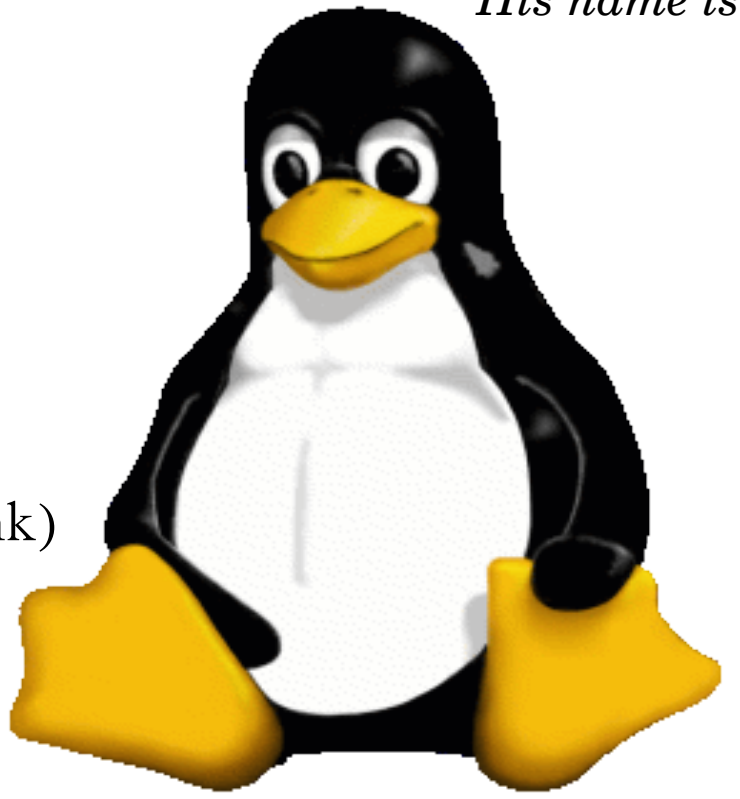
Linux System & Computer Networks

Part 1: Simple Things

The mascot of Linux.
His name is Tux.



Presented by

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Introduction

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)

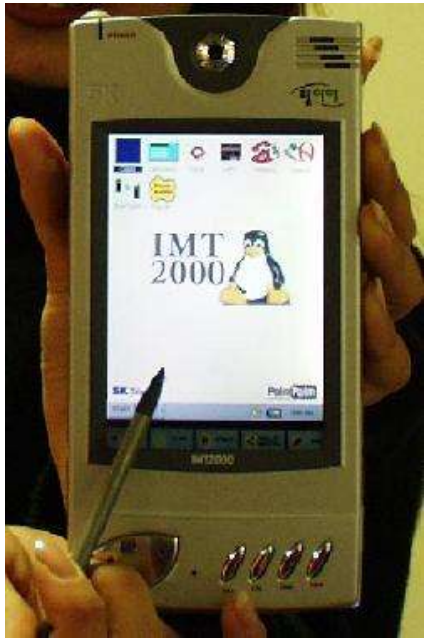
- CD Linux: DemoLinux, Virtual Linux, Knoppix
- Floppy Linux: floppix, tomsrtbt, Tiny Linux
- Firewall/Router: gibalter, floppyfw, fli4l

More Linux?

