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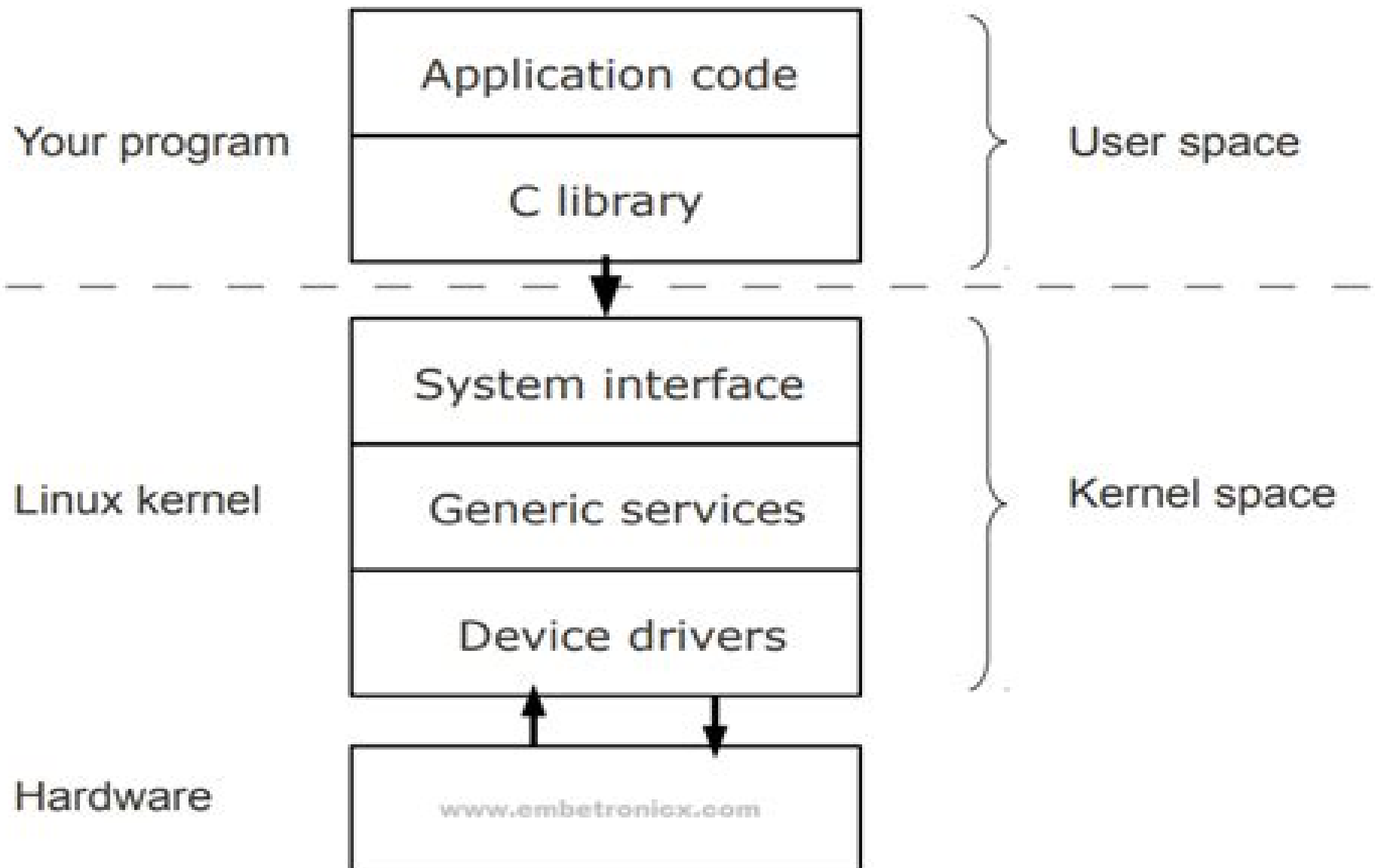# [Linux Device Drivers](#)

John Madieu

Linux Device Drivers:

   Linux Device Drivers Jonathan Corbet,Alessandro Rubini,Greg Kroah-Hartman,2005-02-07 A guide to help programmers learn how to support computer peripherals under the Linux operating system and how to develop new hardware under Linux This third edition covers all the significant changes to Version 2 6 of the Linux kernel Includes full featured examples that programmers can compile and run without special hardware   **Essential Linux Device Drivers** Sreekrishnan Venkateswaran,2008   **Essential Linux Device Drivers** Venkateswaran,2008-09   **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   **Linux Device Drivers Development** John Madieu,2017-10-20 Develop Linux device drivers from scratch with hands on guidance focused on embedded systems covering key subsystems like I2C SPI GPIO IRQ and DMA for real world hardware integration

