Embedded System Design - Linux Device Driver Development

Training Programme
by
Dream Catcher Consulting Sdn Bhd

25 - 29 Nov 19
Dream Catcher Consulting Sdn Bhd, Penang

303-4-5 & 303-4-6 Block B, Krystal Point
Jln Sultan Azlan Shah 11900 Sg Nibong Penang, Malaysia
http://dreamcatcher.asia
enquiry@dreamcatcher.asia
+604 640 7111 / 7112
+604 640 7110
Synopsis

Linux is increasingly the operating system of choice from server farms right down to embedded systems. The majority of Linux-based systems are now powering non-PC based hardware – such as tablets, routers and mobile phones – whereby customized device drivers are necessary for hardware interfacing.

Every operating system has its own way of dealing with customized hardware devices. Linux has its own device handling mechanism that is different from those of other operating systems. Therefore, it is necessary to learn how to deal with Linux device drivers on their own, even if one has had experience writing device drivers for other operating systems.

Course highlight
Participants will be introduced to device driver development for Linux. This course is delivered through a mixture of socratic lectures and hands-on practicals with plenty of code examples.

What You Will Learn

- Linux kernel driver subsystem.
- Linux driver model.
- Linux interrupt handling.
- Linux device interfacing from user space.
- Writing Linux device drivers.

Who Should Attend

Software developers, programmers, systems engineers and embedded developers are encouraged to attend basically anyone who has an interest in developing Linux device drivers.

Prerequisite

Competency with C language programming is a requirement. This course will focus only on how to write device drivers that are used as part of the Linux kernel. Knowledge on how to use a Linux command line. General knowledge on operating systems. General knowledge on microprocessors.

Course Methodology

The course is presented using socratic style lectures and workshops with interactive sessions that work through common examples.

Course Duration

5 day(s), 9am - 5pm
Course Structure

Day 1
Linux Overview
- Introduction to Linux
- Licensing issues for custom drivers

Linux Subsystems
- System Call Interface
- Process Management
- Memory Management
- Virtual Filesystem
- Network stack
- Device drivers

Linux Bootup
- Linux startup process
- Kernel boot loaders

Linux Device Drivers
- Introduction
- Classes
- Issues

Kernel Modules
- Modules vs Applications
- Loading and Unloading
- Module Parameters
- Using printk()

Practicals
- Writing kernel modules

Day 2
Character Drivers
- Data structures
- Device registration
- Device open and release
- Device read and write
- Using kmalloc() and kfree()

Module Debugging
- Debugging using printk() messages
- Debugging using /proc filesystem
- Debugging using strace tool
- Debugging using other methods

Driver Operations
• Device capabilities
• Device poll and select
• Device seeking
• Device access control

Practicals
• Character device driver

**Day 3**
Kernel Memory
• Memory basics
• Understanding kmalloc()
• Memory pools
• Memory limits

Accessing Hardware
• Using I/O ports
• Using I/O memory
• Memory Mapping in Linux with mmap()
• Using direct I/O

Interrupt Handling
• Interrupt handler installation
• Handler implementation
• Interrupt sharing
• Interrupt driven I/O

Practicals
• Writing interrupt handlers.

**Day 4**
Data Types
• Basic C data types
• Interfacing data types
• Portability issues
• Linked lists

Block Drivers
• Device registration
• Device operations
• Device processing

Practicals
• Block device driver

**Day 5**
Mini-Project
Completed custom device driver.

Examining

Miscellaneous

- Discussions
- Q&A

**Course Instructor(s)**

Dr Shawn Tan Ser Ngiap

Dr Shawn Tan has a deep passion for swimming (and drowning) at the hardware and software boundary. He began writing software in 1989 and released his first commercial product in 1997, an education management system initially trialled at Putrajaya Precint 9 Smart-School. His second commercial software system, a financial transaction authorisation system, was a Top 10 phase 1 winner for both Venture 2001 & 2002 business plan competitions organised by McKinsey & Co.

After a decade with software, he decided to deepen his hardware knowledge as well and began designing digital hardware in 1999. His proven microprocessor IP core is currently used by both academia and industry in US/EU/China, powering products from several companies. His company, Aeste Wbrks (M) Sdn Bhd, is also engaged in design and engineering consultancy services for various local companies.

This trajectory ultimately led him to a PhD in Integrated Circuit Design from the University of Cambridge, funded by the Ministry of Science, Technology and Innovation (MOSTI) of Malaysia. During his time at the University of Cambridge, he was contracted as a Teaching Assistant covering a number of subjects including CMOS Mixed-Signal Design, C/C++ Programming, Computer Architecture and Data Communications, and project supervision at both undergraduate and masters levels.

