Learning Raspbian

The huge popularity of the Raspberry Pi has led to the development of many excellent operating systems such as Raspbian, which is the official operating system for Raspberry Pi. It is a Debian-based operating system that is specially optimized for the Raspberry Pi hardware.

With this book, you will be taken through starting Raspbian after its first boot and move on to learn about the different features of the Raspbian desktop. This book will then walk you through installing different software on your machine to make your work easier, familiarizing you with the console and teaching you how to interact with the Raspbian operating system. Finally, you will be equipped with ample information about other Linux distributions based on Raspbian.

Packed full of useful screenshots, this book is an excellent guide to the Raspbian operating system and will ensure your success with the Raspberry Pi!

Who this book is written for

This book is intended for developers who have worked with the Raspberry Pi and who want to learn how to make the most of the Raspbian operating system and their Raspberry Pi. Whether you are a beginner to the Raspberry Pi or a seasoned expert, this book will make you familiar with the Raspbian operating system and teach you how to get your Raspberry Pi up and running.

What you will learn from this book

- Understand your Raspberry Pi and the different components that make up the Raspbian operating system
- Set up and configure your Raspberry Pi
- Download and install Raspbian onto an SD card suitable for the Raspberry Pi
- Learn about the XFCE desktop environment that is bundled with Raspbian
- Experiment with the different ways you can install software in Raspbian
- Grasp the basics of the Linux command prompt

In this package, you will find:

- The author biography
- A preview chapter from the book, Chapter 1 'The Raspberry Pi and Raspbian'
- A synopsis of the book’s content
- More information on Learning Raspbian

About the Author

**William Harrington** lives and works at his family's cattle station, Olga Downs, in northwest Queensland, Australia. He attended university at James Cook University, Townsville. At the age of 20, he established his own company, Harrington Systems Electronics, which sells the NLIS RFID tag reader – The Pipe Reader that he designed and manufactures. He also received the AgForce President's Innovation Award in 2005. In 2006, he graduated with honors as a computer systems engineer and received the Queensland Primary Industries Young Achiever Award. Since then, he has gone on to design the uSee remote monitoring system, a revolutionary and low-cost remote monitoring solution.

Having a home-based company has become part of a unique diversification strategy for the family and has provided them the opportunity to stay on the land. Due to a never-ending passion for technology, William speaks regularly on many topics, so he will bring a futuristic version of the technology that is possible in the next decade.

Since 2011, he has also been a director and programmer for Farm Apps Pty Ltd, developing smartphone and tablet apps that increase farming efficiency.

He enjoys travelling and brewing beer at home.

William works alongside his wife Hollie, having recently welcomed their young son, Jack, into the world.

I would like to thank my wife, Hollie, for her love and support throughout the process of writing this book. I would also like to thank our son, Jack, for reminding us that he is there, along with the rest of my family, Peter, Carmel, Emily, and Grace!
Learning Raspbian

This book is an introduction to the revolutionary Raspberry Pi computer and its official operating system, Raspbian. Raspbian is a free, open source operating system based on the extremely popular Debian Linux distribution. Raspbian has been specifically customized for maximum performance on the Raspberry Pi.

After reading this book, you will be able to do the following:

- Set up and configure a Raspberry Pi from scratch
- Install and configure the Raspbian operating system
- Customize the desktop environment to suit your requirements and taste
- Install and manage software packages on your Raspberry Pi

You can get a good understanding of the capabilities of your Raspberry Pi and Raspbian by taking a look at some of the other projects that are based on Raspbian.

What This Book Covers

Chapter 1, The Raspberry Pi and Raspbian, runs you through the history of the Raspberry Pi and the different hardware and software components that make up the Raspberry Pi.

Chapter 2, Getting Started with Raspbian, walks you through how to set up your Raspberry Pi and how to load Raspbian onto your SD card.

Chapter 3, Starting Raspbian, walks you through the initial setup of Raspbian and the Linux boot process.

Chapter 4, An Introduction to the Raspbian Desktop, details the Raspbian desktop and runs you through the preinstalled software that is included with Raspbian.

Chapter 5, Installing Software on Raspbian, teaches you how to install software on your Raspberry Pi using the different methods explained in this chapter.

Chapter 6, The Console, takes you through the basic use of the bash console in Raspbian.

Chapter 7, Other Linux Distributions Based on Raspbian, looks at several other exciting projects that are based on Raspbian.

