CHAPTER 2

Installing Linux

By James Turnbull, Peter Lieverdink, and Dennis Matotek

In this chapter, we're going to take you through the process of installing a host with Red Hat Enterprise Linux (RHEL) and a host with Ubuntu Server. We'll show each distribution's installation process using the graphical installation tools and detail the options available during installation. We're going to perform the base installation and also install the packages needed to run a basic web, mail, and DNS server. Don't worry if you don't know what these functions are at the moment—we explain web servers in Chapter 11, mail in Chapter 10, and DNS in Chapter 9.

Tip We recommend you read the whole chapter, including the sections covering the Red Hat and Ubuntu installation processes, to gain the best understanding of installing Linux hosts.

We'll start by installing a Red Hat–based distribution in the "Red Hat Enterprise Linux Installation" section. While the screenshots in this section are specific to RHEL, the installation processes for CentOS and Fedora are derived from RHEL and operate in a very similar fashion. So if you've chosen either of these distributions, you should be able to recognize easily the installation process of these distributions from our explanation. You'll find this is true of most configuration and management of Red Hat–derived distributions.

If you have chosen Ubuntu, you will find a full explanation of the Ubuntu installation process in the "Ubuntu Server Installation" section. Ubuntu is derived from Debian, but it has a different installation process. The configuration and options are closely aligned, though, and by following the Ubuntu installation process you should be able to recognize the installation process for Debian and other Debian-derived distributions.

Note If you want use the CD/DVD-based installation process and the graphical installers provided, then you will need to install on a host with a monitor, a keyboard, and preferably a mouse. These peripherals will allow you to interact with the installation tool effectively. We'll describe how to do an *unattended* or *headless* (without a monitor) installation in Chapter 19.

We will also expand on the potential installation options in Chapter 7, when we look at installing software on Linux, and in Chapter 19, when we examine methods of automating installations and builds.

■ **Caution** Distributions change, and installation screens and options change with them. Don't panic if the screenshots presented in this chapter don't exactly match the ones you see during installation. Generally, most installation options and steps remain similar between releases.

LiveCDs and Virtual Machines

Before we begin our first installation, we'll cover two other options for getting to know Linux on a host that may be useful to try before committing to build a physical server: LiveCDs and virtual machines. These methods allow you to explore a Linux distribution and how to use it with a minimal investment of time and infrastructure.

LiveCDs

LiveCDs are versions of distributions that you can run on your computer from a CD or DVD. They load themselves into memory without the need to install any software on your computer. This means you can try a distribution on your computer and then remove the CD and reboot to return to your existing operating system, making it very easy to explore and test Linux distributions and software without changing anything on your computer. You can find out more about LiveCDs at `http://en.wikipedia.org/wiki/Live_CD`.

You can find popular distributions such as the following in LiveCD format:

- Ubuntu: `https://help.ubuntu.com/community/LiveCD`
- Fedora: `http://fedoraproject.org/wiki/FedoraLiveCD`
- Debian: `http://debian-live.alioth.debian.org/`

You can also find a full list of the many LiveCDs available at `http://www.livecdlist.com/`.

Virtual Machines

You can also run your Linux distribution on a virtual machine. *Virtual machines* are software implementations of hosts that run just like physical hosts. You can run multiple virtual hosts on a single physical host. Examples of virtualization applications and servers include VMware (`http://www.vmware.com/`), VirtualBox (`http://www.virtualbox.org/`), and open source alternatives like Xen (`http://www.xen.org/`), among others. You can also purchase virtual hosts from hosting companies.

■ **Note** In this chapter, we demonstrate how to install Linux hosts. Our instructions detail the steps to install "bare metal" hosts rather than virtual hosts. The differences between bare metal installs and virtual installs are relatively minor. One of the differences with virtual hosts is that you can install your host directly from an ISO image, rather than having to burn an ISO image to CD/DVD first and load it into the CD/DVD drive. Virtual host installations also make building and rebuilding your host easier, and you can perform functions like creating point-in-time backups of different kinds of hosts.

You may also wish to take advantage of premade *virtual appliances*, which are virtual images of Linux distributions that you load with your virtualization software. They are already installed and configured, and the appliances are usually created with a particular purpose in mind, like a VoIP server, file server, or mail server. You can view the lists of appliances available at these sites:

- `http://www.vmware.com/appliances/`: Virtual appliances for VMware
- `http://virtualappliances.net/`: Ubuntu virtual appliances for a variety of virtualization engines
- `http://jailtime.org/`: Virtual appliances for Xen

■ **Note** We'll cover Linux virtual machines in more detail in Chapter 20.

Red Hat Enterprise Linux Installation

Let's start by installing a Red Hat Enterprise Linux host. We will make a few assumptions here:

- You are using a Red Hat Enterprise Linux ISO from the Red Hat website (`https://www.redhat.com/apps/download/`), and you have burned it onto a CD.
- You are building just a basic mail, DNS, and web server.
- You are installing on a fresh server without any previous operating system.

First, put your installation media (usually a CD or DVD) into your host and power it on.

■ **Note** If you were building a virtual machine, you'd build instead from the raw ISO. A virtual machine usually includes a "virtual DVD," where you would mount the installation ISO to boot from.

After loading your installation media and starting your host, you'll see the Red Hat installation splash screen shown in Figure 2-1.

Figure 2-1. *The Red Hat Enterprise Linux splash screen*

From the splash screen you can initiate the installation, via either a graphical interface or a text-based installation mechanism. For this walk-through, we're going to use the graphical interface.

Additional options are available via the function keys. The F1 key returns you to the main menu. The F2 key shows you the installer's additional boot options that can be passed to Red Hat, including testing your installation media, checking your memory, and adding additional disk drivers. You can also prompt Red Hat to initiate a network-based installation, as we'll discuss in Chapter 19.

The F3 key shows general help and describes some options you can pass if you are having issues installing Red Hat. The F4 key describes some of the options you can pass to the kernel to customize your installation.

Lastly, the F5 function key shows the rescue mode options. Rescue mode assumes you already have Linux loaded, and it allows you to boot and potentially repair or rescue a broken Linux installation. You will boot into a rescue prompt that allows you to mount disks, edit configuration files, and access other useful utilities. You can find out more about rescue mode at `http://www.redhat.com/docs/manuals/enterprise/RHEL-5-manual/Installation_Guide-en-US/s1-rescuemode-boot.html`.

For now, though, just press Enter to move on to the next stage of the installation. On the next screen you are prompted to check your installation media. This check will scan your CD or DVD for errors. If you wish, you can skip this process and continue.

In Figure 2-2, the "anaconda" installer process that will install the host has been started. The anaconda application is the software that installs RHEL, and it runs in the X Window System—also known as simply X—but it also has a command-line mode. X is the graphical user interface used commonly on Linux; we'll talk a bit more about it in Chapter 3. You will first be shown the Release Notes, and you can then click Next to progress to the next screen.

Figure 2-2. *The Red Hat Enterprise Linux graphical installer*

■ **Tip** The Release Notes tell you what has changed between this version and the last version. If you were upgrading your host, it would be a good idea to read and understand the implications of any changes documented in the Release Notes.

In the next few screens you will select your host's basic requirements, such as the language the host will use and the keyboard layout. In Figure 2-3 we have selected the language used in Australia; you should select the language relevant to you.

Figure 2-3. *Selecting the language to use during installation*

The keyboard mapping affects the default layout of your keyboard keys. In Figure 2-4 we selected the keyboard layout for our particular keyboard.

Figure 2-4. *Selecting the desired keyboard layout*

■ **Tip** If you use the Gnome desktop (more on desktops in Chapter 3), you can change your keyboard options by opening the Applications menu (the main menu on the panel), clicking the System Settings tab, and selecting the Keyboard application. On the command line you can run the `system-config-keyboard` command.

On the next screen we need to input the Red Hat Installation Number. When you purchased your Red Hat subscription, you were provided an Installation Number. If you've purchased a subscription and can't find the Installation Number, you can go to the Red Hat Support website and find it there: `https://www.redhat.com/wapps/support/protected/subscriptions.html`. Figure 2-5 shows the Installation Number entry screen.

Figure 2-5. *Enter your Installation Number here.*

■ **Note** If you don't want to pay for a subscription, a distribution like CentOS, Fedora, or Ubuntu may be a better choice, rather than running Red Hat Enterprise Linux without having the patches and updates available to your host.

We will assume that you have a subscription and have entered it. If you don't have a subscription, you can still continue and either provide the number at a later date or use the Red Hat Enterprise Linux server without access to any updates until you purchase the subscription. We recommend that you purchase a subscription so you can get the latest patches and security fixes for your host.

■ **Caution** The next few steps can be dangerous. If you are installing on a host that has an existing operating system or important data, you can lose all existing data and the operating system may become unusable. Please proceed with appropriate caution and a necessary backup regime if needed.

Next, after the Installation Number screen, you will likely receive a warning informing you that you are about to create a new partition table. On brand-new hosts, this is normal and something you want to do, so select Yes to continue. If your host has had an operating system previously installed on it, or if you are sharing this host with another operating system such as Microsoft Windows, this next step may not be desired and this is your opportunity to quit the process. If you think you will destroy valuable data from a previous install, select No and exit the installation.

■ **Note** If you are overwriting an existing installation of RHEL or installing a virtual machine, you won't see the aforementioned warning.

You can see the partition initialization process in Figure 2-6.

Figure 2-6. *Initializing a drive by creating a new partition table*

Having created the new partition table, you move on to creating the partitions for your system. Partitioning a disk is like slicing a cake: you can choose how big each "slice" of disk should be, depending on the appetite of the slice's consumer. For example, if your system has a website and that website has pretty extensive logging, you may choose to divide the disk so that you have more room in the partition that holds your web data and logging files. If you are running a file server instead, you will reserve more of the disk for user data rather than web data or logging.

■ **Note** We'll explain a lot more about partitions and how to customize and change your disks and storage in Chapter 8.

You will see that the hard disks available to you are listed, and you can select the disks you want to use. In our case, we have only one disk available to us, so we just select the default "Remove linux partitions on selected drives and create default layout" option. We also select the "Review and modify partitioning layout" option so we can see the resultant layout of the default settings. Figure 2-7 shows the options we are selecting.

Figure 2-7. *Selecting the partitioning layout*

You will now see another warning, this time telling you that you are removing all the Linux partitions from the drive and asking if you would like to proceed (see Figure 2-8). Select Yes.

Figure 2-8. *Removing partitions warning*

Finally, Figure 2-9 shows the layout of our partitioning scheme.

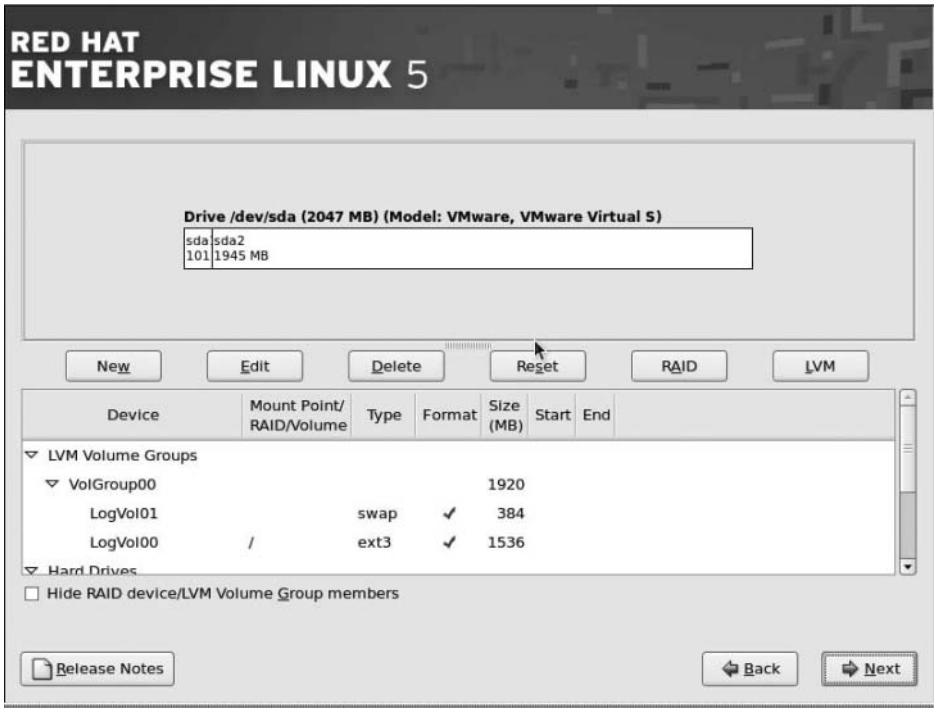

Figure 2-9. *Reviewing the partition layout*

As you can see, the default is to use logical volume management (LVM) to create one group with two logical volumes.

