Sixth Formers' IT Camp Workshop 2004

Introduction to Linux

Presented by

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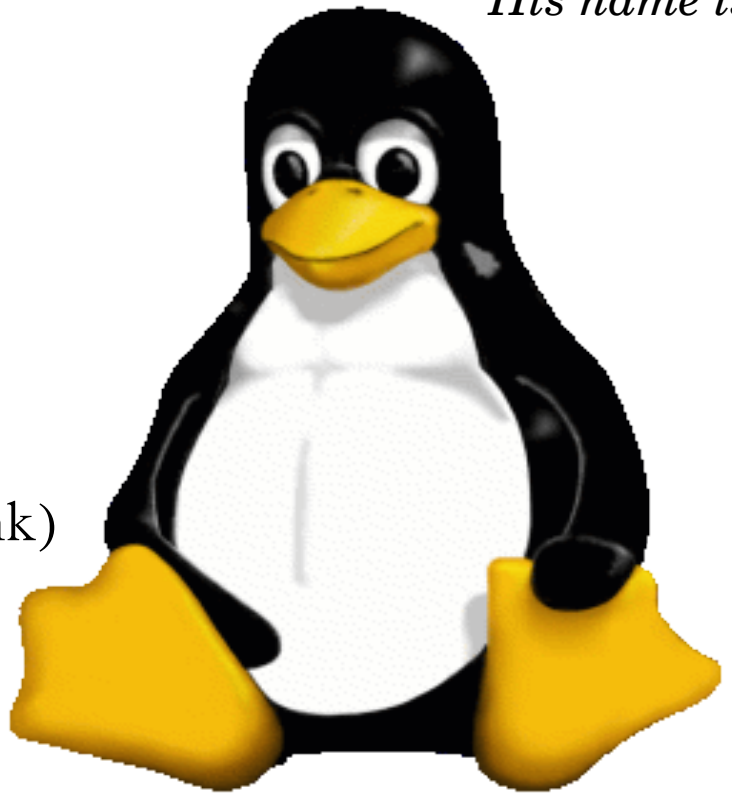
He is the mascot of Linux.
His name is Tux.



What is Linux?

- Developed by Linus Torvalds in 1991.
  - Linux provides kernel
- GNU (Free Software Foundation) provides software

- Combine = GNU/Linux = Complete OS package

Red Hat is not Linux

- Red Hat is a distribution, not a Linux
- List of well-known distributions:
  - Red Hat/Fedora (Most well-known by non-Linuxians)
  - Mandrake-Linux (Largest in US)
  - SuSE (Best reputation in Europe)
  - Debian (Official Distribution of Developers)
  - Slackware (Grandfather's memory)
  - Gentoo (Maybe the best distro ever)
  - LFS (Real player's choice)

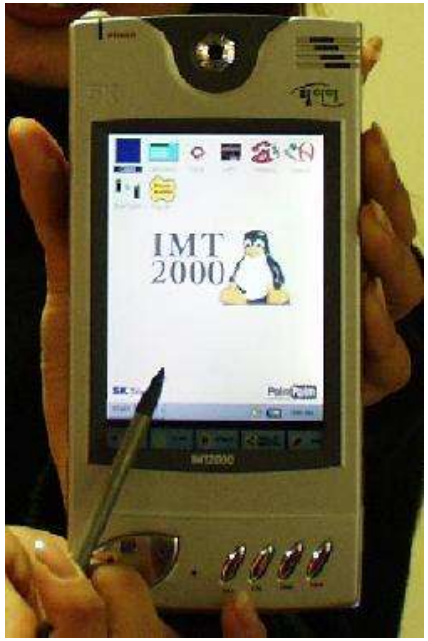
- CD Linux: DemoLinux, Virtual Linux, Knoppix
- Floppy Linux: floppix, tomsrtbt, Tiny Linux
- Firewall/Router: gibalter, floppyfw, fli4l

More Linux?

