

Linux For Embedded And Real Time Applications 4th Edition

The Eclipse environment solves the problem of having to maintain your own Integrated Development Environment (IDE), which is time consuming and costly. Embedded tools can also be easily integrated into Eclipse. The C/C++CDT is ideal for the embedded community with more than 70% of embedded developers using this language to write embedded code. Eclipse simplifies embedded system development and then eases its integration into larger platforms and frameworks. In this book, Doug Abbott examines Eclipse, an IDE, which can be vital in saving money and time in the design and development of an embedded system. Eclipse was created by IBM in 2001 and then became an open-source project in 2004. Since then it has become the de-facto IDE for embedded developers. Virtually all of the major Linux vendors have adopted this platform, including MontaVista, LynuxWorks, and Wind River. *Details the Eclipse Integrated Development Environment (IDE) essential to streamlining your embedded development process *Overview of the latest C/C++ Developer's Toolkit (CDT) *Includes case studies of Eclipse use including Monta Vista, LynuxWorks, and Wind River

This book provides a unified, coordinated path for embedded developers starting out in embedded Linux programming. It takes a tutorial-style approach, and is unique in using the DS-5 Integrated Development Environment (IDE), matched with ARM's architecture, to create a complete guide from installation to developing simple applications. Through clear, concise and accessible explanation and examples, this book kick starts embedded Linux development in the most practical way possible. With this book you will learn: • What embedded Linux can do for you, and how to achieve particular development goals • How to set up and install the development environment • The very basics of embedded Linux, starting with toggling I/O pins • How to use the Linux command line to perform basic tasks • How to debug code • Profiling and performance tuning • How to use TCP/IP and USB interfaces in Linux. Go from basic set-up to developing complete applications, with examples throughout The only book to approach embedded Linux with a particular development focus: the DS-5 IDE speeds up the learning process whilst focusing on the requirements of embedded applications, such as low level hardware access & TCP/IP socket communication Companion website includes a demo version of the Keil DS-5 tools, including a full IDE, cross compiler, debugger, profiler, hardware simulator and example applications enabling you to get started immediately

The open source nature of Linux has always intrigued embedded engineers, and the latest kernel releases have provided new features enabling more robust functionality for embedded applications. Enhanced real-time performance, easier porting to new architectures, support for microcontrollers and an improved I/O system give embedded engineers even more reasons to love Linux! However, the rapid evolution of the Linux world can result in an eternal search for new information sources that will help embedded programmers to keep up! This completely updated second edition of noted author Doug Abbott's respected introduction to embedded Linux brings readers up-to-speed on all the latest developments. This practical, hands-on guide covers the many issues of special concern to Linux users in the embedded space, taking into account their specific needs and constraints. You'll find updated information on: • The GNU toolchain • Configuring and building the kernel • BlueCat Linux • Debugging on the target • Kernel Modules • Devices Drivers • Embedded Networking • Real-time programming tips and techniques • The RTAI environment • And much more The accompanying CD-ROM contains all the source code from the book's examples, helpful software and other resources to help you get up to speed quickly. This is still the reference you'll reach for again and again! * 100+ pages of new material adds depth and breadth to the 2003 embedded bestseller. * Covers new Linux kernel 2.6 and the recent major OS release, Fedora. * Gives the engineer a guide to working with popular and cost-efficient open-source code.

A guide to using Linux on embedded platforms for interfacing to the real world. "Embedded Linux" is one of the first books available that teaches readers development and implementation of interfacing applications on an Embedded Linux platform.

