Linux
Kernel Debugging

Leverage proven tools and advanced techniques to effectively debug
Linux kernels and kernel modules

Kaiwan N Billimoria

[The Linux Kernel Debugging Computer Science](#)

Clifford Lane

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   Linux Kernel Debugging Kaiwan N. Billimoria,2022-08-05 Effectively debug kernel modules device drivers and the kernel itself by gaining a solid understanding of powerful open source tools and advanced kernel debugging techniques Key Features Fully understand how to use a variety of kernel and module debugging tools and techniques using examples Learn to expertly interpret a kernel Oops and identify underlying defect s Use easy to look up tables and clear explanations of kernel level defects to make this complex topic easy Book DescriptionThe Linux kernel is at the very core of arguably the world s best production quality OS Debugging it though can be a complex endeavor Linux Kernel Debugging is a comprehensive guide to learning all about advanced kernel debugging This book covers many areas in depth such as instrumentation based debugging techniques printk and the dynamic debug framework and shows you how to use Kprobes Memory related bugs tend to be a nightmare two chapters are packed with tools and techniques devoted to debugging them When the kernel gifts you an Oops how exactly do you interpret it to be able to debug the underlying issue We ve got you covered Concurrency tends to be an inherently complex topic so a chapter on lock debugging will help you to learn precisely what data races are including using KCSAN to detect them Some thorny issues both debug and performance wise require detailed kernel level tracing you ll learn to wield the impressive power of Ftrace and its frontends You ll also discover how to handle kernel lockups hangs and the dreaded kernel panic as well as leverage the venerable GDB tool within the kernel KGDB along with much more By the end of this book you will have at your disposal a wide range of powerful kernel debugging tools and techniques along with a keen sense of when to use which What you will learn Explore instrumentation based printk along with the powerful dynamic debug framework Use static and dynamic Kprobes to trap into kernel module functions Catch kernel memory defects with KASAN UBSAN SLUB debug and kmemleak Interpret an Oops in depth and precisely identify it s source location Understand data races and use KCSAN to catch evasive concurrency defects Leverage Ftrace and trace cmd to trace the kernel flow in great detail Write a custom kernel panic handler and detect kernel lockups and hangs Use KGDB to single step and debug kernel module source code Who this book is for This book is for Linux kernel developers module driver authors and testers interested in debugging and enhancing their Linux systems at the level of the kernel System administrators who want to understand and debug the internal infrastructure of their Linux kernels will also find this book useful A good grasp on C programming and the Linux command line is necessary Some experience with kernel module development will help you follow along   Linux Kernel Development Robert Love,2010 This practical guide helps programmers better understand the Linux kernel and to write and develop kernel code It provides in depth coverage of all the major subsystems and features of the Linux 2 6 kernel   The Linux Kernel Primer Claudia Salzberg Rodriguez,Claudia Salzberg,Gordon Fischer,Steven Smolski,2006 Offers a comprehensive view of the underpinnings of the Linux kernel on the Intel x86 and the Power PC   *Memory Dump Analysis Anthology* Dmitry Vostokov,2008-04 This revised cross referenced

