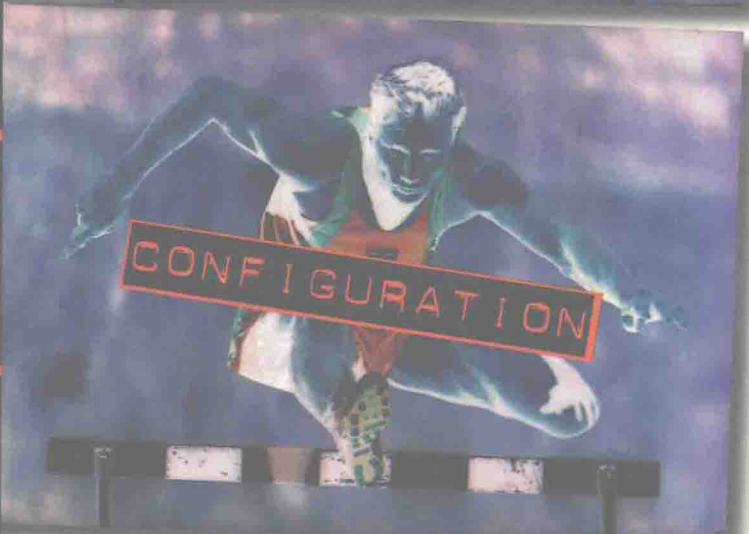


X D N I J



MICHAEL
KOFER



CD-ROM
included

LINUX

Installation, configuration, and use

Michael Kofler



Addison-Wesley

Harlow, England • Reading, Massachusetts • Menlo Park, California • New York
Don Mills, Ontario • Amsterdam • Bonn • Sydney • Singapore • Tokyo • Madrid
San Juan • Milan • Mexico City • Seoul • Taipei

First published by Addison-Wesley (Deutschland) GmbH 1996
as *LINUX: Installation, Konfiguration, Anwendung*

© Addison Wesley Longman 1997

Addison Wesley Longman Limited
Edinburgh Gate
Harlow
Essex
CM20 2JE
England

and Associated Companies throughout the World.

The right of Michael Kofler to be identified as the author of this Work has been asserted by him in accordance with the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without either the prior written permission of the publisher or a licence permitting restricted copying in the United Kingdom issued by the Copyright Licensing Agency Ltd, 90 Tottenham Court Road, London W1P 9HE.

The programs in this book have been included for their instructional value. They have been tested with care but are not guaranteed for any particular purpose. The publisher does not offer any warranties or representations nor does it accept any liabilities with respect to the programs.

Translated and typeset by Logotechnics Sales & Marketing Ltd., Sheffield
Cover designed by Designers and Partners, Oxford
and printed by the Riverside Printing Co. (Reading) Ltd.

Printed and bound in the United States of America

First printed 1997

ISBN 0-201-17809-5

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library

Preface

LINUX is a thoroughly unbelievable operating system. How it came into being is unbelievable: LINUX – a complete, UNIX compatible operating system – has not been developed by a huge software empire, but is the outcome of the cooperation of a vast number of computer boffins (led by Linus Torvalds) working together over a number of years.

Its price is also unbelievable: LINUX is free and is distributed on a CD together with this book! ‘Free’ refers to both price and availability of source code. If you are not happy with LINUX, you may (if you are familiar enough with programming) try to solve your particular problem yourself.

Its documentation and support are unbelievable: while printed documentation obviously cannot be provided within a no-charge system (except for installation manuals which come with some distributions), there are numerous online documents which describe nearly every aspect of LINUX usage. If, in spite of all this, you still have problems, or discover an error, you can address one of the LINUX news-groups – and chances are you will get an answer back within a couple of days (sometimes hours).

Originally LINUX was just a toy for computer freaks, but today this has changed completely: LINUX has become the predominant UNIX platform for the PC. More and more Web servers worldwide run under LINUX. The number of commercial programs ported to LINUX increases every week. Some LINUX distributions have achieved POSIX certification. Commercial distributions, such as LINUX Caldera, have made LINUX more interesting for professional users than ever before.

Why this book?

The aim of this book is to provide the reader with a competent introduction to the handling of LINUX – from installation and usage to simple programming. This book should be helpful in getting acquainted with LINUX as quickly as possible, without wasting time on installation problems or searching for online documentation. At the same time, it shows the most relevant basic features of LINUX and UNIX, so that you can understand your LINUX system and become capable of configuring it to your own requirements.

