

Installing Linux

A study of installing Linux as an end-user desktop / laptop operating system for use in local government

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Introduction

The aim of this study and report is to review the practical installation of the Linux operating system on end-user desktops and laptops with a specific focus on the local government community. This report is however of wider relevance and interest to anyone considering Linux or selecting a Linux distribution, either for personal or corporate use.

The range of hardware configurations and Linux distributions means that it is not feasible to study all cases. There are also many possible “organisational” contexts, ranging from the non-technical home user to the PC support team managing a large computing estate, as well as the super-technical home user. This study chose to consider the time and effort required to install common “out of the box” Linux distributions on standard desktop and laptop equipment.

The study was initiated by the public sector Society of IT Managers (SOCITM) Open Source Special Interest Group, and the testing process carried out by National Computing Centre (NCC) staff within the Open Source Academy (OSA) project. The study was designed to assess the ease of installation and survey the basic functionality of the selected distributions. The functions were identified and agreed by SOCITM in discussion with NCC, and intended to cover many of the requirements of a public sector PC user. Similarly SOCITM also selected the trial distributions and specified the two hardware platforms. The results are being released under a creative commons license and will be made available via the OSA, NCC and SOCITM.

Scope of the Study

There are a great deal of issues which this study does not address, such as...

- Interface design
- Security
- Comparison with other non-Linux operating systems
- Long-term reliability

As this study is published in its entirety, interested parties can extend the testing to include these aspects of a desktop operating system, or in fact any others they can identify.

What this study provides is a basic comparison of some of the major Linux distributions with an onus on desktop use. It is not meant to indicate how long installations would take in (for example) an ICT department in which skills would be developed and imaging would most likely be used to roll-out the installation.

Please note that it is understood by the author that technically, Linux refers to just the kernel component of the distributions tested. What we are actually testing heavily relies on the use of individual software packages which are distributed with the Linux kernel such as desktop environments (GNOME, KDE etc.), office suites (OpenOffice.org) and other such software. This is NOT an authoritative or exhaustive study of the Linux kernel or any specific software bundled with

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the Linux kernel. Due to the sheer volume of software available which purport to accomplish these tasks, testing each and every combination would be a somewhat laborious task, and is outside the scope of this study.

It should also be noted that Linux distributions are targeted at different markets. Ubuntu / Kubuntu for example aim to simply provide a basic desktop installation that can be tweaked and configured post-install. In contrast, SuSe and Fedora provide much more control during the installation stage. This requires more understanding on the users part in general. The grading and / or appreciation of these different approaches is outside the context of this study in terms of scoring although observations made will be noted and commented upon.

Planning

A number of Linux distributions will be tested for desktop viability using a pre-defined test-plan incorporating a range of requirements split into individual tests.

The test plan was originally developed by the SOCITM Open Source Special Interest Group with sign-off from NCC. Upon working through the test-plan, it was further developed for a number of reasons.

- The order of tests (or questions) was not ideal for practical work. Filling the original test-plan out involved skipping around. A certain amount of restructuring helped to avoid this in the revised plan.
- During initial practical work, it became apparent some experience was not being captured by the test-plans and they were duly enhanced, following discussion with SOCITM representatives.

There is a maximum of three points available for each question. Yes/No answers will simply score three or one points respectively while questions on a sliding scale were scored between three and one. Each of the scored questions were denoted as being “Essential” or “Desirable” (E/D in the test-plan.) All data will be made available such that individual comparisons and studies can be made.

The test-plan was designed to cover aspects such as installation, hardware, desktop environment, networking, system administration and interoperability with other operating systems and protocols. During the testing process, qualitative observations were noted and reported on. Installation time for each of the distributions was also recorded.

Hardware Specification

The agreed (minimum) hardware specification is as follows...

- **Desktop PC** – Intel Pentium 4 > 2 GHz, 512Mb RAM, 60Gb Hard disk
- **Laptop** – Intel Centrino Laptop (with WiFi), Min 1.6GHz, 512Mb RAM, 60Gb Hard disk

Distributions Tested

The following distributions were tested...

