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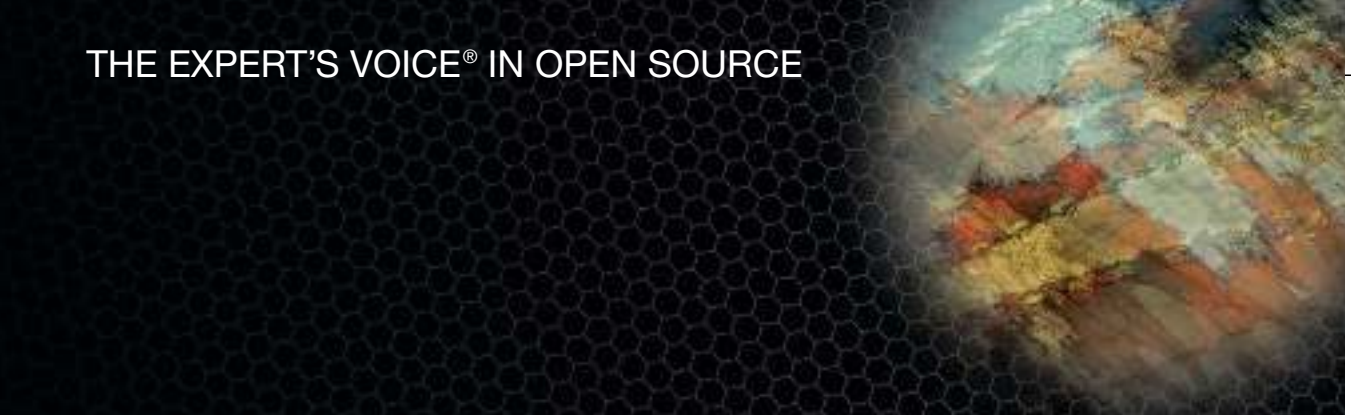

From Bash to Z Shell

Conquering the Command Line

Oliver Kiddle, Jerry Peek,
and Peter Stephenson

Apress®

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About the Authors

OLIVER KIDDLE was first introduced to Unix systems while studying at the University of York. Since graduating in 1998, Oliver has worked as a software developer and system administrator. Over the past five years, Oliver has been actively involved with the development of the Z shell.

JERRY PEEK is a freelance writer and instructor. He has used shells extensively and has taught users about them for over 20 years. Peek is the "Power Tools" columnist for *Linux Magazine* and coauthored the book *Unix Power Tools* (O'Reilly Media).

PETER STEPHENSON grew up in northeast England and studied physics at Oxford. After nine years as a researcher in computational physics, he became a software engineer with Cambridge Silicon Radio, where he now works on short-range digital radio. He has been involved with `zsh` since the early 1990s and currently coordinates its development.

About the Technical Reviewers

BART SCHAEFER has served as a key architect and senior developer of e-mail systems for more than 15 years, creating flexible and scalable solutions with an emphasis on open standards. Before cofounding iPost he was a founder of Z-Code Software, whose groundbreaking multiplatform e-mail application, Z-Mail, won numerous awards. Dr. Schaefer contributes regularly to open software projects, including SpamAssassin and `zsh`. He holds a PhD in computer science from the Oregon Graduate Institute, focusing on automated process distribution and scheduling for massively parallel computer systems, and a BSS in computer science from Cornell College.

ED SCHAEFER is an ex-paratrooper, an ex-military intelligence officer, and an ex-oil field service engineer. He's not a total has-been. Presently, he's a software developer and DBA for a Fortune 50 company—a Unix island in a sea of Windows. He's also a contributing editor to *Sys Admin, the Journal for UNIX and Linux Systems Administrators*, and edits *Unix Review*'s monthly "Shell Corner" column at `http://www.unixreview.com`.

Acknowledgments

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Jerry Peek's portrait is by Meredith Hayes.

Preface

A shell is a sophisticated way to control your computer—Unix, Linux, Microsoft Windows, Mac OS X, and others. If you do more than the most basic operations, you can do many of them more powerfully and quickly with a shell and your keyboard than by using a mouse.

The history of shells goes back some 30 years. In the early days of the Unix operating system, choosing and customizing your interface to a computer was a new idea. (It still *is* new to many people today, users of "one-size-fits-all" window systems that can be changed only superficially.) Before windows and a mouse were common, programmers began developing an interface that used the keyboard: typing one or a few words to run programs, then reading results from the same screen. As time went on, more shells were developed, giving users more choices.

New features have been added continually over the years, making the modern shell an incredibly rich environment that saves power users hours of time and frustration. Tasks that take lots of repetitive work with a mouse can be automated. For example, shell features such as *completion* let you accomplish a lot with little typing.

A shell can work in two ways. You can use it interactively to do things by hand. You can also automate a task by packaging those same operations into a *script* or *function*. Learning shell features lets you do both of those because a shell is a user interface and a programming language in one.

