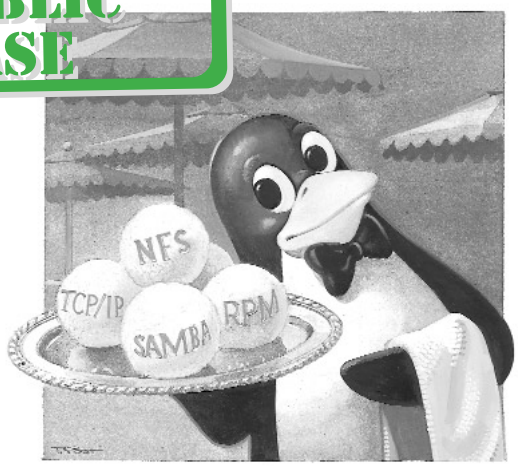

CHAPTER
10

X Window

10.1 X Window

The design of the GUI in Linux may seem confusing and fragmented to people with experience from the Windows and Mac environments. But most people who use Linux for a while come to appreciate the flexibility of the Linux GUI. Most of the components are found in Microsoft Windows and Apple Mac OS, but as these operating systems are marketed as complete packages, most people aren't used to thinking of the separate processes and systems they are composed of. GUIs in Linux and Unix are based on a system called X Window. The X Consortium, controlled from the Massachusetts Institute of Technology (MIT), is behind X Window. X (X Window) is written as a system that is independent of the hardware and CPU platform.

This means that the software is completely independent from the hardware architecture. It is possible to download a version of X from the X Consortium, but this only serves as an implementation example, and lacks elements like display card support. It is up to others to use this example implementation in their own solutions. This is exactly what all the commercial Unix producers do. Most Linux distributions come with an implementation of X called Xfree86. This is a version of X that is free like the rest of the Linux system. There are also commercial versions of X for Linux, such as those from MetroLink and Xi.

X Window is based on a simple client/server architecture, where the X client is running the application itself while the server simply is a graphical display server that generates the graphical picture.

If you are running Linux on a PC, the PC will work both as the X client and the X server. But there is nothing stopping you from setting up your PC as an X server (display server) for other Linux/Unix workstations.

Under X, the physical resolution of the workstation (the PC) or the X terminal limits the display resolution. Each terminal session can be either a standard character-based terminal image or the graphical pictures and applications of X Window.

But X is only the foundation of the GUI. The next layer is the window manager. Whereas X takes care of the connection to the hardware and some basic graphical libraries, the window manager looks after things like the looks and behavior of the windows in your system. Several window managers are available for Linux. For example:

- OSF/Motif—A commercial implementation which is the default in most Unix versions.
- Fvwm—A fast and configurable window manager that for a long time was the de facto standard under Linux.
- Qvwm—A window manager that tries to be a Windows look-alike visually as well as practically.
- Enlightenment—A window manager that aims at being as adaptable as possible and at the same time look trendy.
- WindowMaker—A window manager that tries to look like NextStep, which many users regard as one of the most attractive GUIs ever made.
- Sawmill—A window manager that is easy to integrate and has lean resource consumption.

The third layer in the GUI consists of libraries, i.e., standards and protocols for program development purposes. In the Unix world, this is centered on a set of libraries called Motif. The problem with Motif as seen from the Linux point of view was that it was commercially available only, in addition to having a poor design. Additionally, it was lacking some functionality. As a result of this, there were a number of free libraries developed in the Linux environment, including a free Motif clone called Lesstif. Consequently, Linux programs don't have the same standardized look that the Mac and Windows worlds offer.

This initiated two ambitious projects that aimed at developing an integrated Linux GUI with as good or, preferably, better features than those offered by Mac and Windows. The first of these projects was KDE (K Desktop Environment). KDE was developed with a set of commercial C++ libraries (Qt) from the Norwegian company Troll Tech. This connection to a commercial product and some disagreements over technical solutions were reasons why the GNOME (Gnu Network Object Model Environment) project started. GNOME quickly gained support from important Linux groups like GNU ("GNU is Not Unix"), Debian, and Red Hat. GNOME is based on the C library Gtk, but has threads for development under a number of languages.

KDE as well as GNOME are available for free download, and are supplied together with most Linux distributions, including Red Hat 7.x. KDE was completed first and has built up a considerable number of users in the Linux community. However, GNOME seems to have the greatest momentum and developer support, and my guess is that GNOME will probably be the de facto standard user interface in the future. Even though the licensing rules for the Qt library (the Qt library is now GPL – GNU Public License) have been modified in an attempt to accommodate the critical Linux users, the chunk of them still feel that using the "dedicated" Linux library license (LGPL) is the only acceptable solution for such a central part of the OS.

10.2 Configuring X

When you want to configure X, it is important to know as much as possible about your video card. The important details are the make, model, and which chipset your card uses. X Window can be set up by running Xconfigurator (Red

Hat Linux), which I went through in the installation chapter, or you can run `xf86config`, which updates the `XF86Config` file. (You can read more about this in the `/usr/X11R6/lib/X11/doc/README.Config` file.) You can also start Xconfigurator (see Figure 10-1) from the setup program. You must be a system administrator (root) to use setup and Xconfigurator.