Leverage the power of Linux to develop captivating and powerful embedded Linux projects About This Book Explore the best practices for all embedded product development stages Learn about the compelling features offered by the Yocto Project, such as customization, virtualization, and many more Minimize project costs by using open source tools and programs Who This Book Is For If you are a developer who wants to build embedded systems using Linux, this book is for you. It is the ideal guide for you if you want to become proficient and broaden your knowledge. A basic understanding of C programming and experience with systems programming is needed. Experienced embedded Yocto developers will find new insight into working methodologies and ARM specific development competence. What You Will Learn Use the Yocto Project in the embedded Linux development process Get familiar with and customize the bootloader for a board Discover more about real-time layer, security, virtualization, CGL, and LSB See development workflows for the U-Boot and the Linux kernel, including debugging and optimization Understand the open source licensing requirements and how to comply with them when cohabiting with proprietary programs Optimize your production systems by reducing the size of both the Linux kernel and root filesystems Understand device trees and make changes to accommodate new hardware on your device Design and write multi-threaded applications using POSIX threads Measure real-time latencies and tune the Linux kernel to minimize them In Detail Embedded Linux is a complete Linux distribution employed to operate embedded devices such as smartphones, tablets, PDAs, set-top boxes, and many more. An example of an embedded Linux distribution is Android, developed by Google. This learning path starts with the module Learning Embedded Linux Using the Yocto Project. It introduces embedded Linux software and hardware architecture and presents information about the bootloader. You will go through Linux kernel features and source code and get an overview of the Yocto Project components available. The next module Embedded Linux Projects Using Yocto Project Cookbook takes you through the installation of a professional embedded Yocto setup, then advises you on best practices. Finally, it explains how to quickly get hands-on with the Freescale ARM ecosystem and community layer using the affordable and open source Wandboard embedded board. Moving ahead, the final module Mastering Embedded Linux Programming takes you through the product cycle and gives you an in-depth description of the components and options that are available at each stage. You will see how functions are split between processes and the usage of POSIX threads. By the end of this learning path, your capabilities will be enhanced to create robust and versatile embedded projects. This Learning Path combines some of the best that Packt has to offer in one complete, curated package. It includes content from the following Packt products: Learning Embedded Linux Using the Yocto Project by Alexandru Vaduva Embedded Linux Projects Using Yocto Project Cookbook by Alex Gonzalez Mastering Embedded Linux Programming by Chris Simmonds Style and approach This comprehensive, step-by-

step, pragmatic guide enables you to build custom versions of Linux for new embedded systems with examples that are immediately applicable to your embedded developments. Practical examples provide an easy-to-follow way to learn Yocto project development using the best practices and working methodologies. Coupled with hints and best practices, this will help you understand embedded Linux better.

Market_Desc: Cracking the Code titles are geared for experienced developers. Readers should be skilled in Java or C++. Special Features: · This code-intensive guide provides an in depth analysis of the inner workings of embedded software development for a variety of embedded operating systems including LINUX, NT and Palm OS. · New Series - Cracking the Code books provide a look at the code behind commercial quality applications. These code-heavy titles are exactly what developers are looking for as programmers learn best by examining code. Includes fully functioning, commercial-quality embedded applications that readers 'tear apart to see how it works' with source code in C++ and Java. · Includes coverage of embedded development for embedded databases, Voice over IP, security systems and even Global Positioning Systems (GPS). Every project comes complete with a detailed Flow Diagram, design specifications and line by line explanation of the code. By 2003, 400 million Internet appliances will be in use, and that by 2010, all home PCs will be replaced by embedded system-based devices. - DataQuest. Embedded Linux projects are expected to triple in the next year. - Evans Data About The Book: · Presents a variety of complete embedded applications with design specifications, flow diagrams and source code with line-by-line explanation. Includes discussion of the challenges of embedded development such as timing, processor clocks and virtual environment development. The target platforms for embedded software are covered: microcontrollers (16 bit and 32 bit) as well as Digital Signal processors. After discussing the basic architecture of these processors, the specifics of architecture are covered with special reference to 8051, ADSP 2181 and ARM processors. · An overview of the Operating systems (embedded, real time and mobile Operating Systems) will be given with discussion on APIs for development of embedded software. The function calls in C/++ and Java will be illustrated with examples. · Line by line detailed analysis of the source code behind cutting-edge embedded applications including GPS, security systems, networked information appliances, cellular phones, embedded databases and wireless network devices. · Applications built on a variety of popular embedded operating systems including NT, LINUX and Java (J2ME)

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A practical tutorial guide which introduces you to the basics of Yocto Project, and also helps you with its real hardware use to boost your Embedded Linux-based project. If you are an embedded systems enthusiast and willing to learn about compelling features offered by the Yocto Project, then this book is for you. With prior experience in the embedded Linux domain, you can make the most of this book to efficiently create custom Linux-based systems.