Yopy YP3700

IBM-Citizen
Workpad

Sharp Zaurus
SL-A3000

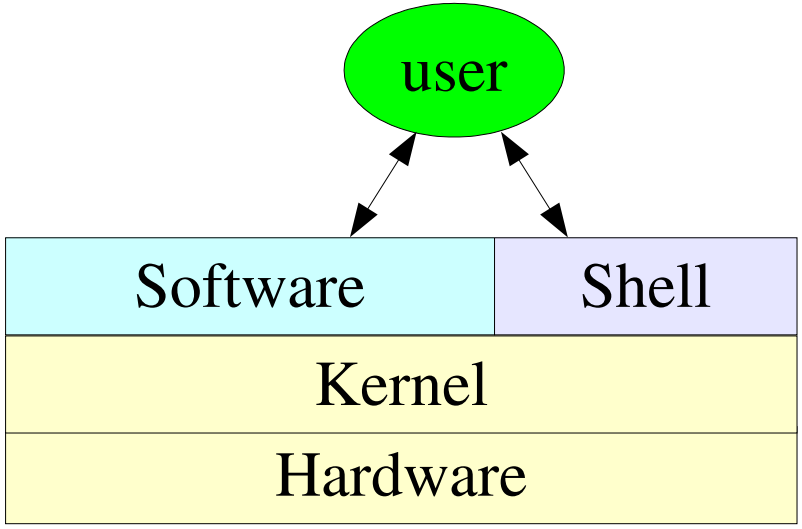


SK Telecom
IMT2000
Cellphone

Isamu 3

What is Linux?

- Linux = an OS kernel
  - Locates between (app.) software and electronics
  - Process handling (coordination, scheduling)
  - Error handling (system exceptions)
  - Hardware interfacing (file system, network, devices)
  - Memory management (system vs virtual)



What is Linux?

- OS needs software
  - User interface (sh, csh, bash, tcsh, ash, zsh, pdksh)
  - File manipulation (cp, rm, ln, ls, mkdir, cd, rmdir)
  - Text processing (vi, sed, awk, grep, uniq, sort)
  - Archiving (zip, rar, arj, tar, bzip2, gzip, cpio, dd)
  - User management (useradd, usermod, userdel)
  - Process management (ps, kill, top, nice, renice)
  - Networking (ftp, wget, telnet, ping, snort, tcpdump)
  - Programming (gcc, gmake, g++, g77, gcj, gdb)
  - Automation (cron, at, batch, perl, sh, bg, fg)
  - GUI (X, xfs, gnome, xfce, kde, mozilla, xfig, lyx, dia, gimp)

What is Linux?

- GNU/Linux is not FREE!
  - Money can be charged
  - Efforts should be paid
- GNU/Linux is FREE!
  - Freedom to do everything
  - Freedom to know everything

Why Linux?

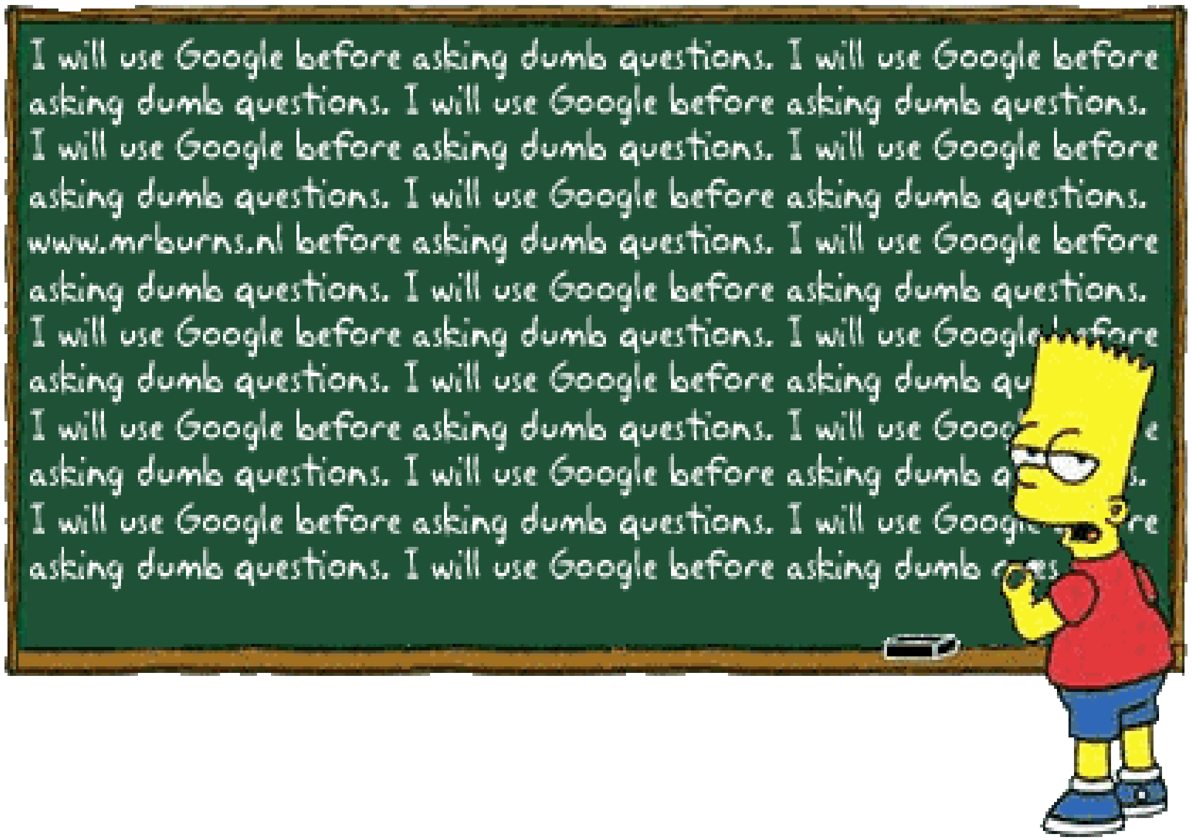
- Linux is POWERFUL
  - Inherits 40 years' experience from UNIX
    - SCO UnixWare, SCO OpenUNIX, Sun Solaris, IBM AIX, HP-UX, DEC OSF/1, XENIX, Xinu, SGI IRIX, BSDi BSD/OS, Ultrix, Digital Unix, Dynix, Atari Unix, NeXTSTEP, Tru64 Unix, OS/390, Unicos, Darwin, Apple MacOS X
    - FreeBSD, NetBSD, OpenBSD, Dragonfly BSD, GNU Hurd, OSF Mach, OpenDarwin, Minix, BeOS, QNX, AtheOS, AT&T Plan9
  - Couples with UNIX software packages
  - Uses the wonderful design of UNIX
    - Portability, Efficiency, Functionality, Availability, Reliability