- Ubuntu Linux 5.10 (Breezy Badger)
- Kubuntu Linux 5.10 (Breezy Badger)
- SuSe Linux 10.0 (Open Source release)
- Fedora Core 4

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- Novell Linux Desktop 9

The following were also tested as an extension piece of work (see NOTE below)

- SuSe Linux 10.0 (Evaluation)
- Fedora Core 4 (DVD version)

The distributions were selected to represent the commonly available up to date distributions. Ubuntu and Kubuntu were selected to represent two different desktop environments, GNOME and KDE respectively. Fedora Core 4 (FC4) was selected as the main desktop offering from RedHat. SuSe and Novell Linux Desktop (NLD) are both from Novell. They were included as distributions focussing on the OS community and community power users (SUSE) and more corporate commercial users (NLD).

There are many other distributions we could have considered for this. Debian, it was felt, is a very stable distribution, however the package versions in Debian's stable branch are rather old in comparison to the selected offerings. While an argument can be made for testing Debian's "unstable" branch this was rejected as it is unlikely to be considered for local government use simply because of the tag "unstable". Gentoo as also not included due to the more complex nature of the install procedure, and the fact that being a source-based distribution requires lots of time and effort. That is not to say either of these distributions should not be considered for desktop use, rather they are outside the scope of this finite study.

NOTE: Upon completion of the testing phase, it was felt some quality assurance needed to be done as members of SOCITM SOSS had reported experiences contrary to the given results. This involved an extra timetabled day to be used to identify potential reasons for the difference in experiences. SuSE 10.0 was re-tested using alternative media from a magazine cover.

The two distributions of SuSE were in fact different. The original test was conducted on Novell's SuSE 10.0 (Open source edition), while the second (QA) test was conducted on an evaluation version of SuSE 10.0, which contained a number of extra packages the open source edition could not include due to software licensing issues. The extra time was also used to identify and overcome a previous problem with Fedora Core 4, which had previously proved to be a "show-stopper". This problem was down to Anaconda, RedHat's graphical installation engine, which is used in Fedora. The problem was later fixed by performing a text mode installation.

The additional tests were done on the laptop hardware only due to time and resource limitations.

Results

Summary of Scores (% of maximum available points)

| <i>Distribution</i> | <i>Install Time (Desktop)</i> | <i>Weighted Score (Desktop)</i> | <i>Install Time (Laptop)</i> | <i>Weighted Score (Laptop)</i> |
|----------------------|-------------------------------|---------------------------------|------------------------------|--------------------------------|
| Ubuntu 5.10 | 1 hr 20 mins | 66.9% | 1 hr 10 mins | 59.83% |
| Kubuntu 5.10 | 1 hr 10 mins | 67.88% | 1 hr | 63.06% |
| SuSe 10.0 (OSS) | 2 hrs 45 mins | 79.87% | 1 hr 45 mins | 76.2% |
| Fedora Core 4 | 40 mins | 72.17% | n/a | n/a |
| Novell Linux Desktop | 50 mins | 80.82% | 1 hr | 66.91% |

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| <i>Distribution</i> | <i>Install Time (Desktop)</i> | <i>Weighted Score (Desktop)</i> | <i>Install Time (Laptop)</i> | <i>Weighted Score (Laptop)</i> |
|------------------------|-----------------------------------|---|----------------------------------|--|
| SuSe 10.0 (Eval) | | | 1hr 40 mins | 77.67% |
| Fedora Core 4 (test 2) | | | 45 mins | 63.94% |