Master the techniques needed to build great, efficient embedded devices on Linux About This Book Discover how to build and configure reliable embedded Linux devices This book has been updated to include Linux 4.9 and Yocto Project 2.2 (Morty) This comprehensive guide covers the remote update of devices in the field and power management Who This Book Is For If you are an engineer who wishes to understand and use Linux in embedded devices, this book is for you. It is also for Linux developers and system programmers who are familiar with embedded systems and want to learn and program the best in class devices. It is appropriate for students studying embedded techniques, for developers implementing embedded Linux devices, and engineers supporting existing Linux devices. What You Will Learn Evaluate the Board Support Packages offered by most manufacturers of a system on chip or embedded module Use Buildroot and the Yocto Project to create embedded Linux systems quickly and efficiently Update IoT devices in the field without compromising security Reduce the power budget of devices to make batteries last longer Interact with the hardware without having to write kernel device drivers Debug devices remotely using GDB, and see how to measure the performance of the systems using powerful tools such as `perf`, `ftrace`, and `valgrind` Find out how to configure Linux as a real-time operating system In Detail Embedded Linux runs many of the devices we use every day, from smart TVs to WiFi routers, test equipment to industrial controllers - all of them have Linux at their heart. Linux is a core technology in the implementation of the inter-connected world of the Internet of Things. The comprehensive guide shows you the technologies and techniques required to build Linux into embedded systems. You will begin by learning about the fundamental elements that underpin all embedded Linux projects: the toolchain, the bootloader, the kernel, and the root filesystem. You'll see how to create each of these elements from scratch, and how to automate the process using Buildroot and the Yocto Project. Moving on, you'll find out how to implement an effective storage strategy for flash memory chips, and how to install updates to the device remotely once it is deployed. You'll also get to know the key aspects of writing code for embedded Linux, such as how to access hardware from applications, the implications of writing multi-threaded code, and techniques to manage memory in an efficient way. The final chapters show you how to debug your code, both in applications and in the Linux kernel, and how to profile the system so that you can look out for performance bottlenecks. By the end of the book, you will have a complete overview of the steps required to create a successful embedded Linux system. Style and approach This book is an easy-to-follow and pragmatic guide with in-depth analysis of the implementation of embedded devices. It follows the life cycle of a project from inception through to completion, at each stage giving both the theory that underlies the topic and practical step-by-step walkthroughs of an example implementation. Expand Raspberry Pi capabilities with fundamental engineering principles Exploring Raspberry Pi is the innovators guide to bringing Raspberry Pi to life. This book favors engineering principles over a 'recipe' approach to give you the skills you need to design and build your own projects. You'll understand the fundamental principles in a way that transfers to any type of electronics, electronic modules, or external peripherals, using a "learning by doing" approach that caters to both beginners and experts. The book begins with basic Linux and programming skills, and helps you stock your inventory with common parts and supplies. Next, you'll learn how to make parts work together to achieve the goals of your project, no matter what type of components you use. The companion website provides a full repository that structures all of the code and scripts, along with links to video tutorials and supplementary content that takes you deeper into your project. The Raspberry Pi's most famous feature is its adaptability. It can be used for thousands of electronic applications, and using the Linux OS expands the functionality even more. This book helps you get the most from your Raspberry Pi, but it also gives you the fundamental engineering skills you need to incorporate any electronics into any project. Develop the Linux and programming skills you need to build basic applications Build your inventory of parts so you can always "make it work" Understand interfacing, controlling, and communicating with almost any component Explore advanced applications with video, audio, real-world interactions, and more Be free to adapt and create with Exploring Raspberry Pi.

operational hardware running current versions of embedded Linux using the latest development and debugging tools. This book's wide-ranging, practical coverage includes: Linux kernel initialization; the special role of bootloaders and U-Boot in embedded Linux; the use of embedded Linux file systems, including JFFS2; building Flash resident file systems; using the Memory Technology Devices (MTD) subsystem with today's popular flash memory devices; and much more. This Second Edition has been updated for the latest kernel versions, and contains new chapters on the PCI Subsystem, Hotplug and UDEV, USB, and Reducing Boot Time. Readers will also find a detailed introduction to multicore, one of the hottest trends in embedded computing.

An annotated guide to program and develop GNU/Linux Embedded systems quickly About This Book 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 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. 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 Practical example usage of several devices such as RFID readers, Smart card readers, barcode readers, z-Wave devices, GSM/GPRS modems Usage of several sensors such as light, pressure, moisture, temperature, infrared, power, motion In Detail 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. Style and approach This practical tutorial will get you quickly prototyping embedded systems on GNU/Linux. This book uses a variety of hardware to program the peripherals and build simple prototypes.