We must be careful not to raise too many expectations: this book obviously cannot cover every single aspect of LINUX – even ten books of this size would not be up to such a task. However, the matters we do cover – whether it is how to use the standard shell (bash) or how to connect your computer to the Internet – are described in sufficient depth that you can work effectively with LINUX and its programs. Rather than being offered a superficial listing of the many programs that run under LINUX, you have here a detailed description of the main components.

The CD which comes with this book contains a complete LINUX system including the most important application programs (it is an up-to-date version of the RedHat distribution). To install it, all you need is a PC with a CD-ROM drive. Installation and configuration details are described extensively in the first part of this book.

With Linux into the future!

- If you need a cost-effective entry to the Internet or a stable network server,
- if you no longer wish to be at the mercy of big software houses for better or for worse (usually the latter),
- if stability and data security are more important for you than colorful icons,
- if you want to look inside your operating system,
- if you want to gather experience with the most varied programming languages (from C++ to SmallTalk),

then LINUX is for you. Let yourselves get carried away by my own enthusiasm for LINUX!

Michael Kofler <kofler@ping.at>

<http://www.addison-wesley.de/Service/Kofler/home.html>

Acknowledgments

I would like to thank Marc Ewing and Bob Young of RedHat, whose excellent LINUX distribution could be used as a base for the CD-ROM. Many thanks to Markus Dickebohm for the text on offline news configuration and to Chris Blum for the underlying programs. Warm thanks also to Mathias Dümmler, Jochen Hein, Eberhard Mönkeberg, Thomas Ploss, Sven Probst, Joachim Schreiber, Dirk vom Stein and all the people who supplied me with advice, told me about numerous errors and flaws in the first German edition, and helped to improve this book with their constructive criticism.

Structure of the book

This book is divided into four parts:

- Part I (Chapters 1 to 4) explains installation and first-time usage of LINUX.
- Part II (Chapters 5 to 7) provides much information on the optimum LINUX configuration. It also supplies the necessary basic knowledge.
- Part III (Chapters 8 to 13) describes how to apply the LINUX system. A substantial part of Part III is also valid for most other UNIX systems (not only for LINUX).
- Part IV (Chapters 14 to 16) covers some fairly simplified characteristics of programming under LINUX.

Part I first answers some elementary questions about LINUX: What is LINUX? How did it originate? What is a distribution? Chapter 2 explains the installation of LINUX. (Detailed information about how to install the RedHat, Caldera, Slackware, and SuSE distributions follows in Appendices A to D.) Chapter 3 provides a quick-start guide to running a LINUX system: login, logout, shutdown, file handling, displaying and editing files, and so on. Chapter 4 is also very useful when you are taking your first steps with LINUX: it describes where you can find online documentation about LINUX.

Part II begins with a chapter about the basics of LINUX, such as its file system structure, the integration of various hardware components under LINUX (for example, mouse, floppy disk drive, streamer), process administration, the boot process, and so on. This chapter is not necessarily a prerequisite for the following chapters about configuration, but it makes their understanding considerably easier. The remaining chapters cover the subjects of basic configuration, elementary network configuration, kernel configuration, and X configuration.

Part III assumes that LINUX has been installed and configured to such an extent that you can comfortably work with it. Chapter 8 describes the operation of bash, which is the standard shell for entering commands under LINUX. Chapter 9 gives an overview of the most important commands available under LINUX (ls, cp, find, grep, and so on).

Chapter 10 describes the standard tools that simplify your everyday work at a text terminal or an X Window terminal, such as the Midnight Commander (a file

manager similar to Norton Commander), `recode` (for the conversion of text files between LINUX and DOS/Windows), `xterm` (a terminal window for X), tools for the handling of PostScript files and the processing of images, and so on.

Two special chapters have been dedicated to the two most important program packages for many LINUX users, namely the Emacs editor and the \LaTeX typesetting software. Chapter 11 gives an introduction to the handling of GNU Emacs. Chapter 12 describes how to generate professional documents with \LaTeX (from a single letter to a whole book). Chapter 13 is the last (but certainly not the least important) chapter in the application part. It is dedicated to the Internet and describes the Internet connection of your computer via PPP or SLIP and the use of the most important Internet services: reading and writing email, data transfer using ftp, and surfing the World Wide Web.

Part IV, about programming under LINUX, is rather short, as the book primarily addresses the LINUX user. It is limited to the popular shell programming languages `bash` (Chapter 14) and Tcl/Tk (Chapter 15), which can be learned without great effort, but which nonetheless offer extensive possibilities for the automation of repetitive tasks. Part IV concludes with a chapter about Emacs programming, a concise introduction that shows how to configure Emacs to your own requirements.