Appendix, References, lists a collection of links to the resources used in this book and other interesting information.
In this chapter, you will learn about the Raspberry Pi, the Raspberry Pi Foundation and Raspbian, the official Linux-based operating system of Raspberry Pi.

In this chapter, we will cover:

- The Raspberry Pi
- History of the Raspberry Pi
- The Raspberry Pi hardware
- The Raspbian operating system
- Raspbian components

The Raspberry Pi

Despite first impressions, the Raspberry Pi is not a tasty snack. The Raspberry Pi is a small, powerful, and inexpensive single board computer developed over several years by the Raspberry Pi Foundation.

If you are looking for a low cost, small, easy-to-use computer for your next project, or are interested in learning how computers work, then the Raspberry Pi is for you.
The Raspberry Pi was designed as an educational device and was inspired by the success of the BBC Micro for teaching computer programming to a generation. The Raspberry Pi Foundation set out to do the same in today's world, where you don't need to know how to write software to use a computer. At the time of printing, the Raspberry Pi Foundation had shipped over 2.5 million units, and it is safe to say that they have exceeded their expectations!

The Raspberry Pi Foundation

The Raspberry Pi Foundation is a not-for-profit charity and was founded in 2006 by Eben Upton, Rob Mullins, Jack Lang, and Alan Mycroft. The aim of this charity is to promote the study of computer science to a generation that didn't grow up with the BBC Micro or the Commodore 64.

They became concerned about the lack of devices that a hobbyist could use to learn and experiment with. The home computer was often ruled out, as it was so expensive, leaving the hobbyist and children with nothing to develop their skills with.
History of the Raspberry Pi

Any new product goes through many iterations before mass production. In the case of the Raspberry Pi, it all began in 2006 when several concept versions of the Raspberry Pi based on the Atmel 8-bit ATmega664 microcontroller were developed. Another concept based on a USB memory stick with an ARM processor (similar to what is used in the current Raspberry Pi) was created after that. It took six years of hardware development to create the Raspberry Pi that we know and love today!

The official logo of the Raspberry Pi is shown in the following screenshot:

![Raspberry Pi Logo](image)

It wasn't until August 2011 when 50 boards of the Alpha version of the Raspberry Pi were built. These boards were slightly larger than the current version to allow the Raspberry Pi Foundation, to debug the device and confirm that it would all work as expected. Twenty-five beta versions of the Raspberry Pi were assembled in December 2011 and auctioned to raise money for the Raspberry Pi Foundation. Only a single small error with these was found and corrected for the first production run.

The first production run consisted of 10,000 boards of Raspberry Pi manufactured overseas in China and Taiwan. Unfortunately, there was a problem with the Ethernet jack on the Raspberry Pi being incorrectly substituted with an incompatible part. This led to some minor shipping delays, but all the Raspberry Pi boards were delivered within weeks of their due date. As a bonus, the foundation was able to upgrade the Model A Raspberry Pi to 256 MB of RAM instead of the 128 MB that was planned. This upgrade in memory size allowed the Raspberry Pi to perform even more amazing tasks, such as real-time image processing.
The Raspberry Pi and Raspbian

The Raspberry Pi is now manufactured in the United Kingdom, leading to the creation of many new jobs.

The release of the Raspberry Pi was met with great fanfare, and the two original retailers of the Raspberry Pi - Premier Farnell and RS components - sold out of the first batch within minutes.

The Raspberry Pi hardware

At the heart of Raspberry Pi is the powerful Broadcom BCM2835 "system on a chip". The BCM2835 is similar to the chip at the heart of almost every smartphone and set top box in the world that uses ARM architecture. The BCM2835 CPU on the Raspberry Pi runs at 700 MHz and its performance is roughly equivalent to a 300 MHz Pentium II computer that was available back in 1999.

To put this in perspective, the guidance computer used in the Apollo missions was less powerful than a pocket calculator!

The Raspberry Pi comes with either 256 MB or 512 MB of RAM, depending on which model you buy. Hopefully, this will increase in future versions!

