the cost will be higher and the learning curve steeper.

NOT SO OBVIOUS …

- **Desktop**: Users have a new desktop environment and possibly new tools they will be using frequently. The desktop environment should be easy for most commercial Unix users to adopt. If training is needed, there are Linux user-training classes offered by various Linux-support companies. In addition, O'Reilly and other publishers have a lot of self-tutoring material to chose from.

- **Integration**: The cost of integrating Linux systems into an existing Unix environment is likely to be low. However, there may be issues with NFS (pv3), NIS+, and 3rd party codes that applications in your environment rely on. The Linux distribution may not (yet) support all the quirks of unpopular/new printers or other input/output devices. In addition, you may have some OS-specific dependencies in homegrown codes that you use. In an NT environment, there may be more authentication, printer-sharing and file-sharing issues.

- **Productivity Applications**: The cost of productivity applications for Linux should be relatively low if you are already in a UNIX-centric environment because you can use VNC or native Unix/Linux office applications to address your productivity application needs. The cost will be higher if you require WIN32-only applications, unless can get a good deal on an emulator that allows you to run your WIN32 application atop Linux. You should also consider the long-term costs associated with using applications with closed or expensive interchange formats; getting locked into these will significantly reduce your future choices and flexibility, and hinder what you can get at the price you are willing to pay.

NOT SO OBVIOUS … (continued)

- **Support**: The cost of supporting the system and application software on the Linux desktop is relatively low for several reasons:
  - source is available for many of the base-level software components
  - patches/fixes are generally made available to the entire user community quickly
  - a wide variety of competitive support plans are available from multiple support suppliers

- **Quality**: Because of the stability, reliability, and robustness of Linux, downtime should be minimal. This translates into lower cost (relative to other less-stable environments) due to less loss of productivity and computer services.

- **System Upgrades**: Linux system upgrade costs should be relatively low for many of the same reasons that the distribution costs are low. One unknown issue is how foolproof the RPM and DEB mechanisms are for handling the myriad of patching and upgrading operations. It appears that these package managers do cover the basics well.

- **Golden Image**: Some distributions provide a way to download a golden image over the network. As far as I know, such methods for Linux are mostly undocumented, but a good system administrator can probably figure them out (eventually). Thus, the cost of proliferating or reloading a golden image via the network might be higher than what you are used to if you use mechanisms such as HP's Ignite-UX. The Linux 'certification' courses may cover this kind of task -- if not, you might request that it be covered.

- **Application [Upgrade] Costs**: The costs for licenses and upgrades of commercial applications for Linux are not likely to differ from what the ISV charges for other operating systems. Theoretically the lower development costs for Linux should mean more applications to choose from, and *maybe* a little more pricing pressure.

- **New Hardware**: In theory, new IA32-based hardware with Linux installed should cost less than the same hardware coming with a licensed OS installed on it. And, in theory, the same should apply to pending IA64-based hardware. However, Linux has historically been out-of-process for most hardware vendors, causing them to charge more for pre-loading Linux versus another popular OS that is in-process. Part of this cost differential could be up-front fees for 30/90-day OS support or a similar per-system cost that the hardware vendor must pay to a Linux distributor.

  Another cost for Linux might be the development of drivers for new devices. For example (fictitious!), WhizzyGraphics just released their latest, coolest, fastest, cheapest graphics card ever, and Daniel Mill of Mill Computer has procured a billion WhizzyGraphics cards for Mill's Incision desktop computer models running the Picopuff mass-market OS. Well, WhizzyGraphics has **NO** incentive to write Linux drivers for this card; they've already invested plenty in writing and/or certifying drivers for the Picopuff OS. So, Mill Computer must now invest in writing a Linux driver if they expect to sell some of those Incision systems with Linux pre-installed (… of course, Linux is an option on their web page order form). This fictitious account also points to another cost of Linux -- the lag time for support of new hardware -- though this lag time is getting shorter as more hardware vendors actively pursue (versus passively allow) Linux markets.