Why not Linux?

- Linux is not so good
  - Weak networking
  - Young
  - Not unified
  - Not guarenteed
- But:
  - Improving, continuously
  - Maturing
  - Linux standard base is available
  - Community responds quick

Mottos

- Everything is a file
- Command line is wonderful
- Join the building blocks
- Man is powerful
- Google is almighty



Installation

- Detail: During the lab session
- Where to find Linux?

```
# ncftp ftp.cuhk.edu.hk
Anonymous access granted, restrictions apply.
Logged in to ftp.cuhk.edu.hk.
ncftp / > cd pub/Linux/distributions
ncftp /pub/Linux/distributions > ls -l
drwxr-xr-x   3 ftpadmin itsc         4096   Nov  6  2003   fedora
drwxr-xr-x   3 ftpadmin itsc         4096   Apr 26  2002   gentoo
drwxr-xr-x   3 ftpadmin itsc         4096   Jul 15 09:42   mandrake
drwxr-xr-x   3 ftpadmin itsc         4096   May 27 07:15   redhat
drwxr-xr-x   4 ftpadmin itsc         4096   Jun 30 06:10   slackware
drwxr-xr-x   3 ftpadmin itsc         4096   Jul  2 07:15   suse
ncftp /pub/Linux/distributions >
```

- **ftp://ftp.cuhk.edu.hk/pub/Linux/distributions**
- Download and burn a CD, then boot with it to install
  - Alternatively: use a floppy to do network install