Graphic capabilities

Graphics in the Raspberry Pi are provided by a Videocore 4 GPU. The graphic performance of the graphics processing unit (GPU) is roughly equivalent to the Xbox, launched in 2011, which cost many hundreds of dollars. These might seem like very low specifications, but they are enough to play Quake 3 at 1080p and full HD movies.
There are two ways to connect a display to the Raspberry Pi. The first is using a composite video cable and the second is using HDMI. The composite output is useful as you are able to use any old TV as a monitor. The HDMI output is recommended however, as it provides superior video quality. A VGA connection is not provided on the Raspberry Pi as it would be cost prohibitive. However, it is possible to use an HDMI to VGA/DVI converter for users who have VGA or DVI monitors.

The Raspberry Pi also supports an LCD touchscreen. An official version has not been released yet, although many unofficial ones are available. The Raspberry Pi Foundation says that they expect to release one this year.

The Raspberry Pi model

The Raspberry Pi has several different variants: the Model A and the Model B. The Model A is a low-cost version and unfortunately omits the USB hub chip. This chip also functions as a USB to an Ethernet converter. The Raspberry Pi Foundation has also just released the Raspberry Pi Model B+ that has extra USB ports and resolves many of the power issues surrounding the Model B and Model B USB ports.

<table>
<thead>
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<th>Model B</th>
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Did you know that the Raspberry Pi is so popular that if you search for raspberry pie in Google, they will actually show you results for the Raspberry Pi!
The Raspberry Pi and Raspbian

Accessories
The success of the Raspberry Pi has encouraged many other groups to design accessories for the Raspberry Pi, and users to use them. These accessories range from a camera to a controller for an automatic CNC machine. Some of these accessories include:

<table>
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<th>Accessories</th>
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<td>Case</td>
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Raspbian
No matter how good the hardware of the Raspberry Pi is, without an operating system it is just a piece of silicon, fiberglass, and a few other materials. There are several different operating systems for the Raspberry Pi, including RISC OS, Pidora, Arch Linux, and Raspbian.

Currently, Raspbian is the most popular Linux-based operating system for the Raspberry Pi. Raspbian is an open source operating system based on Debian, which has been modified specifically for the Raspberry Pi (thus the name Raspbian). Raspbian includes customizations that are designed to make the Raspberry Pi easier to use and includes many different software packages out of the box.

Raspbian is designed to be easy to use and is the recommended operating system for beginners to start off with their Raspberry Pi.

Debian
The Debian operating system was created in August 1993 by Ian Murdock and is one of the original distributions of Linux.

As Raspbian is based on the Debian operating system, it shares almost all the features of Debian, including its large repository of software packages. There are over 35,000 free software packages available for your Raspberry Pi, and they are available for use right now!
An excellent resource for more information on Debian, and therefore Raspbian, is the Debian administrator's handbook. The handbook is available at http://debian-handbook.info.

**Open source software**
The majority of the software that makes up Raspbian on the Raspberry Pi is open source. Open source software is a software whose source code is available for modification or enhancement by anyone.

The Linux kernel and most of the other software that makes up Raspbian is licensed under the GPLv2 License. This means that the software is made available to you at no cost, and that the source code that makes up the software is available for you to do what you want to. The GPLv2 license also removes any claim or warranty. The following extract from the GPLv2 license preamble gives you a good idea of the spirit of free software:

"The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users....

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things."

**Raspbian components**
There are many components that make up a modern Linux distribution. These components work together to provide you with all the modern features you expect in a computer.

There are several key components that Raspbian is built from. These components are:

- The Raspberry Pi bootloader
- The Linux kernel
- Daemons
- The shell
- Shell utilities
The Raspberry Pi and Raspbian

- The X.Org graphical server
- The desktop environment

The Raspberry Pi bootloader
When your Raspberry Pi is powered on, a lot of things happen behind the scene. The role of the bootloader is to initialize the hardware in the Raspberry Pi to a known state, and then to start loading the Linux kernel. In the case of the Raspberry Pi, this is done by the first and second stage bootloaders. The first stage bootloader is programmed into the ROM of the Raspberry Pi during manufacture and cannot be modified. The second and third stage bootloaders are stored on the SD card and are automatically run by the previous stage bootloader.

The Linux kernel
The Linux kernel is one of the most fundamental parts of Raspbian. It manages every part of the operation of your Raspberry Pi, from displaying text on the screen to receiving keystrokes when you type on your keyboard.

The Linux kernel was created by Linus Torvalds, who started working on the kernel in April 1991. Since then, groups of volunteers and organizations have worked together to continue the development of the kernel and make it what it is today.

