Painless Linux Experimentation

Tak Auyeung

August 10, 2004

Contents

1 What is Linux?

If you already know what Linux is, you may want to consider skipping this chapter. However, this section may still be entertaining if you know Linux already.

1.1 Executive summary

Linux is a free operating system that even ordinary end users will find useful. It is robust, time-tested, and surprisingly end-user friendly. It also hosts a large number of free application programs that are useful to most end-users.

1.2 It's a Server OS

If you have heard of Linux, you probably heard of it as the operating system of servers. It is true that Linux presents more challenge to Windows (product of Microsoft) in server rooms than anywhere else.

I personally use Linux for my online server. I use the same old machine (AMD K6-2 300Mhz 128MB RAM, 40GB HD) for web server, email server and file server, and it can still handle the load!

1.3 It's a desktop/notebook OS

Linux is becoming more visible as a desktop operating system. This is an area where Windows is extremely dominant. HP and some other large PC manufacturers are now starting to install Linux on their notebook and desktop computers sold in Asian and European countries. Hopefully, we'll see more machine pre-installed with Linux in the U.S. in the near future.

I use Linux for my desktop and notebook computers. Although Linux does not require a GUI (graphical user interface), quite a few GUI environments are available.

It is interesting that I also use Linux on my *old* tablet PC. This tablet PC uses a Pentium MMX 233MHz processor, has 160MB of RAM and 4GB of hard disk space. Even so, Linux succeeds to provide a GUI frontend so I can use this tablet PC for in-class presentations as well as free-hand drawing.

1.4 It's an embedded OS

Okay, we are getting into some really techy stuff here. Linux is also used in many "embedded applications". An embedded application is simply the use of a computer in a machine that serves purposes other than that of a usual computer.

For example, many low-end consumer-grade routers use Linux as an operating system. Other specialized devices utilizing Linux include ceilometers (machines to measure cloud height), robots, and many projects at Lawrence Livermore National Lab and other high-end research facilities.

1.5 It's free!

Although you can pay for shrink-wrapped Linux distributions at a store, Linux is actually a free operating system. In other words, you can download it for free from the web, or have someone else to download it and burn it onto CDs.

This is free as in "free beer".

Linux is also free as in "freedom". The source code of Linux is freely available, and the license (called GNU General Public License) allows anyone to modify the source, given that the modification be made available free to others. This is partially why Linux spreads to all kinds of platforms and processors quickly.

1.6 It has apps.

Even the best operating system (such as AmigaDOS back in its days) is useless without a good selection of application programs. It is natural for Linux to have a good selection of *server* programs, such as Apache, mySQL, Squid, Samba and etc. However, most people don't know that Linux also has a good selection of programs that are useful to end-users.

Huh?

Linux has a free office suite that is mostly compatible with Microsoft Office products. It also has project management programs, PIM (personal information manager) programs, browsers, photo processing programs, sound processing programs and etc. If this is not enough, it also has simple CAD programs, games and multimedia programs. We'll do a quick review of these programs shortly.

2 Getting and Installing Linux

This has got to hurt, right? I mean, most end-users do not know how to install Windows, let alone Linux!

This is where "live-CDs" come in handy. A live-CD is a CD that is bootable (assuming the BIOS of a computer is set up accordingly). There are many Linux live-CD distributions. In this presentation, I will use the mature Knoppix live-CD.

So, how hard is it to run Linux with a live-CD? Here's how:

- open the CD tray
- place the Linux live-CD in it
- reboot the computer
- that's it!

This is easier than installing Microsoft Office on your computer!

3 But Why?

Okay, it's free, and it's easy. But why do I want to use or experiment with Linux?

3.1 It's free!

Did I mention Linux is free? Not only is the operating system free, but many application programs that get distributed with Linux are also free.

While most computers come with an installed operating system, it costs a bit of money to stay up-to-date with a non-free operating system. Using a free operating system means saving money in the long run. This is especially the case for large installations.

3.2 It's efficient

Linux runs okay even on a Pentium MMX 233MHz system, need I say more? Even older computers that are considered too old for new Windows operating systems can still be useful when Linux is the operating system.

3.3 It's got apps

The Knoppix live-CD comes with lots of application programs. From web browsing, office suite, games to specialized network diagnostic tools, there is no need to install!

3.4 It can share with Windows

Using Linux doesn't mean you have to give up Windows. Most Linux distributions, including Knoppix, readily read from and write to FAT and FAT32 partitions (commonly used by Windows operating systems). Furthermore, most Linux distributions can also share networked drives like Windows.

3.5 It's more secure

Okay, no operating system is absolutely secure.

However, at this point, the majority of viruses and worms are written for Windows operating systems. Few target Linux. There are still chances of getting compromised, but at least at this point, such chances are much lower than that of using Windows.