The shells we discuss run on many operating systems. What you learn about shells will let you use all of these operating systems in the same way. If you use more than one operating system, a shell gives you a powerful and familiar interface to all of them.

There are several major shells. Because each has its differences, covering all of the shells could make a book that's both confusing and unwieldy. We've concentrated on `bash` and `zsh`, two of the most modern and powerful shells. Both are freely available; in fact, they're installed on many of the systems we've listed and can be downloaded from the Internet for the rest.

- `bash` is the de facto standard shell on Linux. `bash` runs most scripts written for other Bourne-type shells, including the original Unix shell `sh`, and it has a growing list of features.
- `zsh`, also called Z shell, is an extremely powerful shell that's not as well known as `bash`. `zsh` combines most of the best features of several shells, including C-type shells such as `tcsh`. However, its basic usage is similar to `bash`.

  This book provides the first comprehensive Z shell coverage that we know of. If you consider yourself a power user (or if, after reading what shells can do, you want to *become* a power user!), you owe it to yourself to get familiar with all that `zsh` can do to make your work easier.

Covering both `bash` and `zsh` shows you what features the two shells have in common as well as their different approaches to the same tasks.

How This Book Is Structured

This book is divided into three parts consisting of 15 chapters. Part 1, *Introducing the Shell*, contains Chapters 1 through 3. Part 2, *Using bash and zsh*, is made up of Chapters 4 through 11. Part 3, *Extending the Shell*, includes Chapters 12 through 15. The book also has three appendices: a list of Unix-like commands, a list of resources, and a glossary. In this section we offer a brief introduction of each chapter.

Chapter 1: Introduction to Shells

This chapter covers the highlights of shells. Topics include: what a shell is, how to start one, the parts of a command line, running simple Unix commands and getting help with them, an introduction to the filesystem and how to use files by typing only part of their names, how the shell finds the programs you need, how the shell processes command lines, and recalling and editing command lines.

Chapter 2: Using Shell Features Together

Here we introduce several important features, including rerouting a program's input and output, using utility programs to edit text automatically, running loops (repeating a series of commands), handy command-line techniques, and more. The emphasis, though, is on one of the capabilities that make shells so useful: that you can combine programs, together with features of the shell, to do completely new things.

Chapter 3: More Shell Features

This chapter moves more slowly through several other major shell topics: passing information between programs, managing processes, using quoting to control how the shell interprets a command line, and a time-saving technique for moving through the filesystem.

Chapter 4: Entering and Editing the Command Line

When you use a shell interactively, you tell it what to do by typing commands on its command line. (When programming the shell, as we'll discuss in Chapter 13, you put those same commands into a shell function or a file.) Chapter 4 covers the command line in depth—including how to fix errors and how to save time by reusing previous command lines. This chapter also covers the interaction of a shell with its window (a terminal).

Chapter 5: Starting the Shell

A shell can be customized to work the way you want it to by setting its options and variables, by installing your own commands, and more. You can do this interactively (from the command line) after the shell has started. You can also customize the shell automatically each time it starts. Chapter 5 shows how.

Chapter 6: More About Shell History

Chapter 4 introduced shell history—a remembered list of previous command lines. Chapter 6 describes how to save, recall, and share history between shells. It also covers a way to let you reuse parts of previous command lines in later ones.

Chapter 7: Prompts

When the shell needs to ask you something (for instance, "Do you want to change the spelling of this word?") or tell you something (such as "You can enter a command line now"), it prompts you. Like almost everything about the shells, the prompt can be customized to show information you want, as you want it. This chapter shows you how.

Chapter 8: Files and Directories

One of a shell's greatest strengths is the power and control it gives you for working with files. This chapter highlights some useful information about files on a Unix-type system such as Linux and Mac OS X (also under Microsoft Windows, with Cygwin). Next it discusses how to refer to and use files from the shell.

Chapter 9: Pattern Matching

This chapter carries on from Chapter 8, showing one of the most useful and work-saving techniques in a shell: finding one or many files by their names and other characteristics. After seeing these powerful techniques, you might wish that the file-handling menus on your graphical applications (word processors, for instance) had a shell built in.

Chapter 10: Completion

One handy shell feature that *is* available on some graphical file-handling menus is filename completion: the ability to type the first few characters of a filename and have the remaining characters completed for you. As this chapter shows, modern shells have extended this basic idea in many ways. This chapter covers the many aspects of `bash`'s and `zsh`'s completion systems and the ways in which their behavior can be configured.

Chapter 11: Jobs and Processes

Shells let you control multiple programs (multiple processes) from a single terminal: starting them, suspending them, ending them early, and more. The shell lets you control some of the resources that a process uses—the amount of memory, for example. And, shells being the flexible tools that they are, there's more.

Chapter 12: Variables

Variables are places to store information within the shell and to pass information between the shell and other programs (processes). Variables are used to customize the shell and to keep something you want to reuse later (like a filename), and they are especially useful if you're programming.

