Linux Kernel Debugging and Performance

Course Description

This course is designed to train developers in effective debugging and performance measurement and improvement techniques for the Linux kernel.

Overview

This course walks participants through kernel documentation, kernel configuration, kernel debugging, kernel measurement and other tools.

Course Objectives

After this course attendees will be able to ...

- browse the kernel source code
- create and use proc, sysfs, and debugfs files
- use a variety of kernel debugging configuration features
- use GDB with the kernel
- profile the kernel for various performance characteristics

Who Should Attend:

The course is for programmers who are relatively new to Linux kernel debugging and performance measurement and improvement. Attendees should have experience with C and be able to perform Linux commands.

Duration

Two days.

Course Materials

The workshop materials include a comprehensive student workbook. The workbook contains all of the slides used in the course as well as hands-on lab exercises.

Students should bring a personal USB thumb drive to use to bring home class files.

Course Workshop and Set-up:

The workshop makes use of laptops with a desktop Linux distribution for development. Students will share a computer with two students per computer. Students work as a team on the laboratory exercises.

Course Outline

1. Linux Kernel Source code and documentation

1.1. Browsing the source
1.2. LXR
1.3. tags
1.4. cscope
1.5. documentation

Lab Exercises

- Find kernel source for various features
- Customize kernel source
- Determine kernel functionality from source and specialized documentation

2. Kernel Configuration for Debugging and Performance Measurement

2.1. spin lock configuration
2.2. statistics
2.3. lock usage
2.4. debug info
2.5. mutex
2.6. Magic SysRq
2.7. KGDB
2.8. stack
2.9. Memory allocation

Lab Exercises

- Create custom kernel configuration for debugging and measurement
- Enable a variety of debugging features
- Examine features provided by configuration values
- Debug spin lock problems

3. Filesystems For Debugging

3.1. procfs
3.2. prof files
3.3. creating proc files
3.4. sysfs
3.5. sysfs information
3.6. debugfs
3.7. creating debugfs files

Lab Exercises

- creating proc files
- sysfs and module parameters
- creating and using debugfs files

4. Kernel Debugging

4.1. GDB and the kernel
4.2. KGDB
4.3. KDB
4.4. printk
4.5. console
4.6. Magic SysRq
4.7. strace

Lab Exercises

- Examining kernel state with GDB.
- Kernel deadlocks
- Kernel memory leaks
- Magic SysRq
- KDB

5. Kernel Performance

5.1. Interrupt response
5.2. scheduling
5.3. preemption
5.4. rt-preempt
5.5. benchmarking
5.6. tools

Lab Exercises

- LTTng
- oprofile
- page faults
- timer precision
- rt-preempt

6. Kernel Errors

6.1. oops
6.2. logging daemon
6.3. dmesg
6.4. panic
6.5. dumps and crashes

Lab Exercises

- Working with an Oops
- Working with a panic