N.B. Please refer to Appendix B for full results

Observations

Fedora Core 4

Desktop & General

- Very short installation time.
- Disk swapping means inability to do unattended installation. This may be possible using an FTP server however.
- During “post-install configuration” stage, the mouse became unmovable and progress bar was stuck at 50%. Eventually this was OK, however the user may feel something is wrong.
- Nice clean default interface.
- Good automatic update widget and schedule provided by default.
- Excellent support for automatic mounting of drives, USB keys etc.
- SELinux installed by default for increased security in the default install.
- Failed to identify other installed operating systems during boot-loader install. This had to be configured manually. First-time user could easily render their other OS un-bootable.
- Language support was not trivial to configure. Even after selecting “Welsh”, the interface was not updates. This could be either a bug or a lack of understanding on the part of the tester. Only US-English language was selectable for office applications.
- Lack of browser plug-ins (flash, RealPlayer) and file format (MPEG / MP3) capability due to licensing issues. Flash plug-in failed after being installed manually.

Laptop

- Distribution refused to install. GUI installer complained that insufficient space was available despite being allocated the full hard disk (80Gb) in a single ext3 partition. The installation was attempted three times and the same error was encountered. On a fourth attempt, the install appeared to be working until it came to installing the packages. Anaconda (Fedora's graphical installer engine) complained of an “unhandled exception” and rebooted the laptop. A second test was conducted as a QA exercise at the request of SOCITM SOSS. On this attempt, installing Fedora Core was successful but only using the text-mode installer. Unfortunately, we did not have the time to test everything however we completed the tests pertaining to hardware differences from the desktop tests, i.e. WiFi, video card, ethernet etc.
- WiFi failed to configure despite there being two main network configuration points, which could be confusing. Presumably this failure is down to the lack of firmware for the WiFi card, which is unavailable under a license compatible with Fedora's distribution, and therefore not included on the CD.

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- Sound card failed to configure, despite there being no requirement for external firmware.
- The external monitor worked with Fedora, however the aspect ratio of the mirrored image of the LCD screen was uncorrected and the resolution was not acceptable for use. It did not seem immediately apparent how to correct this without hand-editing configuration files, which a non-technical user is unlikely to do without feeling lost or possibly worse, breaking something.

SuSe 10.0 - OSS Version

Desktop & General

- Very long installation time however a great deal of configuration flexibility at install-time due the inclusion of the YaSt installer.
- Automatic updates at installation time, secures the machine for first boot. Lot's of updates were available to install, clearly marked as either functionality updates or security patches. Complete control over which updates are included. Included a kernel update.
- Clean default desktop, sensible branding.
- Attractive boot-splash screen, shields user from kernel / boot messages which may be confusing to non-technical users.
- YaSt configuration tool consolidates configuration options, both during and after install. Very flexible, easy to use and well integrated into desktop environment.
- Switching language required 3 CD's from original install-set.
- Xpdf installed as default PDF application. Very old with an ugly interface. Many more advanced PDF viewers are available and marked as stable in most distributions.
- Nautilus (Gnome file-manager) crashed when attempting to mount remote SAMBA shares. These could be mounted effectively via the command-line interface however a non-experienced user could be put off by this.

Laptop

- Installation much shorter than that of the desktop machine (probably due to newer hardware), however just under two hours can be a long time if a number of machines need to be installed. It is possible however to create a DVD from the 5 CD's, which can then be used for installation, saving time in disk-swapping, and leaving the person installing to undertake other tasks.
- Needed to boot without ACPI support in order to run the installation program. Discovered by failing a second time and searching on the internet. Simple procedure of passing "noacpi" option to boot command-line. Non-technical user may not think to try this and ascertain that distribution does not work with hardware. After installation, ACPI was enabled and working as expected.
- Resolution after first boot was not the native resolution of the LCD display. It was however acceptable in comparison with the other distributions. Auto-configured the ATI Radeon card with the freely available open-source driver (where other distributions failed to). Installing the proprietary driver from ATI's website allowed the screen to operate at full native resolution and enabled 3D acceleration however this was not a trivial task and involved running shell scripts. Would have been much better had an RPM packaged version been available.
- Could not get WiFi to work. Installed proprietary drivers available from the internet,

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however the laptop would not connect to the configured wireless access point. The test was repeated three times.