Linux® is being adopted by an increasing number of embedded systems developers, who have been won over by its sophisticated scheduling and networking, its cost-free license, its open development model, and the support offered by rich and powerful programming tools. While there is a great deal of hype surrounding the use of Linux in embedded systems, there is not a lot of practical information. Building Embedded Linux Systems is the first in-depth, hard-core guide to putting together an embedded system based on the Linux kernel. This indispensable book features arcane and previously undocumented procedures for: Building your own GNU development toolchain Using an efficient embedded development framework Selecting, configuring, building, and installing a target-specific kernel Creating a complete target root filesystem Setting up, manipulating, and using solid-state storage devices Installing and configuring a bootloader for the target Cross-compiling a slew of utilities and packages Debugging your embedded system using a plethora of tools and techniques Details are provided for various target architectures and hardware configurations, including a thorough review of Linux's support for embedded hardware. All explanations rely on the use of open source and free software packages. By presenting how to build the operating system components from pristine sources and how to find more documentation or help, this book greatly simplifies the task of keeping complete control over one's embedded operating system, whether it be for technical or sound financial reasons. Author Karim Yaghmour, a well-known designer and speaker who is responsible for the Linux Trace Toolkit, starts by discussing the strengths and weaknesses of Linux as an embedded operating system. Licensing issues are included, followed by a discussion of the basics of building embedded Linux systems. The configuration, setup, and use of over forty different open source and free software packages commonly used in embedded Linux systems are also covered. uClibc, BusyBox, U-Boot, OpenSSH, tftpd, tftp, strace, and gdb are among the packages discussed.

Optimize and boost your Linux-based system with Yocto Project and increase its reliability and robustness efficiently and cost-effectively. About This Book Optimize your Yocto Project tools to develop efficient Linux-based projects Practical approach to learning Linux development using Yocto Project Demonstrates concepts in a practical and easy-to-understand way Who This Book Is For If you are an embedded Linux developer with a basic knowledge of Yocto Project and want to broaden your knowledge with examples of embedded development, then this book is for you. This book is also for professionals who want to find new insights into working methodologies for Linux development. What You

Will Learn Understand the basic concepts involved in Poky workflows along with configuring and preparing the Poky build environment. Configure a build server and customize images using Toaster. Generate images and fit packages into created images using BitBake. Support the development process by setting up and using Package feeds. Debug Yocto Project by configuring Poky. Build an image for the BeagleBone Black, RaspberryPi 3, and Wandboard, and boot it from an SD card. In Detail Yocto Project is turning out to be the best integration framework for creating reliable embedded Linux projects. It has the edge over other frameworks because of its features such as less development time and improved reliability and robustness. Embedded Linux Development using Yocto Project starts with an in-depth explanation of all Yocto Project tools, to help you perform different Linux-based tasks. The book then moves on to in-depth explanations of Poky and BitBake. It also includes some practical use cases for building a Linux subsystem project using Yocto Project tools available for embedded Linux. The book also covers topics such as SDK, recipetool, and others. By the end of the book, you will have learned how to generate and run an image for real hardware boards and will have gained hands-on experience at building efficient Linux systems using Yocto Project. Style and approach A clear, concise, and straightforward book that will enable you to use and implement the latest features of Yocto Project.

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. Configure the Memory Technology Devices (MTD) subsystem to interface with flash (and other) memory devices. Make the most of BusyBox and latest open source development tools. Learn from expanded and updated coverage of kernel debugging. Build and analyze real-time systems with Linux. Learn to configure device files and driver loading with UDEV. Walk through detailed coverage of the USB subsystem. Introduces the latest open source embedded Linux build systems. Reference appendices include U-Boot and BusyBox commands.