With a live-CD, *even* if a worm or virus manages to gain access, it cannot install itself! This is because the operating system and application programs are stored on a CD, which is read-only. In theory, a worm or virus can still do damage while it is active. However, because it cannot be installed permanently, a reboot of the system cleanly eliminates the virus or worm.

4 Why Knoppix?

I know it is a hassle to learn a new operating system. However, Knoppix is a distribution of Linux that is worth at least looking into. Spend 15 minutes or less, and determine for yourself whether it is useful or not.

This section discusses some real reasons to use Knoppix, when your "usual" operating system cannot handle the job.

4.1 Crippled "Native" Operating System

Let's say you have Windows XP Professional installed on a computer. One day, after applying a patch, the computer does not work anymore. Sure, you can spend some time to troubleshoot or reinstall the operating system, but you also have a presentation to make the next day, and you need to continue to work on the documents created in Microsoft Ofice.

Knoppix can help. Natively Knoppix includes Linux modules to handle most Microsoft partitions (FAT and NTFS). You may have heard that Linux cannot handle the NTFS in Windows XP. This is true that Linux has no native modules to do this. However, Knoppix includes a handy utility to use Microsoft's own drivers to handle its NTFS partition. So all is good.

Furthermore, OpenOffice is included in Knoppix. This is an office suite application that can read/write Microsoft Office formats (except Access database files).

In other words, with Knoppix, you can now continue to work on your documents on your hard drive, even though the native Windows XP operating system is crippled.

4.2 Diskless Workstations

Knoppix happily works on computers with just a single CD-ROM drive (no floppy drive, no hard disk, no ZIP drive).

Who wants such a computer?

A computer without hard disk is easy to maintain. Afterall, there is no place for viruses and worms to hide! Furthermore, users cannot install all kinds of junk programs and spyware. When there is a new version, just burn a new CD and the computer is "upgraded".

This kind of computers can be small, quiet (completely silent most of the time) and inexpensive. With a USB connector, files can still be saved on USB storage devices. As mentioned in the previous section, Knoppix includes an office suite (among many other programs). Even a diskless computer can still be used for office or school related work.

Combining the fact that Knoppix Linux is free with minimal hardware requirements, diskless computers running Knoppix are good candidates for schools, libraries, homes, offices and etc.

4.3 Defense Against Web Hostilities

No defense is perfect. However, we *can* reduce damage by choosing a more secure computing environment.

Since Knoppix Linux is based on Linux, there are relatively few viruses and worms that target it. This is good news, because one can "accidentally" bump into viruses and worms and remain uninfected.

What if one bumps into a virus or worm that targets Linux? On a diskless workstation, the worst that can happen is the invading program can log keys (and hence steal passwords). However, there is little else that a hostile program can do. This is because the operating system resides on a read-only medium, so it cannot be corrupted. A reboot of the system should rid any infection.

If you run Knoppix on a computer that has a hard disk, it is still *possible* for a hostile program to steal and corrupt files. However, this is difficult because Knoppix, by default, disables most incoming network connections. This is not to say it is impossible, but it is going to be very difficult for someone to break into a Knoppix box via the internet.

4.4 Cheap and Portable Computing Environment

Knoppix has an option to save configurations on non-volatile storage. This means you don't have to start with default settings every time you use Knoppix. In fact, you can save such configurations on a removeable USB storage device, along with your data files.

What does this mean?

This means you can bring all you apps and data files with you easily. Imagine this: all you need to bring are a single Knoppix CD and a USB storage device. Optionally, you can also bring two floppy disks for computers that cannot boot from CD.

Okay, but why is that good?

With this approach, you can bring your work with you to any computer that has a CD-ROM drive and a USB connector (and optionally a floppy drive). You don't have to worry about viruses and spyware on other computers, either. This is because you are not even touching the "native" operating system on the computers!

Knoppix comes with many options to connect to a network. From direct connection to a LAN, cable/DSL modem, to dial-up access, you get network connectivity. Network connectivity enhances the portability of a computing environment because you don't even need to bring the files with you. All the files can be transmitted to/from a hosting server. If you worry about security, Knoppix includes the entire SSH (secure shell) tool suite, which can encrypt traffic on the network so that your file transmissions remain secure.

A portable computing environment is great for schools, especially when the software is all free! A school can freely distribute Knoppix CDs to students, and require students to use some form of removeable medium for data files. The students can now work on their homework assignments and projects at school and at home. The only cost to the school or student is that of a blank CD-R and a USB storage keychain. On the other hand, the school can save a lot of money on systems maintenance, and the students can save a lot of money on commercial operating systems and applications.

Note that Knoppix include many applications. These applications include an office suite, a graphics program similar to Photoshop, audio processing and recording utility programs, CD burning programs and even programming environments.