- External monitor did work, however only showed a mirror image of the main desktop, and did not use the native resolution of the external monitor. Use of the external monitor also required a restart of the Xserver, something a non-technical user may not have the inclination to try. Further configuration of the monitor was only available through hand-editing the Xserver configuration file. This is far too technical for the average desktop end-user and they would expect a GUI configuration tool.

Novell Linux Desktop

Desktop & General

- Simple install, required minimal user interaction. Dialog boxes easy to understand for a first-time user.
- Due to NLD being a commercial distribution, MP3 / MPEG and DVD capability was installed by default.
- Flash and RealPlayer plug-ins installed by default.
- Attractive boot-splash screen, shields user from kernel / boot messages which may be confusing to non-technical users.
- Included Adobe Acrobat PDF viewer, unlike SuSe which provides ancient Xpdf.
- “Friendly” interface for non-technical users, clean default desktop with sensible branding.
- Boot-up could seem confusing. Does include a splash-screen however full verbosity is apparent.
- Automatic updates at installation time, secures the machine for first boot.
- YaSt configuration tool consolidates configuration options, both during and after install. Very flexible, easy to use and well integrated into desktop environment.

Laptop

- Auto-update procedure during installation did not work despite (seemingly) setting the network up. It was later discovered network was in fact not set-up.
- lspci (command to show what devices are available on the machine) showed lots of devices as “unknown device”. This is unacceptable as it only requires a small PCI-ID database to be compiled into the kernel.
- Display manager did not start in the native LCD resolution.
- Could not set-up ethernet card driver. Even after choosing the correct module (unlikely to be obvious to non-technical users), the device still failed to configure. The tests in this area were tried three times for clarification.
- Wireless adapter would not configure, despite manually installing proprietary drivers available from the internet.
- Sound card failed to configure. Probing for sound card failed.
- External monitor would not work for desktop use, however when left unattended, it was found the screensaver module was in fact using the external monitor as a second screen. Could not find a simple tool to configure the external monitor for desktop use.

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- Due to non-configuration of either the ethernet or WiFi adapter, none of the networking tests could be completed.

Kubuntu 5.10

Desktop & General

- Lack of set-up at install-time for modems, ISDN and USB-ADSL adapters.
- Very simple install procedure, a single CD and minimal dialogs. Easy to install however a lack of flexibility in configuration.
- No manual package selection during install, packages must be tweaked after install.
- No graphical installer, positive in some respects as the distribution is likely to install on more systems, however could also be negative as the first-time or non-technical user may find this daunting.
- No Welsh language support included by default or easily selectable.
- Network configuration dialog refused to set default gateway, had to be hand-configured from command-line interface. A non-technical user is unlikely to know how to do this and may find they are unable to configure their network.
- Auto-mounting of USB keys was problematic. Error message was displayed to suggest USB key could not be mounted however some investigative work showed the key WAS mounted in a non-standard place.
- Would not use some file formats or play DVD's due to exclusion of packages for licensing reasons. Also a lack of browser plug-ins for Flash, RealPlayer etc.
- Default terminal font was difficult to read.
- KDE desktop fonts were very large and look ugly. Possible lack of fonts packages provided in default installation.
- OGG / WAV files did play, however sound was choppy and un-listenable.
- 3D graphics acceleration enabled by default.
- Installation of browser plug-ins via the browser did not work, however these plug-ins were available by adding extra package repositories and using Ubuntu's own package management system.

Laptop

- Display manager did not start due to lack of auto-configuration for ATI video card. Manually installing the drivers using Kubuntu's package management system (from the command-line) fixed the problem, however the Xserver configuration needed to be done by hand. This would most certainly put-off first time or non-technical users. Native resolution and 3D acceleration was available after installation of the drivers. On a positive note, it was handy to see that the drivers were available from the official Ubuntu repositories.
- Plugging of the external monitor produced no output or response from the operating system. It is possible this could have been configured manually, however this would be outside the realms of a non-technical users understanding, and they could assume it simply "doesn't work".