In-depth instruction and practical techniques for building with the BeagleBone embedded Linux platform Exploring BeagleBone is a hands-on guide to bringing gadgets, gizmos, and robots to life using the popular BeagleBone embedded Linux platform. Comprehensive content and deep detail provide more than just a BeagleBone instruction manual—you'll also learn the underlying engineering techniques that will allow you to create your own projects. The book begins with a foundational primer on essential skills, and then gradually moves into communication, control, and advanced applications using C/C++, allowing you to learn at your own pace. In addition, the book's companion website features instructional videos, source code, discussion forums, and more, to ensure that you have everything you need. The BeagleBone's small size, high performance, low cost, and extreme adaptability have made it a favorite development platform, and the Linux software base allows for complex yet flexible functionality. The BeagleBone has applications in smart buildings, robot control, environmental sensing, to name a few; and, expansion boards and peripherals dramatically increase the possibilities. Exploring BeagleBone provides a reader-friendly guide to the device, including a crash course in computer engineering. While following step by step, you can: Get up to speed on embedded Linux, electronics, and programming Master interfacing electronic circuits, buses and modules, with practical examples Explore the Internet-connected BeagleBone and the BeagleBone with a display Apply the BeagleBone to sensing applications, including video and sound Explore the BeagleBone's Programmable Real-Time Controllers Hands-on learning helps ensure that your new skills stay with you, allowing you to design with electronics, modules, or peripherals even beyond the BeagleBone. Insightful guidance and online peer support help you transition from beginner to expert as you master the techniques presented in Exploring BeagleBone, the practical handbook for the popular computing platform.

An operating system (OS) is an important component of most computer systems. At a minimum, the OS is responsible for managing tasks and resources. This becomes more challenging in a multicore environment, where multiple tasks can execute concurrently and must vie for shared resources. So the OS configuration is a critical consideration when building a multicore system. This chapter describes the different ways one or more Oses can be instantiated in multicore systems, along with many of the more critical controls that architects and programmers have for customizing the behavior of the OS. Included is a discussion of some of the debugging tools that are often shipped with Oses.

Embedded Linux Development is designed to give experienced programmers a solid understanding of adapting the Linux kernel and customized user-space libraries and utilities to embedded applications such as those in use in consumer electronics, military, medical, industrial, and auto industries. This five day course includes extensive hands-on exercises and demonstrations designed to give you the necessary tools to develop an embedded Linux device.

There's a great deal of excitement surrounding the use of Linux in embedded systems -- for everything from cell phones to car ABS systems and water-filtration plants -- but not a lot of practical information. Building Embedded Linux Systems offers an in-depth, hard-core guide to putting together embedded systems based on Linux. Updated for the latest version of the Linux kernel, this new edition gives you the basics of building embedded Linux systems, along with the configuration, setup, and use of more than 40 different open source and free software packages in common use. The book also looks at the

strengths and weaknesses of using Linux in an embedded system, plus a discussion of licensing issues, and an introduction to real-time, with a discussion of real-time options for Linux. This indispensable book features arcane and previously undocumented procedures for: Building your own GNU development toolchain Using an efficient embedded development framework Selecting, configuring, building, and installing a target-specific kernel Creating a complete target root filesystem Setting up, manipulating, and using solid-state storage devices Installing and configuring a bootloader for the target Cross-compiling a slew of utilities and packages Debugging your embedded system using a plethora of tools and techniques Using the uClibc, BusyBox, U-Boot, OpenSSH, tftpd, strace, and gdb packages By presenting how to build the operating system components from pristine sources and how to find more documentation or help, Building Embedded Linux Systems greatly simplifies the task of keeping complete control over your embedded operating system.

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.

This book integrates new ideas and topics from real time systems, embedded systems, and software engineering to give a complete picture of the whole process of developing software for real-time embedded applications. You will not only gain a thorough understanding of concepts related to microprocessors, interrupts, and system boot process, appreciating the importance of real-time modeling and scheduling, but you will also learn software engineering practices such as model documentation, model analysis, design patterns, and standard conformance. This book is split into four parts to help you learn the key concept of embedded systems; Part one introduces the development process, and includes two chapters on microprocessors and interrupts---fundamental topics for software engineers; Part two is dedicated to modeling techniques for real-time systems; Part three looks at the design of software architectures and Part four covers software implementations, with a focus on POSIX-compliant operating systems. With this book you will learn: The pros and cons of different architectures for embedded systems POSIX real-time extensions, and how to develop POSIX-compliant real time applications How to use real-time UML to document system designs with timing constraints The challenges and concepts related to cross-development Multitasking design and inter-task communication techniques (shared memory objects, message queues, pipes, signals) How to use kernel objects (e.g. Semaphores, Mutex, Condition variables) to address resource sharing issues in RTOS applications The philosophy underpinning the notion of "resource manager" and how to implement a virtual file system using a resource manager The key principles of real-time scheduling and several key algorithms Coverage of the latest UML standard (UML 2.4) Over 20 design patterns which represent the best practices for reuse in a wide range of real-time embedded systems Example codes which have been tested in QNX---a real-time operating system widely adopted in industry