The **appendices** deal with the installation details of some important LINUX distributions (RedHat, Caldera, Slackware, SuSE) and recent updates. There is also a contents list of the enclosed **CD-ROM**, a **Glossary** of the most important LINUX terms, and a **References** section.

What you won't find in this book

LINUX is too vast to be completely described in one book. In order to avoid disillusionment, here is a list of topics not to be found in this book.

- This book only touches upon the subject of programming. It provides an introduction to the `bash` and Tcl/Tk languages, but leaves out more professional languages, such as C, C++, Perl, and so on.
- Consequently, this book does not describe kernel internals and the corresponding program code. It does, however, explain how the kernel can be recompiled, thus allowing you to generate your own version of LINUX – optimized for your hardware configuration. No programming knowledge is required.
- A further gap concerns networking: the book describes some basics of network configurations (NFS, ftp, Internet access with a modem via PPP or SLIP), but only from the client point of view. If you want to use LINUX to run an Internet or Intranet server, you will need some more specific literature.
- Distribution-specific extensions and supplementary software are more or less ignored outside the appendices. This book attempts instead to describe the

common denominator of all or at least most **LINUX** distributions. For further information about specific (and mostly commercial) extensions, you will have to consult their accompanying manuals.

Icons

In order to make this book visually more attractive and for ease of reading, many paragraphs are marked with icons.



- This symbol indicates a note, that is, supplementary information which may be relevant to you only in special cases.



- More important are paragraphs marked with this danger sign: they indicate danger and possible sources of errors.



- You should not overlook tips for the solution of everyday problems. Sometimes it is only a simple matter, easily avoided, that makes the handling of **LINUX** unnecessarily difficult.



- Paragraphs containing cross-references to other sections of this book or to other books (*see* References at the end of this book) are indicated by a hand pointing to an open book.



- A lot of detailed documentation is available to you online after the installation of **LINUX** (or on the enclosed CD-ROM).



- **LINUX** cannot exist without the Internet. Even now, the most up-to-date versions of programs, documentation, and so on, can only be found on the Internet. You will find many links to ftp servers and WWW pages for **LINUX** on the author's home page (*see* Preface). If you do not have access to the Internet, do not despair: the contents of the most important **LINUX** servers are regularly transferred to CD-ROM and can be obtained at a relatively low cost as server mirror images.

Contents

Preface **v**

Why this book?	v
With LINUX into the future!	vi
Acknowledgments	vi

Structure of the book **xxi**

What you won't find in this book	xxii
Icons	xxiii

Part I Installation **1**

1 About LINUX **3**

1.1 What is LINUX?	3
1.2 What does LINUX offer?	5
1.3 Distributions	9
Some current LINUX distributions	10
1.4 The origin of LINUX	12
Legal matters – the General Public License	14

2 Installation **15**

2.1 Requirements	15
2.2 Overview of the installation process	16
2.3 Repartitioning your hard disk under DOS	19
Basics	19
Partition types	20

	How much space should be reserved for LINUX?	21
	Reducing a partition using FIPS	22
	Partitioning your hard disk with FDISK	24
2.4	Installation diskettes, boot kernel	28
	Background information	28
	Selecting the boot kernel	29
	Booting LINUX for the first time	31
2.5	Creating LINUX partitions	33
	About hard disk management	33
	Naming conventions for partitions	36
	The ideal LINUX configuration	37
	How to use fdisk	39
	How to use cfdisk	42
	Manual creation of swap partitions	43
2.6	Installing LINUX via NFS	43
2.7	Umsdos – LINUX for tasting	45
	Installation	45
2.8	Problems before, during, and after installation	46
	Boot parameters	46
	Installation from hard disk	52
	No CD-ROM access after installation	53
	The computer won't boot any more	54
	mount does not function	55
	Memory problems (RAM)	55
2.9	System changes and extensions	56
	Additional installation of packages	56
	Manual installation of additional programs using tar	57
	LINUX updates	57
2.10	Removing LINUX	58

3 LINUX quick start 59

3.1	From DOS to LINUX	59
	System startup	59
	Shutdown	60
	Handling text consoles	60
	Executing commands	61
	Keyboard specials	61
	Directories	62
	Files	62
3.2	Displaying and editing text files	63
	Emacs, Jove, and Jed	63
	Joe	64
	pico	64
	vi, vim, and elvis	64

