



Your Short Cut to Knowledge

# Debugging Linux Systems

Sreekrishnan Venkateswaran

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# Debugging Linux Systems Digital Short Cut Sreekrishnan Venkateswaran

**Kaiwan N. Billimoria**



## **Debugging Linux Systems Digital Short Cut Sreekrishnan Venkateswaran:**

**Debugging Linux Systems (Digital Short Cut)** Sreekrishnan Venkateswaran, 2009-11-03 Debugging Linux Systems discusses the main tools available today to debug 2.6 Linux Kernels We start by exploring the seemingly esoteric operations of the Kernel Debugger KDB Kernel GNU DeBugger KGDB the plain GNU DeBugger GDB and JTAG debuggers We then investigate Kernel Probes a feature that lets you intrude into a kernel function and extract debug information or apply a medicated patch Analyzing a crash dump can yield clues for postmortem analysis of kernel crashes or hangs so we take a look at Kdump a serviceability tool that collects a system dump after spawning a new kernel Profiling points you to code regions that burn more CPU cycles so we learn to use the OProfile kernel profiler and the gprof application profiler to sense the presence of code bottlenecks Because tracing provides insight into behavioral problems that manifest during interactions between different code modules we delve into the Linux Trace Toolkit a system designed for high volume trace capture The section Debugging Embedded Linux takes a tour of the I/O interfaces commonly found on embedded hardware such as flash memory serial port PCMCIA Secure Digital media USB RTC audio video touch screen and Bluetooth and provides pointers to debug the associated device drivers We also pick up some board level debugging skills with the help of a case study The section Debugging Network Throughput takes you through some device driver design issues and protocol implementation characteristics that can affect the horsepower of your network interface card We end the shortcut by examining several options available in the kernel configuration menu that can emit valuable debug information

*Essential Linux Device Drivers* Sreekrishnan Venkateswaran, 2008-03-27 Probably the most wide ranging and complete Linux device driver book I've read Alan Cox Linux Guru and Key Kernel Developer Very comprehensive and detailed covering almost every single Linux device driver type Theodore Ts'o First Linux Kernel Developer in North America and Chief Platform Strategist of the Linux Foundation The Most Practical Guide to Writing Linux Device Drivers Linux now offers an exceptionally robust environment for driver development with today's kernels what once required years of development time can be accomplished in days In this practical example driven book one of the world's most experienced Linux driver developers systematically demonstrates how to develop reliable Linux drivers for virtually any device *Essential Linux Device Drivers* is for any programmer with a working knowledge of operating systems and C including programmers who have never written drivers before Sreekrishnan Venkateswaran focuses on the essentials bringing together all the concepts and techniques you need while avoiding topics that only matter in highly specialized situations Venkateswaran begins by reviewing the Linux 2.6 kernel capabilities that are most relevant to driver developers He introduces simple device classes then turns to serial buses such as I2C and SPI external buses such as PCMCIA PCI and USB video audio block network and wireless device drivers user space drivers and drivers for embedded Linux one of today's fastest growing areas of Linux development For each Venkateswaran explains the technology inspects relevant kernel source files and walks through developing a complete example Addresses drivers

discussed in no other book including drivers for I2C video sound PCMCIA and different types of flash memory Demystifies essential kernel services and facilities including kernel threads and helper interfaces Teaches polling asynchronous notification and I O control Introduces the Inter Integrated Circuit Protocol for embedded Linux drivers Covers multimedia device drivers using the Linux Video subsystem and Linux Audio framework Shows how Linux implements support for wireless technologies such as Bluetooth Infrared WiFi and cellular networking Describes the entire driver development lifecycle through debugging and maintenance Includes reference appendixes covering Linux assembly BIOS calls and Seq files

**Effective Debugging** Diomidis Spinellis,2016-06-29 Every software developer and IT professional understands the crucial importance of effective debugging Often debugging consumes most of a developer s workday and mastering the required techniques and skills can take a lifetime In **Effective Debugging** Diomidis Spinellis helps experienced programmers accelerate their journey to mastery by systematically categorizing explaining and illustrating the most useful debugging methods strategies techniques and tools Drawing on more than thirty five years of experience Spinellis expands your arsenal of debugging techniques helping you choose the best approaches for each challenge He presents vendor neutral example rich advice on general principles high level strategies concrete techniques high efficiency tools creative tricks and the behavioral traits associated with effective debugging Spinellis s 66 expert techniques address every facet of debugging and are illustrated with step by step instructions and actual code He addresses the full spectrum of problems that can arise in modern software systems especially problems caused by complex interactions among components and services running on hosts scattered around the planet Whether you re debugging isolated runtime errors or catastrophic enterprise system failures this guide will help you get the job done more quickly and with less pain Key features include High level strategies and methods for addressing diverse software failures Specific techniques to apply when programming compiling and running code Better ways to make the most of your debugger General purpose skills and tools worth investing in Advanced ideas and techniques for escaping dead ends and the maze of complexity Advice for making programs easier to debug Specialized approaches for debugging multithreaded asynchronous and embedded code Bug avoidance through improved software design construction and management

**Linux Debugging and Performance Tuning** Steve Best ((Steve Francis)),2005

**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 its 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

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