# An Introduction To JayOS

*by*

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# Abstract

Not too long ago, I found myself without a personal computer to configure as my own. My laptop had just died of old age, and I decided that I would wait awhile before purchasing a more modern system. I had compiled several CDs worth of data before my old system crashed, but they were for usage under the Linux operating system, not Windows. It had never posed a problem before, but now that the only systems I could get my hands on ran Windows, it seemed that I wouldn't be able to access my data without first installing Linux. And I needed to do it without changing the host.

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"Ever hear of a live rescue CD, ya moron!" some guy in
a loud shirt shouts.  Someone else snickers and pats
their Knoppix CD.
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Truth is, I've used most of the better rescue CDs out there, but none of them were what I really wanted, which is my own personalized workstation. Distributions generally err on the side of either too much or too little. Some of them throw in everything but the kitchen sink (which could arguably be said to be KDE) and include multiple and sometimes redundant applications. Others are so stripped down, although they are marvels of ingenuity, can only be used in specialized applications. Since none of them were just right for me, I decided to roll my own.

# 1 About

The object of my customized distribution is to allow me to use any computer as my own personal workstation. Only the applications that I find universally useful are included. The system must also run well (not just run) on the aging hardware all people who only use their computer for email and web surfing seem to have. The last point is important because I intend to target this distribution to those people, and to those who find their Windows systems too slow.

This distribution is lightweight, modular, and has a small footprint. It can be run from various combinations of media, including CDs and USB drives. It is also compact. When packaged on CD, only five or so files are needed. This makes it easy to, say, put the boot file on a floppy disk, load the root filesystem from a USB drive, and read other filesystems from CD.

The final and most important objective is that it must maintain a high level of personal security. By this I don't mean host and firewall security, I mean data integrity.

# 2 Design Philosophy

Some of the choices I made during the design of JayOS need to be explained. Keep in mind that these are simply my own reasons, and not intrinsically right or wrong.

## 2.1 Target Audience

Although I put JayOS together to suit my own needs, it can very easily be used by anyone who is familiar with the typical Microsoft interface. My goal is to make it as easy and intuitive as posible for the novice, yet powerful enough to entertain the expert.

## 2.2 Differences from Windows

A Windows distribution such as XP includes only a limited set of hardware drivers. A good example of this is whenever you install new hardware such as a printer, scanner, or digital camera, you must also install the corresponding 3rd party drivers that Windows won't supply.

The vendor will supply programs which allow you to use the hardware, but invariably they are no more than proof-of-concept programs with limited capabilities. In order to really use your new toy, you have to purchase additional software.

But what happens if, after using a program, you decide you want to change a certain behavior or modify a feature? Say want the scrollbar on the left, or you don't want it to perform a default action on startup. With Linux, since you have the source code to the program, you can make whatever changes you want and recompile it.

## 2.3 Performance

It is my notion that the vast majority of home users would have no need for super blazingly fast hardware if their software ran at acceptable performance levels. But through the very nature of Windows, most people incorrectly believe that new hardware is required for additional performance, instead of new software, when all they really need is better software.

Don't get me wrong; fast hardware is nice when you have it. CPU-intensive tasks such as number crunching, program compilation, and databases benefit greatly from new hardware. But one shouldn't need state-of-the-art hardware just to send email, surf the web, and write documents. In fact, I believe that Windows has become bloated over the years, and emphasizes quantity over quality.

For example, Windows XP performs poorly on hardware that was cutting edge when Windows 98 was first released, but since the latter is no longer supported, users are forced to purchase new hardware just to keep up with the requirements of new software.

Do not be misled into thinking that JayOS installs old and unsupported programs in order to be compatible with older hardware. Ninety-eight percent of the programs I have chosen to compile are stable and under active development by their respective authors.

The bottom line is that JayOS will outperform Windows 98 when run on the same hardware. Should you be so lucky as to own high-end hardware, you will find JayOS to be faster and more efficient than Windows XP, yet capable of the same tasks.

## 2.4 User Interface

Think of Windows 98 and you've got the picture. There is a start button, cascading menus, and a taskbar. All windows have title bar icons to iconify, minimize, maximize, and close, and they can be positioned anywhere on or off screen. Programs are launched by either selecting a menu item, or double-clicking within the file manager. The window manager also defines multiple workspaces to reduce desktop clutter.

## 2.5 Security

One of the most glaring changes I have made is the decision to run everything as root. The user is automatically logged in as root, and never has to enter a password. My rationale is that I'm not going to prevent the user from shooting themselves in the foot, but they will have to search long and hard for the gun. I assume the average user, coming from Windows, has no idea what a root account is, and doesn't care. Likewise, they probably don't know any UNIX commands. Thus, the probability of them intentionally mounting a partition on the host computer *and* issuing the commands to remove everything on said partition is very small.

JayOS is intended to be a desktop system, not a server (although plenty of server functionality exists). Desktops and workstations are typically single-user, with the user only needing the administrative account for system configuration changes and other special circumstances. I do not expect the user to perform setup operations themselves, but to enlist the help of more knowledgeable users. So if you install this on grandma's computer, then you are the one who will provide specialized help.

