

Linux Device Driver (LDD)

Course Objective

This course deals with the issues of developing drivers in the Linux environment, with a discussion of broader operating systems issues for developers. The course covers the key issues in Linux device drivers. Questions such as: how do I develop a character device, how do I debug a driver, how do I use task queues are examined. Upon completion of this course, you will have the information and technical understanding of how file systems work and device drivers developed in Linux environment

Course Contents

Linux Architecture

Linux Architecture Overview
Security Issues
Version Numbering
License Terms

An Introduction To Device Drivers

The Role of the Device Driver
Splitting the Kernel
Classes of Devices and Modules

Building And Running Modules

Kernel Modules Versus Applications
Compiling and Loading
The Kernel Symbol Table
Initialization and Shutdown
Using Resources
Automatic and Manual Configuration
Doing It in User Space

Tracing and Debugging

printf for debugging
Device information in /proc
strace to track system calls
ksyms and ksymoops
Debuggers, e.g., gdb, and kgdb

Character Devices

Classes of device files
Major and minor numbers
Creating device files with mknod
Registering character device file
Listing character device driver methods

Data: User To/From Kernel

Important functions for accessing user space
Shared Memory
Kiobufs

IOCTLS

What is ioctl
Using ioctl commands to interact with a device
Implementing IOCTL in drivers

Memory management

The Real Story of kmalloc
Memory allocation with kmalloc and kfree
Lookaside Caches
get_free_page and Friends
vmalloc and Friends
Boot-Time Allocation
Page-oriented memory allocation
Memory allocation in the virtual address space
The mmap() method.

JUDICIOUS USE OF DATA TYPES

Use of Standard C Types
Assigning an Explicit Size to Data Items
Interface-Specific Types
Other Portability Issues
Linked Lists

Block Device Read/Write

Block vs Char Read/Write
Block Device Global Variables
Request Handling
Creating a RAM Disk



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Blocking and Wait Queues

Multi-tasking
Schedule()
Wait Queues
Save sleeping
Poll()

Synchronization

Race conditions
Atomic access
Dead lock

Reference:

- Advance Linux Programming
Richard Stevens

- Advance Linux Programming
Code Saurcery LLC

Prerequisite:

Fluent C Programming
Algorithms & Data Structures
Sound Operating System Fundamentals
Familiarity with Linux environment

Spinlocks
The Kernel Lock
Disabling interrupts

Creating Virtual File System Driver

Registering
Readdir Lookup Semantics
Organization of Code
Adding entry into the proc file system

Understanding Linux Source Tree

Physical Layout of Linux Kernel Source