

Course Syllabus

Advanced Programming in the UNIX Environment

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UNIX OS is Popular ...

Let's see some numbers ...

Worldwide Device Shipments by Operating System (Thousands of Units)

	2012	2013	2014	2015	2016
Android	505,509	898,944	1,156,111	1,454,760	1,619,030
Windows	346,468	326,060	262,615	279,415	298,896
iOS/Mac OS	212,875	236,200	333,017	355035	393,256
Others	1,152,588	873,195	626,358	380,545	261,155
Total	2,217,440	2,334,399	2,378,101	2,469,755	2,572,337

Android + Apple ~ 80%. The raise of mobile operating systems!

Source: Gartner

<http://www.gartner.com/newsroom/id/2610015>, 2791017, 2954317

Course Objective

UNIX programming tools

Library calls and system calls

Implement (console-based) tools and applications

Low-level programming in the UNIX environment

Security issues in the UNIX programming environment

The Instructor

Chun-Ying Huang (黃俊穎)

- Office: EC 417
- Office Hour: Wed 10am-12nn, or by appointment
- Email: chuang@cs.nctu.edu.tw
- Phone: (03)5731875

Teaching Assistant

TBD

- Office:
- Office Hour: TBD
- Email:
- Phone:

Lecture

Prerequisite

- C and/or C++ programming
- Some Assembly language (IA32 and IA64) – will be introduced in the class
- Operating system
- Computer network

Allocated time and classroom

- 10:10—12:00, Monday @ EC 022
- 9:00—9:50, Wednesday @ EC 022

This course is lectured in English

Textbook

W. Richard Stevens and Stephen A. Rago, “Advanced Programming in the UNIX Environment,” 2nd ed. or 3rd ed, Addison Wesley (開發圖書)

Course Topics

Fundamental tools and shell programming

Files and directories

File I/O and standard I/O

System data files and information

Process environment

Process control

Signals

Assembly language integration

Threads

Thread control

Daemon processes

Advanced I/O

Inter-process communication

Network I/O

Other Topics

Working Environment – Setup (1/3)

Option #1: Install your own virtual machine and your preferred OS

- VirtualBox – Open-source solution, supports Windows, Mac OS X, and Linux
- VMware – Commercial solution, supports Windows, Linux, and Mac OS X
- HyperV – Built-in since Windows 8
- ➔ You may have to enable CPU's VT-x feature (in BIOS) to have better performance

Intel® Virtualization Technology

Phoenix TrustedCore(tm) Setup Utility		
Advanced		
Advanced Processor Configuration		Item Specific Help
CPU Mismatch Detection:	[Enabled]	When enabled, a VMM (Virtual Machine Monitor) can utilize the additional hardware capabilities provided by Vanderpool Technology.
Core Multi-Processing:	[Enabled]	
Processor Power Management:	[Disabled]	
Intel(R) Virtualization Technology	[Enabled]	
Execute Disable Bit:	[Enabled]	
Adjacent Cache Line Prefetch:	[Disabled]	If this option is changed, a Power Off-On sequence will be applied on the next boot.
Hardware Prefetch:	[Disabled]	
Direct Cache Access	[Disabled]	
Set Max Ext CPUID = 3	[Disabled]	
F1 Info ↑↓ Select Item -/+ Change Values F9 Setup Defaults		
Esc Exit ← Select Menu Enter Select ▸ Sub-Menu F10 Save and Exit		

Working Environment – Setup (2/3)

Option #2: ~~For CS students, you may try Linux or BSD workstations~~

- linux1.cs.nctu.edu.tw ~ linux4.cs.nctu.edu.tw
- bsd1.cs.nctu.edu.tw ~ bsd4.cs.nctu.edu.tw
- **No root permission - we may need root permission for some topics**

Option #3: If you have a Mac

- Install Xcode, and you should have the required tools
- iOS and Mac OS X are based on a BSD kernel
- In addition, you can install homebrew, macports, or fink
- Current recommendation: docker (DockerDesktop) on Mac

Working Environment – Setup (3/3)

Option #4: If you were a hardcore Windows player

- Install CYGWIN or MSYS2 and the required tools
- **Not really recommended**, because it is an emulated environment.

Instructor's Recommendation

- Native Linux or Linux in a virtual machine

Popular UNIX distributions (mostly Linux)

- <http://distrowatch.com/>: Statistics based on web visitors
- Manjaro, Mint, Debian, Ubuntu, OpenSUSE, Fedora, FreeBSD



Working Environment – Required Tools

Terminal

- putty (recommended ssh client for accessing the platform on Windows)
- Built-in terminal app in Mac OS X and Linux/UNIX
- CYGWIN/MSYS2's default terminal

Development tools

- gcc/g++/clang/yasm/nasm
- gdb
- make

Text Editors

- Visual studio code (multiple platforms)
- notepad++: <https://notepad-plus-plus.org/> (Windows only)
- vim (multiple platforms)

bash – for shell programming

Grading Policy

Midterm: 25%

Final Exam: 35%

Homework and class participation: 40%

***No copycats!** You are encouraged to discuss with your classmates, but all your submissions must be your own work.*

Course Web Site

URL

- <http://people.cs.nctu.edu.tw/~chuang/courses/unixprog/>
- Instructor's personal web page -> Courses -> UNIX Programming

Course materials are password protected

- Username: `unix108`
- Password: `up20taro`

Q & A

BEFORE OUR NEXT CLASS, PLEASE ENSURE THAT
YOU HAVE SETUP YOUR WORKING ENVIRONMENT