

WHERE THE KERNEL MEETS THE HARDWARE

3rd Edition

LINUX DEVICE DRIVERS



O'REILLY®

JONATHAN CORIET, ALESSANDRO RUBINI
& GREG KROAH-HARTMAN

Linux Device Drivers 3rd Edition

Philip Hazel



Linux Device Drivers 3rd Edition:

Linux Device Drivers Jonathan Corbet, Alessandro Rubini, Greg Kroah-Hartman, 2005-02-07 Device drivers literally drive everything you're interested in: disks, monitors, keyboards, modems, everything outside the computer chip and memory. And writing device drivers is one of the few areas of programming for the Linux operating system that calls for unique Linux-specific knowledge. For years now, programmers have relied on the classic *Linux Device Drivers* from O'Reilly to master this critical subject. Now in its third edition, this bestselling guide provides all the information you'll need to write drivers for a wide range of devices. Over the years, the book has helped countless programmers learn how to support computer peripherals under the Linux operating system, how to develop and write software for new hardware under Linux, the basics of Linux operation even if they are not expecting to write a driver. The new edition of *Linux Device Drivers* is better than ever. The book covers all the significant changes to Version 2.6 of the Linux kernel, which simplifies many activities and contains subtle new features that can make a driver both more efficient and more flexible. Readers will find new chapters on important types of drivers not covered previously, such as consoles, USB drivers, and more. Best of all, you don't have to be a kernel hacker to understand and enjoy this book. All you need is an understanding of the C programming language and some background in Unix system calls. And for maximum ease of use, the book uses full-featured examples that you can compile and run without special hardware. Today, Linux holds fast as the most rapidly growing segment of the computer market and continues to win over enthusiastic adherents in many application areas. With this increasing support, Linux is now absolutely mainstream and viewed as a solid platform for embedded systems. If you're writing device drivers, you'll want this book. In fact, you'll wonder how drivers are ever written without it.

Linux Device Drivers Jessica McKellar, Alessandro Rubini, Jonathan Corbet, 2015-02-25 Having already helped two generations of programmers explore Linux and write devices, the fourth edition of this classic book delves into tty, USB, and HCI devices such as keyboards in addition to basic character devices. *Linux Device Drivers* includes numerous full-featured examples that you can compile and run without special hardware. Written by well-known leaders in Linux development and programming, this book covers significant changes to Version 3.2 of the Linux kernel, the basis of the Precise Pangolin release of Ubuntu. All you need to get started is an understanding of the C programming language and some background in Unix system calls. Learn how to support computer peripherals under the Linux operating system. Develop and write software for new hardware that Linux supports. Understand the basics of Linux operation even if you don't expect to write a driver. Dive into new chapters on video, audio, wireless, and Bluetooth devices. As the operating system for Android and many embedded systems, Linux constantly needs new device drivers. This book helps you get it done.

[Easy Linux Device Driver, Second Edition](#) Mahesh Sambhaji Jadhav, 2014-03-13 *Easy Linux Device Driver: First Step Towards Device Driver Programming*. *Easy Linux Device Driver* book is an easy and friendly way of learning device driver programming. Book contains all latest programs along with output screen screenshots. Highlighting important sections.