Chapter 12 shows how data stored in variables can be manipulated. In addition, Chapter 12 shows how to use the shell's built-in math facilities.

Chapter 13: Scripting and Functions

The shell incorporates a full programming language. Chapter 13 covers features like loops and condition tests, which allow powerful things to be done just from the command line. Often, however, it can be useful to save a set of commands for later reuse—including some commands you just ran from the command line.

This "duality" ability of the shell—where it lets you use the same language for controlling your system interactively as for writing programs (to do things automatically)—is, as we've said, one of the great things about shells. The focus of Chapter 13 is on how you can write programs with the shell and how you can use these programs to extend the basic functionality of the shell.

Chapter 14: Writing Editor Commands

The Z shell has a completely configurable editor built in. This chapter explains how you can add new commands to your zsh editor.

Chapter 15: Writing Completion Functions

Chapter 10 shows how completion works "out of the box." If that's not enough for you, both bash and zsh also let you write your own custom completion definitions. Chapter 15 explains how.

Who Should Read This Book

Although shells are sophisticated, they aren't just for experts. For those of you without considerable shell experience, we've carefully chosen topics and a manner of instruction that will enable you to immediately begin using shells at a new level of proficiency. In particular, Part I of this book will help prepare you for some of the more advanced topics that follow throughout the remainder of the book.

Expert users interested in maximizing their already efficient use of the command line will find the hundreds of tips, tricks, and hidden gems that we present throughout this book quite useful. Based on our years of experience immersed in command-line interaction, we're well aware of the features that can even further improve your shell proficiency, and condense that knowledge into this book.

Prerequisites

This book covers bash version 3.0 and zsh version 4.2. Most of this material applies to other versions of these two shells—especially bash 2.04 and zsh 4.0—and the concepts apply to other shells as well.

You can download all of the latest versions of both of these shells—as well as the Cygwin package you'll need for Microsoft Windows—for free on the Internet. If your system didn't come with a version you like available, don't be concerned: this software is the highest quality, maintained by groups of professional programmers who want the very best software for their own use.

There's more information about the software and where to get it in Appendix B.

Tips for Reading Technical Material

If you've found that reading technical topics can be a challenge, here are tips that may help:

- **Reading technical material is different than reading a novel:** In technical writing, the authors aren't trying to disguise secrets or surprise you. They're giving you information as clearly as they can. Instead of trying to obscure the clues to the "mystery," they're laying them out in front of you. But even words spelled out clearly don't always mean that a concept will be obvious at first.

- **Put on your detective's cap:** If the puzzle doesn't seem to be coming together, go back and see what the missing parts are. This can take some time and effort: learning something new isn't always easy! But, like reading a good mystery novel, finding the answer—putting the puzzle together—is well worth the time you spend.

- **If something's missing, find it:** Read each paragraph, or each group of a few paragraphs, then be sure the new concepts make sense before you go on. Sometimes they just won't make sense; there might be a missing piece to the puzzle. If that happens, try going back and reviewing what you've read before.

- **Check for understanding as you go:** Most sentences aren't "flat"—they're out trying to make a point, or to introduce a new idea or to tie some ideas together. For instance, after you've read a while and learned some new concepts, you might see a sentence like this:

  ```
  The list of directories comes from the standard output of tr.
  ```

  It's best not to just say "Oh, umm-hmm" and keep reading. Instead, you should ask yourself a question like "On the basis of what I've read before, does that sentence make sense?" or "Do I agree with what the sentence says?" You could also ask yourself about each part of the sentence, like "What list?" or "What's a directory?" or "What's the standard output again?" or "What does tr do and why does it write to its standard output?" If you aren't sure, don't read too much more before you go back to hunt for the missing clues.

- **Talk it over:** If you have some questions, and you have some computer-literate friends, talk it over with them. Discuss the problem—and, if you'd like to learn more than just the answer, discuss the topic in general. Explaining a problem to someone else, and being sure that each of you understands the other, is a great way to increase understanding.

  This is true even if your friends don't know about shell scripts! Then they won't only be impressed at what you're doing, soon your friends will be studying scripts, too, and possibly asking you for advice!

- **Please experiment:** Experimenting on your system is a great way to learn and to check your understanding—if that is, you're careful about programs that could do damage, like rm, a program that removes files. For instance, as you read through a section, take some of the provided examples and change them slightly to see how that affects the results... then be sure you understand why.

We don't assign formal exercises in this book, but you could come up with a practical problem and see how to handle it. As an example, after you've learned how to remove many files at once by using a wildcard, create a lot of dummy files and try to remove them.

Contacting the Authors

You can send e-mail to the authors at `shellbook@jpeek.com`. While we can't promise to answer every message, we will do our best, and you can be sure that we *will* read every one. Thanks in advance for your messages.

We've listed some good places to get more information in Appendix B.