Computer System Administration

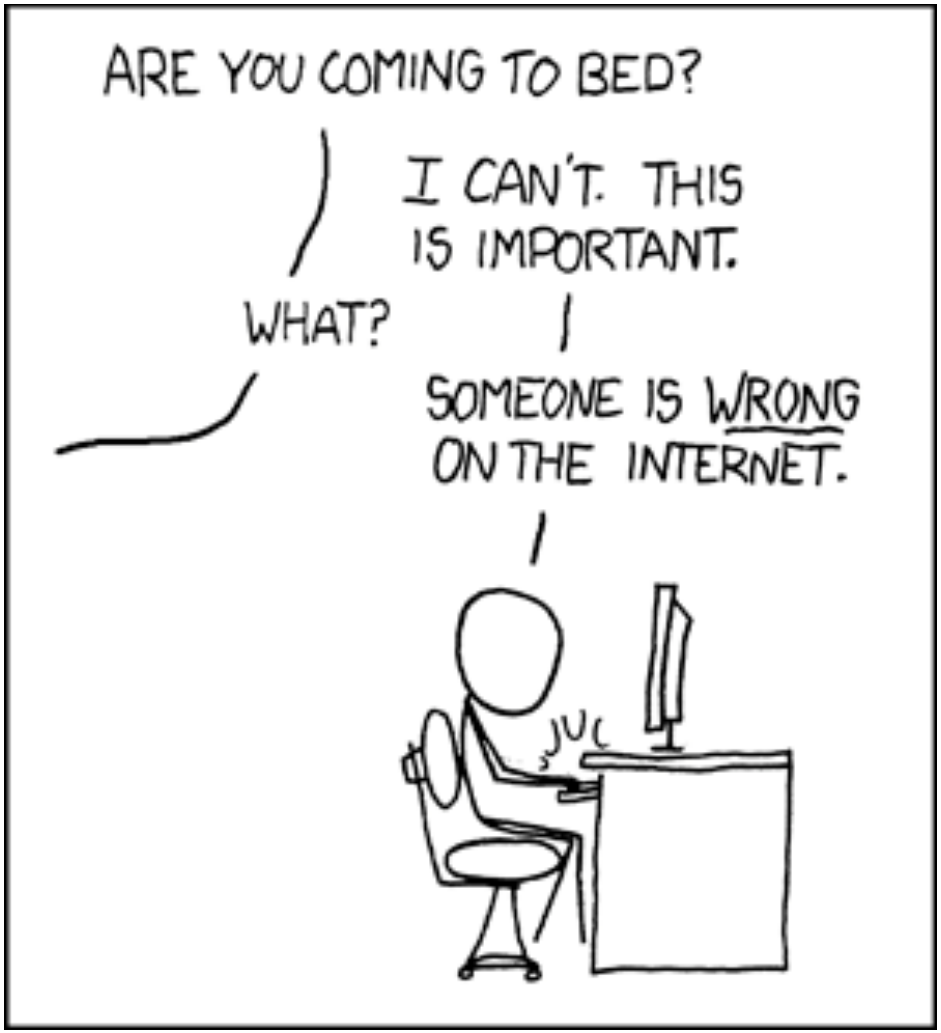
Computer Center, Department of Computer Science
(CSCC)
Lecturer: Liang-Chi Tseng (lctseng)

What System Administrator Should do? (1)

- Ordinary list
  - Install new system, programs and OS updates
  - Monitoring system and trying to Tune performance
  - Adding and removing users
  - Adding and removing hardware
  - Backup and Restore
  - Configuration management (Ansible, Chef, Puppet, SaltStack, …)
  - Infrastructure management (Terraform, …)
  - Continuous Integration / Continuous Delivery (Git, Jenkins / Travis CI, …)
  - Log management (Fluentd, Papertrail, …)
  - Security
  - Virtualization (Docker, …)
  - …

What System Administrator Should do? (2)

- Non-technique list
  - Helping users
  - Maintaining documentation
  - Moving furniture
  - Burning your liver
  - Good communication and memorization