Get Started: Login/Logout

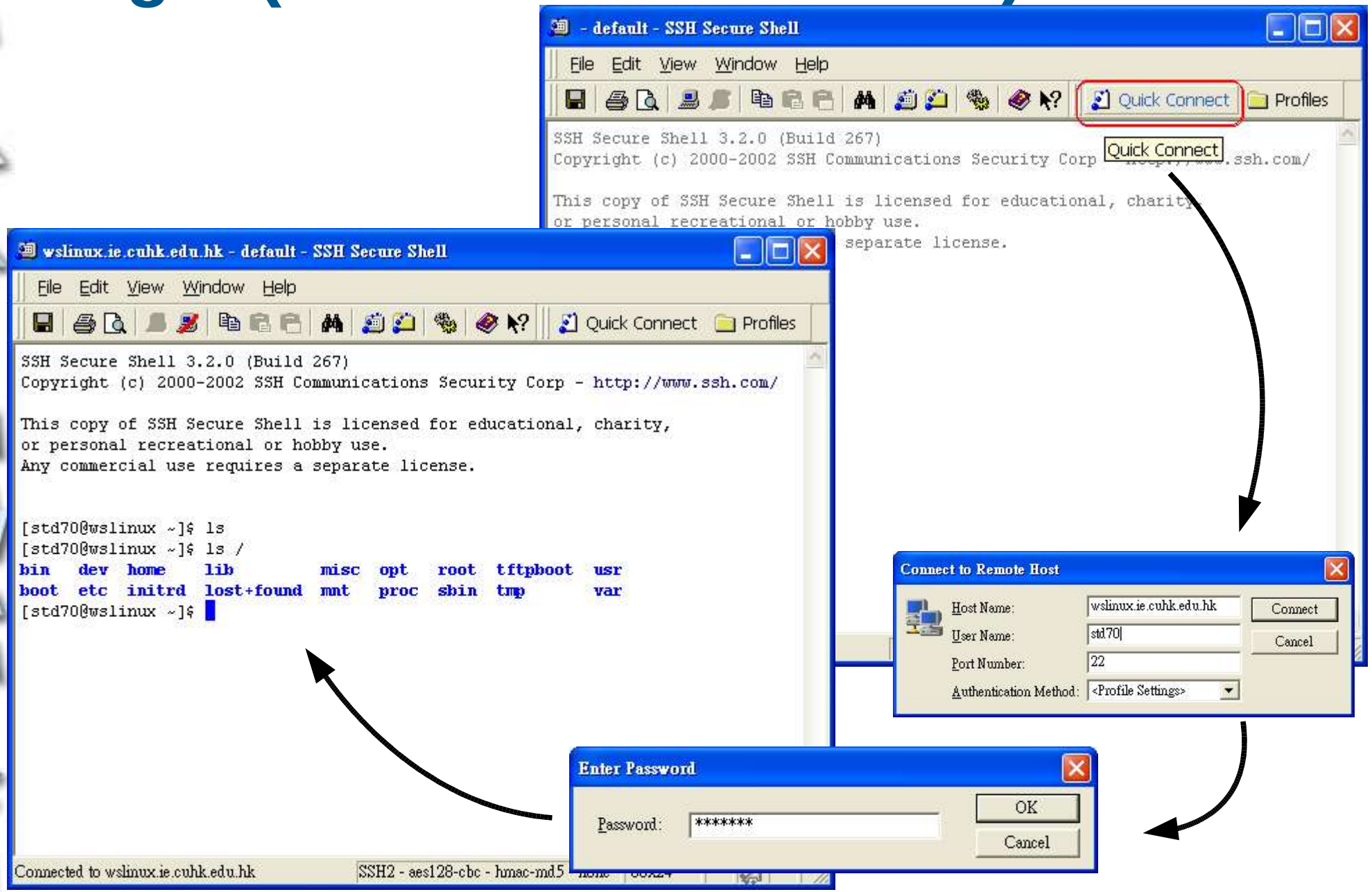
Login

- Console Login

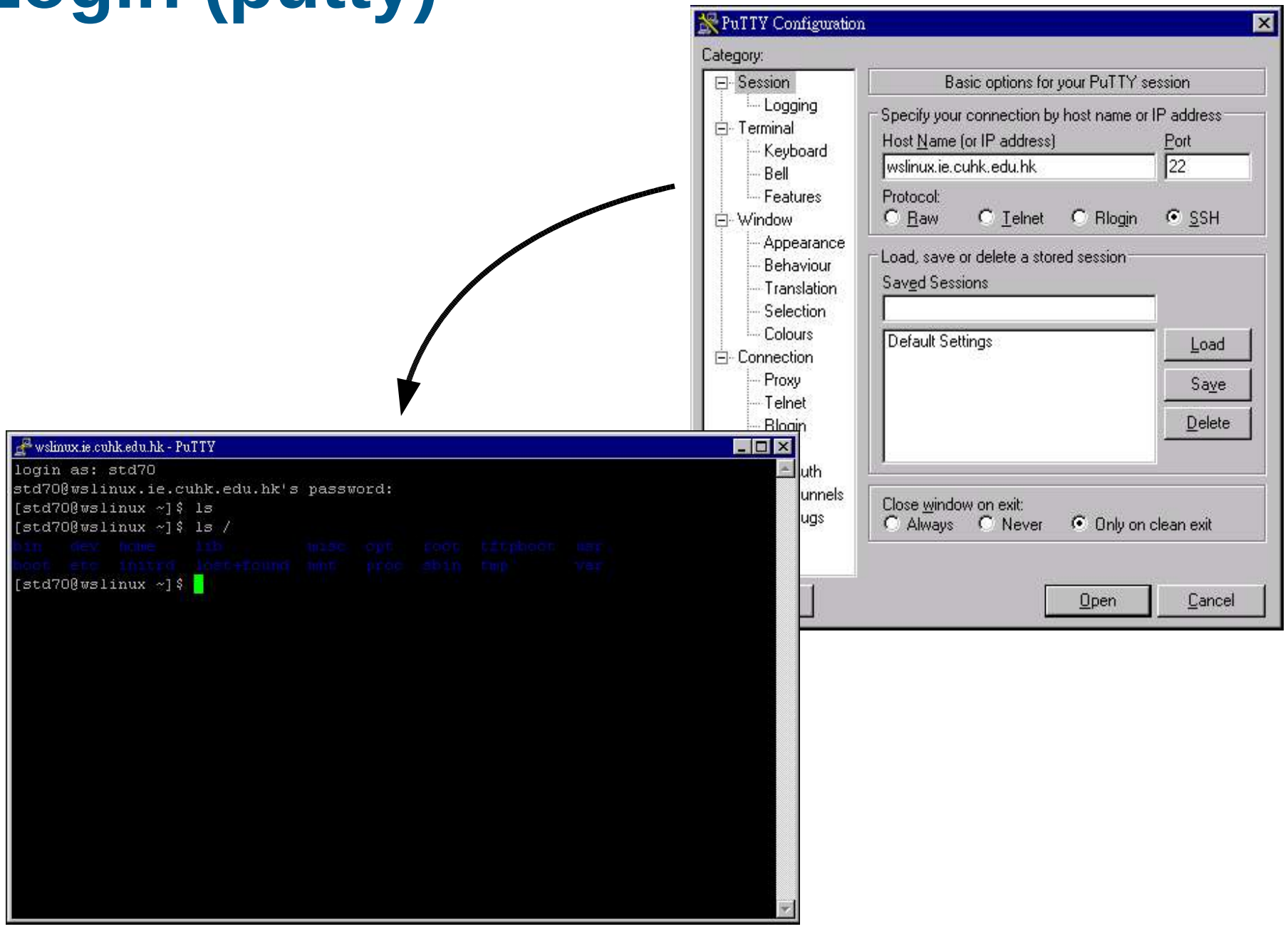
```
Debian GNU/Linux stable server1 tty1
server1 login: root
Password: xxxxx
Last login: Mon Sep 2 09:32:28 2002 on tty1
Linux server1 2.4.19 #24 Sun Aug 25 20:13:22 HKT 2002 i686 unknown unkn
server1:~#
```