■ **Note** LVM allows you to manage disk volumes and extend, shrink, and change the size of your disk partitions on the fly. The LVM software allows the administrator to change the disk layout, add new disk storage, or remove and repurpose disk storage to another part of the system without having to rebuild the system and reformat the underlying disks. We'll talk about LVM in detail in Chapter 8.

By default, the first volume is called `swap`. The `swap` volume is disk space used to hold data that overflows from RAM. It is usually sized at double the available RAM; for example, if you have 512MB of RAM you would have a 1GB `swap` disk. The second volume is called the `root` or `/` volume. This partition holds all of your host's data and applications. Although it is not clearly shown in Figure 2-9, there is also a 100MB partition called `/boot`. The `/boot` partition holds the Linux kernel and some code required to boot your host.

If you had any special requirements, you could alter this default structure and create new partitions, or you could delete everything and start again using the installer's partition manager. We will go into greater detail in Chapter 8 about how to carve up one or several drives for various purposes.

The next screen is the Grand Unified Bootloader (GRUB) loader installation screen. A *boot loader* is the program that the BIOS runs just after you start your computer, and it is installed into the first 512 bytes of the primary hard drive (the master boot record or MBR) by default. GRUB is used to load the Linux kernel when your computer is turned on; you will first encounter it when you reboot your host and see the menu it provides at startup.

■ **Note** In some cases you may wish to install the boot loader in another partition. For example, you can run a host with the ability to *dual boot*, meaning the host can boot into two or more different operating systems, like Windows and RHEL, but not at the same time. In this instance, your MBR could be overwritten by the other operating system and you would temporarily lose your ability to boot your Linux host. You can see the GRUB menu that appears when you boot your host in Figure 2-20 later in this chapter. You can find a guide that explains dual booting at `http://apcmag.com/the_definitive_dualbooting_guide_linux_vista_and_xp_stepbystep.htm`.

In the screen in Figure 2-10, you select where you would like to install your boot loader. We have chosen the only disk available to us, `/dev/sda`.

■ **Note** You can use a variety of disk types as your storage hardware. The different disks get different names. Figure 2-10 shows the drive `/dev/sda`, where `s` stands for SCSI or SATA. An IDE disk would be prefixed with `h` (e.g., `/dev/hda`). The latest kernel versions, however, use newer IDE drivers that name IDE disks as `/dev/sd*` to make things more consistent.

Figure 2-10. *Installing the boot loader on* `/dev/sda`

You could also set a password for your boot loader, which offers protection against changes being made to your boot options. For example, if someone wanted to make a change to the GRUB boot menu, that person would need to provide the correct password before being allowed to make any change. This is often a good idea for hosts that are co-located in a data center where there is ready access to the host, or in other places with poor physical security.

■ **Caution** Physical security for your Linux hosts is important—you don't want anyone to steal your costly physical asset (and your data!). You should store your host in a locked cabinet or rack, or in a room to which you can control access. If you are hosting your server in a co-lo or data center, then you should ensure the location has appropriate physical security controls to protect your hosts.

The advanced boot loader configuration options allow you to specify where the boot record is installed, change the drive order, and set some legacy options like Force LBA32. If you need to pass any kernel parameters during boot-up, you can also add them here. Generally, you won't ever need to change any of these options, so we are just going to select the defaults.

You can see in Figure 2-10 that the default operating system we will boot is selected and it's Red Hat Enterprise Linux Server.

After installing the boot loader, you are now ready to configure the network. The next screen (see Figure 2-11) shows our networking configuration.

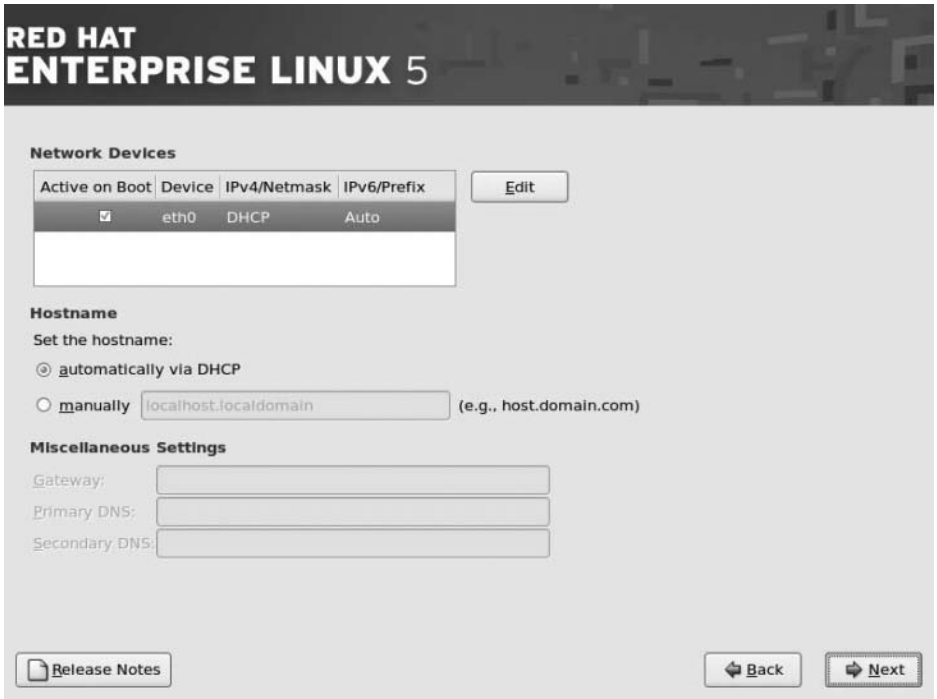

Figure 2-11. *Network settings*

The most important configuration item here is your IP address, which is the network address of your host that allows other hosts to find and communicate with it.

■ **Tip** You can read about IP addresses and addressing at `http://en.wikipedia.org/wiki/IP_address` and `http://computer.howstuffworks.com/question549.htm`.

There are generally two ways to assign an IP address on your network. The first is by directly specifying each host's IP address during configuration. These are called *static addresses*. The second method uses a networking service called Dynamic Host Configuration Protocol (DHCP). DHCP uses a server located on your network to assign IP addresses to hosts when they request them. The DHCP server tracks these addresses and ensures there are no conflicts. You may already have a router that is capable of DHCP (as most ADSL modem/routers are) on your network. In the next screen, you could select the DHCP option and get an IP address automatically.

■ **Note** We'll show you how to configure your own DHCP server in Chapter 9.

For the purposes of this installation, however, we are going to add a static IP address by selecting Edit to set the IP address. We've specified an address suitable for our network in Figure 2-12; you should enter a configuration appropriate for your environment. Select OK when you are done.

■ **Tip** Figure 2-12 shows a check box for IPv6, which is another, newer form of IP addressing that isn't in wide use yet. You can read about IPv6 at `http://en.wikipedia.org/wiki/IPv6`. Most Linux distributions also support this new form of addressing.

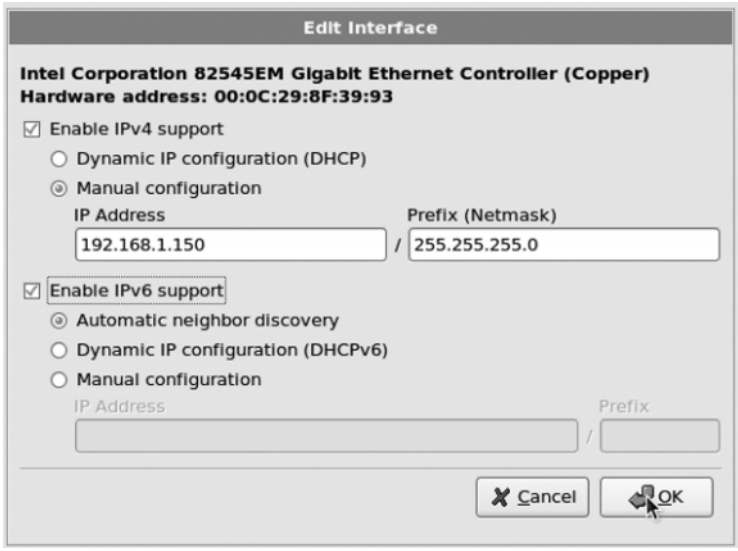

Figure 2-12. *Setting the IP address*

After setting your IP address, you now need to add a name for your host, or a *hostname*. It is a trend in small startups to name hosts after favorite TV characters, bands, or mythical creatures. While this is fun, it soon becomes annoying when you have multiple hosts in multiple geographical locations doing particular jobs. Our hostname is au-mel-rhel-1, as we prefer the descriptive naming standard *region-city-OS type-number*. As another example of a descriptive naming format, if you have a file server in the United States with an IP address ending in 155, you could choose us-ny-fileserver-155. The main thing is to be descriptive rather than naming your host "Brittany" or "Thor."

■ **Note** You can choose any naming standard you like that suits your environment. Our preference is for a descriptive naming convention.

You also need to specify a default gateway and one or more Domain Name System (DNS) name servers. The default gateway is the route all traffic passes along before leaving your network. It will be either a modem/ADSL gateway or a physical router that connects your network to the Internet or other private networks. The primary and secondary DNS name servers are special servers that resolve IP addresses to fully qualified domain names.

■ **Tip** Specifying a primary and a secondary DNS server adds redundancy to your network. If one server doesn't respond, your host will try the other server.

Every time your host goes to a website, it uses both the default gateway and DNS server to find out how to get there. For example, if you type `www.google.com` in your browser's address bar, your host will first find the DNS server, which may or may not be on your network. If it is not on your network, your host will use the default gateway to reach it. Your host then will ask the DNS server the IP address of `www.google.com`, and the DNS server will answer with something like 74.125.19.104. Your host will then again use your default gateway to leave your network and fetch the web page provided by `www.google.com`. In general terms, your DNS server is a map, and your default gateway is the first street you take to find what you want.

In Figure 2-13 we have chosen the appropriate settings for our network. We will talk about these services and their settings in much greater detail in Chapter 9 when we explain how to set your own DNS servers and manage your own routers.