5 Using Knoppix

5.1 Getting Started

This seminar includes a free Knoppix CD. I download and make copies of the latest version. You can freely make additional copies for others without infringing on any copyrights.

The computer that is going to run Knoppix should have at least 512kB of RAM. Interestingly, no hard disk is really required! As for the processor, any Pentium processor should work. To get *reasonable* performance, I recommand a Pentium II class processor or better.

One necessary feature on the computer is the ability to boot from CD. This is fairly common and usually enabled on modern PCs. However, older PCs may not have this feature. To check for this feature, let's do it the lazy way:

- insert the Knoppix CD into the CD drive
- reboot the computer
- if the computer boots to Knoppix-Linux, there is no need to do anything
- if the computer boots to the current operating system, follow these steps:
  - if you do not feel comfortable dealing with BIOS settings, *stop here*. Ask for help, or boot from floppy (see instruction below)
  - reboot the computer again
  - in the BIOS startup screen, see how you can get into the BIOS settings screens
    - some BIOSes use the delete key

Figure 1: Screenshot of the bootstrap option screen of Knoppix.

    - other BIOSes use the function key F2
    - yet other BIOSes do not even indicate how to get into the BIOS configuration screens
  - press whatever key is necessary to get into the configuration screens; if you press the key too late, just reboot again and press the key sooner
  - go to the advanced CMOS setting screen
  - check the order of bootstrapping
  - if the CD drive is on the list but after HD (hard disk), change the order so that the BIOS tries to boot from CD before the HD
  - if the CD drive is not on the list, go to a particular spot, and see if you can change it to the CD drive. I suggest that you try the floppy disk spot
  - save the changed BIOS settings
  - reboot the computer

If you cannot get your computer to boot from CD, Knoppix can boot from two floppy disks. Give me two blank floppy disks, and I'll return the boot floppy disks. Insert the first bootable floppy disk, and insert the Knoppix CD. Then reboot the computer. This time, the computer boots from the floppy disk, and the bootstrap software should read the rest from the CD.

5.2 Startup Options

Most modern computers do not need any special startup options. The prompt for options times out, and the bootstrap process continues.

However, if you have an older computer, you may want to consider typing in the following when you are prompted for options:

```
knoppix nodma
```

There are many options available. For more details, press F2 or F3 to get a more extended list of startup options. Refer to figure 1 for a sample view of the boot-up screen.

5.3 Exiting from Knoppix

Click on the "K" button at the lower left corner, then select "logout". The shutdown sequence is a little long, and it switches from graphics mode back to text mode. At the end of the sequence, the CD tray should be popped, and a message asks you to remove the CD and then press ENTER.

Refer to figure 2 for a screen shot of exiting Knoppix. Also, refer to figure 3 for a screen shot of the exit options dialog box.

After the shutdown sequence completes, you'll be prompted to remove the CD from the tray, and then press the ENTER key.

5.4 Starting apps from Knoppix

Click on the "K" button at the lower left corner, then select the application based on category.

6 Using a FAT partition

6.1 What is a FAT partition?

"FAT" stands for File Allocation Table. It is an older method to organize data on a hard disk. All versions of Windows and DOS knows how to read and write various generations of FAT partitions.

And so does Linux (and Knoppix).

This is very good, because now you can save data and files to a partition that is backward compatible with Microsoft operating systems when you are using Knoppix.

6.2 Where can I find a FAT partition?

If you are running Knoppix on a computer that has one of the following operating systems installed, you *most likely* have at least one FAT partition:

- all versions of DOS (MS-DOS, DRDOS, PC-DOS)
- Windows 3.1, 3.11 (based on MS-DOS)
- Windows 95
- Windows 98, 98 SE
- Windows Me

What if you are running Windows NT/2000/XP? If your computer is "upgraded" from one of the operating systems on the list, you may have a legacy partition that is still FAT-based. Otherwise, you probably only have NTFS partitions. But that's okay, we'll discuss that later.

You can also find FAT partitions on floppy disks, ZIP disks and most USB flash storage devices (also called jump drives, keychain drives, flash drives, etc.). This is great, because now you can save data onto a removeable medium!

6.3 Knowing your partitions

Knoppix automatically detects partitions on your hard disk and removeable drives (including USB drives). These partitions are displayed as icons on the left hand side of the main Knoppix screen. Refer to figure 4 for a screenshot identifying these icons.

You can click on a partition icon to open it and browse its contents.

6.4 Making a partition writeable

All partitions are read-only by default. Why? The creator of Knoppix wants to make sure that it is nearly impossible for someone to accidentally overwrite a partition. This is also protection against viruses and worms. If a partition is read-only, "bad programs" cannot cause any permanent harm to the system.