and stepwise approach helps for quick understanding of programming Book contains Linux installation Hello world program up to USB 3.0 Display Driver PCI device driver programming concepts in stepwise approach Program gives best understanding of theoretical and practical fundamentals of Linux device driver Beginners should start learning Linux device driver from this book to become device driver expertise Topics covered Introduction of Linux Advantages of Linux History of Linux Architecture of Linux Definitions Ubuntu installation Ubuntu Installation Steps User Interface Difference About KNOPIX Important links Terminal Soul of Linux Creating Root account Terminal Commands Virtual Editor Commands Linux Kernel Linux Kernel Internals Kernel Space and User space Device Driver Place of Driver in System Device Driver working Characteristics of Device Driver Module Commands Hello World Program pre settings Write Program Printf function Makefile Run program Parameter passing Parameter passing program Parameter Array Process related program Process related program Character Device Driver Major and Minor number API to registers a device Program to show device number Character Driver File Operations File operation program Include h header Functions in module h file Important code snippets Summary of file operations PCI Device Driver Direct Memory Access Module Device Table Code for Basic Device Driver Important code snippets USB Device Driver Fundamentals Architecture of USB device driver USB Device Driver program Structure of USB Device Driver Parts of USB end points Important features USB information Driver USB device Driver File Operations Using URB Simple data transfer Program to read and write Important code snippets Gadget Driver Complete USB Device Driver Program Skeleton Driver Program Special USB 3.0 USB 3.0 Port connection Bulk endpoint streaming Stream ID Device Driver Lock Mutual Exclusion Semaphore Spin Lock Display Device Driver Frame buffer concept Framebuffer Data Structure Check and set Parameter Accelerated Method Display Driver summary Memory Allocation Kmalloc Vmalloc Ioremap Interrupt Handling interrupt registration Proc interface Path of interrupt Programming Tips Softirqs Tasklets Work Queues I/O Control Introducing ioctl Prototype Stepwise execution of ioctl Sample Device Driver Complete memory Driver Complete Parallel Port Driver Device Driver Debugging Data Display Debugger Graphical Display Debugger Kernel Graphical Debugger Appendix I Exported Symbols Kobjects Ksets and Subsystems DMA I/O

Linux Kernel Programming Part 2 - Char Device Drivers and Kernel Synchronization Kaiwan N Billimoria, 2021-03-19

Discover how to write high quality character driver code interface with userspace work with chip memory and gain an in depth understanding of working with hardware interrupts and kernel synchronization Key Features Delve into hardware interrupt handling threaded IRQs tasklets softirqs and understand which to use when Explore powerful techniques to perform user kernel interfacing peripheral I/O and use kernel mechanisms Work with key kernel synchronization primitives to solve kernel concurrency issues Book Description Linux Kernel Programming Part 2 Char Device Drivers and Kernel Synchronization is an ideal companion guide to the Linux Kernel Programming book This book provides a comprehensive introduction for those new to Linux device driver development and will have you up and running with writing misc class

character device driver code on the 5.4 LTS Linux kernel in next to no time You'll begin by learning how to write a simple and complete misc class character driver before interfacing your driver with user mode processes via procfs sysfs debugfs netlink sockets and ioctl You'll then find out how to work with hardware I/O memory The book covers working with hardware interrupts in depth and helps you understand interrupt request IRQ allocation threaded IRQ handlers tasklets and softirqs You'll also explore the practical usage of useful kernel mechanisms setting up delays timers kernel threads and workqueues Finally you'll discover how to deal with the complexity of kernel synchronization with locking technologies mutexes spinlocks and atomic refcount operators including more advanced topics such as cache effects a primer on lock free techniques deadlock avoidance with lockdep and kernel lock debugging techniques By the end of this Linux kernel book you'll have learned the fundamentals of writing Linux character device driver code for real world projects and products What you will learn

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Who this book is for An understanding of the topics covered in the Linux Kernel Programming book is highly recommended to make the most of this book This book is for Linux programmers beginning to find their way with device driver development Linux device driver developers looking to overcome frequent and common kernel driver development issues as well as perform common driver tasks such as user kernel interfaces performing peripheral I/O handling hardware interrupts and dealing with concurrency will benefit from this book A basic understanding of Linux kernel internals and common APIs kernel module development and C programming is required

Open Source for the Enterprise Dan Woods, Gautam Guliani, 2005-07-27 This book provides something far more valuable than either the cheerleading or the fear mongering one hears about open source The authors are Dan Woods former CTO of TheStreet.com and a consultant and author of several books about IT and Gautam Guliani Director of Software Architecture at Kaplan Test Prep Admissions Each has used open source software for some 15 years at IT departments large and small They have collected the wisdom of a host of experts from IT departments open source communities and software companies Open Source for the Enterprise provides a top to bottom view not only of the technology but of the skills required to manage it and the organizational issues that must be addressed

