

ANDROID™ **DEEP DIVE**

Roger YE

EMBEDDED PROGRAMMING with ANDROID

Bringing Up an Android System from Scratch

Embedded Programming with Android™

Embedded Programming with Android: Bringing Up an Android System from Scratch

Table of Contents

| | \sim | _ | | te | | 1_ |
|---|--------|---|---|----|---|----|
| ı | | n | n | ĪΡ | n | TC |

Preface

Acknowledgments

About the Author

I: Bare Metal Programming

1 Introduction to Embedded System Programming

What Is an Embedded System?

Bare Metal Programming

Learning Embedded System Programming

Software Layers in an Embedded System

Tools and Hardware Platform

The Difference between Virtual Hardware and Real Hardware

Summary

2 Inside Android Emulator

Overview of the Virtual Hardware

Configuring Android Virtual Devices

Hardware Interfaces

Serial

Timer

Summary

3 Setting Up the Development Environment



The Host and Client Environments

Development Environment Setup

Downloading and Installing Android SDK

Downloading and Installing the GNU Toolchain for ARM

Integrated Development Environment

Your First ARM Program

Building the Binary

Running in the Android Emulator

makefile for the Example Projects

Summary

4 Linker Script and Memory Map

Memory Map

Linker

Linker Script

Initializing Data in RAM

Summary

5 Using the C Language

C Startup in a Bare Metal Environment

Calling Convention

Goldfish Serial Port Support

Summary

6 Using the C Library

C Library Variants

Newlib C Library

Common Startup Code Sequence

CS3 Linker Scripts

Customized CS3 Startup Code for the Goldfish Platform

System Call Implementations

Running and Debugging the Library



Using Newlib with QEMU ARM Semihosting

Summary

7 Exception Handling and Timer

Goldfish Interrupt Controller

The Simplest Interrupt Handler

Nested Interrupt Handler

Testing System Calls/Software Interrupts

Timer

Real-Time Clock

Summary

8 NAND Flash Support in Goldfish

Android File System

NAND Flash Properties

NAND Flash Programming in the Goldfish Platform

Memory Technology Device Support

MTD API

NAND Flash Programming Interface Test Program

Summary

II: U-Boot

9 U-Boot Porting

Introducing U-Boot

Downloading and Compiling U-Boot

Debugging U-Boot with GDB

Porting U-Boot to the Goldfish Platform

Summary

10 Using U-Boot to Boot the Goldfish Kernel

Building the Goldfish Kernel

Prebuilt Toolchain and Kernel Source Code



Running and Debugging the Kernel in the Emulator

Booting Android from NOR Flash

Booting Android from NAND Flash

Summary

III: Android System Integration

11 Building Your Own AOSP and CyanogenMod

Introducing AOSP and CyanogenMod

Setting Up an Android Virtual Device

AOSP Android Emulator Build

CyanogenMod Android Emulator Build

Summary

12 Customizing Android and Creating Your Own Android ROM

Supporting New Hardware in AOSP

Supporting New Hardware in CyanogenMod

Summary

IV: Appendixes

A: Building the Source Code for This Book

Setting Up the Build Environment

Setting Up a Virtual Machine

Organization of Source Code

Source Code for Part I

Source Code for Part II

Source Code for Part III

B: Using Repo in This Book

Resources for Repo

Syncing a New Source Tree In Minutes

Downloading Git Repositories Using Local Manifest

Index