- Secure Shell (SSH) Login
  - SSH: Allows you to securely login to a remote computer
  - Download SSH software
    - SSH for workstation (http://www.ssh.com/support/downloads/)
    - putty.exe (http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html)
  - In Lab:
    - Host name: wslinux.ie.cuhk.edu.hk
    - User ID: std*NN*
    - Password: newuser

Login (SSH for Workstation)



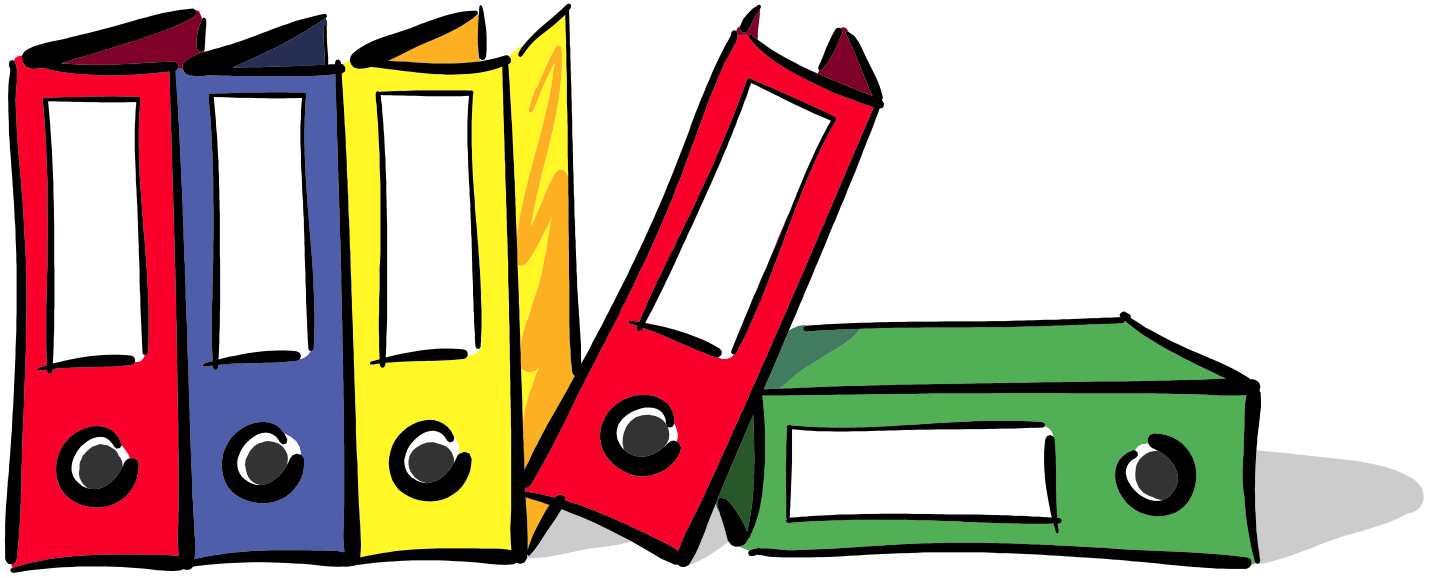
Login (putty)