To make a partition writeable, do the following:

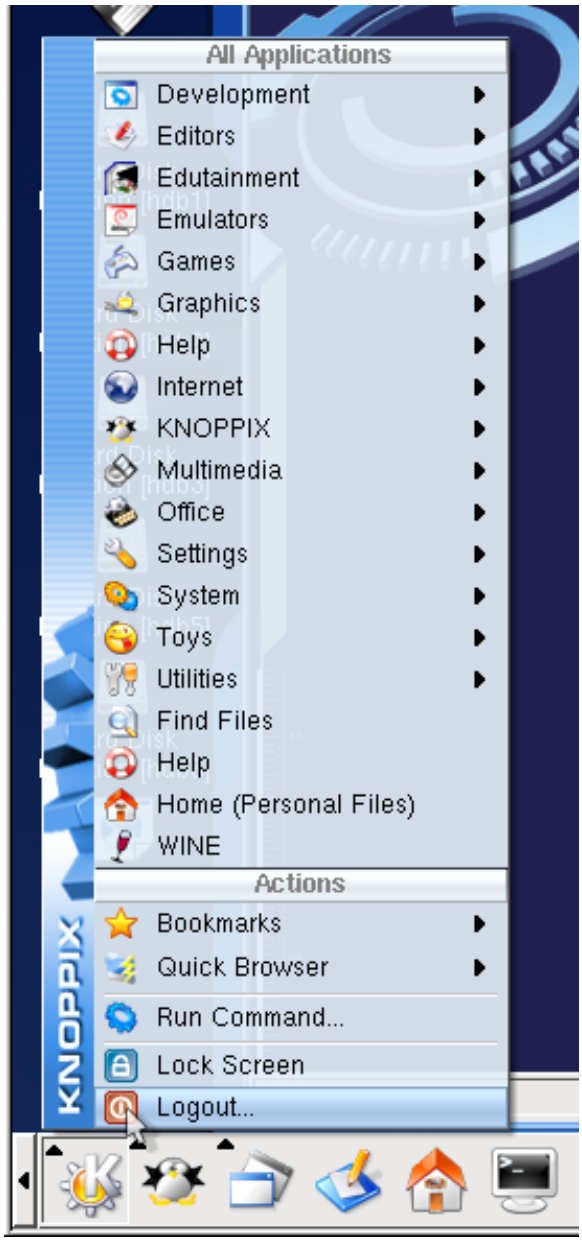
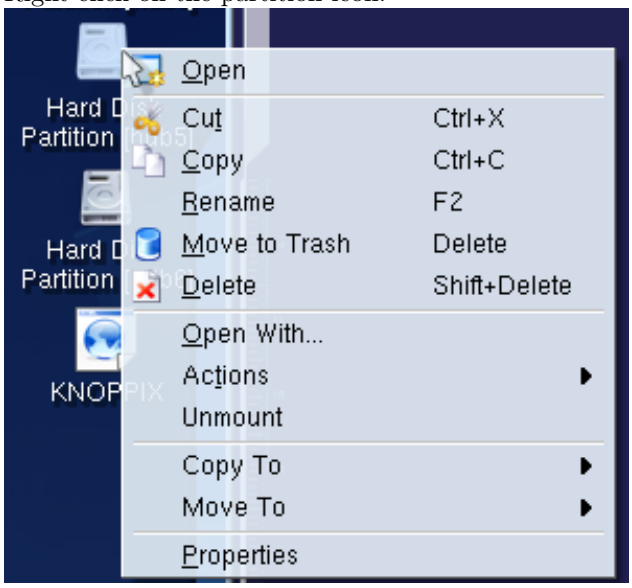


Figure 2: Screenshot of exiting Knoppix.

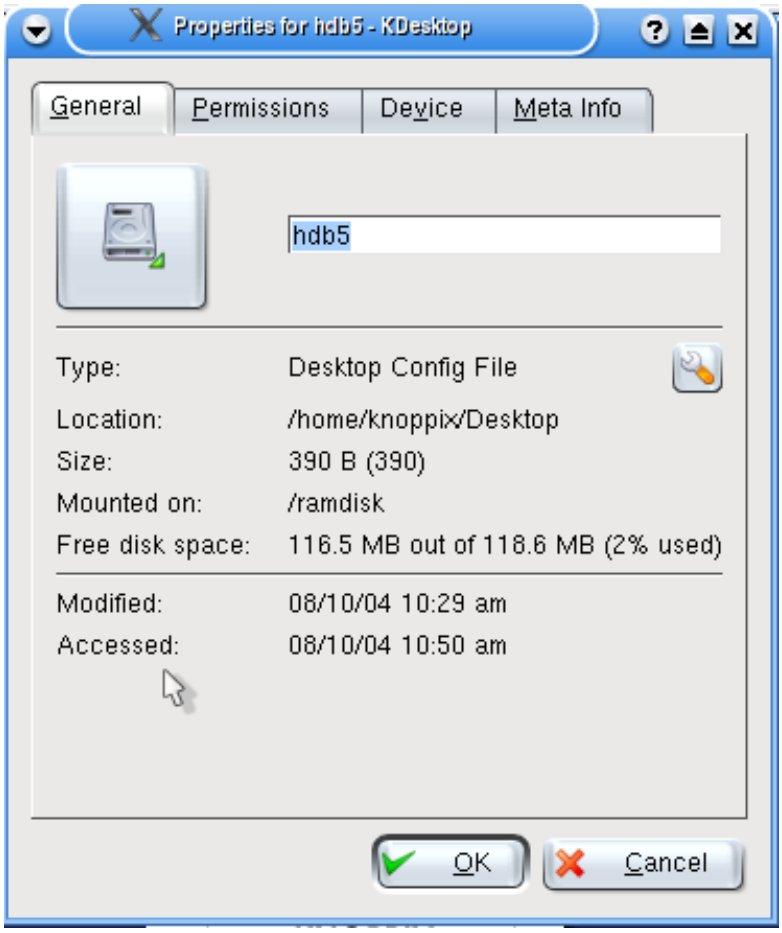
Figure 3: Screenshot of exit options.