After returning home, he worked for the Information Systems Security Lab (ISSL) of the government where he engaged in various information security projects including designing and developing a multi-mode user authentication platform in use by several ministries for secure user authentication.

Formerly, he was a research fellow to TMR&D, treasurer for the Institution of Engineering and Technology (IET), auditor for MOSTI TechnoFund, advisor to Virtuous Investment Circle and industry advisory panel to UCSI University. He is a regular columnist for Digital News Asia. During his leisure time, he likes to play PS3 games and watch a good movie.
Administrative Details

Programme Logistics

**Duration:** 5 day(s), 9am - 5pm  
**Date:** 25 - 29 Nov 19  
**Venue:** Dream Catcher Consulting Sdn Bhd, Penang

Morning break, lunch and tea break will be provided throughout the course duration. Course Manual and Certificate of Attendance will be provided.

Your Investment

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<th>Condition</th>
<th>Price per Pax</th>
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<th>Price per Pax incl SST</th>
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<td>Regular fee</td>
<td>RM4,540.00</td>
<td>RM272.40</td>
<td>RM4,812.40</td>
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<td>Early bird discount for registration before 28-Oct-2019. N/A for SBL KHAS</td>
<td>RM4,125.00</td>
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<td>Group discount for every 3 pax registered, receive 1 complimentary seat</td>
<td>RM4,540.00</td>
<td>RM272.40</td>
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Additional cost may incur for customization or extra material request. Course fee is 100% claimable from PSMB (SBL scheme) in accordance to PSMB guidelines.

3 Easy Steps to Register

- **Phone**  +604 640 7111 / 7112  
- **Fax registration form** to +604 640 7110  
- **Email registration form** to register@dreamcatcher.asia
Method of Payment

Crossed cheque / bank draft made in favour of DREAM CATCHER CONSULTING SDN BHD. Registration form together with payment to be couriered to:

Dream Catcher Consulting Sdn Bhd
303-4-5 & 303-4-6
Block B, Krystal Point
Jln Sultan Azlan Shah
11900 Sg Nibong
Penang, Malaysia

Payment must be received no later than 10 working days before the course commences. An undertaking may be accepted in cases where payment is delayed. However all payments must be made before the course commences. Closing registration date is 11-Nov-2019.

Refund and Cancellation

Fees will only be refunded in full for cancellation received in writing more than 10 working days prior to the commencement date. Substitute attendee(s) will be accepted at no extra charge.

Disclaimer

Dream Catcher Consulting Sdn Bhd reserves the right to change the instructors, date and to vary/cancel the programme should unavoidable circumstances arise. All effort will be taken to inform participants of the changes. Upon sending the registration form, you are deemed to have read and accepted the terms.

Enquiries

call us at +604 640 7111 / 7112 or email us at enquiry@dreamcatcher.asia
# Registration Form

**Course Title**: Embedded System Design - Linux Device Driver Development  
**Course Date**: 25 - 29 Nov 19  
**Location**: Dream Catcher Consulting Sdn Bhd, Penang

*(Emails are required to ensure notification of any changes reach the participant)*

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<th>No.</th>
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**Total Amount**

*(Emails are required to ensure notification of any changes reach the participant)*

**Submitted by:**

- **Company Name:**
- **Company Address:**
- **Contact Person:**
  - Designation:
  - Phone:
- **Email:**

*Please complete this form with an authorised signature below and fax to fax registration form to +604 640 7110 or email to email registration form to register@dreamcatcher.asia. Call us at phone +604 640 7111 / 7112 for any enquiry*

**Authorised Signature:**

*Please print full name (authorised signature) if you submit via email*

- **Name:**
- **Designation:**
- **Dept:**
- **Date:**

*This registration is invalid without a signature. Payment must be made no later than 10 working days before the course commences. An undertaking may be accepted in cases where payment is delayed, however all payment must be made before the course commences. Participants who registered but did not attend will be invoiced accordingly. Fees will only be refunded in full for cancellation received in writing more than 10 working days prior to the commencement date. Substitute attendee(s) will be accepted at no extra charge.*

*Please send payment with this form to*

- **Dream Catcher Consulting Sdn Bhd**
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  - Block B, Krystal Point
  - Jln Sultan Azlan Shah
  - 11900 Sg Nibong
  - Penang, Malaysia

*Enclosed cheque/bank draft no __________________ made in favour of DREAM CATCHER CONSULTING SDN BHD*