PuTTY Configuration
Category:
Session
Logging
Terminal
Keyboard
Bell
Features
Window
Appearance
Behaviour
Translation
Selection
Colours
Connection
Proxy
Telnet
Rlogin
Basic options for your PuTTY session
Specify your connection by host name or IP address
Host Name (or IP address)
Port
wslinux.ie.cuhk.edu.hk
22
Protocol:
Raw
Telnet
Rlogin
SSH
Load, save or delete a stored session
Saved Sessions
Default Settings
Load
Save
Delete
Close window on exit:
Always
Never
Only on clean exit
Open
Cancel
wslinux.ie.cuhk.edu.hk - PuTTY
login as: std70
std70@wslinux.ie.cuhk.edu.hk's password:
[std70@wslinux ~]$ ls
[std70@wslinux ~]$ ls /
[std70@wslinux ~]$

Logout

- exit
- Keyboard: Ctrl-D
- shutdown -h now
- shutdown -r now

File Hierarchy



File Hierarchy

```
/
|-- bin          binary executables (essential)
|-- boot         boot files
|-- dev          device file system
|-- etc          configuration files, startup scripts
|-- home         home directories of users
|   |-- adrian   home dir. of Adrian
|   |-- brian    home dir. of Brian
|   `-- carson   home dir. of Carson
|-- lib          dynamic linking libraries
|-- misc         miscellaneous (empty)
|-- mnt          mount points
|-- net          network mounts (empty)
|-- opt          optionals (empty)
|-- proc         process file system
|-- root         home dir. of root user
|-- sbin         binary executables for system admin use (essential)
|-- swap         swaps (optional)
|-- tmp          temporaries
|-- usr          (user) static data
|   |-- X11R6    X-Window
|   |-- bin      application executables
|   |-- etc
|   |-- include  C/C++ header files
|   |-- lib      C/C++ static linking libraries
|   |-- local
|   |-- man      man pages
|   |-- sbin     application executables for system admin use
|   |-- share    share files (pics, icons, ...)
|   `-- src      source
`-- var          dynamic data
```

File Hierarchy - System

- `/boot`

  Boot files (kernel, System.map, boot loader)
- `/bin`

  Essential binary files (programs)
- `/sbin`

  Essential system binary files
- `/dev`

  Device files resides here
- `/proc`

  Process files resides here

File Hierarchy – Configuration

- `/etc`
  Usually configuration files stores here
- `/lib`
  Dynamic linking libraries, system modules
- `/tmp`
  Temp dir
- `/var`
  Variable data (log files, caches, spools)
- `/usr`
  Static data (C:\Program Files\ ?)

File Hierarchy – User Files

- `/root`

  The home directory of root
- `/home`

  The home directories of other users
- `/home/adrian`

  The home directory of user 'adrian'

File Hierarchy (Further)

- `/usr/bin`: Not-so-essential binary
- `/usr/sbin`: Not-so-essential system binary
- `/usr/lib`: Not-so-essential libraries
- `/usr/share`: Shared data
- `/usr/share/doc`: Documentation
- `/usr/local`: Local data (user-made programs)
- `/usr/local/bin`: User-made binary programs
- `/usr/local/sbin`: User-made system binary programs

File Hierarchy (Further)

- `/var/log`: Log files
- `/var/cache`: Cache files
- `/var/spool`: Spools (print spool, etc.)
- `/var/tmp`: Temp files

File Hierarchy (Summary)

```
/
|-- bin          binary executables (essential)
|-- boot         boot files
|-- dev          device file system
|-- etc          configuration files, startup scripts
|-- home         home directories of users
|   |-- adrian   home dir. of Adrian
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|-- lib          dynamic linking libraries
|-- misc         miscellaneous (empty)
|-- mnt          mount points
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|-- opt          optionals (empty)
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|-- root         home dir. of root user
|-- sbin         binary executables for system admin use (essential)
|-- swap         swaps (optional)
|-- tmp          temporaries
|-- usr          (user) static data
|   |-- X11R6    X-Window
|   |-- bin      application executables
|   |-- etc
|   |-- include  C/C++ header files
|   |-- lib      C/C++ static linking libraries
|   |-- local
|   |-- man      man pages
|   |-- sbin     application executables for system admin use
|   |-- share    share files (pics, icons, ...)
|   `-- src      source
`-- var          dynamic data
```