- Right-click on the partition icon.

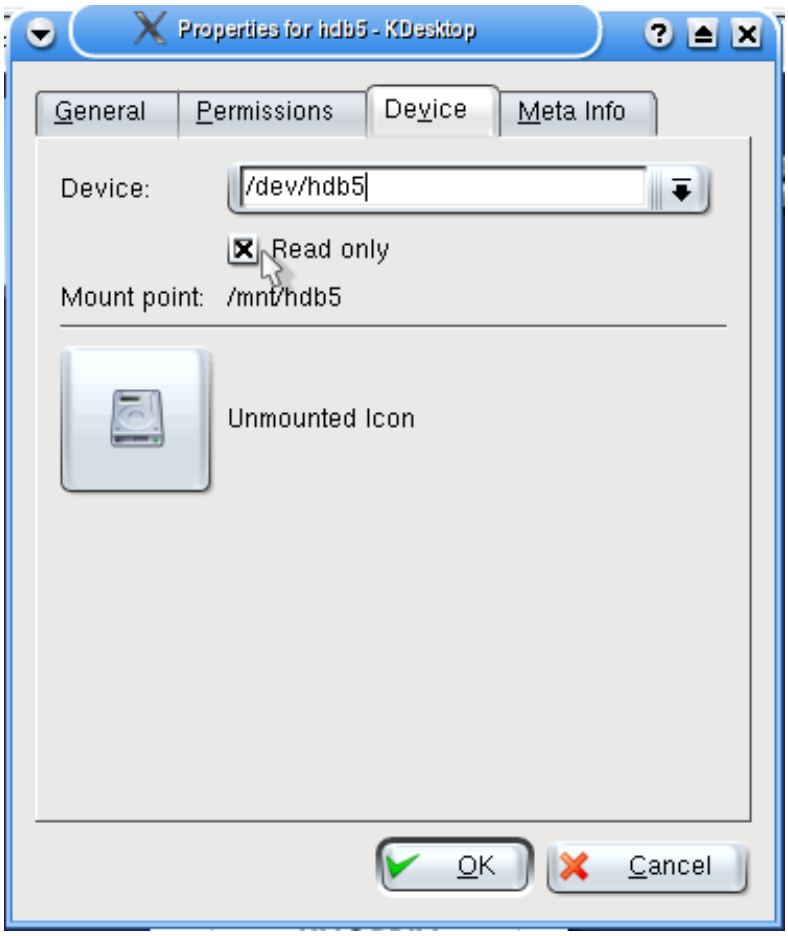


- Click on “properties”, you should then see the following dialog box

Figure 4: Icons representing partitions.



- If "unmount" is one the options, click on it to unmount the partition first. Then repeat the previous steps from the beginning. If you get a message unmounting the partition, close all windows and applications first, then retry from the first step.
- Click on the "Device" tab, you should see the following screen



- Click and uncheck the checkbox "Read only", then click the "OK" button.
- The partition is now writeable!

6.5 Safely removing a removeable medium

If you have saved data on a removeable medium (flash drive, floppy disk, ZIP disk, etc.), make sure you follow these steps so you don't lose data.

- Right click on the partition icon.
- If "unmount" is an option, click "unmount". If an error message appears, try to close all windows and applications first, then repeat from the first step.

Once a partition is safely "unmounted", you can remove the medium.

6.6 Finding USB drives

A hint: a USB drive appears with a name of `sd??` rather than `hd??`.

7 Common applications

7.1 Connecting to the network

There are a few ways for Knoppix to connect to the internet. You can view these options by clicking the "K" icon at the lower left corner, then select "Internet". Figure 5 shows you the choices.