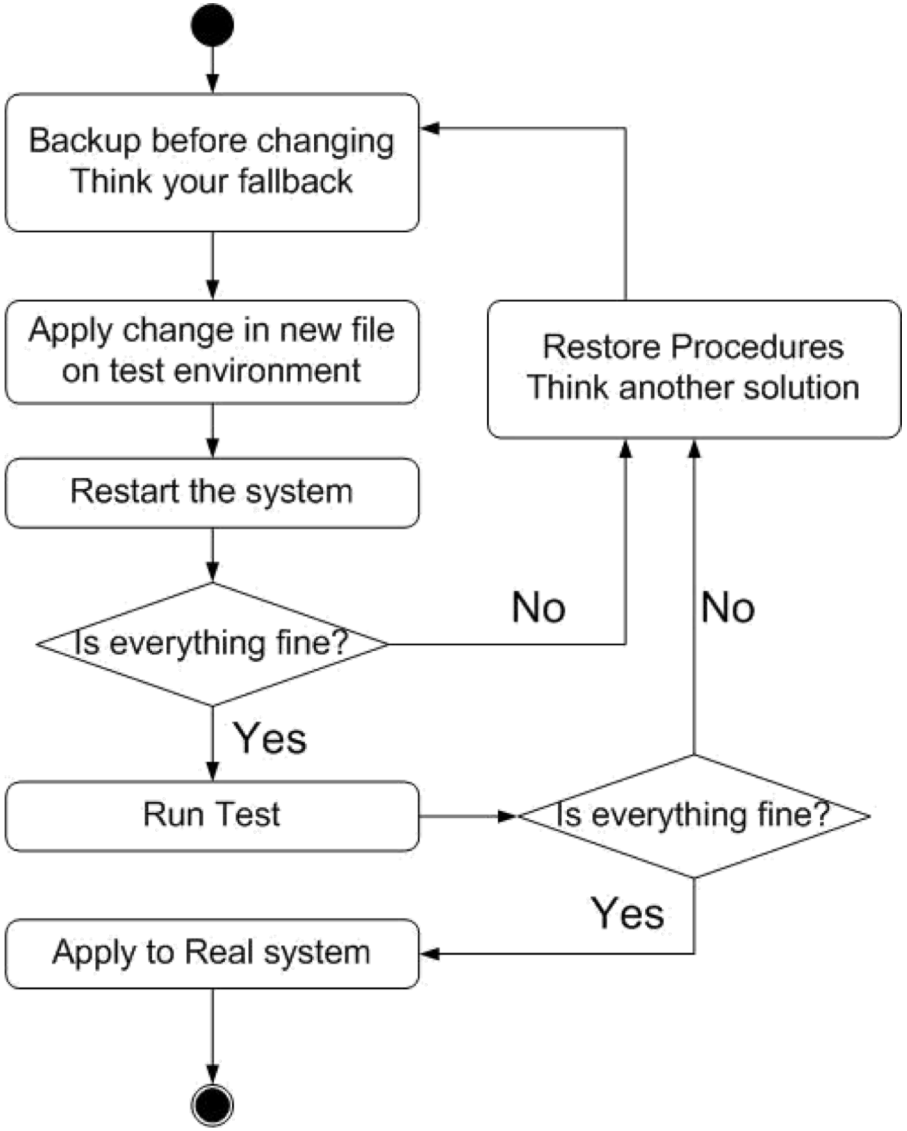


What System Administrator Should do? (3)

- The best words to describe the job
  - Thankless job.
    - http://www.sysadminday.com/
  - System administration is like keeping the trains on time; no one notices except when they're late.
  - 氣象局：「我們對的時候，沒人記得；我們錯的時候，沒人忘記。」
- Philosophy of system administration
  - Know how things really work.
  - Plan it before you do it.
  - Make it reversible.
  - Make changes incrementally.
  - Test before you unleash it.

What System Administrator Should do? (4)

- Flow of Change



What you can learn in this course?