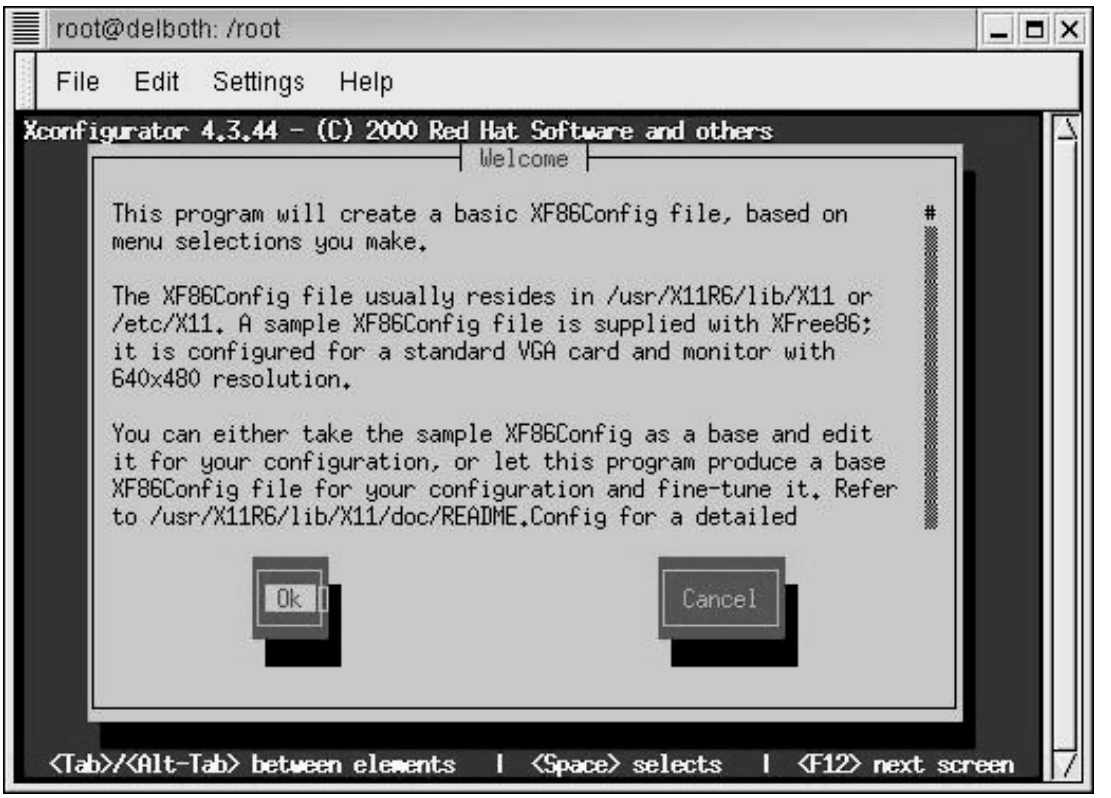

Figure 10–1
The startup screen from the Xconfigurator program.

If you don't know which parameters to enter when running `XF86config`, the SuperProbe program can help you find out which video card you are using. You must obtain the specifications of your display, for instance, its sync frequency. To run X, your machine must have at least an Intel 80386 CPU, a minimum of 16 megabytes of RAM, and 16 megabytes of swap. A faster CPU and more memory will give faster processing.

The table below lists some of the video cards supported by Linux. If you don't

know anything about your card, choose VGA 16 to get started. VGA 16 uses the 4-bit VGA server on your machine. This server uses the lowest common denominator (640x480 resolution, 16 colors) that almost all video cards will support.

Linux also supports accelerated video cards; for example: ATI Mach8, Mach32; Cirrus CLGD5420, CLGD5422, CLGD5424, CLGD6205, CLGD6215, CLGD6225, CLGD6235; S3 86C911, 86C924, 86C801, 86C805, 86C805i, 86C928, 86C864, 86C964; Western Digital WD90C31, WD90C33; Weitek P9000; IIT AGX-014, AGX-015, AGX-016; and Tseng ET4000/W3X.

Server	Supported Chipset
8514	IBM 8514/A card and clones.
AGX	All XGA cards.
I128	#9 Imagine 128 card.
Mach32	All ATI cards with Mach32 chipset.
Mach64	All ATI cards with Mach64 chipset.
Mach8	All ATI cards with Mach8 chipset.
Mono	All monochrome VGA cards.
P9000	Diamond Viper (not the 9100 series) chipset.
S3	All cards with S3 chipset, most #9, Diamond and Orchids cards.
S3V	All cards with S3 ViRGE chipset.
SVGA	Trident TVGA8800CS, TVGA8900B, TVGA8900C, TVGA8900CL, TVGA9000, TVGA9000i, TVGA9100B, TVGA9200CX, TVGA9320, TVGA9400CX, VGA9420; Cirrus Logic CLGD5420, CLGD5422, CLGD5424, CLGD5426, CLGD5428, CLGD5429, CLGD5430, CLGD5434, CLGD6205, CLGD6215, ET4000, and others.
VGA16	All VGA cards that support 16 colors only.
W32	All ET4000 and W32 cards.

By running the SuperProbe program that comes with the Xfree86 distribution, you can get more information about your video card's chipset. You will find it useful to check Xfree's Web page (http://www.xfree86.org) for more information about new, available drivers.

All standard bus types, including VLB and PCI, are supported. The most usual color configuration is 8 bits, or 16 bits per pixel. If you don't find your Linux video card after installation, you have several device driver options. Video software with a device driver (video card) can, for example, be downloaded from:

- www.xfree.com.
- www.redhat.com.
- Linux CD.

After downloading, the X Window device driver must be connected to the X directory. Below you'll find an example describing how to retrieve the device drivers from the Linux CD:

```
[root@nittedal /root]# mount /mnt/cdrom
[root@nittedal /root]# cd /mnt/cdrom/RedHat/RPMS
[root@nittedal /root]# rpm -i Xfree86-AGX*
```

(Here's an example with a device driver from the Internet: If you download files from the Internet you must also unzip them. Check if you have the `/usr/X11R6` directory. If you haven't got this directory, make it.)

```
[root@nittedal /root]# mkdir /usr/X11R6
```

Unzip the files from `/usr/X11R6` with the `gzip` command:

```
[root@nittedal /root]# gzip --dc XF86_AGX.tar.gz | tar
xfB --
```

Remember that these `tar` files are zipped relative to `/usr/X11R6`, which is why it is important to unzip them in that directory.

Next, link `/usr/X11R6/bin/X` to the server that you intend to use.

```
[root@nittedal /root]# ln -sf /usr/X11R6/bin/XF86_AGX
/etc/X11/X
```

You must apply exactly the same commands when using other servers.

10.3 Starting X

When the `XF86Config` file has been configured, you can start X by entering `startx` (see Figure 10-2), which starts the `xinit` process. If X doesn't start, you must check that the search path (`$PATH`) to `/usr/X11R6/bin` has been set.

```
[david@nittedal david]$ startx
```

When the X server is started, it will search for the initialization file (`.xinitrc`) in your home directory. If there is no local `.xinitrc` file, the system will read the default file, which is located in `/usr/X11R6/lib/X11/xinit/xinitrc`.

If you want to use 16-bit color depth with 65,000 different colors, enter:

```
[david@nittedal david]$ startx -- -bpp 16
```

With the double dashes (--), I pass the arguments directly to `xinit`. In this way, I can start up X in the resolution I need. If you want this automatically, place `exec X :0 -bpp 16` in your Xservers file (`.xserverrc`). This will only work if you have the following in the screen section of your `XF86Config` with `DefaultColorDepth 16`.

```
[david@nittedal david]$ startx -- -bpp 8
```

Here, I start X in 256-color mode.

```
[david@nittedal david]$ startx -- -bpp 32
```

Here, I start X in true color mode.

After a short while, an interface similar to Microsoft Windows will appear. Use the mouse to navigate and activate windows and menus. The graphical appearance can be adjusted to your needs. When you want to exit X, enter the combination [Ctrl]-[Alt]-[Backspace]. The X server will immediately stop and the window system will terminate.