Operating Systems (Self Edition 1.1.Abridged) Sibsanakar Haldar, 2016-05-29 Some previous editions of this book were published from Pearson Education ISBN 9788131730225 This book designed for those who are taking introductory courses on operating systems presents both theoretical and practical aspects of modern operating systems Although the emphasis is on theory while exposing you the reader the subject matter this book maintains a balance between theory and practice The theories and technologies that have fueled the evolution of operating systems are primarily geared

towards two goals user convenience in maneuvering computers and efficient utilization of hardware resources This book also discusses many fundamental concepts that have been formulated over the past several decades and that continue to be used in many modern operating systems In addition this book also discusses those technologies that prevail in many modern operating systems such as UNIX Solaris Linux and Windows While the former two have been used to present many in text examples the latter two are dealt with as separate technological case studies They highlight the various issues in the design and development of operating systems and help you correlate theories to technologies This book also discusses Android exposing you a modern software platform for embedded devices This book supersedes ISBN 9788131730225 and its other derivatives from Pearson Education India They have been used as textbooks in many schools worldwide You will definitely love this self edition and you can use this as a textbook in undergraduate level operating systems courses [Linux Device Driver Development](#) John Madieu,2022-04-21 Get up to speed with the most important concepts in driver development and focus on common embedded system requirements such as memory management interrupt management and locking mechanisms Key FeaturesWrite feature rich and customized Linux device drivers for any character SPI and I2C deviceDevelop a deep understanding of locking primitives IRQ management memory management DMA and so onGain practical experience in the embedded side of Linux using GPIO IIO and input subsystemsBook Description Linux is by far the most used kernel on embedded systems Thanks to its subsystems the Linux kernel supports almost all of the application fields in the industrial world This updated second edition of Linux Device Driver Development is a comprehensive introduction to the Linux kernel world and the different subsystems that it is made of and will be useful for embedded developers from any discipline You ll learn how to configure tailor and build the Linux kernel Filled with real world examples the book covers each of the most used subsystems in the embedded domains such as GPIO direct memory access interrupt management and I2C SPI device drivers This book will show you how Linux abstracts each device from a hardware point of view and how a device is bound to its driver s You ll also see how interrupts are propagated in the system as the book covers the interrupt processing mechanisms in depth and describes every kernel structure and API involved This new edition also addresses how not to write device drivers using user space libraries for GPIO clients I2C and SPI drivers By the end of this Linux book you ll be able to write device drivers for most of the embedded devices out there What you will learnDownload configure build and tailor the Linux kernelDescribe the hardware using a device treeWrite feature rich platform drivers and leverage I2C and SPI busesGet the most out of the new concurrency managed workqueue infrastructureUnderstand the Linux kernel timekeeping mechanism and use time related APIsUse the regmap framework to factor the code and make it genericOffload CPU for memory copies using DMAInteract with the real world using GPIO IIO and input subsystemsWho this book is for This Linux OS book is for embedded system and embedded Linux enthusiasts developers who want to get started with Linux kernel development and leverage its subsystems Electronic hackers and hobbyists interested in Linux kernel

development as well as anyone looking to interact with the platform using GPIO IIO and input subsystems will also find this book useful

Python and XML Christopher A. Jones, Fred L. Drake, 2002 This book has two objectives to provide a comprehensive reference on using XML with Python and to illustrate the practical applications of these technologies in an enterprise environment with examples

UNIX and Linux System Administration Handbook Evi Nemeth, 2011 This fourth edition covers Red Hat Enterprise Linux openSUSE Ubuntu Solaris Opensolaris 11 and AIX 6.1

Running Weblogs with Slash Chromatic, Brian Aker, Dave Krieger, 2002 This is written for system administrators who may not have the time to learn about Slash by reading the source code It collects all the current Slash knowledge from the code Website and mailing lists and organizes it into a coherent package