Yopy YP3700

IBM-Citizen
Workpad

Sharp Zaurus
SL-A3000

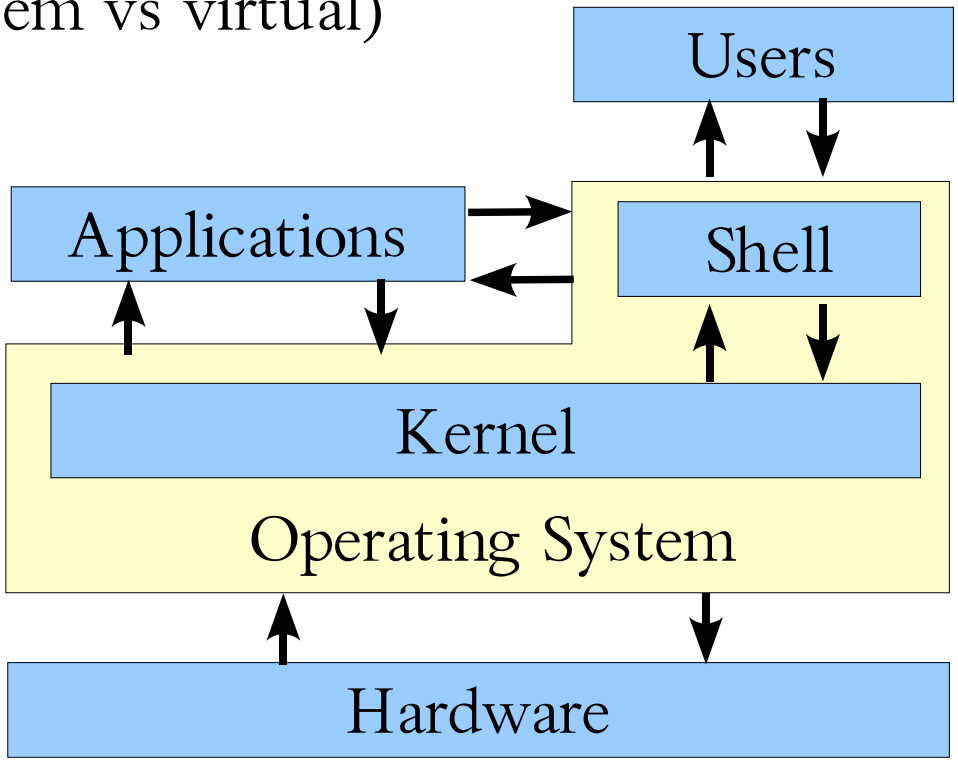


SK Telecom
IMT2000
Cellphone

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

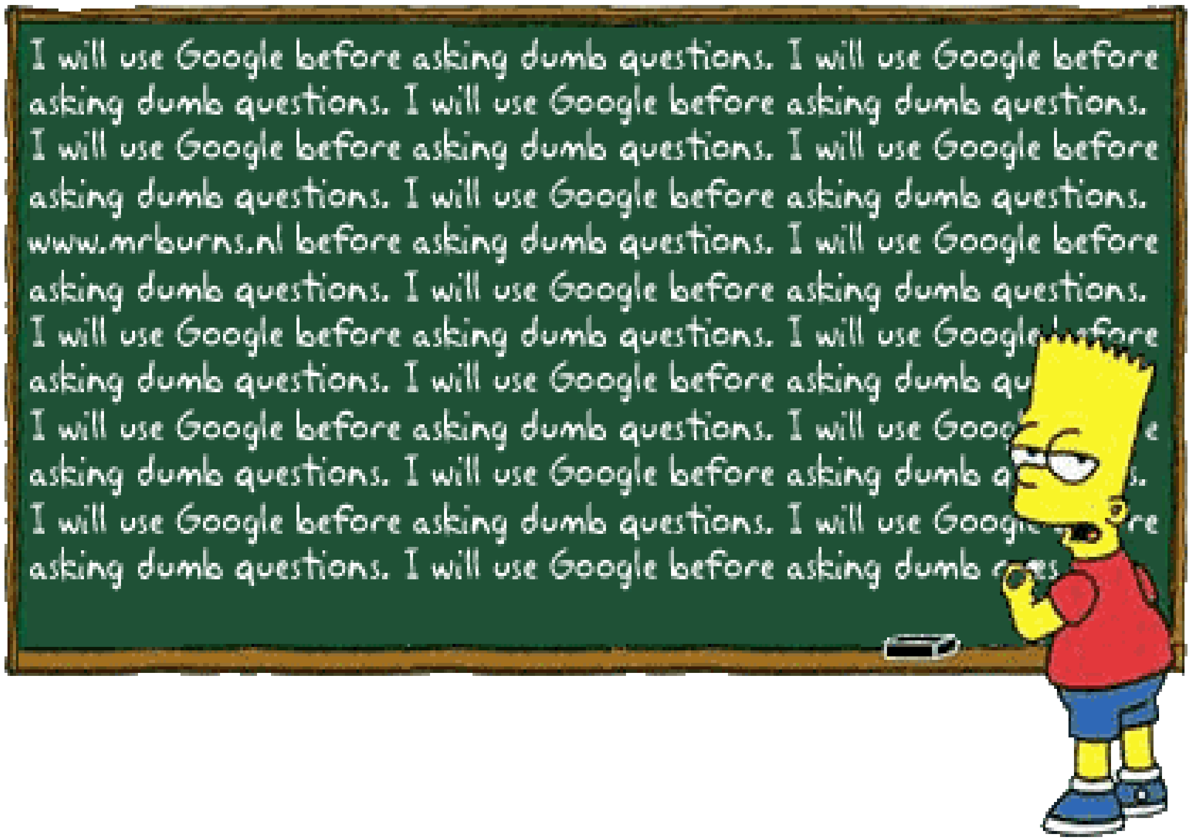
The UNIX Way of Doing Things

- Everything is a file
- Computer is controlled by symbols, not mouse
- Programs do one thing and do it well
- Text stream is the only universal interface

- Basics of UNIX Philosophy, by Eric S. Raymond
  http://www.faqs.org/docs/artu/ch01s06.html

Seeking for Help?

- Google is almighty



Sidebar: 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

History of UNIX

History of UNIX & Linux

- 1957: Bell Labs found they need an OS
- 1965: Scientists from Bell Labs and GE develops Multics
- 1969: Bell withdrew from the effort, but the Bell Lab scientists still loves the idea of Multics
- 1969: UNIX was created by Ken Thompson and Dennis Ritchie
- 1969: Linus Torvalds is born
- 1971: UNIX was first released, with 60 commands
- 1972: C was created by Brian Kernighan and Dennis Ritchie, and UNIX was rewritten in C, portability came
- 1973: UNIX was installed on 16 sites
- 1974: UNIX released the 5th edition
- 1974: Ken Thompson visited UC Berkeley for one year, Bill Joy arrived as a new undergraduate student