using kernel 4 13 Key Features Develop custom drivers for I2C SPI GPIO RTC and input devices using modern Linux kernel APIs Learn memory management IRQ handling DMA and the device tree through hands on examples Explore embedded driver development with platform drivers regmap and IIO frameworks Book DescriptionLinux kernel is a complex portable modular and widely used piece of software running on around 80% of servers and embedded systems in more than half of devices throughout the World Device drivers play a critical role in how well a Linux system performs As Linux has turned out to be one of the most popular operating systems used the interest in developing proprietary device drivers is also increasing steadily This book will initially help you understand the basics of drivers as well as prepare for the long journey through the Linux Kernel This book then covers drivers development based on various Linux subsystems such as memory management PWM RTC IIO IRQ management and so on The book also offers a practical approach on direct memory access and network device drivers By the end of this book you will be comfortable with the concept of device driver development and will be in a position to write any device driver from scratch using the latest kernel version v4 13 at the time of writing this book What you will learn Use kernel facilities to develop powerful drivers Develop drivers for widely used I2C and SPI devices and use the regmap API Write and support devicetree from within your drivers Program advanced drivers for network and frame buffer devices Delve into the Linux irqdomain API and write interrupt controller drivers Enhance your skills with regulator and PWM frameworks Develop measurement system drivers with IIO framework Get the best from memory management and the DMA subsystem Access and manage GPIO subsystems and develop GPIO controller drivers Who this book is for This book is ideal for embedded systems developers engineers and Linux enthusiasts who want to learn how to write device drivers from scratch Whether you re new to kernel development or looking to deepen your understanding of subsystems like I2C SPI and IRQs this book provides practical real world instructions tailored for working with embedded Linux platforms Foundational knowledge of C and basic Linux concepts is recommended   **Linux Device Driver Development Cookbook** Rodolfo Giometti,2019-05-31 Over 30 recipes to develop custom drivers for your embedded Linux applications Key Features Use kernel facilities to develop powerful drivers Learn core concepts for developing device drivers using a practical approach Program a custom character device to get access to kernel internals Book DescriptionLinux is a unified kernel that is widely used to develop embedded systems As Linux has turned out to be one of the most popular operating systems worldwide the interest in developing proprietary device drivers has also increased Device drivers play a critical role in how the system performs and ensure that the device works in the manner intended By exploring several examples on the development of character devices the technique of managing a device tree and how to use other kernel internals such as interrupts kernel timers and wait queue you ll be able to add proper management for custom peripherals to your embedded system You ll begin by installing the Linux kernel and then configuring it Once you have installed the system you will learn to use different kernel features and character drivers You will also cover interrupts in depth and understand how you can manage them Later

you will explore the kernel internals required for developing applications As you approach the concluding chapters you will learn to implement advanced character drivers and also discover how to write important Linux device drivers By the end of this book you will be equipped with the skills you need to write a custom character driver and kernel code according to your requirements What you will learn Become familiar with the latest kernel releases 4 19 5 x running on the ESPRESSOBin devkit an ARM 64 bit machine Download configure modify and build kernel sources Add and remove a device driver or a module from the kernel Understand how to implement character drivers to manage different kinds of computer peripherals Get well versed with kernel helper functions and objects that can be used to build kernel applications Gain comprehensive insights into managing custom hardware with Linux from both the kernel and user space Who this book is for This book is for anyone who wants to develop their own Linux device drivers for embedded systems Basic hands on experience with the Linux operating system and embedded concepts is necessary   Linux Driver Development for Embedded Processors - Second Edition Alberto de los Ríos,2018-10-31 LINUX DRIVER DEVELOPMENT FOR EMBEDDED PROCESSORS SECOND EDITION The flexibility of Linux embedded the availability of powerful energy efficient processors designed for embedded computing and the low cost of new processors are encouraging many industrial companies to come up with new developments based on embedded processors Current engineers have in their hands powerful tools for developing applications previously unimagined but they need to understand the countless features that Linux offers today This book will teach you how to develop device drivers for Device Tree Linux embedded systems You will learn how to write different types of Linux drivers as well as the appropriate APIs Application Program Interfaces and methods to interface with kernel and user spaces This is a book is meant to be practical but also provides an important theoretical base More than twenty drivers are written and ported to three different processors You can choose between NXP i MX7D Microchip SAMA5D2 and Broadcom BCM2837 processors to develop and test the drivers whose implementation is described in detail in the practical lab sections of the book Before you start reading I encourage you to acquire any of these processor boards whenever you have access to some GPIOs and at least one SPI and I2C controllers The hardware configurations of the different evaluation boards used to develop the drivers are explained in detail throughout this book one of the boards used to implement the drivers is the famous Raspberry PI 3 Model B board You will learn how to develop drivers from the simplest ones that do not interact with any external hardware to drivers that manage different kind of devices accelerometers DACs ADCs RGB LEDs Multi Display LED controllers I O expanders and Buttons You will also develop DMA drivers drivers that manage interrupts and drivers that write read on the internal registers of the processor to control external devices To easy the development of some of these drivers you will use different types of Frameworks Miscellaneous framework LED framework UIO framework Input framework and the IIO industrial one This second edition has been updated to the v4 9 LTS kernel Recently all the drivers have been ported to the new Microchip SAMA5D27 SOM1 SAMA5D27 System On Module using kernel 4 14 LTS and