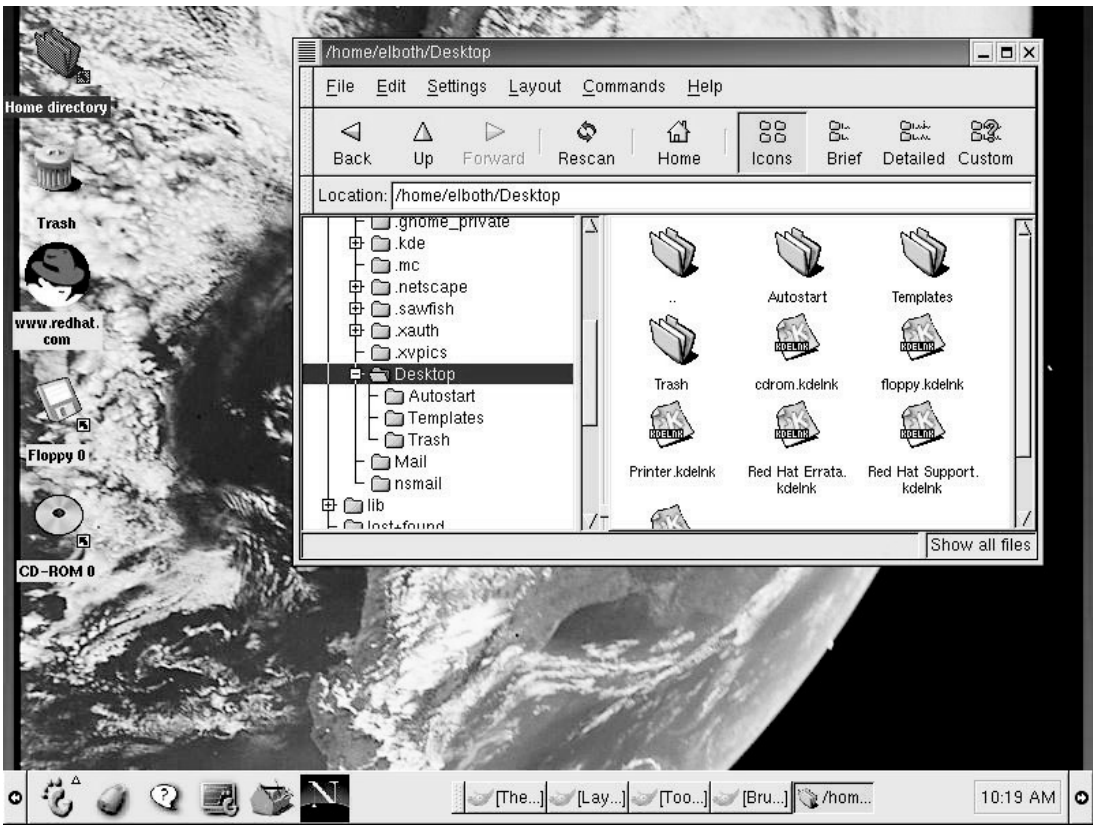

Figure 10–2
An example of a GNOME environment under Red Hat Linux (the screen has 1024 x 768-pixel resolution).

10.4 GNOME or KDE user interface

The illustrations in this chapter show either the GNOME or KDE user interface (see Figure 10-3). Under Red Hat Linux, you can choose from several window managers. It is possible to run X Window directly from a window manager without GNOME or KDE, but you'll lose the additional functionality offered by these interfaces. Most Linux distributions use GNOME or KDE as the basis of their GUI. It is therefore important to choose a window manager that supports both the GNOME and KDE interfaces.

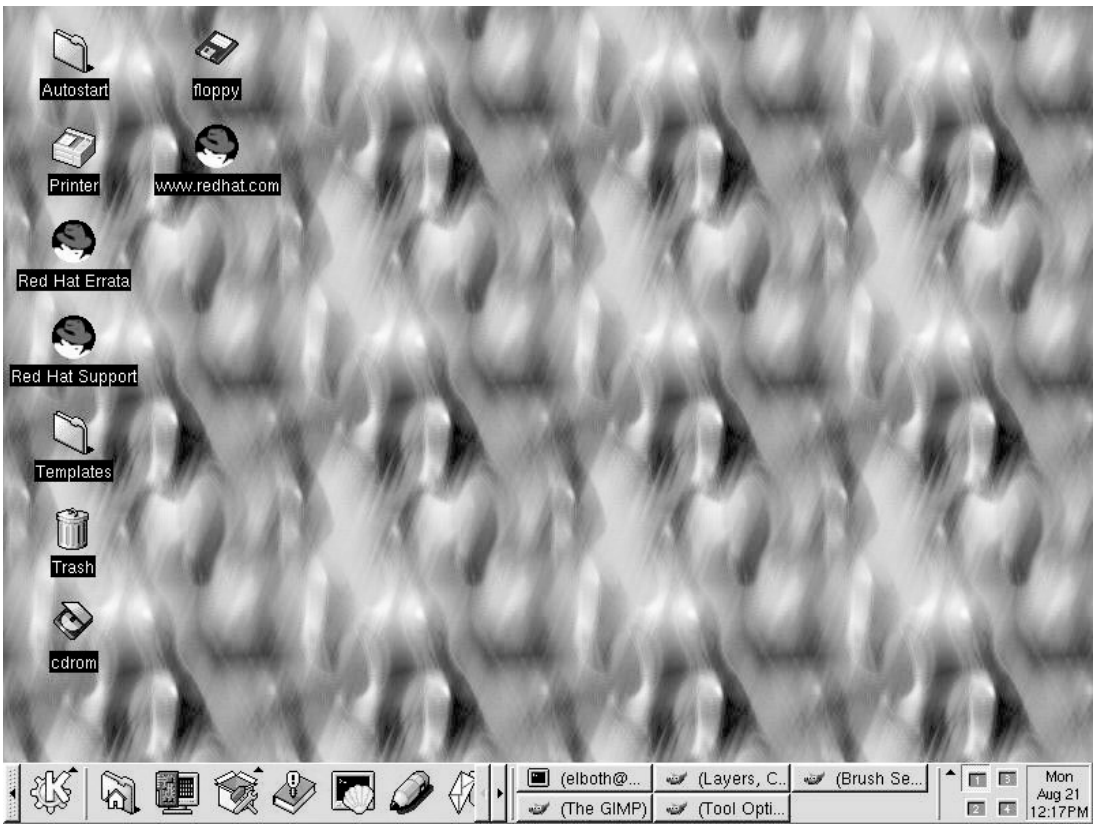

Figure 10–3
An example with KDE environment under Red Hat Linux.

KDE is by default equipped with its own window manager, KWM, but also Blackbox and WindowMaker support KDE to some extent. GNOME has always tried to remain more independent from window managers; up to now, Enlightenment has been the default. In addition, WindowMaker, Qvwm, Afterstep, Icewm, Fvwm, Sawmill, and Flwm support GNOME. In the new version of GNOME, Sawmill is now the default due to its better integration and lean resource consumption.

In the future, most window managers will work with both systems because of a project that aims at establishing a new, common standard for window managers.

GNOME offers functionality on a level with what you are used to from Windows 98 and Windows 2000. This includes copying to intermediate storage, drag-and-drop, etc. GNOME 1.x is now available in more than 18 languages.