- Default: by default, Knoppix detects any ethernet network card that is installed, and attempt to connect to a network using DHCP (dynamic host configuration protocol). This handles most, if not all, of the cases for office computers. There is nothing that you need to do in this case. This default also works well for most home computers that are connected to a router or firewall device.
- **ADSL/PPPOE configuration**: this is suitable if you have a cable modem or DSL modem connected directly to a NIC (network interface card) on the computer. PPPOE (point-to-point protocol over ethernet) is a common protocol used by DSL and cable modems. You will need your username and password to make the connection.
- **KPPP**: this is suitable if you have a modem on the computer, and wish to use it to connect to the internet. Unfortunately, Linux has relatively sparse support for WinModems (modems that use the main processor to modulate and demodulate signals). You will need your username, password and access phone number to use this feature.

7.2 Web browsing

As mentioned earlier, Knoppix is a good choice for safe web browsing. This is especially the case if the computer has no hard disk at all, so that it is just impossible for any malicious program to get physically get a foot hold.

You can find a wide selection of browsers in Knoppix. Click the "K" icon at the lower left corner, then select "Internet". Figure 5 shows you what the available application programs related to the internet.

Of these programs, "Mozilla Browser" is the most well known web browser. An alternative is "Konqueror". If you like efficiency and don't mind using a text mode browser, "Lynx" is an interesting alternative.

7.3 Office applications

The most comprehensive office suite program in Knoppix is called "OpenOffice". This includes a suite of programs for most office related work, such as word processing, spreadsheet, presentation, web authoring and drawing.

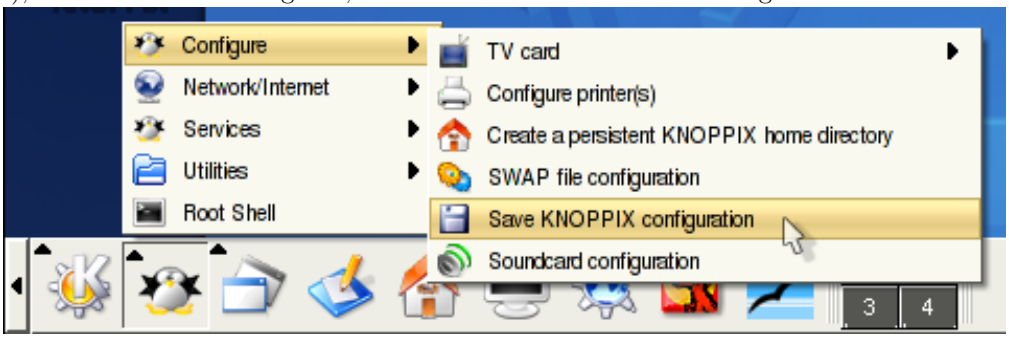
To start OpenOffice, you can browse a partition, and click on a document file that is associated with OpenOffice. To start OpenOffice by itself, click on the double seagull button on the bottom panel. It may take a little bit of time to start OpenOffice, so be patient!

8 Advanced user topics

8.1 Saving system configuration

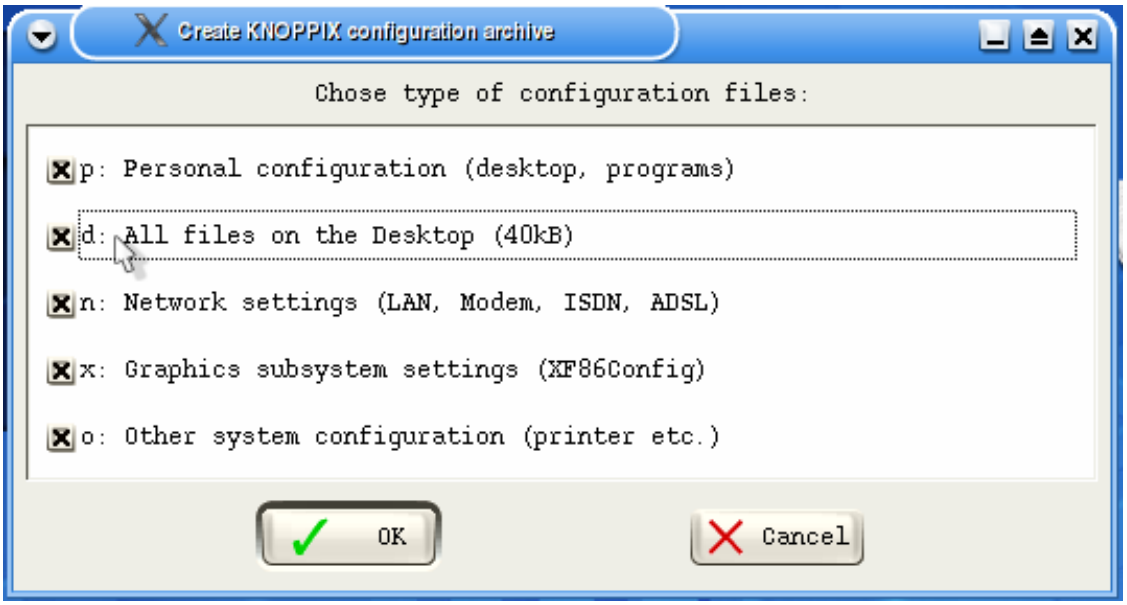
If you configure the network adaptor or internet log in options just the way you like it, you probably feel it is cumbersome that Knoppix restores all settings to "faculty defaults" every time you boot your computer with it.