Ubuntu 5.10

Desktop & General

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- Very nice clean default interface.
- Auto-mounting of devices very slick with import dialogs for drives containing pictures etc. (unlike counterpart Kubuntu).
- Lack of set-up at install-time for modems, ISDN and USB-ADSL adapters.
- Very simple install procedure, a single CD and minimal dialogs. Easy to install however a lack of flexibility in configuration.
- No manual package selection during install, packages must be tweaked after install.
- No graphical installer, positive in some respects as the distribution is likely to install on more systems, however could also be negative as the first-time or non-technical user may find this daunting.
- Would not use some file formats or play DVD's due to exclusion of packages for licensing reasons. Also a lack of browser plug-ins for Flash, RealPlayer etc.
- 3D graphics acceleration enabled by default.
- Installation of browser plug-ins via the browser did not work, however these plug-ins were available by adding extra package repositories and using Ubuntu's own package management system.

Laptop

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SuSe 10.0 – Evaluation Version

Laptop

- Included a number of extra packages not distributed with the OSS version due to licensing issues, specifically, Adobe Acrobat, Flash player, RealPlayer and ipw-firmware. The latter is required to make the wireless interface work correctly. Apart from these extra packages, the two versions of SuSe are identical.

Discussion Points

General

The results show that the difference's between each of the target distributions are mainly centred around approach. Ubuntu and Kubuntu for instance, offer a simple 1 CD installation, with no package management at the installation stage. This offers a quick install that can be largely unattended. System configuration and addition / removal of extra packages can be achieved after initial installation.

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On the other hand, SuSe, Fedora and NLD offer a great deal of flexibility at the installation stage, and provide manual package selection. For the SuSe/Novell distributions, this is largely thanks to the YaST software which provides a central configuration console for use during and after installation. SuSe can however take a long time to install, and if done using the 5 CD set also demands a lot of attention. It is worth noting that most operating systems require a number of CD's for installation. SuSe is available as a DVD download, however in the original test we chose to use the CD's. It has been noted by a SOCITM representative that even when using the DVD to install SuSe, the installer asks for the next CD. Upon leaving the DVD in the drive and hitting ENTER, the installer continues, thus even installing from a DVD requires the user to participate. The second, extended SuSE test (on their evaluation version of SuSE 10.0), was a DVD install, as was the second Fedora Core 4 test. The installation media for each of the extended tests was taken from a popular Linux magazine at SOCITM's request.

All of the distributions contain excellent automatic update mechanisms, which allow the user to stay up-to-date and secure with very little effort. Both SuSe and Novell Linux Desktop provide this feature at the installation stage, which can greatly add to the security on first boot. This does however mean that the installation can take quite a while. SuSe for instance contained over 100 updates.

Language support in the distributions was varied, and attempting to translate the desktop environment into Welsh was only successful on SuSe and NLD although the option was available across the board. It's possible the default installation selected did not contain the necessary packages, however if this is the case, it needs to be more clear to the user.

Windows networking is an essential part of Linux use in a corporate environment as most organisations use some Windows-based file-sharing or authentication systems. All of the distributions CAN interoperate with Windows file-servers, however "out-of-the-box", they did not meet all the required criteria. This is certainly a stumbling block to local government adoption and improved auto-configuration in the field would no doubt be welcomed.

Laptop

The laptop tests required us to explore the world of hardware on Linux. The popular HP Compaq nx8220 we used was a revealing choice as the drivers for both the ATI graphics card and the Intel WiFi adapter are only available as proprietary code. This meant none of the distributions tested actually supplied the drivers as part of their installation media. Installing the ATI driver manually was not a trivial task apart from on Ubuntu and Kubuntu, who package the 3rd party ATI driver and make it available via their repositories. It did however need to be installed from the command line as these two distributions failed to start the desktop environment using the open source ATI Radeon driver. All the other distributions succeeded in booting to the desktop environment using the freely available distributed open source driver, although default resolution was generally not up to scratch, and manual installation of the 3rd party drivers was laborious and required searching on the internet for assistance.