TRENDS IN LINUX DESKTOP SPACE

What I will list next are some trends that I have noticed that apply to the Linux desktop. As of this writing, it seems that Linux on the desktop should be a good, cost-effective, and easy-to-use solution for a wide variety of problem spaces. Linux on the desktop, and on the laptop, looks promising because…

- 3D accelerated direct rendering OpenGL/Xserver runtimes are [nearly] there on Linux
- Still some progress for checklist items (e.g. JFS, …)
- Success from the Trillian IA64 effort (CERN, Cygnus, HP, Intel, SGI, VA Linux Systems, ...)
- The newer (cleaner) XFree86-4.0 Xserver is [nearly] there on Linux
- Corel's full Office Suite for Linux (currently in beta)
- MP support is getting better (up to 4-way today)
- Compatibility is still very good across the various Linux distributions and this continues to enable shrink-wrap apps for Linux.
- Progress continues for addressing the need for office productivity solutions

If we consider announcements by some commercial ISVs for Linux support, it appears that many vendors consider Linux to be technically feasible to enable low-cost highly reliable technical computing. In addition, it appears that there is an expectation that these systems can be deployed on the desktop, not just as part of a compute clusters.

MCAD is one of the more immature application spaces addressed by Linux on the desktop. However, it is encouraging to see the progress being made in the open source and commercial realms to address the development and runtime requirements for MDA:

- One of Precision Insight's businesses is to write Xserver and OpenGL drivers for graphics board vendors (or anyone that wants a driver and will pay them for the work). Precision Insight was contracted by Red Hat and SGI to work on developing a direct-hardware-rendering accelerated OpenGL that will work with XFree86 version 4.0. This work started with a snapshot of MesaGL and was demo'd in May'99, and could be released by the time this paper is presented. (Although I made this same statement six months ago, and it has yet to happen.) Precision Insight has also been instrumental in providing the Xservers for laptop graphics chipsets.

- Silicon Graphics (SGI) has released their glx Xserver/Xprotocol extensions to the XFree86 community to incorporate into XFree86-4.0. SGI has also released their OpenGL sample implementation to open source. SGI has released some of their XFS (journaled file system) to the Linux development community and has attempted to prime the open source pump around this code. Since Linux doesn't crash, JFS is just one of those checklist items for the corporate buyer.☺

- Metro Link and Xi Graphics have released commercial OpenGL, Motif, and CDE development and runtime environments. They have recently begun trying to address the problem of direct-hardware-rendering for OpenGL. I understand that Xi Graphics has been working with SGI and Precision Insight on this. I believe that by the time this paper is presented, both of these companies will have good hardware accelerated OpenGL solutions for some set of higher-end graphics boards.

Linux, with the recent addition of the 2.2 kernel, handles multiple processors on the desktop fairly well. I have heard (second hand) Linus Torvalds comment that the 2.4 kernel should scale well to 8 processors. This should be more than enough for the desktop.

Beowulf and other technologies are being used to cluster Linux desktops together so that they become compute farms. Platform Computing's LSF and similar home grown technologies are used to make the Linux desktop a user's workstation by day, and a node in a compute farm by night.

Dual-boot laptops and desktops work well, but this is not the ideal way to run Win32 applications. Several distributions actually attempt to accommodate multi-boot scenarios as painlessly as possible for the user – they even include repartioning tools for shrinking the Win* partitions.

Graphics chipset companies such as Nvidia are actively working to support Linux. Even so, graphics chipsets are not necessarily supported under Linux, so be sure to check before you buy. If the laptop graphics or graphics card you want is not supported under Linux, *kindly* ask the laptop and/or chipset vendors to provide a driver so that you can buy their product. Note also that there may be issues with motherboard chipsets and/or other peripheral controller chipsets (e.g. SCSI).

Distributions and providers of other runtime environment components are trying to play well and ensure a compatible runtime environment so users can run shrink-wrapped apps. The Linux Standard Base has been formed to enable some of this to happen, though there does not appear to be much activity surrounding this effort currently. See http://www.linuxbase.org/ and its umbrella organization, http://www.spi-inc.org/.

The following image is a screen shot of a Linux desktop running some applications using direct rendering OpenGL. The desktop shows applications including standard Linux favorites like the GNOME desktop, Netscape and GIMP. On the 3D graphics side, we have Fluent's post-processing visualization application and Loki's HereticII game.