- The skill to be a candidate of system administrator
  - We are not going to teach you cool & new things
  - But the how to master these skills
  - Read official docs, not just copy & paste from stackoverflow
- Information about CS computer center
- What FreeBSD can do.
- System Admin / Network Admin ?
  - SA: manage one computer
  - NA: manage a network consist of multiple computers

Why FreeBSD

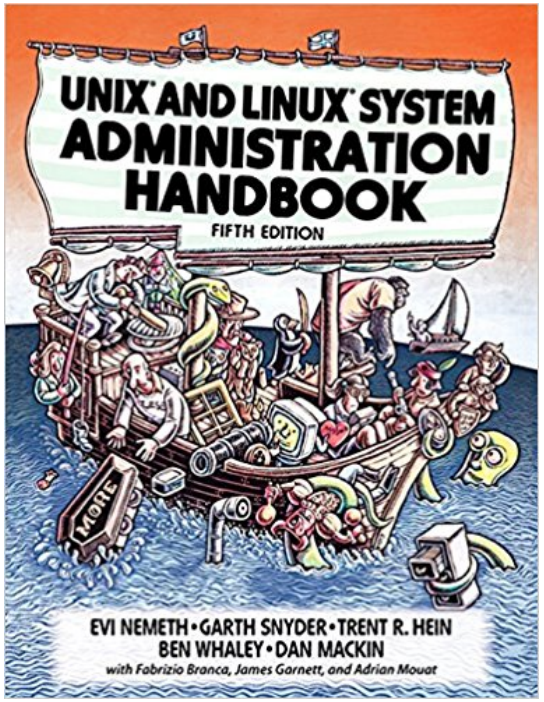
- Our goal is to learn "How it works"
  - FreeBSD is simple and easy to learn
- Linux?
  - Lots of distributions
  - Ubuntu, Mint, Debian, Red Hat, Arch, Kali, Fedora, CentOS, …
- BSD is still popular in some ways
  - Apple MacOS, iOS are based on BSD
  - https://en.wikipedia.org/wiki/Darwin_(operating_system)

Attitude

- Attend every class
- Do every exercise
  - As early as possible
  - On your own
- Read book and practice at least 6 hours every week
  - Use unix-like environment
  - Recommend: more than 1.5 hours/day averagely.
- Collect information on the internet
  - The newer, the better.

Syllabus

- Website:
  - https://nasa.cs.nctu.edu.tw/sa/2019/
- Instructors:
  - 曾亮齊 lctseng@cs.nctu.edu.tw
  - 王則涵 wangth@cs.nctu.edu.tw
  - 林瑞男 jnlin@cs.nctu.edu.tw
  - 許立文 lwhsu@cs.nctu.edu.tw
- Time:
  - Thu. IJK (PM 6:30 ~ 9:20)
- Place:
  - EC122
- TAs:
  - We might get about 6 TAs.
  - Email to TAs: ta@nasa.cs.nctu.edu.tw
  - 3GH every week
- Textbook:
  - Unix and Linux System Administration Handbook (5th Edition)



Syllabus – Content

- We will cover the following chapters in this semester (SysAdm):
  - Chapter 1 ~ 14
  - Chapter 16, 19, 20
  - Chapter 27, 31
- The following chapters is covered in the next semester (NetAdm):
  - Chapter 15 ~ 18, 21, 23 ~ 25, 30 ~ 32
  - NAT, DHCP, VPN, Proxy, …
  - Python Programming for system administration

Syllabus – Text book outline

Part I. Basic Administration

- Chap 1 – Where to start.
- Chap 2 – Booting and Shutting Down
- Chap 3 – The Filesystem
- Chap 4 – Access control and rootly powers
- Chap 5 – Controlling processes
- Chap 6 – User Management
- Chap 7 – Storage
- Chap 8 – Periodic processes
- Chap 9 – Backups
- Chap 10 – Syslog and log files
- Chap 11 – Software installation and management
- Chap 12 – The Kernel
- Chap 13 – Scripting and the Shell
- Chap 14 – Configuration Management

Part II. Networking

- Chap 15 – Physical Networking
- Chap 16 – TCP/IP
- Chap 17 – Routing
- Chap 18 – DNS: Domain Name System
- Chap 19 – NFS: Network File System
- Chap 20 – HTTP: Hypertext Transfer Protocol
- Chap 21 – SMTP: Simple Mail Transfer Protocol
- Chap 22 – Directory Services
- Chap 23 – Electronic Mail
- Chap 24 – Web Applications
- Chap 25 – Network Management and Debugging

Syllabus – Text book outline (Cont.)