Connecting of an external monitor showed mixed results, all being unsatisfactory in terms of user experience. Often, the desktop environment needed restarting and upon doing so, the resolution used for the external monitor was also unsatisfactory. There was little to no configuration options available for multiple monitors on all of the distributions, although this can be configured by hand by editing configuration files. It is unlikely a non-technical user will be experienced enough to find this a trivial exercise.

With regards to the WiFi adapter, drivers were not available as part of the distributed packages. Even after installing the drivers manually, some distributions refused to connect to the test access

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point. This was mainly due to the non-standard installation method of the drivers, i.e. downloading and running a shell-script from the manufacturers web site. This point is very important as use of wireless networks and mobile working becomes more commonplace. For many, this would be a complete show-stopper.

Possibilities

The major difference between the desktop and laptop machines performance in the tests can partly be put down to hardware maturity. The Dell Optiplex SX270 desktop used contains a standard Intel integrated chipset and on-board components, and is around 18 months old. The HP Compaq nx8220 laptop is however much newer, and uses cutting edge technology such as the latest ATI mobile video hardware, and the Intel Centrino processor. Support for newer technologies such as this can take a while to arrive in the Linux kernel because manufacturers are primarily committed to providing Windows and / or MAC drivers which cater for the majority of the market they serve. Some hardware vendors produce Linux drivers, but often this is not with the support and help of the open source community. Others fail to provide non-Windows drivers whatsoever, and any hope of a driver emerging rests on reverse-engineering on the part of Linux “hackers”. These efforts are often successful, however it takes time to perfect and is not the most efficient method of driver production. WPA WiFi encryption is a good example of newer technologies maturing. Support for WPA in Linux is limited to just a few wireless adapters, and requires using a third-party piece of software called “wpa-supPLICANT”, which is still in active development. We could not make WPA encryption work “out-of-the-box” for any of the distributions tested.

Conclusion

The experiences met while conducting this evaluation are similar to those encountered by many who try to install Linux, either for personal or professional use. As a general point, support on older (PC) hardware was better than that of the newer (laptop) hardware. This is significant for individual users who are non-technical, and time consuming for those who can install the drivers. For organisations the effort of establishing a working system is spread across the number of identical machines that it can be imaged onto and so can be dissipated.

If hardware vendors provide only closed-source drivers for Linux, there is a need to package those drivers individually for each of the different distributions or package management systems. They could have a major part to play in Linux achieving desktop readiness. Similarly the projects and companies which create the distributions could make greater efforts to ensure that the latest drivers are packaged, available and implementable through their own package management systems (as Ubuntu / Kubuntu have done with the ATI drivers)

In terms of graphical environment and desktop integration, each of the distributions scored well, and were very usable in terms of accessing files and applications etc. The major differences between the Linux distributions are of no surprise if you know what to expect from each distribution e.g. a simple initial installation vs. a configurable set up of a comprehensive system, or the inclusion or not of proprietary drivers.

A configured Linux machine is highly usable however there are improvements to be made in terms of presentation and substance. Improved presentation of distributions will ensure that users understand the differences between the distributions so that they can choose the right tool for the job. The substantial improvements to be made are around support for new technologies and at the very least providing easily accessible information on which distribution and drivers support which hardware and technology. By and large this is not an issue for most Windows or Mac users, it is

significant however for many existing, potential and / or frustrated Linux users.

Possible extensions to the Study

There are a number of potential improvements to this study. For example to consult the wider open source user community on the design of the test-plan. It would have also been interesting to consult end users who have limited or non-existent experience in using open source software, and to extend the test to include some of the lesser known up-and-coming distributions and more of a mix, possibly including more of the commercial offerings. These extensions would have added more punch to the test-plan and the results would most likely be interesting to a wider audience.

As the whole test-plan is distributed with this report, parties wishing to extend this study can do so.

A. Full Test Plan

B. Results in Full