LINUX OPERATING SYSTEM RESOURCES

WHERE TO START

- http://www.linux.org [Note, same URL with .com is a reasonable commercial Linux portal]

List of Linux Links:

- http://www.yahoo.com/Computers_and_Internet/Software/Operating_Systems/Unix/Linux/

POPULAR DISTRIBUTIONS

Caldera:	http://www.caldera.com
Corel:	http://www.corel.com
Debian:	http://www.debian.org
Red Hat Linux:	http://www.redhat.com
SuSe:	http://www.suse.com
Mandrake:	http://www.mandrakesoft.com/

LAPTOPS

Start here:

- http://www.cs.utexas.edu/users/kharker/linux-laptop/

PCMCIA Drivers and Information:

- http://www.d.shuttle.de/isil/xircom/xirc2ps.html
- http://hyper.stanford.edu/HyperNews/get/pcmcia/home.html

LINUX DESKTOP MANAGEMENT

KDE:	http://www.kde.org
GNOME:	http://www.gnome.org
WM Choices:	http://www.plig.org/xwinman/

APPLICATION SOFTWARE

Netscape:	http://www.netscape.com
VMWare:	http://www.vmware.com
GIMP:	http://www.gimp.org
Applix:	http://www.applix.com/appware/oa/index.htm
Word Perfect:	http://linux.corel.com
Star Office:	http://www.sun.com/staroffice/
Kvirc:	http://www.kvirc.org
Ksirc:	http://www.ksirc.org
Korganizer:	http://www.redhat.com/~pbrown/korganizer
K* Apps:	http://www.kde.org/applications.html
Samba:	http://samba.anu.edu.au/samba/
VNC:	http://www.orl.co.uk/vnc

MORE LINUX INFORMATION

Slashdot:	http://slashdot.org
Freshmeat:	http://freshmeat.net
NC LUG:	http://www.nclug.org/news.html

MY EXPERIENCE

What follows are the glitches in my experience using Caldera 2.2 and Red Hat 5.1, 5.2, 6.0 and 6.1 on 486, Pentium-II, and/or Pentium-III desktop systems:

- Difficult to find all the correct documents to set up graphics for Xserver properly
- Flakiness of SCSI-emulation on IDE device (e.g. for HP 8100i CD-RW and CD burning) though this seems to be better now.
- NFS over 100Mbit links occasionally gives errors – this was due to a non-optimal network driver which, through the help of the open source community, has been fixed.
- Installation requires some know-how but is getting easier for non-gurus all the time
- The Red Hat installer (and possibly others?) have been known to trash the boot sector of your first (e.g. NT) disk when install Linux on a second disk.
- Difficulties in getting sound configured (often 'experimental' driver in my case)
- KDE versus GNOME -- both good and both felt sluggish (in different ways)
- APM flaky on some laptops; [un]docking not always clean
- Caldera's OL2.2 install was a very pleasant experience for an install, but it failed to properly detect the graphics card which left me with a mostly-useless system.
- Difficult to rebuild kernel components that integrate with existing (running) kernel
- RH6.0 to RH6.1 upgrade trashed GNOME environment and runtime – it was unusable.
- RH6.1 install was very nice. One oddity is the spurious timeout errors from the floppy driver when there is no floppy inserted.
- RAID-striping is relatively easy and has expected performance benefits.
- Older and newer laptops can have proprietary hardware not supported under Linux.
- VMWare generally ran well, but my Xservers did not support the DGA extensions it wants for performance. I could not get VMWare to adopt my native Win95 partition.
- Difficulty getting Corel's Linux beta to install easily on my some IA32 system. (Final product may be better).

CONCLUSION

It has been fairly easy for me to ramp up on administering and using Linux, and I am one who has often had his hand held when it came to system administrations tasks. Granted, I have had some very Linux-knowledgeable co-workers to help me wade through some of the issues I encountered along the way, and I was able to rely on the news groups for solutions to some issues (e.g. dual-booting). My only previous Unix experience has been HP-UX, and I have not read any Linux self-help or training books; it was learn-as-you-go. I have found Linux to be quite reliable on the desktop, and Linux integrated easily into my [non-NIS] Unix environment.

Surely there will always be frontiers that Linux needs to mature in to make it truly friendly on the desktop, for both ease-of-use and integration. I am impressed at how far Linux has come in the 1½ years I have been watching it. It is difficult to predict how Linux's maturity rate in the desktop application spaces will fluctuate; for example, I see some acceleration as Linux's popularity grows, but I also see some bogging down as new requirements and larger projects are attempted. Even so, it is difficult for me to see the causes necessary to lead to a dramatic slowing of Linux's progress in the desktop space any time soon. Thus, I expect Linux-based solutions for the desktop to continue to mature and enable Linux-based systems to become a very good option in the technical desktop workstation space.

Acknowlegements

Most of the information in this paper came from the following sources:
- The previous paper I presented at HP World in September, 1999
- Linux news groups, news blurbs, and Linux-centric web sites
- HP co-workers
- Halloween Documents, done by Eric S. Raymond with many reviewers helping