Learn to develop customized device drivers for your embedded Linux system
About This Book* Learn to develop customized Linux device drivers* Learn the core concepts of device drivers such as memory management, kernel caching, advanced IRQ management, and so on.* Practical experience on the embedded side of Linux
Who This Book Is ForThis book will help anyone who wants to get started with developing their own Linux device drivers for embedded systems. Embedded Linux users will benefit highly from this book.
This book covers all about device driver development, from char drivers to network device drivers to memory management.
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
In 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

The emergence of new soft real-time applications such as DVRs (Digital Video Recorders) and other multimedia devices has caused an explosion in the number of embedded real-time systems in use and development. Many engineers working on these emergent products could use a practical and in depth primer on how to apply real-time theory to get products to market quicker, with fewer problems, and better performance. Real-Time Embedded Systems and Components introduces practicing engineers and advanced students of engineering to real-time theory, function, and tools applied to embedded applications. The first portion of the book provides in-depth background on the origins of real-time theory including rate monotonic and dynamic scheduling. From there it explores the use of rate monotonic theory for hard real-time applications commonly used in aircraft flight systems, satellites, telecommunications, and medical systems. Engineers also learn about dynamic scheduling for use in soft real-time applications such as video on demand, VoIP (Voice over Internet Protocol), and video gaming. Sample code is presented and analyzed based upon Linux and VxWorks operating systems running on a standard Intel architecture PC. Finally, readers will be able to build working robotics, video, machine vision, or VoIP projects using low-cost resources and approaches to gain hands on real-time application

experience. Real-Time Embedded Systems and Components is the one single text that provides an in-depth introduction to the theory along with real world examples of how to apply it.

In today's life, embedded systems are ubiquitous. But they differ from traditional desktop systems in many aspects – these include predictable timing behavior (real-time), the management of scarce resources (memory, network), reliable communication protocols, energy management, special purpose user-interfaces (headless operation), system configuration, programming languages (to support software/hardware co-design), and modeling techniques. Within this technical report, authors present results from the lecture “Operating Systems for Embedded Computing” that has been offered by the “Operating Systems and Middleware” group at HPI in Winter term 2013/14. Focus of the lecture and accompanying projects was on principles of real-time computing. Students had the chance to gather practical experience with a number of different OSES and applications and present experiences with near-hardware programming. Projects address the entire spectrum, from bare-metal programming to harnessing a real-time OS to exercising the full software/hardware co-design cycle. Three outstanding projects are at the heart of this technical report. Project 1 focuses on the development of a bare-metal operating system for LEGO Mindstorms EV3. While still a toy, it comes with a powerful ARM processor, 64 MB of main memory, standard interfaces, such as Bluetooth and network protocol stacks. EV3 runs a version of 1.1 Introduction Linux. Sources are available from Lego's web site. However, many devices and their driver software are proprietary and not well documented. Developing a new, bare-metal OS for the EV3 requires an understanding of the EV3 boot process. Since no standard input/output devices are available, initial debugging steps are tedious. After managing these initial steps, the project was able to adapt device drivers for a few Lego devices to an extent that a demonstrator (the Segway application) could be successfully run on the new OS. Project 2 looks at the EV3 from a different angle. The EV3 is running a pretty decent version of Linux- in principle, the RT_PREEMPT patch can turn any Linux system into a real-time OS by modifying the behavior of a number of synchronization constructs at the heart of the OS. Priority inversion is a problem that is solved by protocols such as priority inheritance or priority ceiling. Real-time OSES implement at least one of the protocols. The central idea of the project was the comparison of non-real-time and real-time variants of Linux on the EV3 hardware. A task set that showed effects of priority inversion on standard EV3 Linux would operate flawlessly on the Linux version with the RT_PREEMPT-patch applied. If only patching Lego's version of Linux was that easy... Project 3 takes the notion of real-time computing more seriously. The application scenario was centered around our Carrera Digital 132 racetrack. Obtaining position information from the track, controlling individual cars, detecting and modifying the Carrera Digital protocol required design and implementation of custom controller hardware. What to implement in hardware, firmware, and what to implement in application software – this was the central question addressed by the project.

