Debugging Embedded Linux Systems: Kernel Logging System Overview

Debugging Embedded Linux Training Series [Part 2]
Debugging Embedded Linux Training Series

• Part 1: Linux/Kernel Overview
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• Part 3: printk and Variations
• Part 4: Dynamic Debug
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• Part 6: Understand Kernel Oops Logs
Agenda

• Kernel logging architecture
• Kernel log example
• Retrieve kernel logs
• Kernel log buffer size
• Adding log messages from application
Kernel logging system architecture

- Applications
- I/O & Control API
- Kernel Log Buffer
- Logging API

User Space

Kernel Space
Kernel log example

```plaintext
[ 0.002777]  memory used by lock dependency info: 5167 kB
[ 0.002796]  per task-struct memory footprint: 1536 bytes
[ 0.002851]  Calibrating delay loop... 795.44 BogoMIPS (lpj=3977216)
[ 0.157906]  pid_max: default: 32768 minimum: 301
[ 0.158592]  Security Framework initialized
[ 0.158793]  Mount-cache hash table entries: 2048 (order: 1, 8192 bytes)
[ 0.158825]  Mountpoint-cache hash table entries: 2048 (order: 1, 8192 bytes)
[ 0.165069]  CPU: Testing write buffer coherency: ok
[ 0.165368]  ftrace: allocating 22031 entries in 65 pages
[ 0.248302]  CPU0: thread -1, cpu 0, socket -1, mpidr 0
[ 0.250093]  Setting up static identity map for 0x80100000 - 0x80100070
[ 0.255812]  smp: Bringing up secondary CPUs ...
[ 0.255856]  smp: Brought up 1 node, 1 CPU
[ 0.255881]  SMP: Total of 1 processors activated (795.44 BogoMIPS).
[ 0.255902]  CPU: All CPU(s) started in SVC mode.
[ 0.262088]  devtmpfs: initialized
```
Retrieve kernel logs

• `dmesg` command
  – prints/controls the log buffer

• Common `dmesg` usage:
  – `dmesg` # print the log buffer
  – `dmesg -C` # clear the log buffer
  – `dmesg -c` # print then clear the log buffer
Kernel log buffer size

• Default size is 64KB

• Adjust the size
  – Method #1: Kernel Config Option - CONFIG_LOG_BUF_SHIFT=n
    • menuconfig: “General Setup”
  – Method #2: uboot bootargs: log_buf_len=n
  – Buffer Size = $2^n$
    • n=16: 64KB
    • n=17: 128KB, ...
Adding log messages from user space

• Interface:
  /dev/kmsg

• Usage:
  echo “some comments” > /dev/kmsg

• Example:
  echo “### TESTNOTE: unplugged thumb drive” > /dev/kmsg
  echo “### TESTNOTE: waited for a couple seconds” > /dev/kmsg
  echo “### TESTNOTE: re-plugged thumb drive” > /dev/kmsg
Summary

• Kernel modules use the "Logging API" to generate logs.
• Kernel uses an internal buffer to store logs.
• `dmesg` command can be used to retrieve the logs.
• The log buffer size can be adjusted.
For more information

• Processor SDK Training Series:  
  http://training.ti.com/processor-sdk-training-series

• Debugging Embedded Linux Training Series:  
  http://training.ti.com/debug-embedded-linux-training-series

• Processor SDK Linux Getting Started Guide:  

• Download Processor SDK Linux for Embedded Processors:  
  http://www.ti.com/processorsdk

• For questions about this training, refer to the E2E Embedded Linux Community Forum:  
  http://e2e.ti.com/support/embedded/linux/f/354