Systems Performance Brendan Gregg, 2014 The Complete Guide to Optimizing Systems Performance Written by the winner of the 2013 LISA Award for Outstanding Achievement in System Administration Large scale enterprise cloud and virtualized computing systems have introduced serious performance challenges Now internationally renowned performance expert Brendan Gregg has brought together proven methodologies tools and metrics for analyzing and tuning even the most complex environments Systems Performance Enterprise and the Cloud focuses on Linux R and Unix R performance while illuminating performance issues that are relevant to all operating systems You ll gain deep insight into how systems work and perform and learn methodologies for analyzing and improving system and application performance Gregg presents examples from bare metal systems and virtualized cloud tenants running Linux based Ubuntu R Fedora R CentOS and the illumos based Joyent R SmartOS TM and OmniTI OmniOS R He systematically covers modern systems performance including the traditional analysis of CPUs memory disks and networks and new areas including cloud computing and dynamic tracing This book also helps you identify and fix the unknown unknowns of complex performance bottlenecks that emerge from elements and interactions you were not aware of The text concludes with a detailed case study showing how a real cloud customer issue was analyzed from start to finish Coverage includes Modern performance analysis and tuning terminology concepts models methods and techniques Dynamic tracing techniques and tools including examples of DTrace SystemTap and perf Kernel internals uncovering what the OS is doing Using system observability tools interfaces and frameworks Understanding and monitoring application performance Optimizing CPUs processors cores hardware threads caches interconnects and kernel scheduling Memory optimization virtual memory paging swapping memory architectures busses address spaces and allocators File system I/O including caching Storage devices controllers disk I/O workloads RAID and kernel I/O Network related performance issues protocols sockets interfaces and physical connections Performance implications of OS and hardware based virtualization and new issues encountered with cloud computing Benchmarking getting accurate results and avoiding common mistakes This guide is indispensable for anyone who operates enterprise or cloud environments system network database and web admins developers and other professionals For students and others new to optimization it also provides exercises reflecting Gregg s extensive instructional

experience **ADO ActiveX Data Objects** Jason T. Roff, 2001 The architecture of ADO ActiveX Data Objects Microsoft's newest form of database communication is simple, concise, and efficient. This indispensable reference takes a comprehensive look at every object, collection, method, and property of ADO for developers who want to get a leg up on this technology.

Exim Philip Hazel, 2001 Exim delivers electronic mail both locally and remotely. It's the default mail transport agent installed on some Linux systems; it runs on many versions of Unix and is suitable for any TCP/IP network with any combination of hosts and end-user mail software. Exim is growing in popularity because it's open source, scalable, and rich in features. These include compatibility with sendmail options, database lookups, support for regular expressions, and many kinds of address parsing, sophisticated error handling, and parameters for improving performance. Best of all, Exim is easy to configure. You never have to deal with rulesets or worry that a misplaced asterisk will cause an inadvertent mail bomb. Philip Hazel, the creator of Exim, is the author of this official guide designed for quick access to information when you're in a hurry, as well as thorough coverage of more advanced material. *Linux Administration Handbook* Evi Nemeth, Garth Snyder, Trent R. Hein, 2006-10-30 As this book shows, Linux systems are just as functional, secure, and reliable as their proprietary counterparts. Thanks to the ongoing efforts of thousands of Linux developers, Linux is more ready than ever for deployment at the frontlines of the real world. The authors of this book know their terrain well, and I am happy to leave you in their most capable hands. Linus Torvalds: The most successful sysadmin book of all time because it works. Rik Farrow, editor of *login*: This book clearly explains current technology with the perspective of decades of experience in large-scale system administration. Unique and highly recommended. Jonathan Corbet, cofounder LWN.net: Nemeth et al. is the overall winner for Linux administration; it's intelligent, full of insights, and looks at the implementation of concepts. Peter Salus, editorial director, Matrix.net: Since 2001, *Linux Administration Handbook* has been the definitive resource for every Linux system administrator who must efficiently solve technical problems and maximize the reliability and performance of a production environment. Now the authors have systematically updated this classic guide to address today's most important Linux distributions and most powerful new administrative tools. The authors spell out detailed best practices for every facet of system administration, including storage management, network design, and administration, web hosting, software configuration management, performance analysis, Windows interoperability, and much more. Sysadmins will especially appreciate the thorough and up-to-date discussions of such difficult topics as DNS, LDAP, security, and the management of IT service organizations. *Linux Administration Handbook*, Second Edition, reflects the current versions of these leading distributions: Red Hat Enterprise Linux, Fedora™, Core SUSE Linux Enterprise, Debian GNU/Linux, Ubuntu Linux. Sharing their war stories and hard-won insights, the authors capture the behavior of Linux systems in the real world, not just in ideal environments. They explain complex tasks in detail and illustrate these tasks with examples drawn from their extensive hands-on experience. *Mastering Embedded Linux Programming* Frank Vasquez, Chris Simmonds, 2021-05-14 Build, customize, and deploy Linux-based embedded systems with