In addition to Linux, GNOME can be run under BSD, Solaris, HP-UX, and Digital Unix. Several Linux distributors, including Red Hat, Debian GNU/Linux, LinuxPPC, and SuSE, offer GNOME with their systems.

As mentioned before, there is tough competition between GNOME and KDE. Debian, Red Hat, Linux PPC, and TurboLinux go for GNOME, while Caldera, Corel, and SuSE are some of the Linux distributors that prefer KDE. KDE 2.x is now available in more than 30 languages.

If you want to download a newer version of KDE for your Red Hat Linux, visit www.kde.org for further advice.

GNOME and KDE are different in many ways. The technical differences are mainly different choices of components and architecture for CORBA (Common Object Request Broker Architecture). GNOME has developed an architecture called Bonobo, and KDE has KOM/OpenParts. GNOME is better suited for developers that use languages other than C++; for example, Ada, C, Objective-C, TOM, Perl, Python, and Guile.

Some 350 programmers all over the world develop GNOME. Miguel de Icaza leads this mostly voluntary work. Red Hat has supported the process. The project is connected to the Free Software Foundation (FSF), which is conducted by Richard Stallman, who founded GNU. GNU means "GNU is Not Unix," and was initiated to promote the idea of free software. The FSF has established a license known as the "General Public License" (GPL). This gives full freedom to run, copy, distribute, study, and improve any GPL-licensed program.

Visit www.gnome.org for information when you wish to download a newer version of GNOME for your Linux.

10.5 GNOME with Red Hat Linux

There are several alternative GUIs in Red Hat Linux; for example, GNOME, KDE, FVWM, Enlightenment, WindowMaker, and TWM. When installing Red Hat Linux, GNOME is by default set up as the GUI. From this user interface, you'll see the GNOME taskbar at the bottom of your screen. At the left side of the screen, there are icons with references to Red Hat and Linux documentation. There are also icons for handling peripherals, including a CD-ROM player (see Figure 10-4) and floppy drive (see Figure 10-5).

When you want to look at the contents of a floppy or CD-ROM, click the

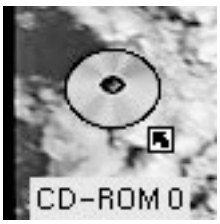

Figure 10–4
The CD-ROM player icon under GNOME.

Figure 10–5
The floppy drive icon under GNOME.

appropriate icon. If you are using an MS-DOS or Windows floppy, you must use the Linux Mtools; for example, `[david@nittedal david]$` **`mdir a:`**

The bottom bar in GNOME is the taskbar (see Figure 10-6), similar to the Windows 2000 taskbar. All operative applications are displayed as application buttons. A clock is displayed at the far right. When you move the cursor across the clock, today's date is displayed.

Figure 10–6
The GNOME taskbar.

Counting from the center of the taskbar to the left, there are buttons for Netscape, the toolbox (the GNOME configuration tool), terminal emulation, help, and lock screen. The GNOME foot button is at the far left (see Figure 10-7).

Figure 10–7
The GNOME foot (button).

This is the same as the Start button; you click it whenever you want to start a function in GNOME.

When you click the Start button, a Start menu appears at the left corner (see Figure 10-8). These are the program folders: Programs, Favorites, Applets, KDE menus, Run, Panel, Lock screen, and Log out.

Pull up the Programs folder by pointing the mouse at the folder. When you touch the folder, a new Programs folder with programs opens. These are the program folders: Applications, Utilities, Development, Games, Graphics,

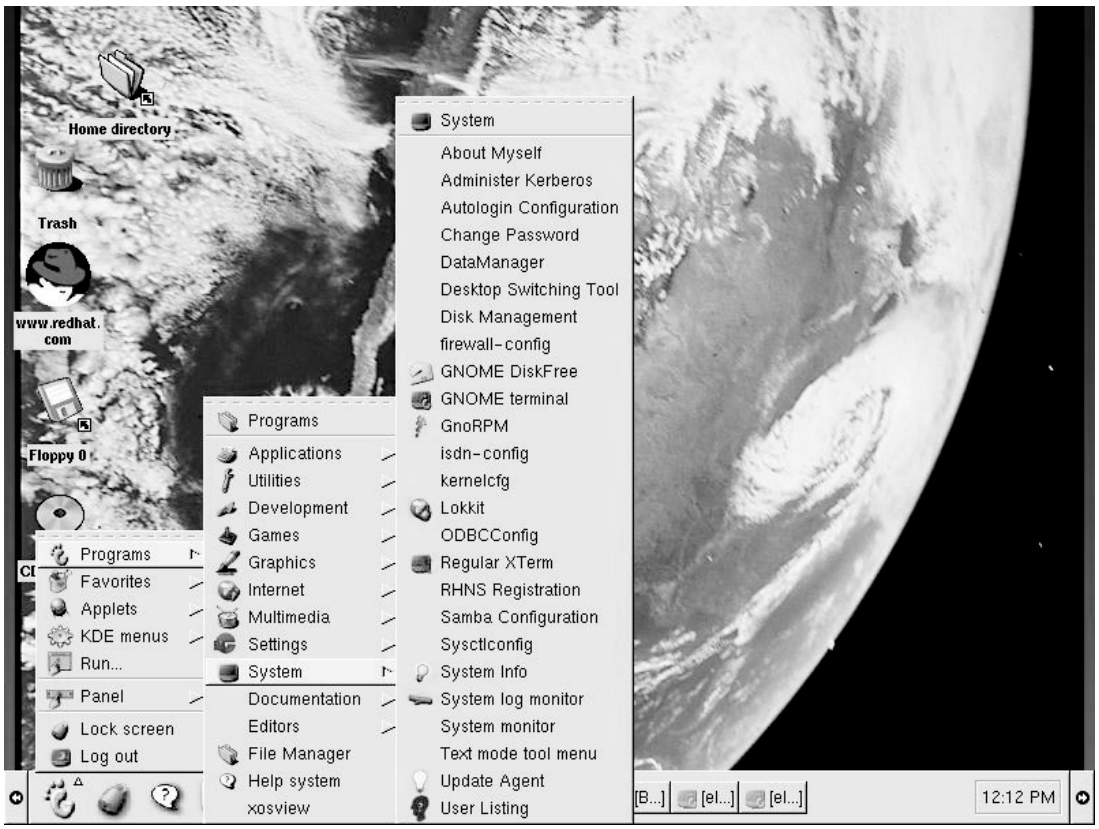

Figure 10–8
Example with the start menu under GNOME.

Internet, Multimedia, Settings, System, Documentation Editors, File Manager, Help system, and xosview (system load).

When making a selection, move the mouse pointer to the desired program and click the left mouse button. The most important folders for system administration are Programs and System.

A graphical interface of your files is found in the folders Programs and File Manager. File Manager is also defined as an icon (see Figure 10-9), so the alternative is to click the icon for the home directory (File Manager).