Editors under X	65
3.3 The X Window System	65

4 Online documentation 67

4.1 Reading online documentation under DOS/Windows	67
4.2 man – the online manual for all commands	68
How to use man	69
Special features of the X version xman	70
tkman	71
man internals	72
Formatting man texts with groff	73
4.3 info – hypertext online help for GNU utilities and Emacs	74
4.4 LINUX-specific online documentation	76
FAQ – Frequently Asked Questions	77
HOWTO – how does that work?	77
LDP – the LINUX Documentation Project	79
Kernel documentation	79
Online documentation on the enclosed CD-ROM	80
4.5 WWW online help	80
WWW help systems of various distributions	80
HTML texts – how to make your own	81

Part II Configuration 83

5 LINUX fundamentals 85

5.1 Fundamentals of file management	85
Files and directories	86
Wildcards	87
Complications using wildcards	88
Wildcards for advanced users	89
Hidden files	90
Directories	90
LINUX directory structure (file system hierarchy standard)	91
Ownership and access privileges	93
Special rights and privileges	95
User and group administration	96
Hard links and symbolic links	97
Links to programs	99
Access to several hard disks (partitions)	99
Access to CD-ROM drives	101
Access to floppy disk drives	103
Access to streamers	103
Access to the RAM disk	104

5.2	File system internals	104
	File system types	104
	Internals of the ext2 file system	106
	Devices	110
	Information about process administration in the /proc directory	111
5.3	Process administration	112
	Background processes	113
	Distribution of CPU time	113
	Daemons	114
	Pipes	115
5.4	Libraries	115
	Problems with shared libraries	116
5.5	System start	117
	System V init process	118
	The Slackware pseudo System V init process	124

6 Configuration and administration 125

6.1	Elementary configuration steps	125
	Keyboard	126
	Function keys in bash	127
	Displaying foreign language characters in various programs	128
	Configuration of less	129
	Basic Emacs configuration	130
	Screen savers in text mode	131
	Inverse or colored text display	131
	Text mode with 80×50 characters	132
	Character sets in text mode	133
	Mouse support in text mode	133
	Time of day	134
	Setting the default editor	135
	Setting the input prompt	135
6.2	Registering users and passwords	136
	Defining a password for root	136
	Registering new users	136
	Access privileges	138
6.3	File system administration	138
	The fstab file	139
	Distributing LINUX file systems across several partitions	141
	Mounting DOS, Windows, and OS/2 partitions	144
	Mounting a CD-ROM drive	145
	Mounting swap partitions	145
	Mounting a swap file	146
6.4	Printer configuration	146
	Configuring lpd	147

	Spooler management	148
	Automatic conversion into printer format	149
6.5	Network configuration	150
	Basics	151
	Configuration files	154
	Configuring a small network with ftp and NFS	156
6.6	The boot process	160
	Creating a boot diskette	160
	Starting LINUX from DOS/Windows (LOADLIN)	161
	Configuring LILO	165
	Preconditions	166
	Creating a backup copy of the boot sector	167
	LILO configuration	167
	Installing LILO in a DOS partition (1024-cylinder limit)	169
	Installing LILO on a diskette	170
	Using LILO	172
	Removing LILO from the hard disk	173
6.7	Recompiling the kernel	173
	Installing/updating the kernel code	174
	Configuring the kernel	176
	Compiling and installing the kernel	179
	Modules	181
	System update when changing from kernel version 1.n to 2.0	183

7 Configuring the X Window System 185

7.1	Configuring the X server	185
	A minimalist X Glossary	186
	Monitor and video card fundamentals	187
	Configuring XFree86 3.1.2	190
	Configuring commercial X servers	203
7.2	Mouse and keyboard under X	204
	Keyboard configuration	204
	Global key combinations	208
	Input focus	208
	Configuring the mouse	208
	Using the mouse	209
7.3	Window managers	210
	The X startup process	212
	fvwm (Virtual Window Manager)	216
	fvwm 1.2n	217
	fvwm 2.0	221
	fvwm 95	222
	twm (Tab Window Manager)	223
	olwm (OpenLook window manager)	223

7.4	X resources	226
	Basics	226
	Resource files	227

Part III Application 229

8 bash – a modern command interpreter 231

8.1	What is a shell?	231
	Changing to a different shell	232
	Changing the default shell	232
8.2	Command input	232
	Expansion of command and file names	233
	Important keyboard shortcuts	234
	Alias abbreviations	235
8.3	Input and output redirection	236
	Pipes	237
	Output multiplication using tee	237
	Syntax summary	238
8.4	Command execution	238
	Background processes	238
	Execution of several commands	239
8.5	Substitution mechanisms	240
	File name generation using wildcards	240
	Character string generation using braces	242
	Calculation of arithmetic expressions in square brackets	242
	Command substitution	243
	Special characters in character strings	244
8.6	Shell variables	244
	Local and global variables (environment variables)	246
	Important shell variables	246