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Optimization Problems ICA3PP 2018 Workshop on Security and Privacy in Data Processing   *Linux Journal* ,2005-07 **Information Security** Colin Boyd,Wenbo Mao,2003-12-12 The 2003 Information Security Conference was the sixth in a series that started with the InformationSecurity Workshopin 1997 A distinct feature of this series is the wide coverage of topics with the aim of encouraging interaction between researchers in di erent aspects of information security This trend continued in the program of this year s conference There were 133 paper submissions to ISC 2003 From these submissions the 31papersintheseproceedingswereselectedbytheprogramcommittee covering a wide range of technical areas These papers are supplemented by two invited papers athirdinvitedtalkwaspresentedattheconferencebutisnotrepresented by a written paper We would like to extend our sincere thanks to all the authors that submitted papers to ISC 2003 and we hope that those whose papers were declined will be able to nd an alternative forum for their work We are also very grateful to the three eminent invited speakers at the conference Paul van Oorschot Carleton University Canada Ueli Maurer ETH Zur ich Switzerland and Andy Clark Inforenz Limited UK We were fortunate to have an energetic team of experts who took onthe task of the program committee Their names may be found overleaf and we thank them warmly for their considerable e orts This team was helped by an even larger number of individuals who reviewed papers in their particular areas of expertise A list of these names is also provided which we hope is complete   InfoWorld ,2003-06-02 InfoWorld is targeted to Senior IT professionals Content is segmented into Channels and Topic Centers InfoWorld also celebrates people companies and projects   *Linux Kernel Programming* THIERRY GAYET,2025-06-11 DESCRIPTION Linus Torvald released the first version of a kernel in 1991 inspired at the time by both proprietary Unix and the Minix system Thirty four years later this system has evolved with stability and robustness making it almost indispensable for the DevSecOps community The Linux kernel forms the robust core of countless systems from embedded devices to vast data centers driving unparalleled power and flexibility This book is your essential guide to deeply understanding this fundamental component and mastering the art of developing high performance kernel level code This book meticulously details the kernel s history architectural evolution and custom build processes You will master device driver fundamentals distinguishing user from kernel space and understanding the Linux Device Model LDM It explores Linux Security Modules intricate kernel memory management and various vital communication interfaces like I2C SPI SERIAL PCI and RTC The guide concludes with task process management real time concepts and essential kernel debugging and profiling By the end of this book you will be well equipped to confidently develop optimize and debug kernel level code This empowers you to build custom Linux systems craft efficient device drivers and troubleshoot complex issues ready to tackle advanced Linux system programming challenges You will also be able to better understand this system and develop your own drivers or low level developments for it WHAT YOU WILL LEARN GNU Linux kernel history feature evolution and licensing Understand and develop your character and block drivers Develop new file systems Manage your systems by communicating with the USB protocol Debug your drivers your kernel or any other

module in the kernel space Understand the layout of the Linux device model Memory management in the kernel as well as via DMA or NUMA Implement Linux Security Modules LSM and Netfilter stack hooks WHO THIS BOOK IS FOR This book is for software engineers looking to understand the Linux kernel s architecture modify it and develop custom modules It also supports project managers team leaders and technical managers seeking a clear view of kernel development and capabilities CISOs and IT managers will benefit from insights into kernel limitations vulnerabilities and security measures such as Linux Security Modules LSMs TABLE OF CONTENTS 1 History of the GNU Linux Kernel 2 Introduction to the Linux Kernel 3 Introduction to Device Drivers 4 Linux Device Model 5 Character Device Drivers 6 Block Drivers and Virtual Filesystem 7 USB Drivers and libusb 8 Network Drivers 9 Linux Security Modules 10 Kernel Memory and DMA 11 Navigating Linux Communication Interfaces 12 Process Management 13 Debugging GNU Linux Kernel and Drivers   **User Mode Linux** Jeff Dike,2006 With User Mode Linux you can create virtual Linux machines within a Linux computer and use them to test and debug applications network services and even kernels This work covers almost everything from getting started through running enterprise class User Mode Linux servers It offers advice on bootup compilation administration and more   Linux Kernel Programming Kaiwan N Billimoria,2021-03-19 Learn how to write high quality kernel module code solve common Linux kernel programming issues and understand the fundamentals of Linux kernel internals Key Features Discover how to write kernel code using the Loadable Kernel Module framework Explore industry grade techniques to perform efficient memory allocation and data synchronization within the kernel Understand the essentials of key internals topics such as kernel architecture memory management CPU scheduling and kernel synchronization Book DescriptionLinux Kernel Programming is a comprehensive introduction for those new to Linux kernel and module development This easy to follow guide will have you up and running with writing kernel code in next to no time This book uses the latest 5 4 Long Term Support LTS Linux kernel which will be maintained from November 2019 through to December 2025 By working with the 5 4 LTS kernel throughout the book you can be confident that your knowledge will continue to be valid for years to come You ll start the journey by learning how to build the kernel from the source Next you ll write your first kernel module using the powerful Loadable Kernel Module LKM framework The following chapters will cover key kernel internals topics including Linux kernel architecture memory management and CPU scheduling During the course of this book you ll delve into the fairly complex topic of concurrency within the kernel understand the issues it can cause and learn how they can be addressed with various locking technologies mutexes spinlocks atomic and refcount operators You ll also benefit from more advanced material on cache effects a primer on lock free techniques within the kernel deadlock avoidance with lockdep and kernel lock debugging techniques By the end of this kernel book you ll have a detailed understanding of the fundamentals of writing Linux kernel module code for real world projects and products What you will learn Write high quality modular kernel code LKM framework for 5 x kernels Configure and build a kernel from source Explore the Linux kernel architecture Get to grips

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