So why not create an initial user account of grandma, and tell grandson the UNIX administrator what the root password is? Because I personally *hate* su'ing to root. Conventional wisdom says to only use root when you need to, and on critical, multi-user systems I agree. But on my system (which JayOS is representative of) I use root exclusively and I don't screw up. I don't make typos on the command line, either, because I can't afford them. Practice makes perfect.

Besides, running things as root gives a tremendous advantage to the ueberadmin, who would be running a great many things as root anyways :) I maintain that this setup works well for the uninitiated ex-Windows user. The more they learn, the more power they find under the hood. However, expert users who wish to change this behavior are more than welcome, and should read the section on Upgrades.

Did I mention encryption? For the security conscious, not only is JayOS completely firewalled, all filesystems and even swap can be encrypted. Said filesystems can only be booted or accessed with the proper passphrase.

# 3 Installed Programs

As I have mentioned before, the goal of JayOS is to perform common user tasks on average to aging hardware, and to release Joe and Jane User from the needless cycle of upgrades. In order to accomplish this, I have carefully chosen programs and subsystems that offer full functionality, without sacrificing speed and precious resources.

JayOS uses GNU/Linux programs, which are freely available under the GNU Licence. I have included a matrix below to identify my desired functionality of a desktop computer, and how it is accomplished under both Linux and Windows. Notice that Linux offers more program choices per item than Windows, but the latter requires 3rd party programs for tasks as basic as printing, and burning CDs/DVDs.

| Functionality | Windows | Linux |
|---|---|---|
| Office Productivity Suite | MS Office | OpenOffice |
| *word processor* | word | soffice |
| *spreadsheet* | excel | scalc |
| *presentation* | powerpoint | presenter |
| File Manager | Internet Explorer | Nautilus<br>Xwc |
| Web Browser | Internet Explorer | Firefox<br>Links |
| Email Client | Outlook | Sylpheed<br>Mh |
| Instant Messenging | IM | Gaim |
| Audio/Video | Media Player<br>(3rd party authoring tools) | Grip<br>xcdroast<br>mplayer |
| Image Manipulation | (3rd party programs) | The GIMP |
| Database | MS Access | Postgres<br>MySQL |
| Window Manager | (Windows look & feel only) | Fvwm95<br>Metacity |
| Printers | (3rd party programs & drivers) | CUPS |
| Scanners | (3rd party programs & drivers) | Xsane |
| Digital Cameras | (3rd party programs & drivers) | Gtkam<br>gphoto2 |
| Program Development | (no compilers, interpreters, or development libraries included) | C, C++, Java, Perl, Python<br>GTK+, Glade, PHP |

I have included sylpheed as an email client because of its powerful, yet easy to use Outlook-like interface. It integrates GnuPG to insure that your privacy is pretty good. The Web browser is Firefox, a branch of the Mozilla code base. Audio support is accomplished through the ALSA subsystem, and all other multimedia achelmy is performed through mplayer, xcdtoast, grip and friends.

# 4 Upgrades

No doubt JayOS is configured by default to use programs you are not familiar with, and/or ones you find unnecessary or distracting. I wouldn't even be surprised, considering the nature of Open Source, if some programs are being outdated as you read this. I will continue to track the latest offering of my chosen installed program base, but if there is something that I haven't yet gotten to, or there is some favorite program you can't do without, there is the opportunity to do it yourself.

When you are at the stage where you want to add functionality, I will show you how to build your own JayOS distribution from source, where along the way you will learn how Open Source projects are integrated into my customized build process. If you've ever typed "make && make install", then you are almost ~/.

In order to show you how upgrades are managed, I first need to first explain how the JayOS filesystem is laid out, and how it relates to loopback filesystems.

# 5 Technical Overview

The system consists of essentially three components: a boot image (1.44 MB), a root filesystem (~40 MB), and a /usr filesystem (~300 MB). In its simple, default configuration, JayOS will boot from CD-ROM and attempt to configure any hardware it finds.

## 5.1 The Boot Sequence

JayOS first reads the boot image, either from CD or from floppy. It contains the latest 2.6 series kernel, an initial ramdisk for the root filesystem, and drivers to access a USB cardreader. From there, a program named linuxrc takes control and determines from where the root and /usr filesystems will be loaded. In the simplest case, both are loaded from CD. The root filesystem is then copied into RAM and control is transferred to /sbin/init. (Strictly speaking, from this point on, a /usr filesystem isn't needed to complete the boot sequence, so even if problems arise, the ueberadmin will still end up with a shell prompt). Init will mount /usr from either CF or CD. Please see the attached flowchart.

## 5.2 Hardware Detection and Configuration

Hardware is probed both during kernel initialization and afterwards at the user level. The kernel is currently compiled to support only the most popular network, SCSI, sound, and video cards, since space is at a premium. The 2.6 kernel is big enough as it is (compared to the 2.4 series) without my personal system having to suffer performance-wise to support hardware I don't even own. My current goal is just to scratch my itch, not to support every doggone piece of hardware ever made. In the future I may provide a kernel with more comprehensive hardware support, or I might just point people to Knoppix. YMMV.

That being said, most modern hardware is supported well enough to be recognized and used. JayOS should support a wide variety of network cards (no wireless yet), printers, scanners, digital cameras, and video cards. Laptops can be problematic for any Linux distribution, and JayOS is no different there. If your hardware isn't recognized, contact me and I will help you resolve any issues.