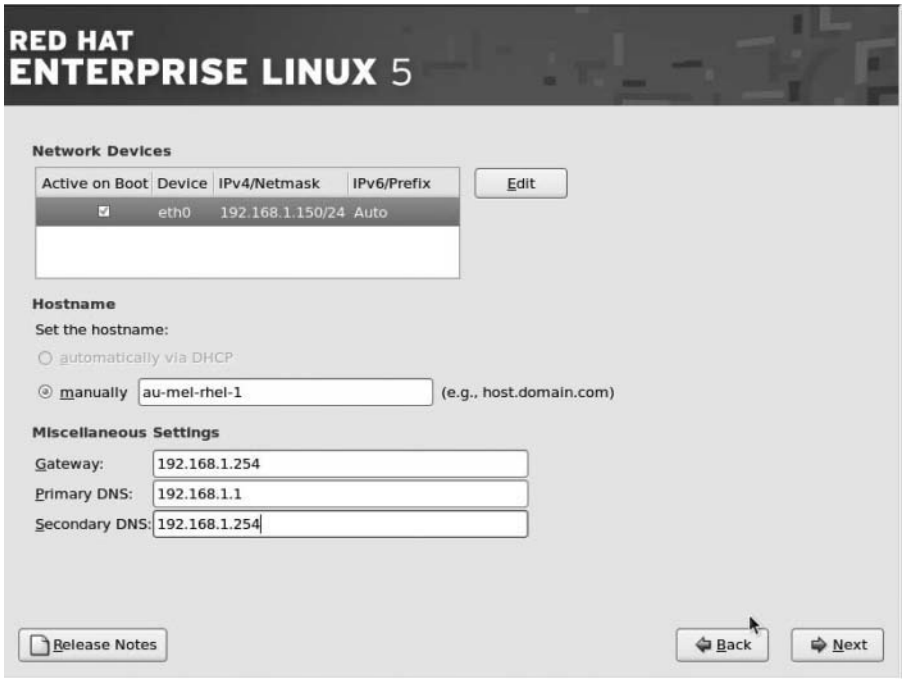

Figure 2-13. *Hostname, default gateway, and DNS settings*

The next screen is a good test to see if you know where you live in relation to other people on the planet. Use your mouse to point to your closest major city's yellow dot to set the right time zone, or select your region from the drop-down list. In Figure 2-14 we have chosen Melbourne, Australia.

Figure 2-14. *Choosing your location*

Next, as shown in Figure 2-15, you are asked for the `root` password. In Linux the `root` user is the superuser who has access to the whole system, much like the Windows Administrator in the Windows OS.

■ **Tip** We will discuss the `root` user in more detail in Chapters 3 and 4.

This password should be complex and consist of a combination of upper- and lowercase characters, numbers, and special punctuation keys like the following: @!%#*. It should also be at least eight characters long.

■ **Tip** You can read about the characteristics of a good password at `http://en.wikipedia.org/wiki/Password_strength`.

Store this password somewhere safe. You could store it on an encrypted USB key using a password-safe program such as the open source product KeePass (`http://keepass.info/`), for instance.

Figure 2-15. *The `root` password*

With all the preliminaries out of the way, you can now get down to selecting the packages you wish to install on your host. You're going to install packages appropriate for a host running web, DNS, and mail servers. The RHEL installation process is highly granular, and you can select the functions and applications to install by specifying roles for your host, right down to individual applications. Figure 2-16 shows some of the potential roles for our host:

- *Clustering*: A member of a cluster of hosts
- *Software Development*: A host being used to develop software and write code
- *Storage Clustering*: A member of a cluster that provides clustered storage
- *Virtualization*: A host that runs virtual machines
- *Web server*: A traditional web server

As you can see, we have deselected all the defaults and selected the Web server and Customize now options. Selecting the Customize now radio button allows us to drill down further and select individual applications.

Figure 2-16. *Selecting packages*

The next page shows all the different package groups you can select to install. When you see an Optional packages button, you can click that to fine-tune the packages. Use the left frame to select the types of groups you are interested in (applications, development, etc.), and use the right frame to select the groups. In Figure 2-17 we have opened the Servers tab and chosen to install a DNS name server, a mail server, and the MySQL database.

Figure 2-17. *Selecting from the Servers list*

If you click the Optional packages button for the MySQL database, you will see 11 other packages (some of which are shown in Figure 2-18) you can select or deselect, depending on your personal preference.

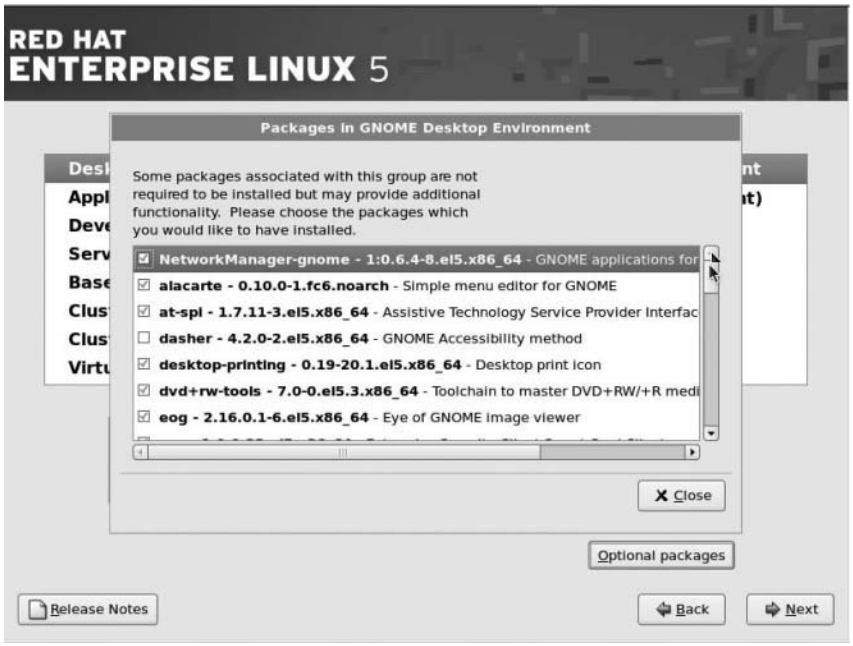

Figure 2-18. *Selecting optional packages*

You are almost ready to start writing your installation to disk. In the first step of this process, the installation program will check for package dependencies. This analysis scans the packages you've chosen to install and identifies any additional packages that need to be installed to support your choices.

Once this check is completed, the installer will then make sure you have enough disk space to install your package selections. Finally, you will be presented with an installation readiness screen like the one shown in Figure 2-19.

Figure 2-19. *Ready to install*

Once the installation has initiated, you will see a progress bar indicating the status of the installation. The installation process itself may take several minutes depending on the number of packages you have chosen to install.

Once the installation is finished, the CD/DVD will eject and you will be presented with a reboot screen. Simply click Reboot to restart your host.

After the reboot, you will see the GRUB menu screen (remember, this is the boot loader you installed earlier), which allows you to choose the operating system to boot into. You don't have to do anything on this screen, because in a few seconds it will select the default and begin to boot your new host. If you press any key during this countdown process, loading will be interrupted and the complete GRUB menu will display (see Figure 2-20).

Figure 2-20. *Booting your new host*

After GRUB has completed, you will be presented with a Red Hat splash screen. You're probably wondering, "What's it doing now?" To view the steps involved in your host's boot process, click Show Details. You can see all the processes the system runs as it starts up and whether they have successfully started, as shown in Figure 2-21.

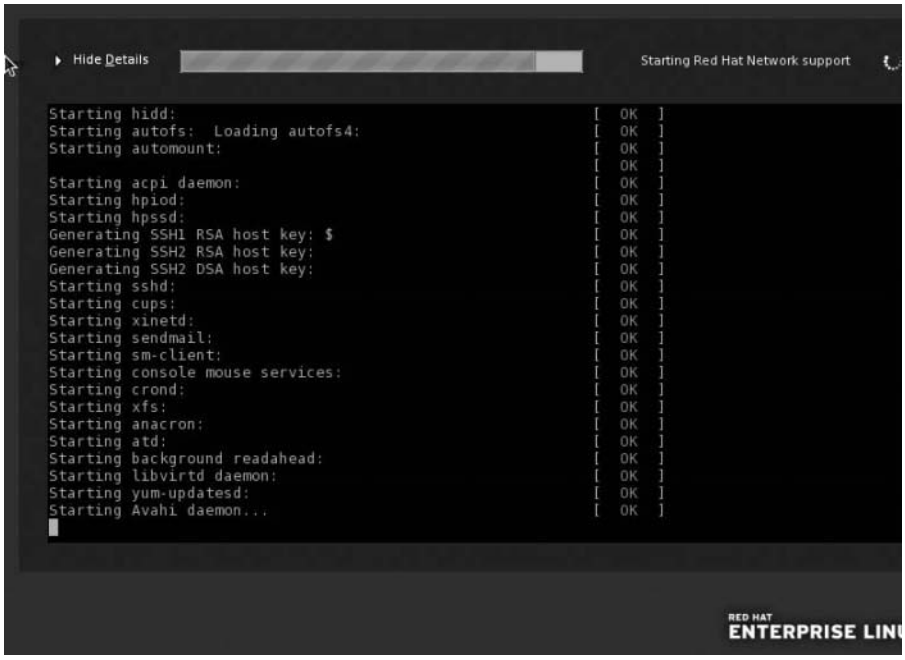

Figure 2-21. *Displaying system startup status*

■ **Note** For a detailed explanation of the boot process, see the "Boot Process" section in Chapter 5.

If you chose the default package options, you will have installed an application called "firstboot." Since this is the first time you have booted this host, the firstboot application will start and you will be asked a series of questions about your host and how you want to configure it. You will also be given the opportunity to register with the Red Hat Network (RHN).

First, you will see the Welcome screen shown in Figure 2-22. Click Forward to proceed.

Figure 2-22. *The Welcome screen*

You are then asked to read and agree to the licensing agreement. Select "Yes, I agree" if you agree to abide by the license or "No, I do not agree" if you don't. If you don't agree to the license, you are given the option to reread the license or terminate your installation; you will not be able to continue to use your host until you agree to the license.

After the license agreement screen, you will be prompted to configure your host's firewall. Most Linux distributions configure and install a host-based firewall that uses the Netfilter firewall (also known as the `iptables` firewall after the command used to configure the firewall). We recommend you enable this firewall on all of your hosts.

For the moment, we'll just configure the firewall to allow TCP packets on port 22 so we can remotely connect to the host using a secure protocol called Secure Shell (SSH). We'll talk more about SSH in Chapters 3 and 6, and more about firewalls in Chapter 6. You can see our firewall configuration in Figure 2-23.

Figure 2-23. *Configuring your firewall*

On the next screen you will be prompted to configure the SELinux mode for your host. SELinux applies a security control called mandatory access control (MAC) to objects like files, processes, and information. SELinux was developed by the US National Security Agency "to enforce the separation of information based on confidentiality and integrity requirements to provide system security" (`http://www.nsa.gov/selinux/index.shtml`).

What does SELinux do? Well, traditional Linux security follows a concept called discretionary access control (DAC). With DAC, normal users can create objects and give these objects permissions (which you'll see more of in Chapters 3 and 4). Permissions allow reading, writing, or executing of objects on your host by particular users and groups. These objects, such as files and applications, can interact with one another based on these permissions.

With MAC provided by SELinux, a set of security policies work on the system level, and these control all objects on the system and how and if those objects interact with each other. So, for example, MAC provided by SELinux will prevent the Apache web server from accessing files belonging to the Postfix mail server, even if the web server was compromised and had gained `root` access to your host. These two processes will be logically separated by the security policy, so that if one is compromised, the other is not automatically compromised as well.

Since you are just starting out with your new host, set the mode to Permissive (see Figure 2-24), which means you will be informed of any issues that might arise from your security policy without that policy actually being enforced. It gives you the opportunity to fine-tune your host until you are ready to deploy it. After trying out this new host, you should set the security policy to Enforcing before moving your host into production to make the system more secure.

■ **Note** You can read about how to implement SELinux on Red Hat at `http://www.redhat.com/docs/manuals/enterprise/RHEL-5-manual/Deployment_Guide-en-US/ch-selinux.html`.

Figure 2-24. *Configuring SELinux*

■ **Note** You don't have to use SELinux on your hosts, and if you don't wish to, you can disable it by selecting Disabled, as you can see in Figure 2-24. Not all Red Hat–derived distributions run SELinux by default, so you may not need to do this on all platforms.

On the next screen, you will set the date and time, which is usually done using a protocol called Network Time Protocol (NTP). NTP sets the time by connecting to time servers located on the Internet (so you'll need to be connected to the Internet for this to work) that are connected to very accurate clocks. Your host will poll these time servers for the time. It will usually poll three servers (the quantity and specific time servers to poll are configurable), and then it uses an algorithm to decide the most accurate time based on the responses and the time zone your host is in.