The File Manager application (see Figure 10-10) lets you manipulate your files. At the left-hand side of the window, you can view the directories, and at the right-hand side, you can see the contents of the selected directories. If you want to move a file or a directory, you simply drag and drop.

To copy a file, select the file while pressing the Ctrl key. To run a program or

Figure 10–9
The File Manager icon under GNOME.

edit, double-click the icon. If you want to execute other operations like deleting or renaming a file, first mark the file by clicking the right mouse button, then make the appropriate choice. When marking multiple files, press the Shift key at the same time.

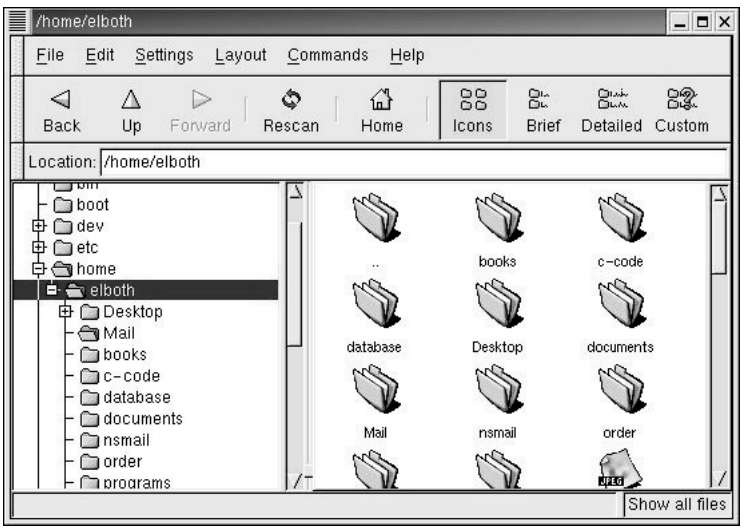

Figure 10–10
The File Manager application under GNOME.

When you want to run several operations between multiple directories, just start more instances of File Manager. You can drag files from File Manager to File Manager or to the GNOME desktop.

When you need help for the GNOME user interface, press the GNOME button, then Programs and Help system.

All Linux programs can be run directly from Run (see Figure 10-11). Just enter the name of the program; for example type `xboard` if you like to play chess.

If you are familiar with the menus in the KDE interface, you will find them under KDE menus. If you need a new program button, select the Panel button

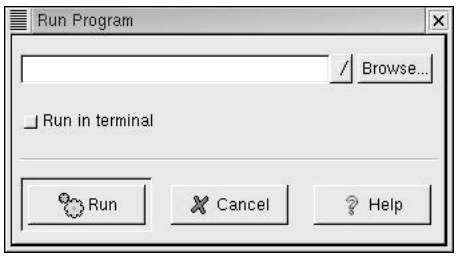

Figure 10–11
The Run Program under GNOME.

(see Figure 10-12). Here you can make your own buttons or update new programs under the Programs directory.

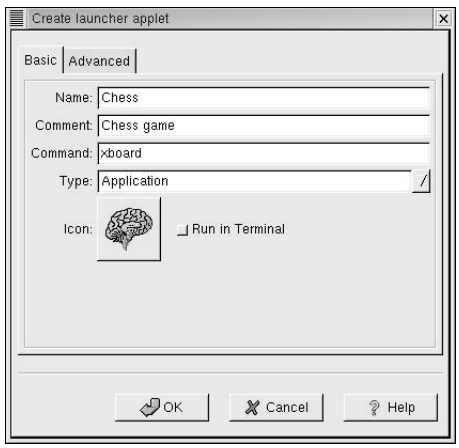

Figure 10–12
Creating a launcher applet under GNOME.

The last, but possibly the most important button, is Log out; here you can log out as well as shut the system down (see Figure 10-13).

Figure 10–13
Here you can choose if you want to logout, halt the system, or reboot.

When the background image is visible, you can change your desktop at any time by clicking the right mouse button. The right mouse button gives you access to the program window, in which you can change the position of icons, create new windows, update your desktop (directories, devices, icons), configure your background image, start a new terminal emulation window, make a new directory, make a URL reference, define an application/directory icon, or run programs like, for example, GIMP (image processing), Gnumeric (spreadsheet), etc.

To create your own fancy desktop with different X applications, just make your own `.xinitrc` file in your home directory. GNOME can generate this file automatically. When doing it manually, check the syntax of the `/usr/X11R6/lib/X11/xinit/xinitrc` file. Additional information is available on the man pages under the commands `xterm`, `xclock`, and `twm`.

10.6 From GNOME to KDE

As Red Hat Linux supports both GNOME and KDE, you always have the option to switch between the two. When you want to change your desktop, you can run the `switchdesk` command (see Figure 10-14) from the terminal prompt; for example:

```
[david@nittedal david]$ switchdesk
```

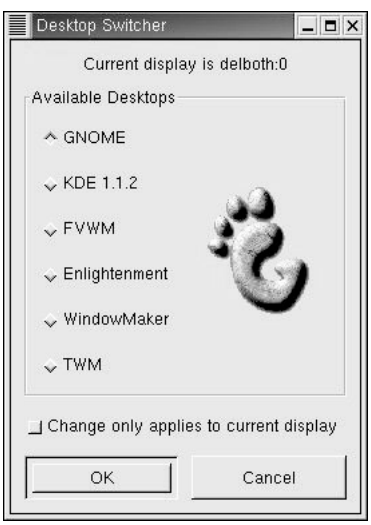

Figure 10–14
From the Desktop Switcher you can change the desktop.

When selecting KDE instead of GNOME, you will have the KDE interface the next time you log in (see Figure 10-15). From the desktop switcher, you will also see that Red Hat Linux support the desktops fvwm, Enlightenment, WindowMaker, and TWM.