Did you know that the cost to rewrite the Linux kernel to where it was in 2011 would be over $3 billion USD?

The Linux logo is a penguin named Tux:

If you want to use a hardware device by connecting it to your Raspberry Pi, the kernel needs to know what it is and how to use it. The vast majority of devices on the market are supported by the Linux kernel, with more being added all the time. A good example of this is when you plug a USB drive into your Raspberry Pi. In this case, the kernel automatically detects the USB drive and notifies a daemon that automatically makes the files available to you.
When the kernel has finished loading, it automatically runs a program called init. This program is designed to finish the initialization of the Raspberry Pi, and then to load the rest of the operating system. This program starts by loading all the daemons into the background, followed by the graphical user interface.

**Daemons**

A daemon is a piece of software that runs behind the scenes to provide the operating system with different features. Some examples of a daemon include the Apache web server, Cron, a job scheduler that is used to run programs automatically at different times, and Autofs, a daemon that automatically mounts removable storage devices such as USB drives.

A distribution such as Raspbian needs more than just the kernel to work. It also needs other software that allows the user to interact with the kernel, and to manage the rest of the operating system. The core operating system consists of a collection of programs and scripts that make this happen.

**The shell**

After all the daemons have loaded, init launches a shell. A shell is an interface to your Raspberry Pi that allows you to monitor and control it using commands typed in using a keyboard. Don’t be fooled by this interface, despite the fact that it looks exactly like what was used in computers 30 years ago. The shell is one of the most powerful parts of Raspbian.

There are several shells available in Linux. Raspbian uses the **Bourne again shell (bash)** This shell is by far the most common shell used in Linux.

```
root@raspberrypi:~ # apt-get install screen
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  screen
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 616 kB of archives.
After this operation, 1.624 kB of additional disk space will be used.
Get:1 http://ftp.uk.debian.org/debian/ squeeze/main screen armel 4.0.3-6
Fetched 616 kB in 0s (1.194 kB/s)
Selecting previously unselected package screen.
(Reading database ... 49685 files and directories currently installed.)
Unpacking screen (from .../screen_4.0.3-14+b1_armel.deb) ...
Processing triggers for man-db ...
Processing triggers for install-info ...
Setting up screen (4.0.3-14+b1) ...
root@raspberrypi:~ # screen bash
```
Bash is an extremely powerful piece of software. One of bash's most powerful features is its ability to run scripts. A script is simply a collection of commands stored in a file that can do things, such as run a program, read keys from the keyboard, and many other things. Later on in this book, you will see how to use bash to make the most from your Raspberry Pi!

**Shell utilities**

A command interpreter is not much of use without any commands to run. While bash provides some very basic commands, all the other commands are shell utilities. These shell utilities together form one of the important parts of Raspbian (essential as without the utilities, the system would crash). They provide many features that range from copying files, creating directories, to the Advanced Packaging Tool (APT) - a package manager application that allows you to install and remove software from your Raspberry Pi.

You will learn more about APT later in this book.

**The X.Org graphical server**

After the shell and daemons are loaded, by default the X.Org graphical server is automatically started. The role of X.Org is to provide you with a common platform from which to build a graphical user interface. X.Org handles everything from moving your mouse pointer, listening, and responding to your key presses to actually drawing the applications you are running onto the screen.

**The desktop environment**

It is difficult to use any computer without a desktop environment. A desktop environment lets you interact with your computer using more than just your keyboard, surf the Internet, view pictures and movies, and many other things. A GUI normally uses Windows, menus, and a mouse to do this.

Raspbian includes a graphical user interface called Lightweight X11 Desktop Environment or LXDE. LXDE is used in Raspbian as it was specifically designed to run on devices such as the Raspberry Pi, which only have limited resources.
Later in this book, you will learn how to customize and use LXDE to make the most of your Raspberry Pi.

A screenshot of the LXDE desktop environment

**Summary**

In this chapter, you learnt what the Raspberry Pi is, about the Raspberry Pi Foundation and its history. You also learnt the basic building blocks of an operating system in general, and Raspbian in particular. In the next chapter, we will learn how to get your shiny new Raspberry Pi up and running!
Where to buy this book

You can buy Learning Raspbian from the Packt Publishing website.

Alternatively, you can buy the book from Amazon, BN.com, Computer Manuals and most internet book retailers.

Click here for ordering and shipping details.