confidence using Yocto bootloaders and build tools Key Features Master build systems toolchains and kernel integration for embedded Linux Set up custom Linux distros with Yocto and manage board specific configurations Learn real world debugging memory handling and system performance tuning Book DescriptionIf you re looking for a book that will demystify embedded Linux then you ve come to the right place Mastering Embedded Linux Programming is a fully comprehensive guide that can serve both as means to learn new things or as a handy reference The first few chapters of this book will break down the fundamental elements that underpin all embedded Linux projects the toolchain the bootloader the kernel and the root filesystem After that you will learn how to create each of these elements from scratch and automate the process using Buildroot and the Yocto Project As you progress the book will show you how to implement an effective storage strategy for flash memory chips and install updates to a device remotely once it s deployed You ll also learn about the key aspects of writing code for embedded Linux such as how to access hardware from apps the implications of writing multi threaded code and techniques to manage memory in an efficient way The final chapters demonstrate how to debug your code whether it resides in apps or in the Linux kernel itself You ll also cover the different tracers and profilers that are available for Linux so that you can quickly pinpoint any performance bottlenecks in your system By the end of this Linux book you ll be able to create efficient and secure embedded devices using Linux What you will learn Use Buildroot and the Yocto Project to create embedded Linux systems Troubleshoot BitBake build failures and streamline your Yocto development workflow Update IoT devices securely in the field using Mender or balena Prototype peripheral additions by reading schematics modifying device trees soldering breakout boards and probing pins with a logic analyzer Interact with hardware without having to write kernel device drivers Divide your system up into services supervised by BusyBox runit Debug devices remotely using GDB and measure the performance of systems using tools such as perf ftrace eBPF and Callgrind Who this book is for If you re a systems software engineer or system administrator who wants to learn how to implement Linux on embedded devices then this book is for you It s also aimed at embedded systems engineers accustomed to programming for low power microcontrollers who can use this book to help make the leap to high speed systems on chips that can run Linux Anyone who develops hardware that needs to run Linux will find something useful in this book but before you get started you ll need a solid grasp on POSIX standard C programming and shell scripting [Understanding the Linux Kernel](#) Daniel P. Bovet,Marco Cesati,2005-11-17 In order to thoroughly understand what makes Linux tick and why it works so well on a wide variety of systems you need to delve deep into the heart of the kernel The kernel handles all interactions between the CPU and the external world and determines which programs will share processor time in what order It manages limited memory so well that hundreds of processes can share the system efficiently and expertly organizes data transfers so that the CPU isn t kept waiting any longer than necessary for the relatively slow disks The third edition of Understanding the Linux Kernel takes you on a guided tour of the most significant data structures algorithms and programming tricks used in the kernel Probing

beyond superficial features the authors offer valuable insights to people who want to know how things really work inside their machine Important Intel specific features are discussed Relevant segments of code are dissected line by line But the book covers more than just the functioning of the code it explains the theoretical underpinnings of why Linux does things the way it does This edition of the book covers Version 2.6 which has seen significant changes to nearly every kernel subsystem particularly in the areas of memory management and block devices The book focuses on the following topics Memory management including file buffering process swapping and Direct memory Access DMA The Virtual Filesystem layer and the Second and Third Extended Filesystems Process creation and scheduling Signals interrupts and the essential interfaces to device drivers Timing Synchronization within the kernel Interprocess Communication IPC Program execution Understanding the Linux Kernel will acquaint you with all the inner workings of Linux but it's more than just an academic exercise You'll learn what conditions bring out Linux's best performance and you'll see how it meets the challenge of providing good system response during process scheduling file access and memory management in a wide variety of environments This book will help you make the most of your Linux system