You enable NTP by selecting the Enable Network Time Protocol option on the Network Time Protocol tab. Red Hat has some time servers available for you to use, and they are automatically configured for you. If you want to add your own, you can use the Add, Edit, or Delete button.

The advanced options area of the Date and Time screen provides two options, as shown in Figure 2-25: "Synchronize system clock before starting service" and "Use Local Time Source." Disable your Local Time Source if you have a particularly unreliable hardware clock.

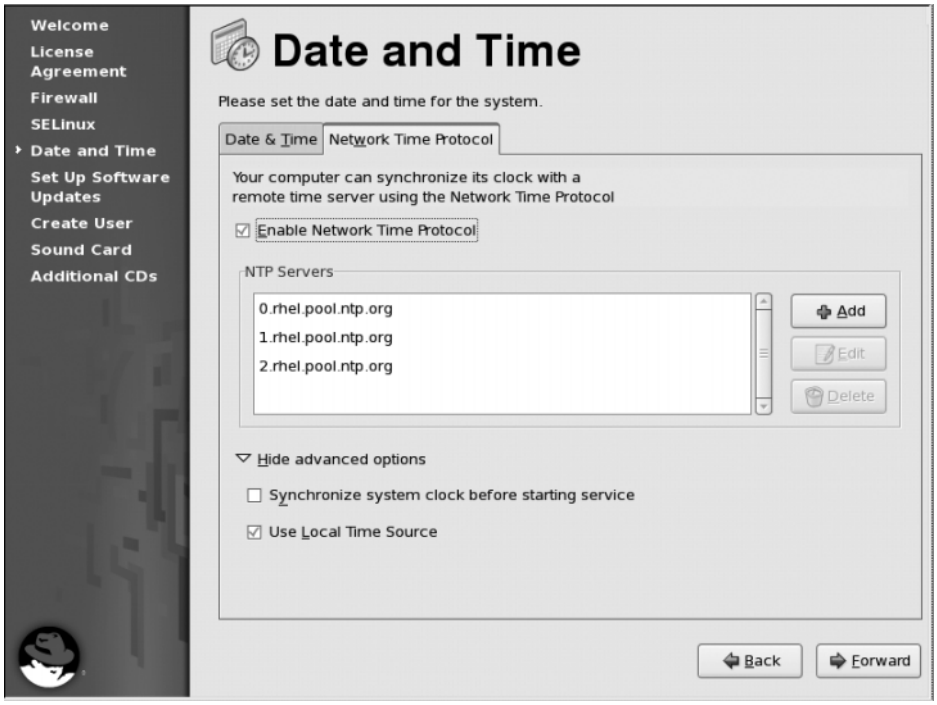

Figure 2-25. *Enabling Network Time Protocol*

■ **Note** You can read more about NTP and the time servers at `http://www.ntp.org`. We'll also discuss NTP in more detail in Chapter 9.

After the installation process tries to contact the NTP servers (provided you have an Internet connection), you will be asked to set up software updates provided by Red Hat. These updates are available only via your RHN subscription (recall that RHN is the software update service you receive as part of your purchase of the Red Hat Enterprise Linux license). This option will work only if you have an appropriate subscription for your host. If so, select "Yes, I'd like to register now" as shown in Figure 2-26 and click the Forward button.

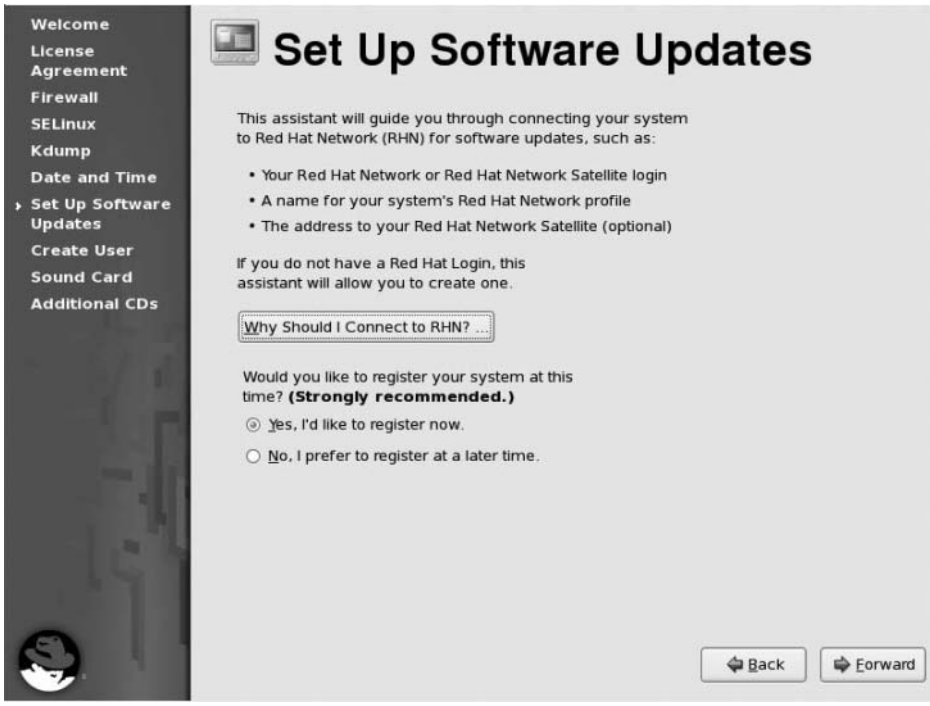

Figure 2-26. *Selecting software updates*

Next, you will choose where you get your updates from. You can choose Red Hat Network hosted by Red Hat either via the RHN portal, or via an RHN Satellite server or a Proxy server. The Satellite and Proxy servers are part of Red Hat's provisioning and management suite of applications. They allow you to set up a distributed network for managing patches and updates, and download updates only once and then distribute them to multiple sites and hosts. It is unlikely you will need to purchase one of these servers when you are starting out, but if you have multiple sites and numerous hosts, you may want to investigate their use; you can read more about these products at `http://www.redhat.com/red_hat_network/` and `http://www.redhat.com/docs/manuals/satellite/Red_Hat_Network_Satellite-5.1.1/html/Proxy_Installation_Guide/s1-intro-proxy.html`.

■ **Tip** Red Hat's Satellite server product has a free equivalent called Spacewalk (`https://fedorahosted.org/spacewalk/`), which is available with distributions like Fedora Core and CentOS. Spacewalk is an upstream development version of Satellite server and contains newer features, but it could be more unstable than RHN Satellite server.

As you can see in Figure 2-27, we have selected the default, which is to get our updates from RHN directly. If you use a Proxy server to connect to the Internet from your network, you can click the Advanced Network Configuration button and provide the details you require to use it there.

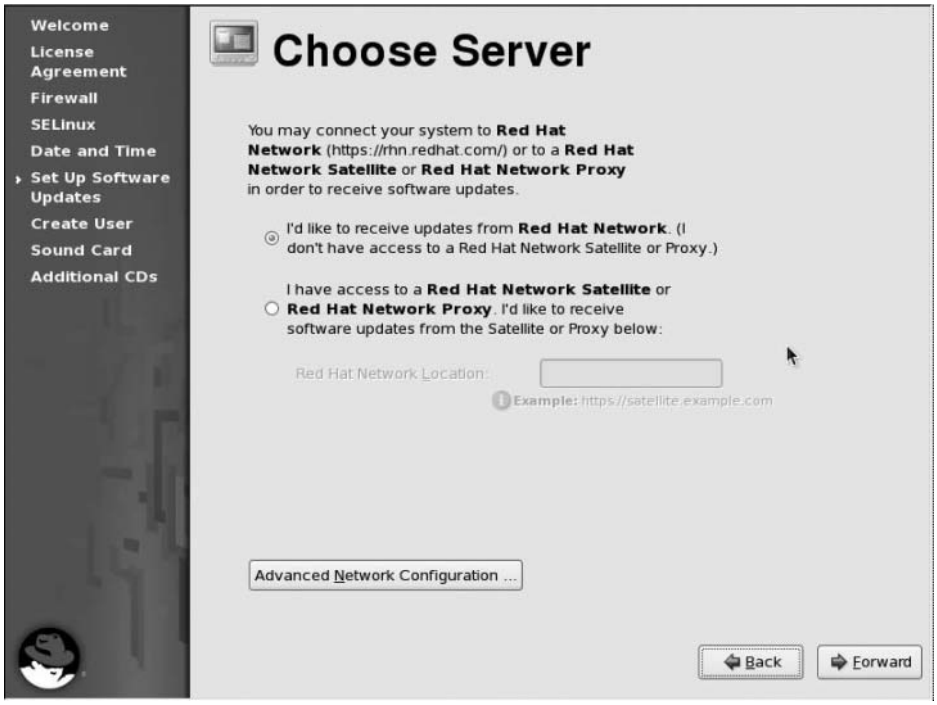

Figure 2-27. *Selecting the source of our software updates*

■ **Tip** We'll discuss RHN and updating our host in more detail in Chapter 7. You will need to have your Red Hat login ID and password and also a subscription available for this new host. If you don't have one, you can register on the Red Hat website (`https://www.redhat.com/wapps/ugc/register.html`), and you can purchase the subscription online from the Red Hat website (`https://www.redhat.com/wapps/store/catalog.html`). Your subscription enables you to download security patches and other applicable software from Red Hat.

You are next asked to enter your Red Hat login ID and password, which are the same ones you use to access the RHN website. After you enter your credentials, click Forward to continue. Your login and password will be verified, and if they are correct you will be allowed to continue.

Next, you define a descriptive system name (preferably the hostname) to identify the host to RHN. You can see that we entered the hostname au-mel-rhel-1 in Figure 2-28. Make sure you have the "Send hardware profile" and "Send package profile" options checked to make the best use of your subscription and allow Red Hat to provide any updates for your system. Clicking Forward will allow you to review your details prior to sending the information to RHN.

Figure 2-28. *Setting the system name for RHN*

You now have a chance to review your subscription information, as you can see in Figure 2-29. If you don't have a subscription, you will see an error message of Code 91. You can check your subscription with Red Hat and purchase an extra subscription for your new host if required.

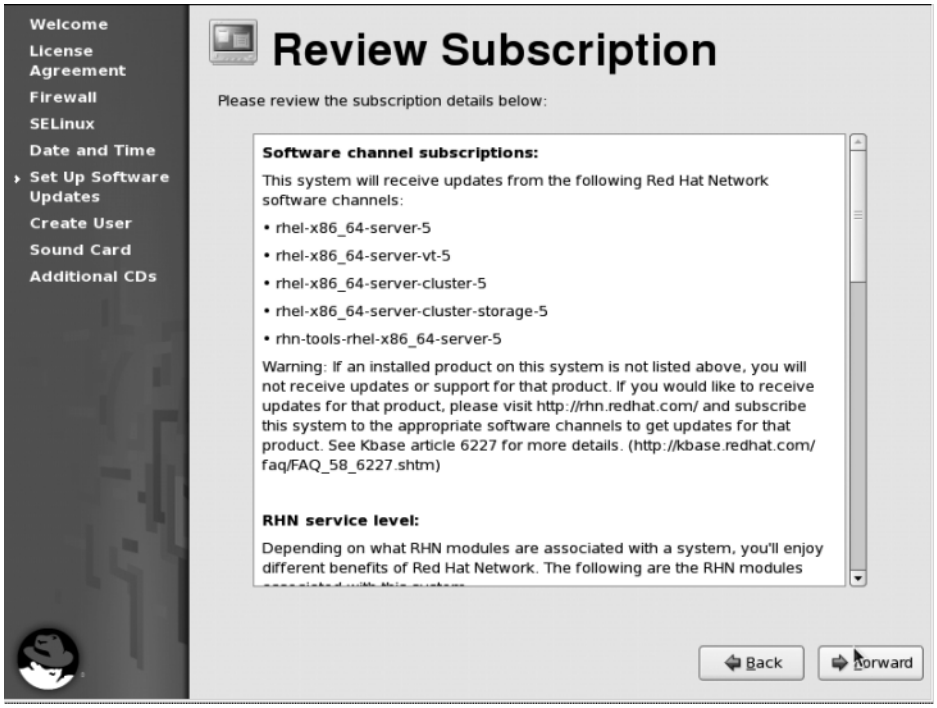

Figure 2-29. *Reviewing your subscription information*

Next, you will see the Finish Updates Setup screen that confirms the successful subscription of your host to Red Hat's RHN. Click Forward to continue.