Fortunately, Knoppix has a utility to save the configurations. Click on the penguin icon (to the right of the "K" icon), then selection "Configure", then select "Save KNOPPIX configuration".

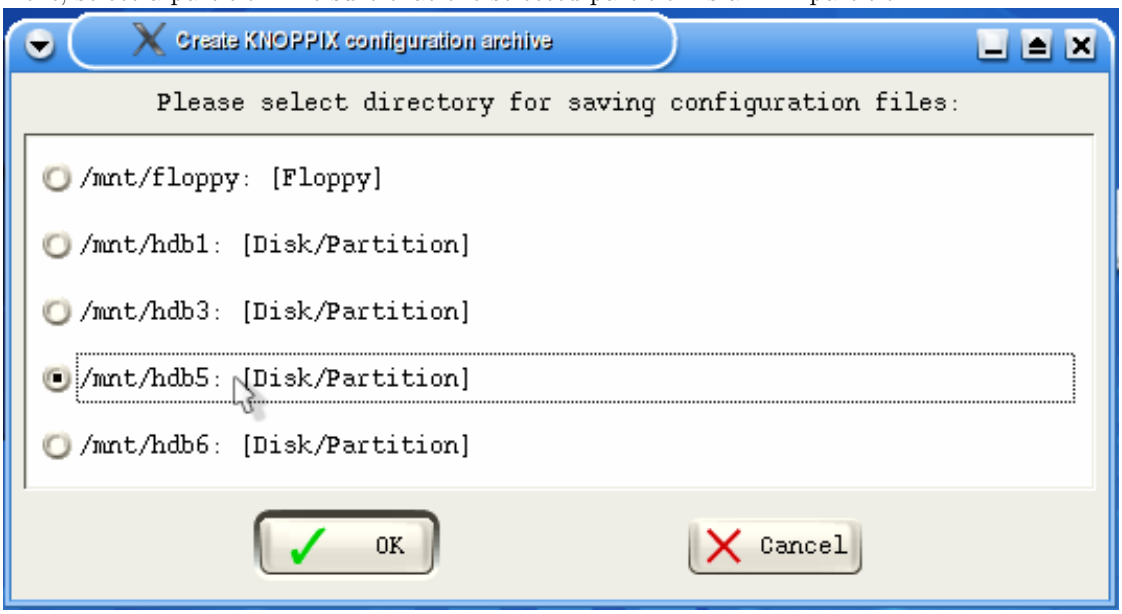


You should then see a dialog box, click "OK".

Figure 5: Programs related to the internet.



Next, select a partition. Be sure that the selected partition is a FAT partition.



Once your configuration is saved, you can use the following option in the boot screen to reload the configurations:

```
knoppix myconfig=/dev/hdb5
```

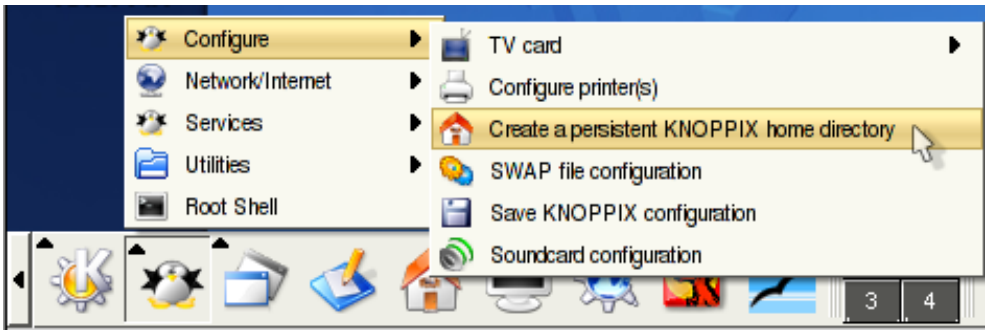
In this example, I used partition `/dev/hdb5` to save the configurations.