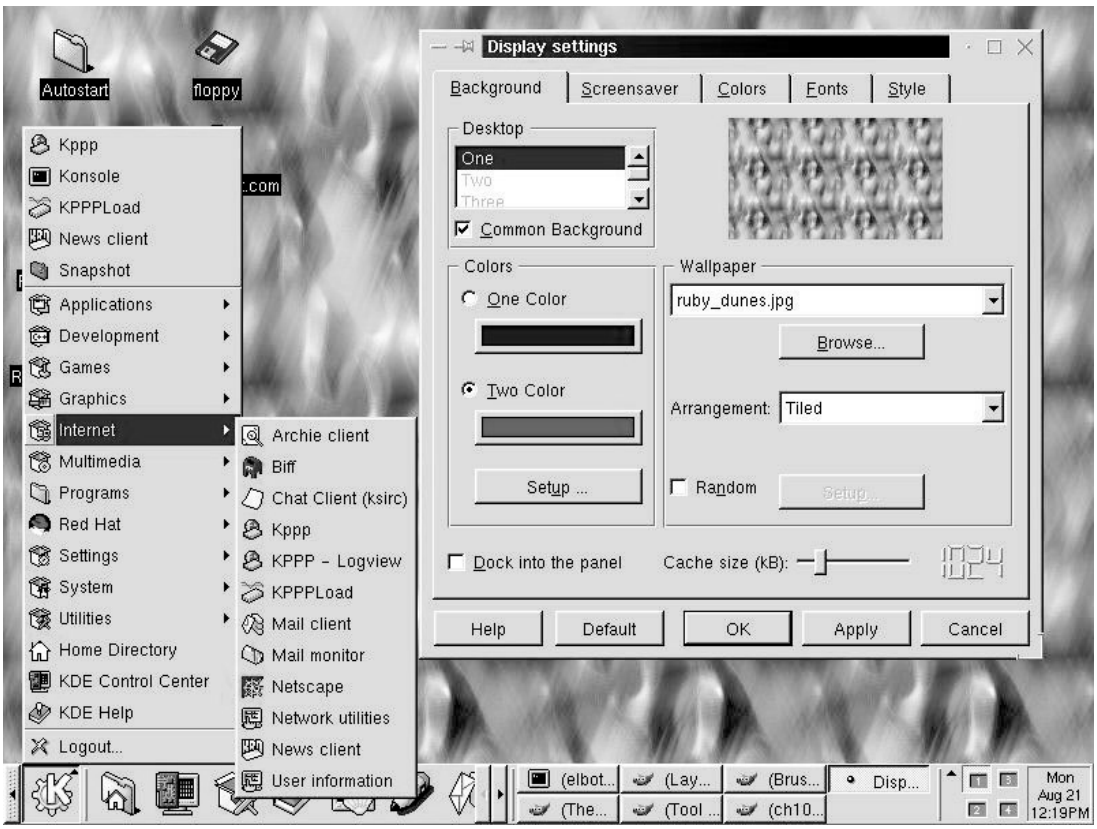

Figure 10–15
An example KDE environment under Red Hat Linux.

At the left side of the screen, there are icons with references to Red Hat and Linux documentation. There are also icons for handling the peripheral floppy disk drive (see Figure 10-16) and CD-ROM drive (see Figure 10-17). Additionally, there are separate icons for Autostart (see Figure 10-18), Printer (see Figure 10-19), Templates (see Figure 10-20), and Trash (see Figure 10-21).

Figure 10–16
KDE floppy icon.

Figure 10–19
KDE Printer icon.

Figure 10–17
KDE CD-ROM icon.

Figure 10–20
KDE Templates icon.

Figure 10–18
KDE Autostart icon.

Figure 10–21
KDE Trash icon.

In KDE, the taskbar (see Figure 10-22) differs a bit from the one in GNOME. At the right of today's date and the clock, there is an overview of your virtual graphical displays. The screen is divided in four logical parts. Your physical screen only overlaps parts of the other screens. You can jump to the desired screen by clicking on the display icon in the center of the taskbar.

Figure 10–22
KDE taskbar.

In the center of the taskbar, all active applications are shown as application buttons. From the center and toward the left of the taskbar, there are buttons for the home directory, KDE Control Center, utilities, KDE Help, a terminal console, an editor (advanced editor), mail client, CD player, sound mixer panel, and Netscape Web client.

The KDE feet at the far left work like the GNOME Start button; you can click the button whenever you want to start something in KDE.

10.7 Changing the window manager in GNOME

When starting an application under GNOME, the application will open in a separate window. You will find dedicated buttons in the right window that manage each window. There are buttons for minimizing, maximizing, and closing windows. The appearance of the windows can be controlled with a window manager. The default window manager for 7.x versions of Red Hat is Sawfish. You can change your GNOME interface by reconfiguring your window manager. This is done by first clicking the toolbox button (the GNOME configuration tool) at the bottom left position on the taskbar. Then, click Window Manager. Select the active window manager. As this by default is Sawfish for Red Hat 7.x, run the configuration tool for Sawfish.

Now you can configure the appearance of your user interface.

The default window manager for Red Hat versions 6.x is Enlightenment. As with Sawfish, you can use various styles, e.g., Clean and ICE. When using the Clean border style (see Figure 10-23), underline means minimize, square means maximize, and the x key closes the window.

Figure 10–23
Example with Clean board style.

ICE (see Figure 10-24), on the other hand, only has an x button and an arrow key. Clicking the x button closes the window. Clicking the arrow with the left mouse button minimizes the window. Clicking the arrow with the right mouse button brings up a menu.

Figure 10–24
Example with ICE board style.

10.8 GNOME/KDE Control center

You can adjust your desktop in the GNOME Control Center or in the KDE Control Center (`[david@nittedal david]$` **`kcontrol &`**). When you

want to access the GNOME Control Center, you click the toolbox icon (the GNOME configuration tool) directly or you press the GNOME foot (button), then Settings, and then GNOME Control Center (see Figure 10-25).

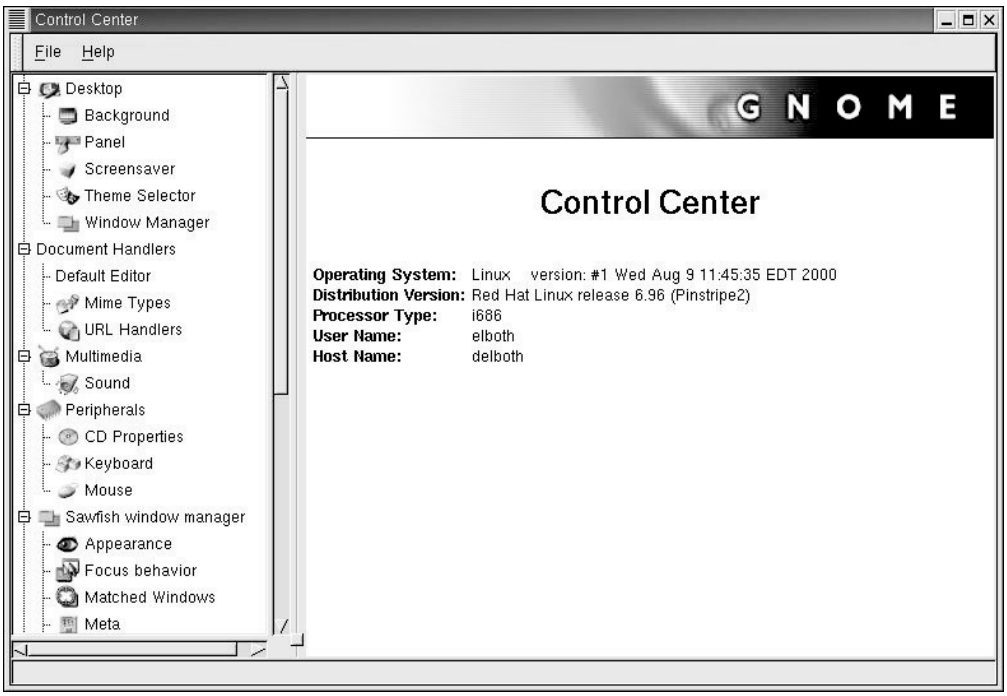

Figure 10–25
The main menu in the GNOME Control Center.