Having set up your updates, you are now asked to set up a new user for your host. In this instance, we are going to create a user called `jsmith`. We will enter `jsmith`'s details and give the user a password. On this screen you can also potentially configure network authentication. *Network authentication* allows you to store users' details and the access they are entitled to in a remote host. This means that instead of needing to manage users and credentials on all your hosts, you can configure them once on this remote host and use them on all your hosts. Another example of network authentication is Microsoft Windows Active Directory.

If you have any network authentication infrastructure set up, you can enter the details after you click the Use Network Login button. In the network login section you are able to select other authentication types like Kerberos, LDAP, Smart Card, SMB, or Winbind, and make use of user information stored in databases like NIS and LDAP. If any of these terms are not familiar to you, don't panic—we will discuss them later in Chapter 16. For now, let's use the details shown in Figure 2-30.

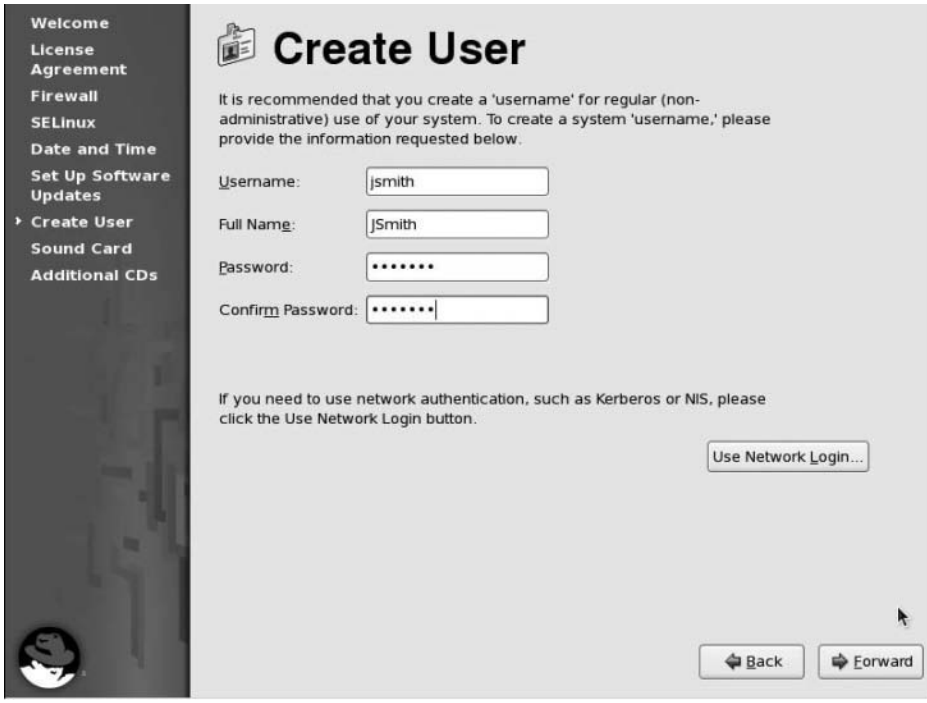

Figure 2-30. *Creating your first user*

Unless you are setting up a desktop system, we recommend ignoring the sound card setup. This is a legacy screen from when sound cards cost hundreds of dollars and were considered flashy on your new system. Nowadays, sound cards are given away on motherboards for free.

You can also ignore the Additional CDs section. Again, this is more or less a legacy screen, from when Internet connections were hopelessly slow and getting software on CDs was the only option you had.

Now your system installation is complete and you are presented with the screen shown in Figure 2-31.

Figure 2-31. *Installation is complete and the system is ready to use.*

From here, you can move on to the next chapter, where we will introduce you to Linux and how to start using your new host. Alternatively, you can continue reading this chapter to learn how to install Ubuntu.

Ubuntu Installation

Ubuntu comes in two flavors: desktop and server. The desktop version is designed to be deployed as a desktop and the server version for your server hosts. In this section, we'll demonstrate how to install the server version. Installing Ubuntu Server is a very similar process to installing a Red Hat Enterprise Linux server. The main concepts are the same: choose the language and keyboard layout, choose the way you want to partition your disk, and then select the packages you want to install.

To install Ubuntu, we're going to download an ISO file from the Ubuntu website that contains much of the data we need to complete the installation. In this exercise we'll use the full-size CD from `http://www.ubuntu.com/getubuntu/download`.

Note Ubuntu and Debian make good use of net installers, providing installation flexibility. A *net installer* is a small version of the operating system usually provided as an ISO file that you can burn to a CD and boot from. It contains a simple kernel and the distribution's installer. The net installer provides your host with the basics it needs to boot and start the installation process, and any additional software or applications are then downloaded from online repositories. This means you need to be connected to the Internet to install a new host. It can also mean that installing a complete 4GB operating system may take a long time on a standard ADSL2, but using a net installer can be a great way to load a smaller system. We will explore net installs further in Chapter 19, when we look at ways to provision multiple systems.

We will make a few assumptions here:

- You are using an Ubuntu 8.04 LTS Server Edition ISO from the Ubuntu website (`http://www.ubuntu.com/getubuntu/download`), and you have burned it to a CD. You can find out more about burning ISO files to CD/DVD here: `https://help.ubuntu.com/community/BurningIsoHowto`.
- You are building just a basic mail, DNS and web server, like we did with the RHEL install.
- You are installing on a fresh server without any previous operating system.

After you place the CD in the CD drive and power on the host, you are presented with a selection of languages to use for the install. As shown in Figure 2-32, we chose English.

Figure 2-32. *Selecting the language of the install*

The next screen (see Figure 2-33) presents a similar set of options to the RHEL installation screen. F1 brings up a comprehensive help system that explains how to use the installer and how to deal with special hardware. F2 and F3 allow you to change the language and keyboard mapping. F4 is unused on the server disk, but it allows you to choose different installation types on the desktop installer disc. F5 allows you to change the display to high-contrast mode and initialize screen readers or Braille displays. Finally, F6 provides you with an option to manually edit the boot command.

On this screen, you can also test to see if the CD has any defects and then go into rescue mode, which we will cover in Chapter 8.

The Test memory option does not boot Linux at all, but starts a utility called `memtest86`. This utility repeatedly writes blocks of data to your RAM and then reads them back, to see if the contents have changed. If you are experiencing random crashes or system lockups, testing the RAM to make sure it is seated properly and not damaged is one of the first things you should do.

If you select "Boot from first hard disk," the system will read the master boot record and boot your system as if there were no CD present. We'll talk about this boot process in more detail in Chapter 3.

Choose the Install Ubuntu Server option by pressing Enter, and your installation will begin.

Figure 2-33. *Ubuntu Server splash screen*

Next is the first of your installation choices: the language you wish to use throughout the installation (see Figure 2-34). This will also be the default language for the final system.

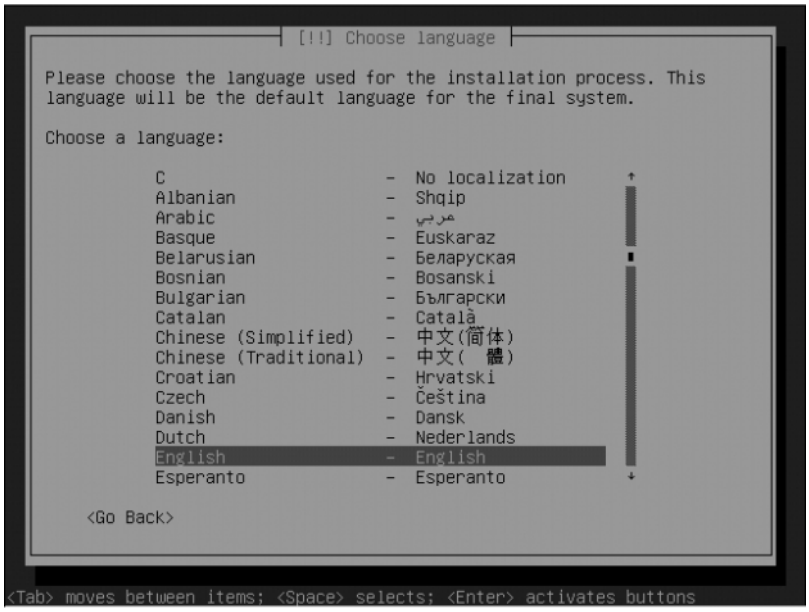

Figure 2-34. *Choosing the language for installation*

You are then asked to select your region. This is the geographical location in which the server you are installing is located. In Figure 2-35 we've selected Australia.

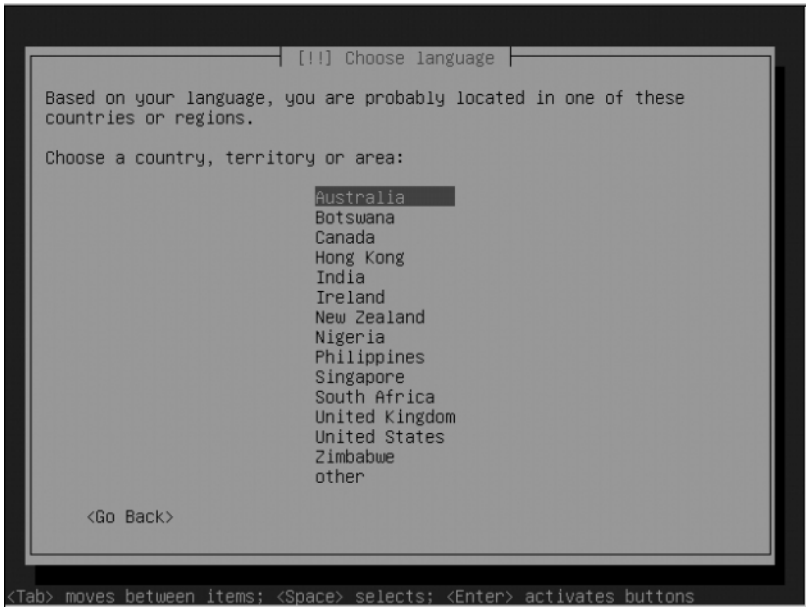

Figure 2-35. *Selecting your region*

Next, you select the keyboard and keyboard layout preference. As mentioned earlier, the keyboard layout is the keyboard mapping you are using. Different regions will have different mappings, so choose the one that best fits your area and language. Choosing Yes here, as shown in Figure 2-36, leads to a further series of questions and answers through which Ubuntu attempts to work out what type of keyboard you are using by having you press different keys.

Select No to save time and directly tell the installation what kind of keyboard you are using. The default here will work for most installations, but feel free to select the one most appropriate to your area. Figure 2-36 begins a series of screenshots that show the keyboard selection.

Figure 2-36. *Ubuntu attempts to detect your keyboard.*

After selecting No, the screen in Figure 2-37 appears, where you select the origin of the keyboard. We will pick USA and continue on.

Figure 2-37. *Selecting the origin of your keyboard*

In Figure 2-38, we select the keyboard layout for USA that will give us the standard key mapping for Australian computers.

■ **Tip** You can change the keyboard settings at any time after the installation is finished.