included in the GitHub repository of this book these drivers have been tested in the ATSAMA5D27 SOM1 EK1 evaluation platform the ATSAMA5D27 SOM1 EK1 practice lab settings are not described throughout the text of this book but in a practice labs user guide that can be downloaded from the book s GitHub   Mastering Linux Device Driver Development John Madieu,2021-01-08 Develop advanced Linux device drivers for embedded systems mastering real world frameworks like PCI ALSA SoC and V4L2 with practical code examples and debugging techniques Key Features Gain hands on expertise with real Linux subsystems PCI ALSA SoC V4L2 and power management Apply advanced techniques for kernel debugging regmap API and custom hardware integration Build robust drivers through step by step examples and practical engineering insights Book DescriptionLinux is one of the fastest growing operating systems around the world and in the last few years the Linux kernel has evolved significantly to support a wide variety of embedded devices with its improved subsystems and a range of new features With this book you ll find out how you can enhance your skills to write custom device drivers for your Linux operating system Mastering Linux Device Driver Development provides complete coverage of kernel topics including video and audio frameworks that usually go unaddressed You ll work with some of the most complex and impactful Linux kernel frameworks such as PCI ALSA for SoC and Video4Linux2 and discover expert tips and best practices along the way In addition to this you ll understand how to make the most of frameworks such as NVMEM and Watchdog Once you ve got to grips with Linux kernel helpers you ll advance to working with special device types such as Multi Function Devices MFD followed by video and audio device drivers By the end of this book you ll be able to write feature rich device drivers and integrate them with some of the most complex Linux kernel frameworks including V4L2 and ALSA for SoC What you will learn Explore and adopt Linux kernel helpers for locking work deferral and interrupt management Understand the Regmap subsystem to manage memory accesses and work with the IRQ subsystem Get to grips with the PCI subsystem and write reliable drivers for PCI devices Write full multimedia device drivers using ALSA SoC and the V4L2 framework Build power aware device drivers using the kernel power management framework Find out how to get the most out of miscellaneous kernel subsystems such as NVMEM and Watchdog Who this book is for This book is for embedded developers Linux system engineers and advanced programmers seeking to master Linux device driver development for custom hardware and peripherals Readers should have C programming experience and a basic grasp of kernel concepts Ideal for those wanting practical project based guidance on leveraging frameworks such as PCI ALSA SoC V4L2 and power management to build production grade drivers   *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

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and manage GPIO subsystems and develop GPIO controller driversIn DetailLinux kernel is a complex portable modular and widely used piece of software running on around 80% of servers and embedded systems in more than half of devices throughout the World Device drivers play a critical role in how well a Linux system performs As Linux has turned out to be one of the most popular operating systems used the interest in developing proprietary device drivers is also increasing steadily This book will initially help you understand the basics of drivers as well as prepare for the long journey through the Linux Kernel This book then covers drivers development based on various Linux subsystems such as memory management PWM RTC IIO IRQ management and so on The book also offers a practical approach on direct memory access and network device drivers By the end of this book you will be comfortable with the concept of device driver development and will be in a position to write any device driver from scratch using the latest kernel version v4 13 at the time of writing this book Style and approachA set of engaging examples to develop Linux device drivers   **Linux Device Driver Development** John Madieu,2022 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   **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 FeaturesDelve into hardware interrupt handling threaded IRQs tasklets softirqs and understand which to use whenExplore powerful techniques to perform user kernel interfacing peripheral I O and use kernel mechanismsWork with key kernel synchronization primitives to solve kernel concurrency issuesBook 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 learnGet to grips with the basics of the modern Linux Device Model LDM Write a simple yet complete misc class character device driverPerform user kernel interfacing using popular methodsUnderstand and handle hardware interrupts confidentlyPerform I O on peripheral hardware chip memoryExplore kernel APIs to work with delays timers kthreads and workqueuesUnderstand kernel concurrency issuesWork with key kernel synchronization primitives and discover how to detect and avoid deadlockWho 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 **Linux Driver Development with Raspberry Pi - Practical Labs** Alberto de los Ríos,2021-06-06 Linux Driver Development with Raspberry Pi Practical Labs Embedded systems have become an integral part of our daily life They are deployed in mobile devices networking infrastructure home and consumer devices digital signage medical imaging automotive infotainment and many other industrial applications The use of embedded systems is growing exponentially Many of these embedded systems are powered by an inexpensive yet powerful system on chip SoC that is running a Linux operating system The BCM2837 from Broadcom is one of these SoCs running quad ARM Cortex A53 cores at 1 2GHz This is the SoC used in the popular Raspberry Pi 3 boards This book follows the learning by doing approach so you will be playing with your Raspberry Pi since the first chapter Besides the Raspberry Pi board you will use several low cost boards to develop the hands on examples In the labs it is described what each step means in detail so that you can use your own hardware components adapting the content of the book to your needs You will learn how to develop Linux drivers for the Raspberry Pi boards You will start with the simplest ones that do not interact with any external hardware then you will develop Linux drivers that manage different kind of devices Accelerometer DAC ADC RGB LED Buttons Joystick controller Multi Display LED controller and I O expanders controlled via I2C and SPI buses You will also develop DMA drivers USB device drivers drivers that manage interrupts and drivers that write and read