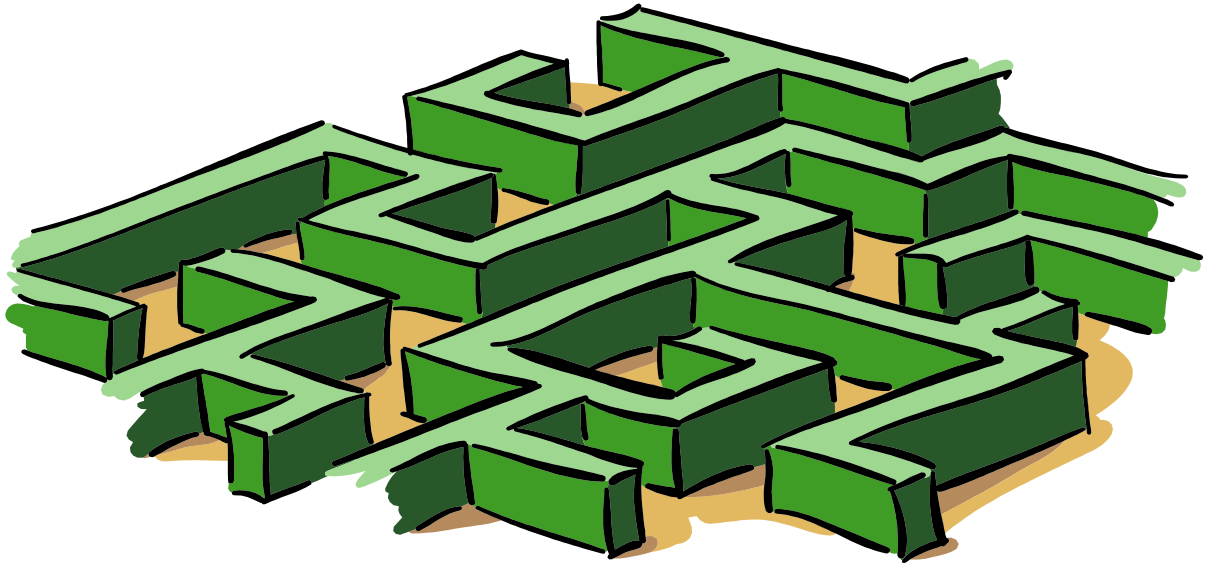
Important Files

- /etc/X11/XF86Config: XFree86 configuration
- /etc/inittab: init table
- /etc/fstab: mount table
- /etc/passwd: password file
- /etc/group: group assignments
- /etc/crontab: table of cron jobs
- /var/log/messages: Program messages
- /var/log/syslog: System logs
- /var/log/auth.log: Authentication logs

Strange??

- No 'drive' concept
- Unified directory tree
- Different media are connected via a 'mount' process
- *BSD can use mount to enlarge a storage space!
  (Not possible in Linux, yet)