8.2 Make Knoppix data non-volatile

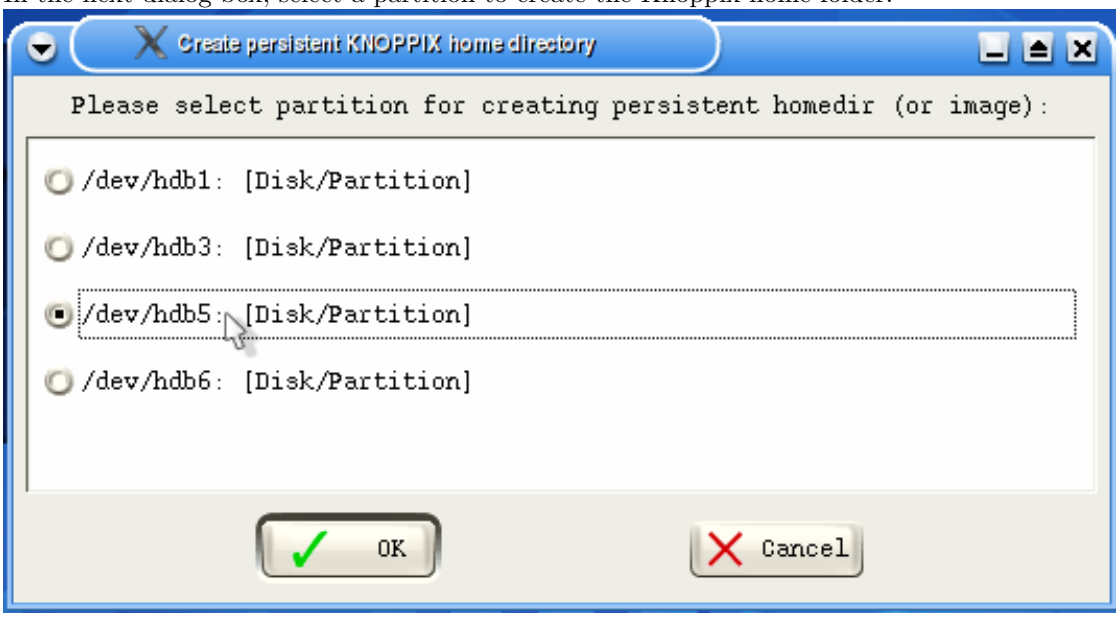
By default, all data you create in Knoppix is volatile. In the previous section, we were introduced to a method to save the system configuration so you can reload it later. This is okay for system configurations, but it is not well suited to your own data files. You can combine the previous technique with a "persisten home folder" feature. This new feature saves all the data files to an existing partition.

You can make the "home" directory of Knoppix persistent. This way, data is being saved as you use Knoppix. This is useful if you want bookmarks in a browser be automatically saved. There is no need to "restore" because the files are readily accessible on a partition.

To use this feature, you need to click on the penguin icon, select "Configure", then select "Create a persistent KNOPPIX home directory".



A dialog box pops up to show you how this feature is used. Click "Yes" after you read the text. In the next dialog box, select a partition to create the Knoppix home folder.



Then, you'll be asked whether you want the whole drive be reformatted for Knoppix, or just to use an image. Click "No" to use just an image. Of course, if you *really* want to dedicate a partition to Knoppix, you can click "Yes". Most people should select "No".

The next screen lets you select the size of the image. This is really up to you. Because the home folder does not contain the operating system, nor the application programs, the default of 30MB is really quite a lot. If you are running low on space, even 5MB should be quite sufficient.

Note that the "image" you create is readable only with Knoppix and other Linux distributions. The image appears as a single big file in Windows, even though you may save many files into the image.

Next, you can choose whether to encrypt the home directory. Most people can select "No". If your computer is shared with other people, and you want to save passwords to log in to websites, I recommend that you enable the encryption feature. This way, even if someone else makes a copy of your home folder image, the content is still safe and secure.

Be sure to read the last screen in this process.

If you just want to boot Knoppix using a persistent home folder, type the following in the boot option screen:

```
knoppix home=/mnt/hdb5
```

If you combine this technique with the previous one (to restore system configuration), you should type the following in the boot option screen:

```
knoppix myconfig=/mnt/hdb5 home=/mnt/hdb5
```

8.3 Carrying everything with you

Knoppix can use *any* FAT partition to save system configuration as well as user data (home folder). You can, indeed, use a USB flash drive to store both the system configuration and home folder. Some of the newer USB flash drives have

up to 1GB of storage, which is more than sufficient for the average end user just for data storage.

This means with a Knoppix CD and a USB flash drive, you can now use most computers as your workstation. This is particularly useful for students because they can now do their homework assignments in the school as long as they can find computers that can boot to Knoppix.

To schools, colleges and universities, this also means the ability to utilize low cost disk-less workstations. There is no need software maintenance, and no software to purchase. Each student only needs to purchase a blank CD-R or CD-RW and a USB flash drive. With the vast amount of included applications, Knoppix can be useful for office tasks to artistic work to even programming homework assignments.