on the internal registers of the SoC to control its GPIOs To ease the development of some of these drivers you will use different types of Linux kernel subsystems Miscellaneous LED UIO USB Input and Industrial I O More than 30 kernel modules have been written besides several user applications which can be downloaded from the book s GitHub repository This book uses the Long Term Support LTS Linux kernel 5 4 which was released on November 2019 and will be maintained until December 2025 The Linux drivers and applications developed in the labs have been ported to three different Raspberry Pi boards Raspberry Pi 3 Model B Raspberry Pi 3 Model B and Raspberry Pi 4 Model B This book is a learning tool to start developing drivers without any previous knowledge about this field so the intention during its writing has been to develop drivers without a high level of complexity that both serve to reinforce the main driver development concepts and can be a starting point to help you to develop your own drivers And remember that the best way to develop a driver is not to write it from scratch You can reuse free code from similar Linux kernel mainline drivers All the drivers written throughout this book are GPL licensed so you can modify and redistribute them under the same license **Linux Device Drivers** Alessandro Rubini,Jonathan Corbet,2001 Provides hands on information on writing device drivers for the Linux system with particular focus on the features of the 2 4 kernel and its implementation *Easy Linux Device Driver, Second Edition* Mahesh Jadhav,2020-01-26 Easy Linux Device Driver First Step Towards Device Driver ProgrammingEasy 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 in book Introduction of LinuxAdvantages of Linux History of LinuxArchitecture of LinuxDefinitions Ubuntu installationUbuntu Installation StepsUser Interface DifferenceAbout KNOPPIXImportant links Terminal Soul of LinuxCreating Root accountTerminal CommandsVirtual Editor Commands Linux KernelLinux Kernel InternalsKernel Space and User space Device DriverPlace of Driver in SystemDevice Driver working Characteristics of Device Driver Module CommandsHello World Programpre settingsWrite ProgramPrintk functionMakefileRun program Parameter passingParameter passing programParameter Array Process related program Character Device DriverMajor and Minor numberAPI to registers a deviceProgram to show device numberCharacter Driver File OperationsFile operation program Include h headerFunctions in module h fileImportant code snippetsSummary of file operations PCI Device DriverDirect Memory AccessModule Device TableCode for Basic Device DriverImportant code snippets USB Device Driver FundamentalsArchitecture of USB device driverUSB Device Driver programStructure of USB Device DriverParts of USB end pointsImportant featuresUSB information Driver USB device Driver File OperationsUsing URBSimple data transferProgram to read and writeImportant code

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hacker to understand and enjoy this book all you need is an understanding of C and some background in Unix system calls You ll learn how to write drivers for character devices block devices and network interfaces guided by full featured examples that you can compile and run without special hardware Major changes in the second edition include discussions of symmetric multiprocessing SMP and locking new CPUs and recently supported buses For those who are curious about how an operating system does its job this book provides insights into address spaces asynchronous events and I O Portability is a major concern in the text The book is centered on version 2 4 but includes information for kernels back to 2 0 where feasible Linux Device Driver also shows how to maximize portability among hardware platforms examples were tested on IA32 PC and IA64 PowerPC SPARC and SPARC64 Alpha ARM and MIPS Contents include Building a driver and loading modules Complete character block and network drivers Debugging a driver Timing Handling symmetric multiprocessing SMP systems Memory management and DMA Interrupts Portability issues Peripheral Component Interconnect PCI

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