Shell Basics



Shell Basics

- Root Prompt: #
- User Prompt: $

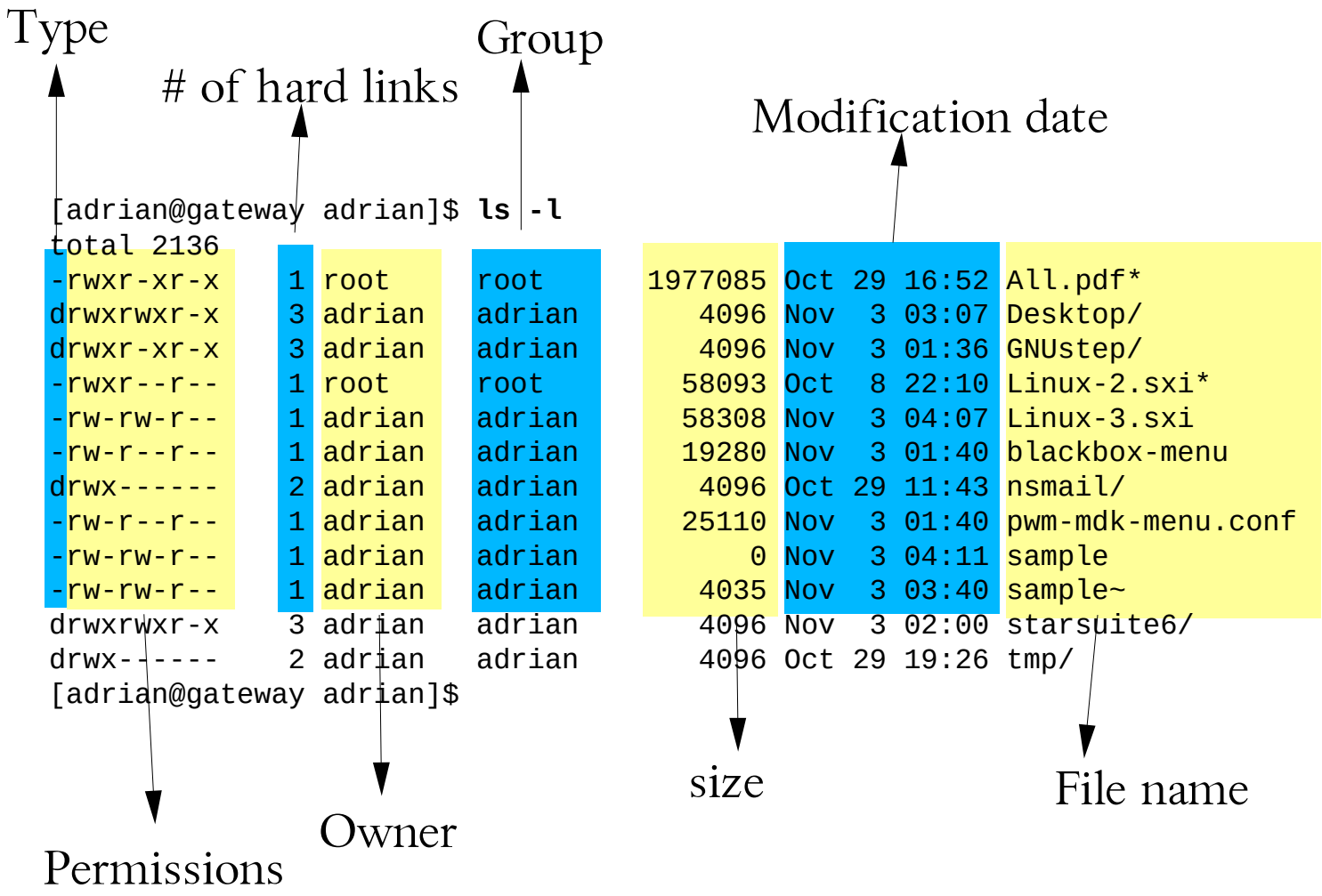
Shell Basics

- Get help:
  - man
  - apropos
  - /usr/share/doc/*
  - Googles

Shell Basics

- Listing directories: ls
  - Long listing: ls -l
  - Include hidden file: ls -a
  - With color: ls --color
  - With mark: ls -F
  - Recurrsive: ls -R

Shell Basics



File Links

- Hard Links
  - Two symbols pointed to same *content* in FS
  - Not for directories
  - Forget about it if you don't understand (not so important)
- Soft Links
  - A symbol pointed to another file
  - Also known as symbolic links
  - It is clear which is the master copy
  - Analogy: 'shortcut' in Windows

File Handling

- Viewing content = cat
- Viewing by pages = more / less
- Copy files = cp
- Moving files or rename = mv
- Remove files = rm
- Make directory = mkdir
- Change directory = cd
- Remove directory = rmdir
- Create links = ln

Nomenclature

- Directory separator = /
- Root directory = /
- Local directory = .
- Parent directory = ..
- Home directory = ~
- Escape character = \
- Chars to be escaped = {space,\,/,',",`,*,?,brackets}
- Names are case-sensitive

Streams

- Make output to a file
  - command > file
- Make file as input
  - command < file
- Make command1's output be command2's input
  - command1 | command2
- Append output to file
  - command >> file

Streams

- Make error and output join together
  - command 2>&1
- Here document
  - command << endmark
- Command substitution
  - command `command1`

Filename expansion

- Wildcards: * and ?
- Single character substitution: ls pic-[abcdefg].jpeg
- Single character substitution: ls pic-[a-gA-G].jpeg
- Single character substitution: ls pic-[^h-z].jpeg
- String substitution: ls pic-{mother,father}.jpeg

Command-line crazy

- echo $((5*4*3*2*1))
- ps aux | grep apache | awk '{print $6;}'
- echo hello | sed -e 's/$/+/'
- echo $((` ps aux | grep apache | awk '{print $6;}' | sed -e 's /$/+/' ; echo 0`))

- for x in set* ; do cd $x ; for y in *[a-z][0-9] ; do mv $y `echo $y | sed -e "s/\([^0-9]\)\([0-9]\)$/\10\2/"` ; done ; cd .. ; done

Want more?

- Find a book and start to learn
- Come! CUHK has much more interesting things to learn
- Keep in touch with us!

Thank you very much