Linux Device Drivers Alessandro Rubini, 1998 This practical guide is for anyone who wants to support computer peripherals under the Linux operating system or who wants to develop new hardware and run it under Linux It shows step by step how to write a driver for character devices m block devices and network interfaces illustrated with examples you can compile and run

CGI Programming with Perl Scott Guelich, Shishir Gundavaram, Gunther Birznies, 2000 A comprehensive explanation of CGI for people who hold on to the dream of providing their own information servers on the Web This edition has been completely rewritten to use the current techniques available in Version 5 of Perl and two popular Perl modules CGI.pm and CGI_lite plus discussions of speed up techniques such as FastCGI and mod_perl

Embedded Linux Primer Christopher Hallinan, 2010-10-26 Up to the Minute Complete Guidance for Developing Embedded Solutions with Linux Linux has emerged as today's #1 operating system for embedded products Christopher Hallinan's Embedded Linux Primer has proven itself as the definitive real world guide to building efficient high value embedded systems with Linux Now Hallinan has thoroughly updated this highly praised book for the newest Linux kernels capabilities tools and hardware support including advanced multicore processors Drawing on more than a decade of embedded Linux experience Hallinan helps you rapidly climb the learning curve whether you're moving from legacy environments or you're new to embedded programming Hallinan addresses today's most important development challenges and demonstrates how to solve the problems you're most likely to encounter You'll learn how to build a modern efficient embedded Linux development environment and then utilize it as productively as possible Hallinan offers up to date guidance on everything from kernel configuration and initialization to bootloaders device drivers to file systems and BusyBox utilities to real time configuration and system analysis This edition adds entirely new chapters on UDEV USB and open source build systems Tour the typical embedded system and development environment and understand its concepts and components

Understand the Linux kernel and userspace initialization processes Preview bootloaders with specific emphasis on U Boot
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[GNU/Linux Rapid Embedded Programming](#) Rodolfo Giometti, 2017-03-29 An annotated guide to program and develop GNU Linux Embedded systems quickly Key Features Rapidly design and build powerful prototypes for GNU Linux Embedded systems Become familiar with the workings of GNU Linux Embedded systems and how to manage its peripherals Write monitor and configure applications quickly and effectively manage an external micro controller and use it as co processor for real time tasks Book Description Embedded computers have become very complex in the last few years and developers need to easily manage them by focusing on how to solve a problem without wasting time in finding supported peripherals or learning how to manage them The main challenge with experienced embedded programmers and engineers is really how long it takes to turn an idea into reality and we show you exactly how to do it This book shows how to interact with external environments through specific peripherals used in the industry We will use the latest Linux kernel release 4.4.x and Debian Ubuntu distributions with embedded distributions like OpenWrt and Yocto The book will present popular boards in the industry that are user friendly to base the rest of the projects on BeagleBone Black SAMA5D3 Xplained Wandboard and system on chip manufacturers Readers will be able to take their first steps in programming the embedded platforms using C Bash and Python PHP languages in order to get access to the external peripherals More about using and programming device driver and accessing the peripherals will be covered to lay a strong foundation The readers will learn how to read write data from to the external environment by using both C programs or a scripting language Bash PHP Python and how to configure a device driver for a specific hardware After finishing this book the readers will be able to gain a good knowledge level and understanding of writing configuring and managing drivers controlling and monitoring applications with the help of efficient quick programming and will be able to apply these skills into real world projects What you will learn Use embedded systems to implement your projects Access and manage peripherals for embedded systems Program embedded systems using languages such as C Python Bash and PHP Use a complete distribution such as Debian or Ubuntu or an embedded one such as OpenWrt or Yocto Harness device driver capabilities to optimize device communications Access data through several kinds of devices such as GPIO s serial ports PWM ADC Ethernet WiFi audio video I2C SPI One Wire USB and CAN Who this book is for This book targets Embedded System developers and GNU Linux programmers who would like to program Embedded Systems and perform Embedded development The book focuses on quick and efficient prototype building Some experience with hardware and Embedded

Systems is assumed as is having done some previous work on GNU Linux systems Knowledge of scripting on GNU Linux is expected as well

Unveiling the Magic of Words: A Report on "**Linux Device Drivers 3rd Edition**"

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