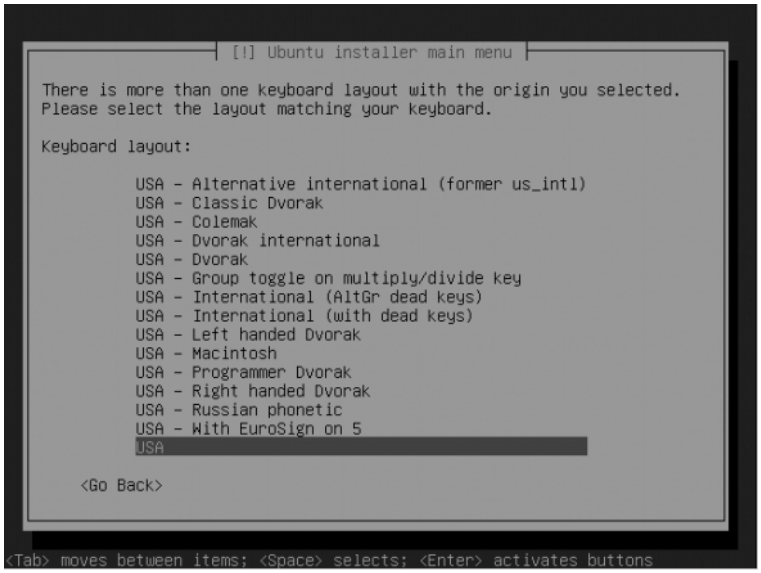

Figure 2-38. *Selecting keyboard layout*

The Ubuntu installation now takes a break to explore your hardware and discover more information about the target host. After this process is completed, you will be prompted for the hostname of your new host. As shown in Figure 2-39, we entered au-mel-ubuntu-1 here as it ties in with the naming standard discussed in the RHEL installation section.

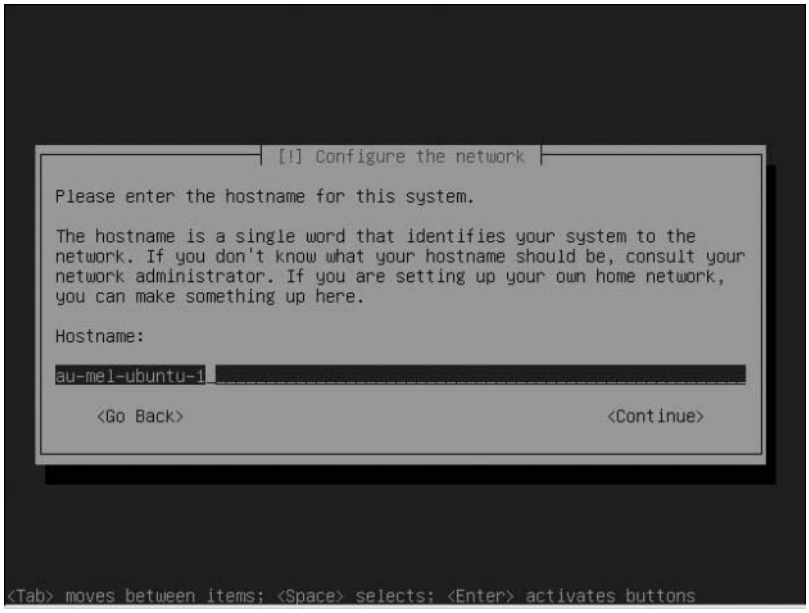

Figure 2-39. *Setting the hostname*

■ **Tip** If you are using a net install ISO, you will be asked to provide the location from which to retrieve the applications you want to install. These locations, called *archive mirrors*, are the online repositories for Ubuntu software. Pick your closest geographic region; in our case, we would pick Australia.

You will next be asked to specify your time zone by selecting your nearest capital city. This is so you can use the right time zone information for setting your host's internal clock. We chose Melbourne, as you can see in Figure 2-40.

Figure 2-40. *Selecting your time zone*

Next, you need to partition your host. This partitioning occurs in much the same way described in our example RHEL installation. You can divide your disks into partitions of differing sizes depending on the requirements of your host. Again, as in the RHEL installation, you are prompted to either select one of several default partitioning options or customize your own using the partitioning tool.

- *Guided - use entire disk*: This option asks you to select a hard disk, which will be completely erased. The system then creates a `root` partition and a `swap` partition.
- *Guided - use entire disk and set up LVM*: This option also erases all data. It then creates a small `boot` partition and uses the rest of the disk for a `root` and `swap` volume in LVM.
- *Guided - use entire disk and set up encrypted LVM*: This option is identical to the previous, except the LVM data is all encrypted. You are asked to provide a password. Note that you need to input this password at boot time, so this option is not suitable for a remote or headless server. If you lose the encryption password, you will not be able to retrieve your data.
- *Manual*: This option opens the partition editor and allows you to manually configure partitions, software raid, encryption, and LVM. This is the option you should choose if you have a preexisting Windows installation you want to resize.

For our example host we are interested in using the "Guided - use entire disk and set up LVM" option. This uses the entire hard disk available to us and makes use of logical volume management (LVM). As described in the RHEL installation section, LVM is a powerful way to manage your partitions and disks, and gives you greater flexibility to make changes to your partition layout later.

■ **Note** We'll discuss LVM in more detail in Chapter 8.

Figure 2-41 displays our default partition choices.

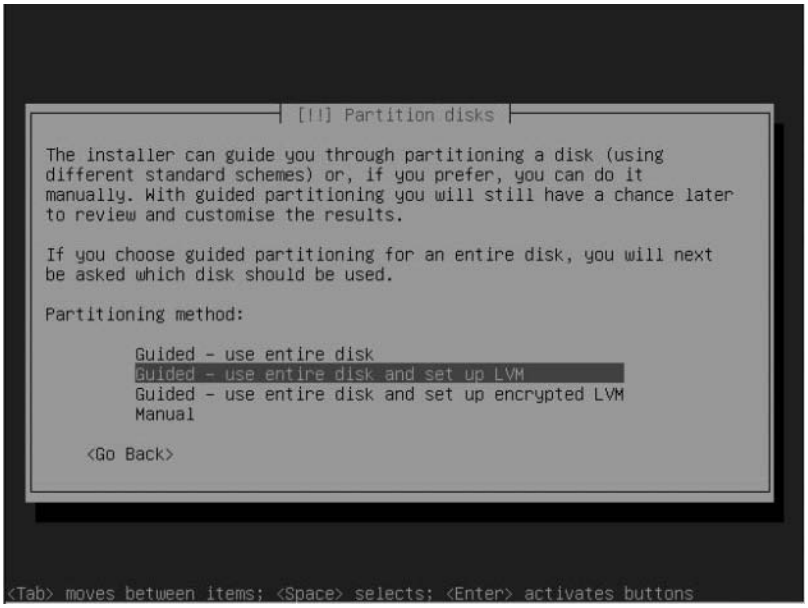

Figure 2-41. *Choosing LVM to partition disks*

Next, select the drive you wish to perform this partitioning on. We are given only one disk to select, as you can see in Figure 2-42.

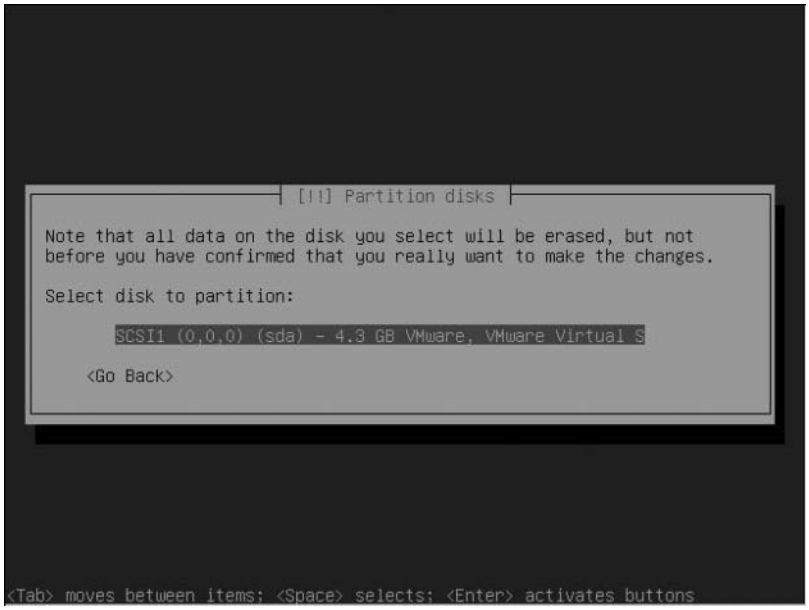

Figure 2-42. *Choosing the disk to partition*

■ **Caution** If the disk already contains partitions, you will be prompted to overwrite them. If you are confident that you want to do this, then specify Yes and continue. Selecting Yes here will destroy any existing data you may have if you are installing over a previous system. If you are not confident, then specify No. Alternatives to this include repartitioning your host using a tool like PartitionMagic (`http://www.symantec.com/norton/partitionmagic`), installing on a hard disk that doesn't already have data on it, or installing on a virtual machine.

The next screen (see Figure 2-43) lets you confirm that you wish to write the partition information to the selected disk. The partition information needs to be written to disk before LVM can be configured. Select Yes and go to the next screen.

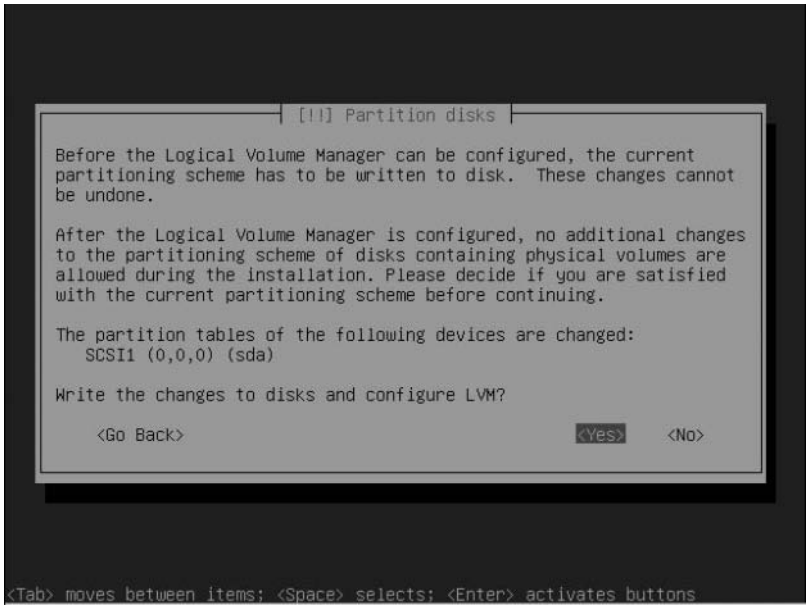

Figure 2-43. *Writing partition information to disk*

You will now be shown the LVM partition layout, which will show a small amount for swap space and the rest for the `root` or / partition. When we confirm this layout by selecting Yes, the LVM partitions shown in Figure 2-44 are created and formatted.

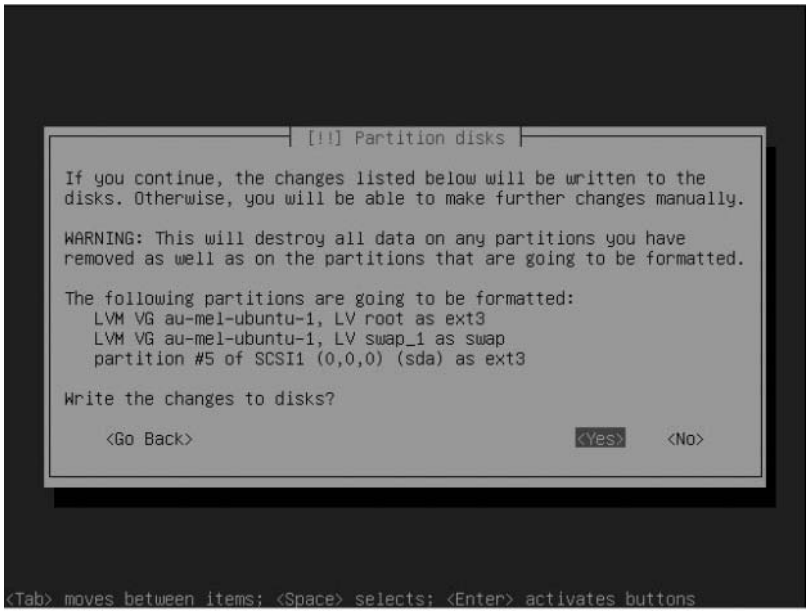

Figure 2-44. *Writing LVM partition changes to disk*

■ **Note** Swap space is additional storage on your hard disk drive that is used for "overflow" data from RAM. If you find your host frequently using all of your swap space or frequently swapping, then you probably need to tune your host and most often add more RAM. We'll talk about swap space in more detail in Chapters 8 and 17.