9 Command reference 249

9.1	Command overview by subject	249
9.2	Alphabetical command reference	253

10 Tools and utilities 303

10.1	File management with the Midnight Commander	303
10.2	Conversion of DOS/Windows text files	305
	Manual conversion of text files	305
	Automatic conversion	306
10.3	X utilities	306
	xterm and other terminal programs	307
	Text and graphics editors	308

File managers	309
Tools	313
10.4 PostScript tools	315
Introduction	315
a2ps for ASCII to PostScript format conversion	317
mpage for printing out several pages onto one sheet	318
dvips for *.dvi to PostScript conversion	319
dvilj for *.dvi to Laserjet format conversion	320
GhostScript for conversion of PostScript into other formats	321
ghostview for PostScript document viewing	323
psutils (PostScript file processing utilities)	324
xdvi for *.dvi file viewing	325
10.5 Image processing, screen shots	327
The graphics program xv	327
xgrab – screen shots for the advanced user	329

11 Emacs – king of all editors **331**

11.1 Quick start	331
Minimal configuration	332
Loading and saving texts, quitting Emacs	332
Elementary commands	333
Processing modes	334
Structure of the screen	334
Keyboard conventions	335
Mouse support	336
Menus	336
Versions	336
11.2 Online help	336
11.3 Cursor movement	338
Saving cursor positions in registers	339
11.4 Marking, deleting, and inserting text	339
Intermediate storage of texts in registers	340
11.5 Elementary editing commands	341
Deleting and overwriting of text	341
Changing upper and lower case spelling	341
Exchanging letters, words, and lines	342
Tabulators	342
Manual indenting and outdenting of text	342
11.6 Flow text in Emacs	343
Indenting flow text	344
Indented text mode	345
11.7 Searching and replacing	346
Incremental search	346
Pattern search (with regular expressions)	346

Searching and replacing	347
11.8 Buffers and windows	348
Buffer commands	349
Window commands	349
11.9 \LaTeX , C and other processing modes	350
\TeX and \LaTeX modes	351
C mode	352
Tcl mode	354
Using Emacs as a shell	354
11.10 Emacs for advanced users	354
Abbreviations	354
Macros	356
Client/server operation	357
Entering foreign language special characters	358
11.11 Emacs and the X Window System	358
Keyboard	359
Mouse support	359
Menu commands	360
X-specific options and resources	360
Colored syntax highlighting	361

12 $\text{\LaTeX}2_{\epsilon}$ 363

12.1 Introduction	364
\LaTeX and the most important utility programs	364
Error detection in \LaTeX tests	367
Introductory example	368
Problems with different \LaTeX distributions	372
The \LaTeX directory tree	372
12.2 Elementary \LaTeX commands	374
Formal details	374
Structuring of texts	374
Fonts and attributes	376
Special characters and accents	378
Tables	380
Bulleted and numbered lists	381
Multi-column text	382
Frames	383
12.3 Typesetting scientific texts	383
Table of contents	384
Cross-references	384
Footnotes	385
References or bibliography	385
Figures	386
Index	388

12.4	Mathematical formulae	390
	Formalities	390
	Important commands for formula construction	391
	Parentheses and brackets	393
	Matrices	393
	Special mathematical characters	394
	Vector arrows and derivation symbols	395
	Greek and calligraphic letters	395
12.5	Layout control	395
	Hyphenation	396
	Word spacing and horizontal spacing	396
	Line breaking and vertical spacing	397
	Forced page break	398
	User-defined headings	398
	Global layout settings	399
12.6	Metafonts and PostScript fonts	400
	Metafont fundamentals	401
	Printing at a resolution higher than 300 dpi	402
	Font files	403
	Using PostScript fonts	403
12.7	\LaTeX for advanced users	404
	Macros	405
	Processing long texts	405
12.8	$\LaTeX 2_{\epsilon}$ versus \LaTeX 2.09	406
	Working with \LaTeX 2.09	406
	Compatibility problems with $\LaTeX 2_{\epsilon}$	407

13 Going Internet with LINUX 409

13.1	Introduction	409
	About the Internet	410
	Internet Services	411
	Cost of the Internet	413
	Internet via telephone	413
13.2	Hardware requirements	416
	Modems	417
	Serial interfaces	417
13.3	Terminal emulators	420
	minicom	421
	seyon	424
13.4	Internet access via PPP/SLIP	426
	PPP/SLIP glossary	427
	Preconditions	429
	PPP	430
	SLIP and CSLIP	437