From the GNOME Control Center, you can fine-tune your desktop setup by:

- Defining your default editor.
- Defining application handling, particularly login handling, a Web browser, and panel setup.
- Defining your desktop (Background, Screensaver, Theme Selector, active Window Manager (in Red Hat Linux, 7.X Sawfish is the default)).
- Defining file types (MIME) based on file suffixes.
- Defining the setup of the keyboard and system sound.
- Reading information about most I/O units like a CD-ROM drive (mount, automount), keyboard (sound and sensitivity), and mouse (acceleration, left, right).

- Defining programs to start at login.
- Defining the URLs of help texts.
- Defining the user interface setup with regard to applications (icons, moving, status), dialogs (buttons, boxes), and MDI.

From the KDE Control Center (see Figure 10-26), you can fine-tune your desktop setup by:

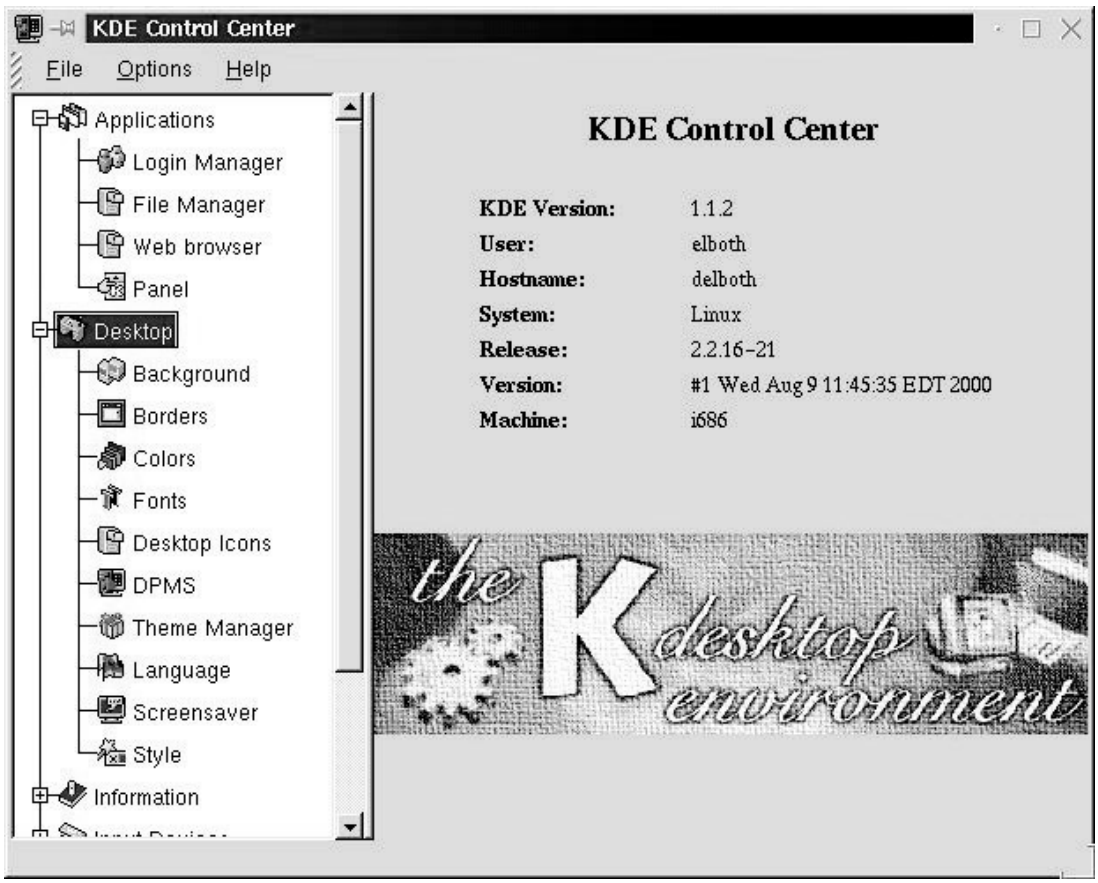

Figure 10–26
The main menu in the KDE Control Center.

- Defining application handling, particularly login handling, a Web browser, and panel setup.
- Defining a desktop setup (Background, Borders, Colors, Fonts, Desktop Icons, DPMS, Theme Manager, plus your choice of

Language, Screensaver, and Style).

- Reading information about most I/O units like DMA, I/O ports, interrupt, etc.
- Defining input devices like setting the keyboard language and adapting the mouse.
- Defining global keys and ordinary keys.
- Defining various network configurations.
- Defining alarms and system sounds.
- Defining the window setup (buttons, title line, and mouse handling).

10.9 Using a mouse with GNOME/KDE

Note that the left mouse button is used for marking and moving files and directories. The right mouse button is used for starting a menu for the selected option. This, of course, works only when there is a menu for the selected option. Most Unix systems are based on a three-button mouse. The middle button is normally used for pasting text or graphics. If you have a two-button mouse, you get the same function by pressing both buttons at the same time.

If you have a two-button mouse that emulates a three-button mouse, you have a function similar to the GNOME/KDE Start button. When only the background picture is displayed on your screen, just press both mouse buttons at the same time.

10.10 The XFCE3 alternative

If you are used to commercial Unix versions, you probably know and feel comfortable with the CDE user interface. CDE is also quite similar to OS/2. XFCE3 (see Figure 10-27) is a user interface for Linux that looks and feels a lot like CDE. The most recent versions offer compatibility with GNOME, which makes this a good alternative. So far, XFCE3 is not included in Red Hat Linux, but you can download it for free from http://www.xfce.org.

Figure 10–27
Example with the XFCE3 GUI.

10.11 Standard X applications

You'll find a lot of Linux applications that are intended to run under X. I have included a collection of programs that I think will be useful to you. Any X application may be started directly from a window manager or from the terminal prompt by entering the name of the program and an ampersand (&). The & character makes the program run in the background.

X Program (Tool)	Description
gimp	Graphics program like Adobe Photoshop.
gv	Viewer for PostScript files.
ical	Simple appointment calendar.
userinfo	User information.
userpasswd	Changes password.
usermount	Mounts and unmounts filesystems.
usernet	Checks network interfaces.
linuxconf	Lets you set most parameters; compares to the Control Panel and Registry of Microsoft Windows 98.
xcalc	A simple calculator.
xclock	A standard clock.
xdos	DOS emulator (runs DOS programs).
xeyes	Eyes that follow your cursor.
xmag	Magnifier for people with poor eyesight.
xman	Gives you the man pages (GUI front for man).
xpdf	Makes it possible to view documents in various formats; uses Adobe's standard format.
xterm	Lets you run several terminal sessions.
gdm (xdm)	Controls login (X terminal).
xv	A simple graphics program.
xwd	A tool for making X11 screen dumps in connection with documentation.