Based upon the authors' experience in designing and deploying an embedded Linux system with a variety of applications, Embedded Linux System Design and Development contains a full embedded Linux system development roadmap for systems architects and software programmers. Explaining the issues that arise out of the use of Linux in embedded systems, the book facilitates movement to embedded Linux from traditional real-time operating systems, and describes the system design model containing embedded Linux. This book delivers practical solutions for writing, debugging, and profiling applications and drivers in embedded Linux, and for understanding Linux BSP architecture. It enables you to understand: various drivers such as serial, I2C and USB gadgets; uClinux architecture and its programming model; and the embedded Linux graphics subsystem. The text also promotes learning of methods to reduce system boot time, optimize memory and storage, and find memory leaks and corruption in applications. This volume benefits IT managers in planning to choose an embedded Linux distribution and in creating a roadmap for OS transition. It also describes the application of the Linux licensing model in commercial products.

This easy-to- follow textbook/reference guides the reader through the creation of a fully functional embedded operating system, from its source code, in order to develop a deeper understanding of each component and how they work together. The text describes in detail the procedure for building the bootloader, kernel, filesystem, shared libraries, start-up scripts, configuration files and system utilities, to produce a GNU/Linux operating system. This fully updated second edition also includes new material on virtual machine technologies such as VirtualBox, Vagrant and the Linux container system Docker. Topics and features: presents an overview of the GNU/Linux system, introducing the components of the system, and covering aspects of process management, input/output and environment; discusses containers and the underlying kernel technology upon which they are based; provides a detailed examination of the GNU/Linux filesystem; explains how to build an embedded system under a virtual machine, and how to build an embedded system to run natively on an actual processor;introduces the concept of the compiler toolchain, and reviews the platforms BeagleBone and Raspberry Pi; describes how to build firmware images for devices running the Openwrt operating system. The hands-on nature and clearly structured approach of this textbook will appeal strongly to practically minded undergraduate and graduate level students, as well as to industry professionals involved in this area.

Today, Linux is included with nearly every embedded platform. Embedded developers can take a more modern route and spend more time tuning Linux and taking advantage of open source code to build more robust, feature-rich applications. While Gene Sally does not neglect porting Linux to new hardware, modern embedded hardware is more sophisticated than ever: most systems include the capabilities found on desktop systems. This book is written from the perspective of a user employing technologies and techniques typically reserved for desktop systems. Modern guide for developing embedded Linux systems Shows you how to work with existing Linux embedded system, while still teaching how to port Linux Explains best practices from somebody who has done it before
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Build Complete Embedded Linux Systems Quickly and Reliably Developers are increasingly integrating Linux into their embedded systems: It supports virtually all hardware architectures and many peripherals, scales well, offers full source code, and requires no royalties. The Yocto Project makes it much easier to customize Linux for embedded systems. If you're a developer with working knowledge of Linux, Embedded Linux Systems with the Yocto Project™ will help you make the most of it. An indispensable companion to the official documentation, this guide starts by offering a solid grounding in the embedded Linux landscape and the challenges of creating custom distributions for embedded systems. You'll master the Yocto Project's toolbox hands-on, by working through the entire development lifecycle with a variety of real-life examples that you can incorporate into your own projects. Author Rudolf Streif offers deep insight into Yocto Project's build system and engine, and addresses advanced topics ranging from board support to compliance management. You'll learn how to Overcome key challenges of creating custom embedded distributions Jumpstart and iterate OS stack builds with the OpenEmbedded Build System Master build workflow, architecture, and the BitBake Build Engine Quickly troubleshoot build problems Customize new distros with built-in blueprints or from scratch Use BitBake recipes to create new software packages Build kernels, set configurations, and apply patches Support diverse CPU architectures and systems Create Board Support Packages (BSP) for hardware-specific adaptations Provide Application Development Toolkits (ADT) for round-trip development Remotely run and debug applications on actual hardware targets Ensure open-source license compliance Scale team-based projects with Toaster, Build History, Source Mirrors, and Autobuilder

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