Part III. Operations

- ❑Chap 26 – Continuous Integration and Delivery
- ❑Chap 27 – Security
- ❑Chap 28 – Cloud Computing
- ❑Chap 29 – Containers and Virtualization
- ❑Chap 30 – Monitoring
- ❑Chap 31 – Performance Analysis
- ❑Chap 32 – Policy and Politics

Syllabus – Grade Policy

- Mid
  - 15 ~ 20%
- Final
  - 15 ~ 20%
- Exercise (Homeworks)
  - 60 ~ 70%
    - No Delay Work
    - 4 exercises
    - 1 term project

What you should prepare?

- Background knowledge
  - Basic knowledge of UNIX commands
  - Basic Programming skills
  - Basic of TCP/IP Networking
- Environment
  - One dedicated PC
  - Dual OS in your PC
  - Virtual Machine (Virtualbox, VMWare)
- Yourself
  - Your hard study

Finally, Am I OK to take this course?

- ❑ Are you willing to devote yourself to exercise?
  - Yes! Please come
- ❑ Are you newbie in this area?
  - Yes!? It's ok, Please come
- ❑ Do you take more than 3 major courses?
  - Yes!??? It is quite dangerous, but I can not stop you
  - Sometimes your may spend the whole weekend to just figure out what to do in the homework
  - Experience from past students: loading of this course equals to 2-3 major courses
- ❑ You will learn a lot if you work hard

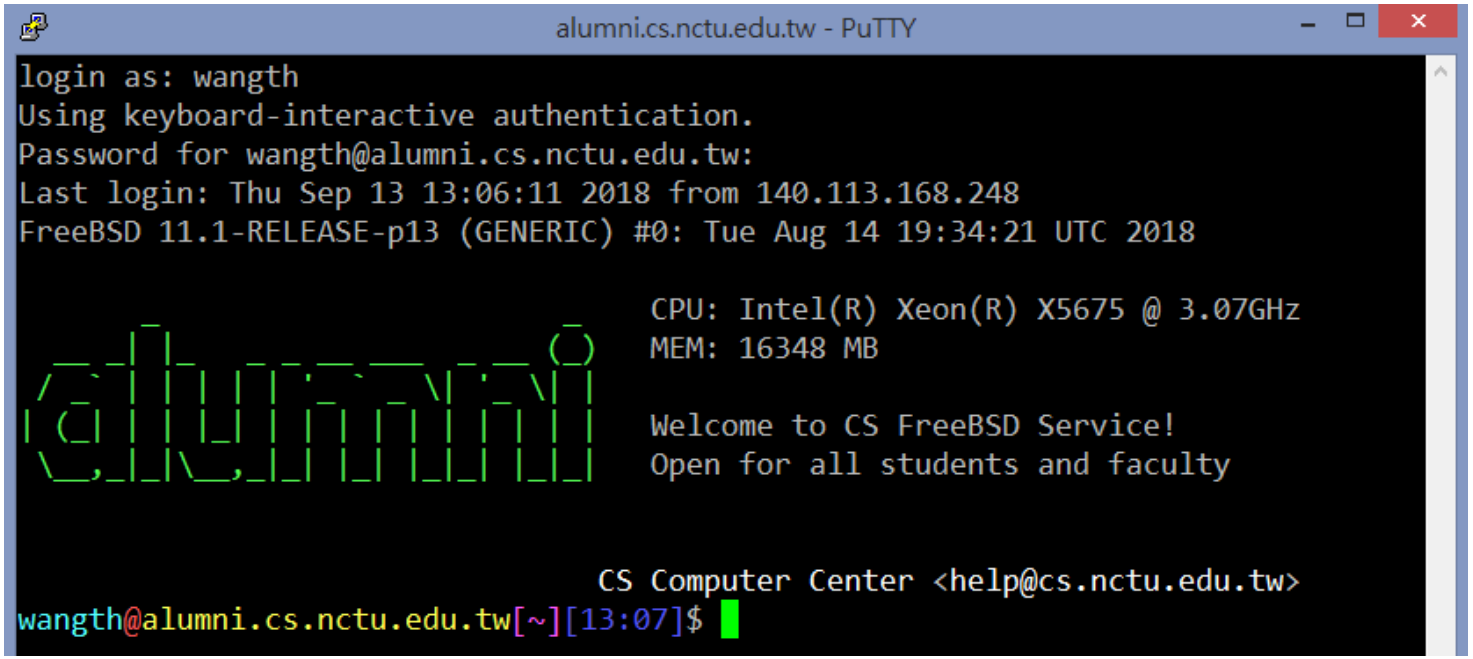
Basic knowledge in this course

Play with FreeBSD system

- Our department has FreeBSD servers for all students
  - bsd{1,2,3,4}.cs.nctu.edu.tw
  - alumni.cs.nctu.edu.tw
  - About CS workstation
    - https://cscc.cs.nctu.edu.tw/workstation-guide
- Login and play with it!
- Get familiar with CLI (command line interface)
  - Without GUI (graphics user interface)
  - Don't be afraid ☺