At this stage of the installation, Ubuntu will start installing the base package requirements needed to get the rest of the operating system installed. If you are using a net install, this may take some time depending on your Internet connection. You will be presented with a progress bar similar to the one shown in Figure 2-45.

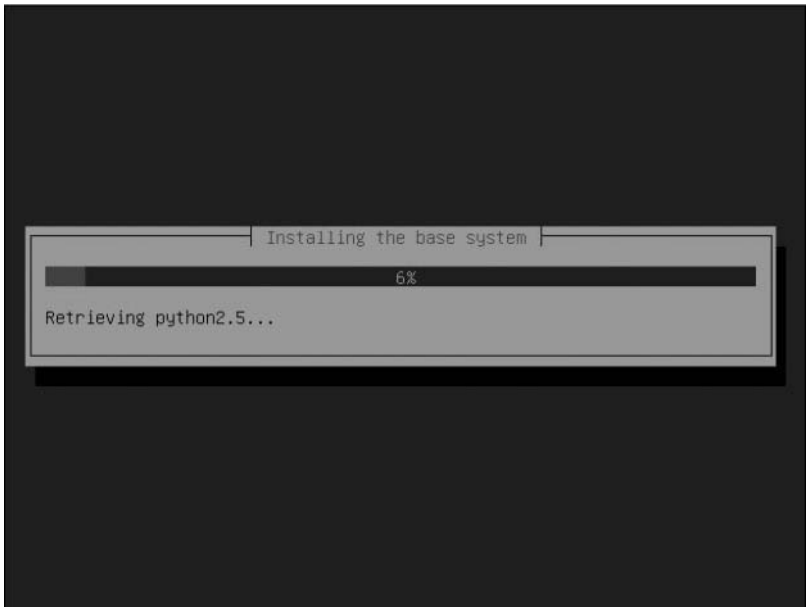

Figure 2-45. *Installing base system requirements*

Next, you are asked to create a user for this host. In Chapter 4 we will discuss user administration in greater detail, but it is important to know that the Ubuntu distribution disables the `root` user account by disabling its password. The `root` user is like the Windows Administrator and has access to everything on the host. In Ubuntu, instead of setting the `root` user's password like we did in the RHEL installation, users use a special command called `sudo` to access all the same privileges as the `root` user. We'll talk more about the `sudo` command in Chapter 4.

In Figure 2-46 you enter the full name of your new user.

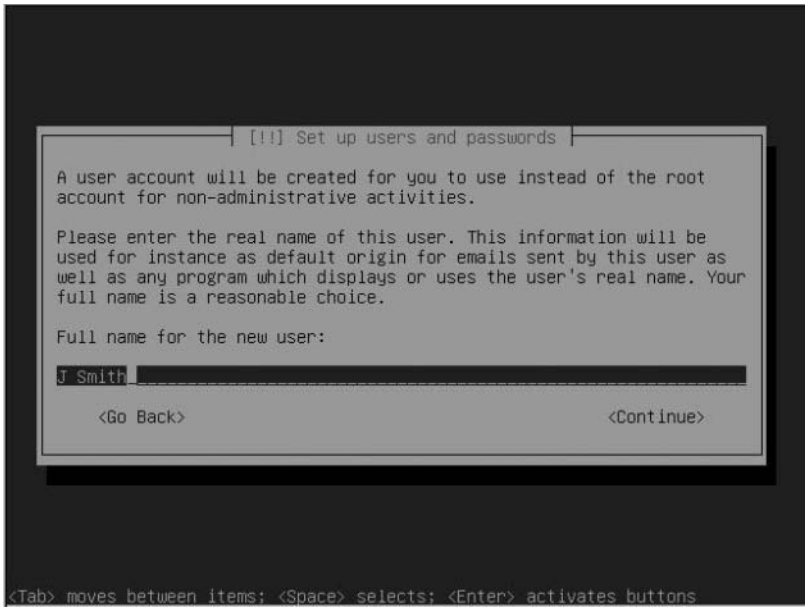

Figure 2-46. *Entering the full name of a new user*

In the next screen (Figure 2-47), you set the username for your new user.

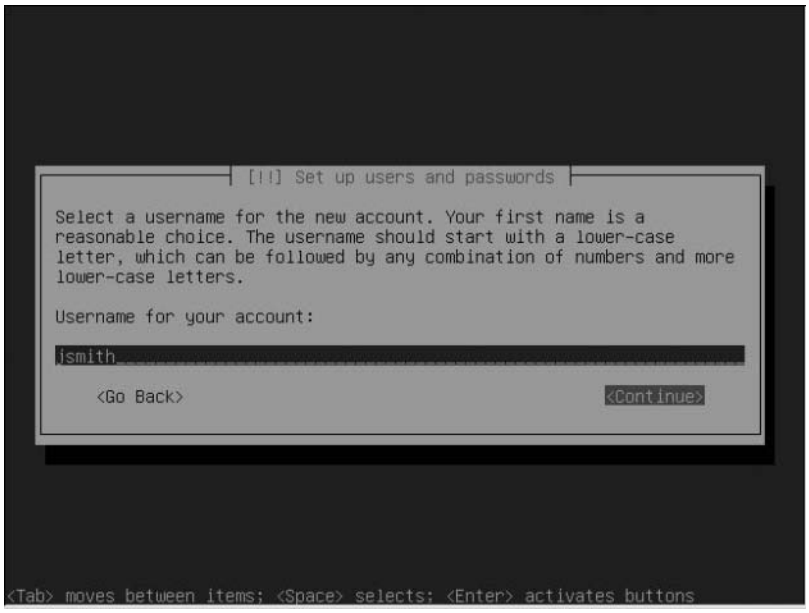

Figure 2-47. *Entering the username for the new user*

Finally, you set the password for your user, as shown in Figure 2-48. Again, as we discussed in the RHEL installation section, we recommend implementing a strong and complex password. You will be asked to verify that password.

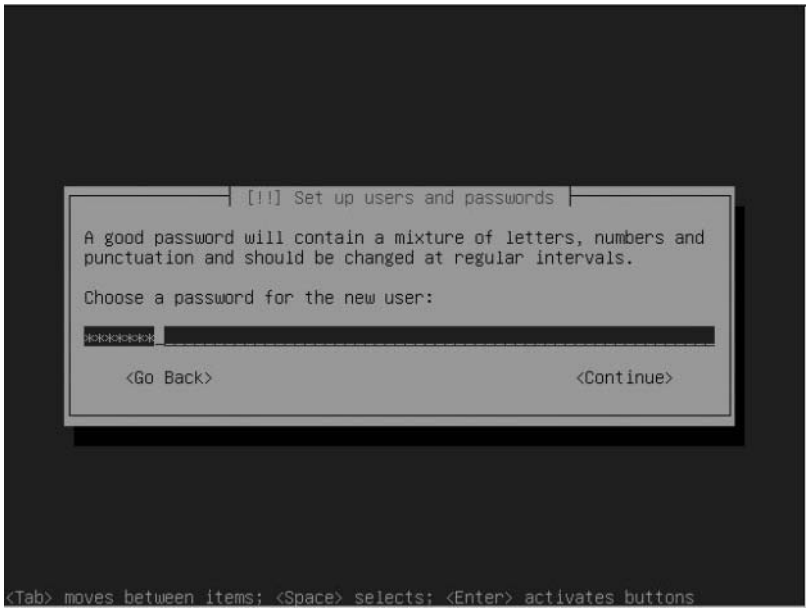

Figure 2-48. *Setting the user's password*

Next, you are asked for information about any Proxy servers you may need to use to access the outside world. We will ignore this for the moment and continue.

You are then asked what applications you would like to install on your host via the selection of application groups. We chose DNS, LAMP server (Linux, Apache, MySQL, and PHP), mail (Postfix), and OpenSSH, as you can see in Figure 2-49. When you are ready, select Continue.

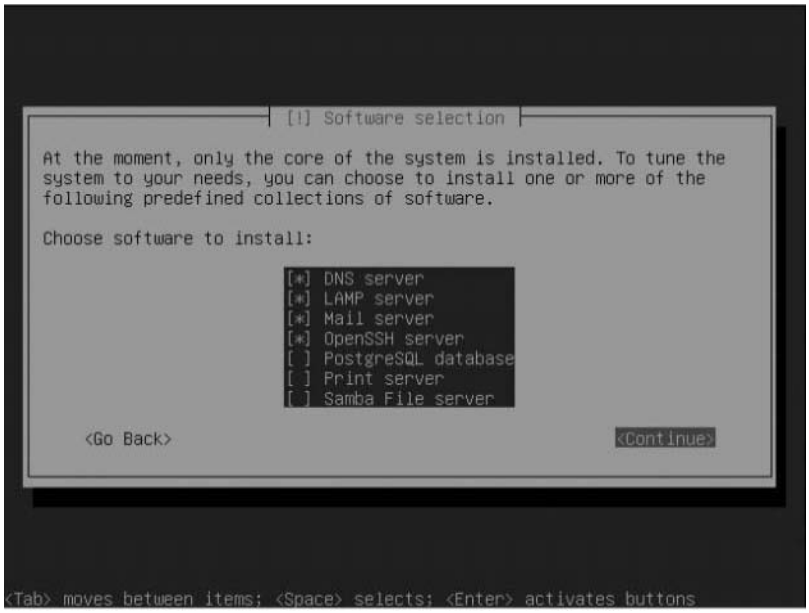

Figure 2-49. *Selecting applications for your host*

In this particular installation, because of the applications you have chosen to install, you are asked a series of questions to help Ubuntu configure or secure your chosen applications. Every time you install new applications on Ubuntu that require input to be configured, you will be prompted to answer similar questions.

As you can see in Figure 2-50, you are first asked to provide a password for the MySQL database `root` user. This is the master password for your MySQL installation and you should enter a secure and complex password. You will be asked to confirm this password by entering it again.

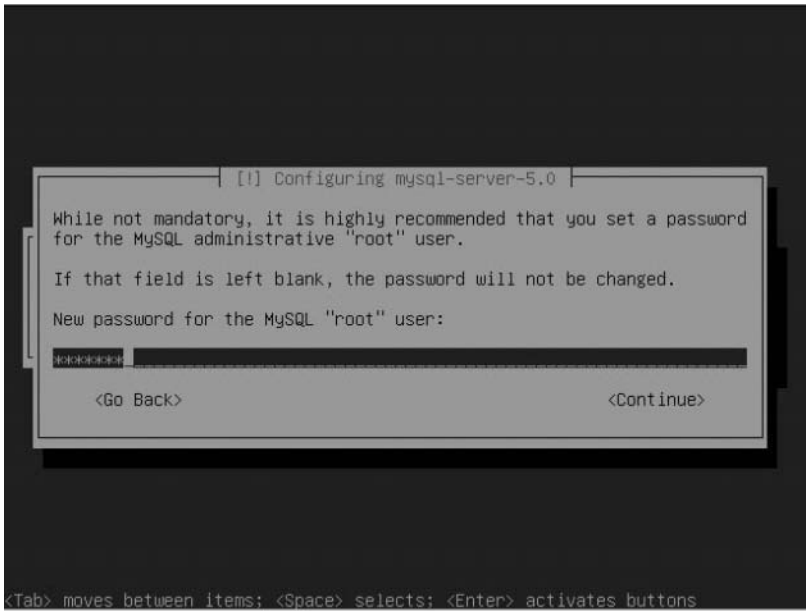

Figure 2-50. *Setting the MySQL* `root` *password*

Once you have provided this password, you are then asked to describe your mail server configuration. The screen in Figure 2-51 shows the configuration options, with each option briefly described. We will just choose the default, Internet Site.