The most important X applications are xterm and gdm. There are many other X applications for Linux, but I have only included the most popular ones.

10.12 X games

Here is a table of interest to gamers:

X Game	Description
acm	Simple flight simulator.
paradise	Net-based combat game.
xbill	Game where the purpose is to stop a virus attack from "Microsoft."
xboard	Very good chess game (see Figure 10-28) that can be played via the Internet.
xchomp	Classic Pac-man game.
xdemineuer	Simple mine sweeper game.
xjewel	Traditional Tetris game with many variations.
xlander	Simple moon landing game.
xpilot	Network-based combat game.
xpuzzles	Bundle of puzzle games.

There are many other X-based Linux games; this is just a selection of some of the most popular ones.

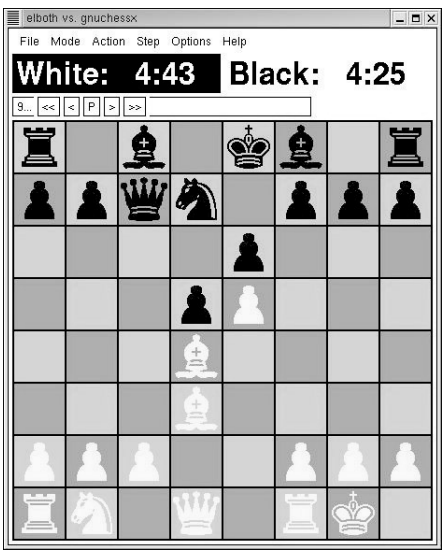

Figure 10–28
Xboard is a popular game.

10.13 X commands

Most X Window preferences can be set from GNOME in a similar way to the Control Panel in Windows. An alternative is to enter the X commands directly.

Examples:

If you need information on how to set up X Window, try the `xwininfo` command:

```
[david@nittedal david]$ xwininfo
```

With X Window, it is in principle possible to log in to any machine (host) in the network and send a GUI image (X Window) to any desired screen. To do this, you must have the required access rights and the `DISPLAY` parameter must be set correctly.

```
[david@nittedal david]$ xhost ftpnode.c2i.no
```

This gives `ftpnode` access to the screen at `nittedal`.

```
[david@nittedal david]$ rlogin ftpnode.c2i.no
```

I log in to the host's `ftpnode`.

```
[ftpnode]$ export DISPLAY=david.nittedal.no:0
```

This defines the use of the screen at host `david.nittedal.no`. If you are running the tcsh shell instead of the bash shell, use the `setenv` command:

```
[ftpnode]$ setenv DISPLAY david.nittedal.no:0
```

```
[ftpnode]$ xboard
```

Finally, I start the chess game xboard on the `ftpnode` machine. The screen image is sent to my display (`nittedal`). All CPU processing generated by the chess game is left to the `ftpnode` machine.

You must request permission from the X server every time you want to write to a screen. You'll find the `.Xauthority` file in your home directory. If you keep a copy of this file at a remote host like, for example, `ftpnode`, you may send screens to this host. You will then not need to use the `xhosts` command.

In the example below, I swap functions between the left and right mouse buttons:

```
[david@nittedal david]$ xmodmap -e  "pointer 3 2 1"
```

This increases the mouse acceleration.

```
[david@nittedal david]$ xset m "50 5"
```

This slows the acceleration.

```
[david@nittedal david]$ xset m "4 8"
```

To make some screen dumps, try `xwd`:

```
[david@nittedal david]$ xwd > printer_image
```

This dumps the screen to the `printer_image` file. You can continue working with this file in the xv or GIMP programs.

```
[david@nittedal david]$ xsetroot -solid blue
```

This sets a blue background.

```
[david@nittedal david]$ xclock &
```

This starts xclock, which is running in the background.

10.14 Starting gdm

When you are running Red Hat Linux 7.x, you will by default start up in X Window. When running other Linux variants, you don't necessary automatically start in X Window. If you want gdm (the X Display Manager) to start by default whenever you start your Linux box, you just need to change one line in the `/etc/inittab` file as follows:

```
[root@nittedal /root]# vi /etc/inittab
```

Find the line with the text `initdefault`. Sometimes, this is what you find:

```
id:3:initdefault:
```

Change the second field, which is the system level, from 3 to 5.

```
id:5:initdefault:
```

Update the changes you have made in `/etc/inittab`. Reboot the system with, for example, init 0, reboot, shutdown, or force `init` to read `/etc/inittab` by entering:

```
[root@nittedal /root]# /sbin/telinit q
```

You must be absolutely sure that X Window starts in a normal way before changing `/etc/inittab`. Test this by entering `startx` from the terminal prompt. If you make changes to `/etc/inittab` other than those I have specified, there is a chance that you will never again get contact with your Linux box!

When starting the machine, you can also select the desired Linux system level from the LILO prompt. Linux 3 (`LILO: linux 3`) gets you to text mode even if the system is set to start in graphical mode. This is a good option if you are experiencing problems with the X server settings. Linux 5 will start you in graphical mode.

10.15 3D acceleration and Linux

For a long time, Linux has lagged a bit behind in supporting 3D acceleration, although Linux supported 3dfx for a while. This is the reason why a project supported by, among others, Red Hat and Silicon Graphics was initiated. The project is administrated by a third company, Precision Insight, which aims at combining the Silicon Graphics GLXtechnology with MesaGL, the free implementation of OpenGL.

The results of this work can be studied in Xfree 4.0. Companies like 3dfx, Nvidia, Elsa, and Matrox support the project and supply drivers.

Several new 3D games are now available for Linux; for example, Quake III Arena and Unreal Tournament.

10.16 X Window references

There are many references for X Window on the Internet. A general description of how to set up X Window is also available on the Linux CD under `XFree86-HOWTO`.

XFree86's home page contains nearly everything you need: http://www.Xfree86.org

For commercially available drivers, you can check**:**

http://www.xi.com

http://www.metrolink.com

Try these sites for information about 3dfx cards and 3D under Linux:

http://glide.xxedgexx.com

http://www.mesa3d.org

http://www.precisioninsight.com

For information about commercial and free games, etc. for Linux and X Window:

http://www.linuxgames.com

http://www.happypenguin.org

http://www.lokigames.com

For more information about GNOME: http://www.gnome.org
For more information about KDE: http://www.kde.org
For more information about XFCE3: http://www.xfce.org

Exercises for Chapter 10

1. What is X Window?
2. Which GUIs are available for Linux?
3. Which tools can be used for configuring X under Linux?
4. Log in as root and try different setups for your graphics card and display. Notice the changes. Do you have the optimal setup?
5. Set up GNOME or KDE for your own purposes.
6. Make the necessary changes in `/etc/inittab` for gdm to start automatically when you load Linux.