Login

- SSH (Secure Shell)
  - PuTTY: (for Windows)
    https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html



Login

- SSH (Secure Shell)
  - Terminal (for MacOS)

```
21:42 lctseng@Henrys-Mac(192.168.89.12)[~]
[T4] % ssh alumni.cs.nctu.edu.tw
Last login: Tue Jun  4 21:41:23 2019 from 123.194.172.52
FreeBSD 11.2-RELEASE-p5 (GENERIC) #0: Tue Nov 27 09:33:52 UTC 2018

                                                CPU: Intel(R) Xeon(R) X5675 @ 3.07GHz
  __ _| |_   _ _ __ ___  _ __ (_)              MEM: 16348 MB
 / _` | | | | | '_ ` _ \| '_ \| |
| (_| | | |_| | | | | | | | | | |              Welcome to CS FreeBSD Service!
 \__,_|_|\__,_|_| |_| |_|_| |_|_|              Open for all students and faculty

====[ Announcement of Computer Center, College of Computer Science, NCTU ]====
 1. Hostnames & IP Addresses of workstations :
    FreeBSD     : bsd1 ~ bsd4 (140.113.235.131 ~ 140.113.235.134)
                  alumni1 (140.113.235.116)
    Linux       : linux1 ~ linux4 (140.113.235.151 ~ 140.113.235.154)
```

Commands

- Useful commands
  - passwd, chsh, chfn, chpass
  - ls
  - ps, top
  - mkdir/rmdir
  - cp/mv/rm
  - write
  - Email reader: mutt, …etc.
  - News reader: tin
  - Connecting: ssh/telnet
  - Manual: man, info, …etc.
  - Editor: vim, joe, ee, …etc.
  - File Transmission: ftp, ncftp, lftp, scp, wget, curl, …etc.
  - Compilers: gcc, g++, javac, …etc.
  - Scripting: perl, php, ruby, python …etc.
  - login/exit/logout/screen/tmux
- Basic command tutorials
  - https://cscc.cs.nctu.edu.tw/unix-basic-commands

Conventions

- Syntax of commands:
  - Anything between "[" and "]" – is optional.
  - Anything followed by "…" – can be repeated.
  - {a | b} – you should choose one of them.
  - Example:
    - bork [-x] { on | off } filename …

      bork on /etc/hosts ○

      bork -x off /etc/hosts /etc/passwd ○

      bork -x /etc/hosts X

      bork -h /etc/hosts X
- Globing characters
  - "*" matches zero or more characters.
  - "?" match one character.
  - "~" (twiddle) means home directory
  - "~user" means home directory of user

man pages (manual)

- man pages (manual)
  - Contain descriptions of
    - Individual command.
      - % man cp
    - File format.
      - % man rc.local
    - Library routines.
      - % man strcpy

man command

- Command
  - % man [section] *title* (BSD)
    - % man printf **(printf command)**
    - % man 3 printf **(C Standard printf func.)**
    - % man -k exit **(keyword search)**
- Man pages organization

%man man

AT&T	BSD	Contents
1	1	User-Level **commands** and applications
2	2	**System calls** and kernel error code
3	3	**Library** calls
4	5	Standard file format
5	7	Miscellaneous files and documents
6	6	Games and demonstrations
7	4	Device Drivers and network protocols
1m	8	System administration commands
9	9	Obscure kernel specs and interfaces

HOWTO - Shutdown

- FreeBSD Shutdown
  - shutdown -p now
    - Or "poweroff"
  - shutdown -r now
    - Or "reboot"
- Everyone can shutdown!?
  - No, only authorized users (root)
  - Of course, you have no permission to shutdown our workstations ☺

Q&A

Break time.