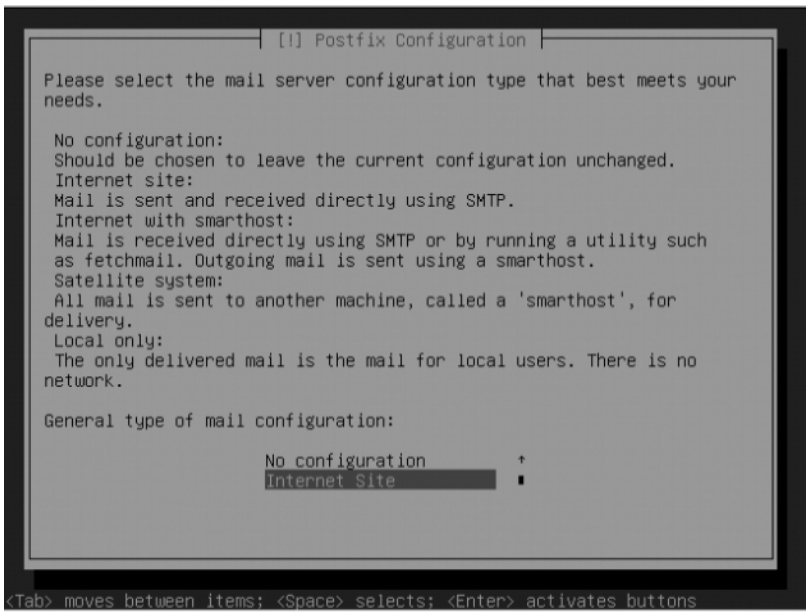

Figure 2-51. *Configuring the mail server*

We will explain how to configure and secure mail services in Chapter 10. Selecting the default here will provide a basic and secure configuration for sending and receiving mail for your domain.

Next, you provide the domain name for your mail server (see Figure 2-52). You should enter the domain name of the host for now, and we'll explain other potential options in Chapter 10.

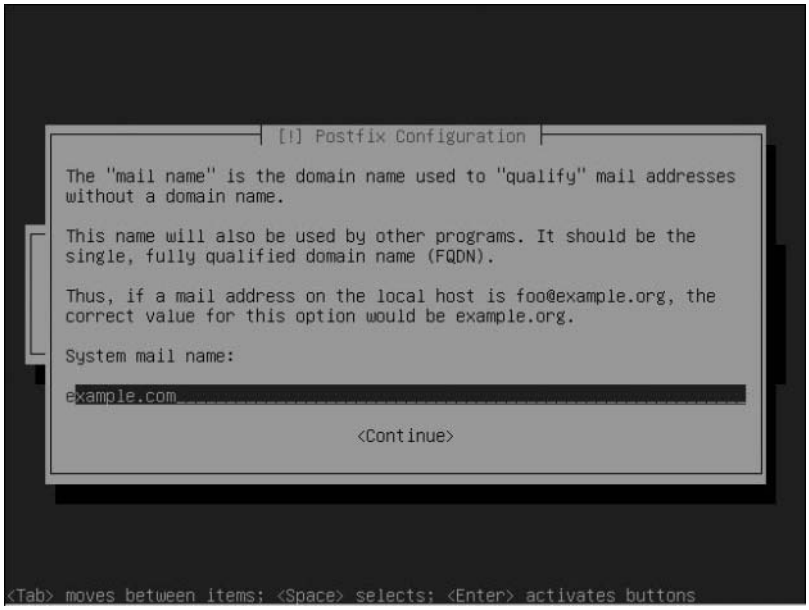

Figure 2-52. *Setting the mail server domain name*

After confirming your computer clock is set to UTC, as shown in Figure 2-53, your installation is nearly complete. UTC is used by your host to convert time into its local time using time zone information.

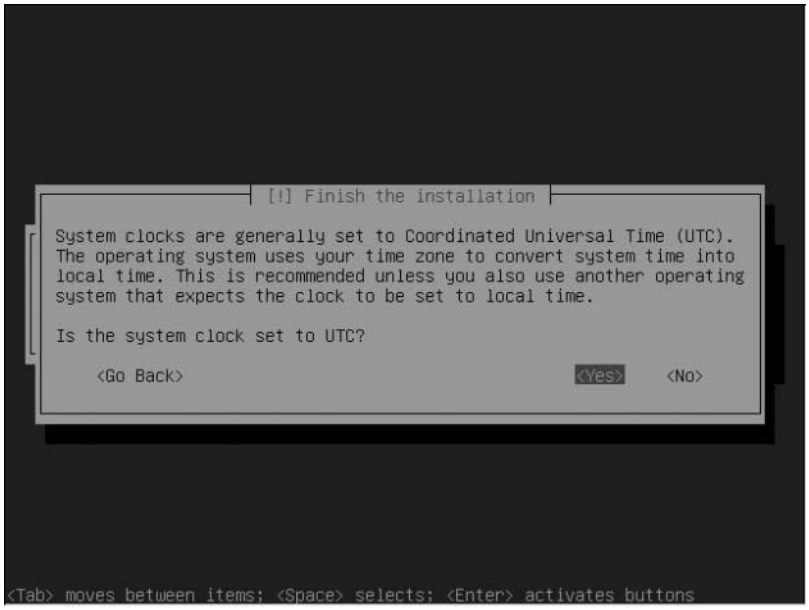

Figure 2-53. *Setting the clock to UTC*

Installation is now complete and Ubuntu will notify you of this, as you can see in Figure 2-54.

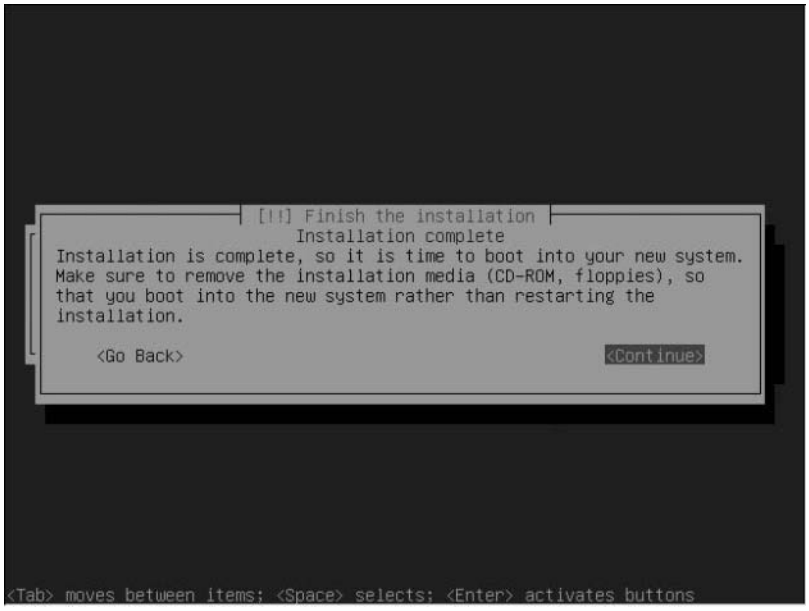

Figure 2-54. *Installation is complete.*

The CD or DVD will eject automatically, and after you remove it from the drive you can select Continue. Your system will now reboot and you will be presented with a login prompt (see Figure 2-55).

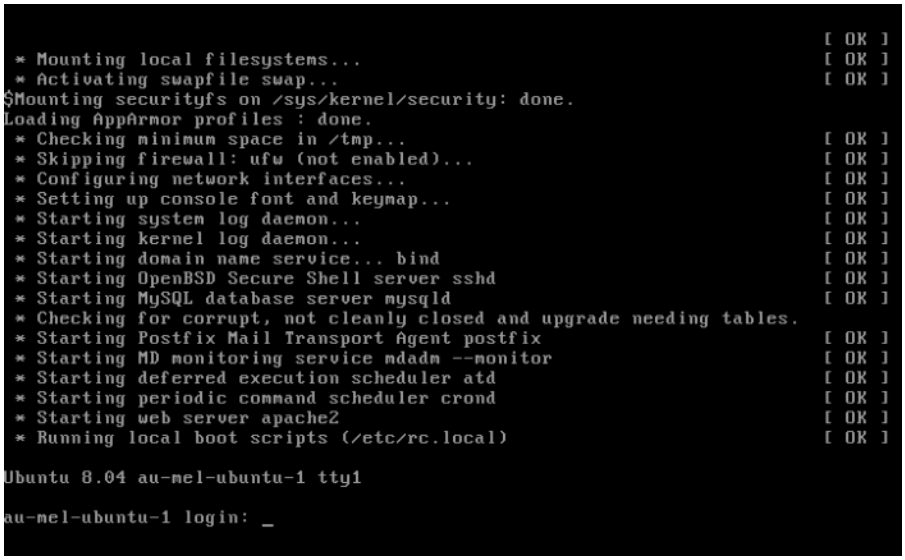

Figure 2-55. *Booting to the console screen*

You will notice that Ubuntu does not boot to a graphical user interface (GUI) but to a console screen. This is because the default Ubuntu Server installation does not install a GUI. We'll talk more about using the command line vs. a GUI in Chapter 3.

You now have a usable mail, DNS, and web server running the Ubuntu distribution that is ready for you to customize further for your environment.

Troubleshooting

Every now and then an installation will fail for some reason. Most commonly this happens due to defective installation media; less often it happens due to unsupported or defective hardware.

If there is a problem with the installation media, you may see read errors being logged or the installer may display an error stating it was unable to read a file. You should check the installation CD or DVD for scratches. If you created the CD or DVD from an ISO file, it might be worth writing a new disc at a lower speed. Media problems usually recur at the same step in the installation process.

Network installations can also fail if the connection is interrupted, so check that cables are plugged in and your Internet connection is working.

The less common type of failure is caused by hardware not being supported. For example, if an installation kernel does not support the disk controller, the installer will be unable to access hard disks. If this happens, check which kernel version is included on the installation disc and verify that it in fact supports your hardware. A newer version of your distribution, with support for more and newer hardware, might be available.

Nonreproducible crashes at random points in the installation usually indicate a hardware problem, and the most common problems are bad RAM or overheating. You can run a RAM tester like `memtest86` (`http://www.memtest.org/`), and you should verify that the CPU and case fans are working properly.

Diagnostic Information

If you need additional diagnostic information while you are installing, you can access a limited shell and some logging information from the installation process. You can use these to further diagnose any problems you might have.

On an RHEL host, the ALT+F2 key combination will give you access to a limited shell, ALT+F3 gives the installation log, ALT+F4 gives the system messages, and ALT+F5 gives miscellaneous messages. ALT+F7 returns to the installation GUI.

On Ubuntu, ALT+F2 and ALT+F3 each give access to a limited shell. ALT+F4 provides verbose installation progress and logs for the installer. The ALT+F1 combination switches back to the installer interface.

Restarting Your Installation

After a problem, you should normally restart installation from the beginning. Because files from the previous installation attempt might still be present on disk, it's best to have the installer reinitialize the partitions and start from scratch.

Troubleshooting Resources

Don't be afraid to make use of the communities that exist around most Linux distributions if you run into trouble. Chances are someone else has experienced the same problem you have and has documented the resolution. Here are some resources to try:

- Red Hat: `https://www.redhat.com/apps/support/`
- Fedora: `http://forums.fedoraforum.org/forumdisplay.php?f=6`
- Ubuntu: `http://ubuntuforums.org/forumdisplay.php?f=333`

Summary

In this chapter, we stepped through the process of installing two of the popular Linux distribution choices:

- Red Hat Enterprise Linux
- Ubuntu Server

We also explained what you might do if something goes wrong during installation. In the next chapter, we will give you a rundown of the basics of how to use your new Linux host.