- 1975: Bourne Shell

History of UNIX & Linux

- 1977: Berkeley Software Distribution released UNIX: 1BSD
  - Distribution secretary: Bill Joy
- 1979: AT&T UNIX: 7th edition
- 1979: BSD: 3BSD
- 1980: BSD: 4.0BSD
- 1982: Silicon Graphics: IRIX
- 1983: SCO: XENIX for Intel 8088
- 1984: Digital: Ultrix
- 1984: BSD: 4.2BSD, includes TCP/IP as well as Berkeley sockets
- 1985: The GNU manifesto is published
- 1986: HP: HP-UX
- 1987: Sun Microsystems and AT&T form an alliance
- 1988: POSIX.1 Standard
- 1990: IBM: AIX (Advanced Interactive eXecutive)

History of UNIX & Linux

- 1991: Sun unveils Solaris
- 1991: Linus introduces Linux
- 1992: Novell acquired UNIX
- 1993: 4.4BSD, the last BSD releases from Berkeley
- 1993: FreeBSD released
- 1994: UCB lost the lawsuit, released BSD4.4-Lite for removal of all infrigement codes
- 1994: Single UNIX Specifications by X/Open
- 1995: Novell sold UNIX to SCO
- 1997: Single UNIX Specification version 2
- 1999: UNIX at 30, Linux released 2.2
- 2001: Single UNIX Specification version 3, Linux released 2.4
- 2003: The Single UNIX Specification version 3 recognized as an international standard, ISO/IEC 9945:2003. Linux released 2.6

History of UNIX & Linux

- References:
  - Twenty Years of Berkeley UNIX, by Marshall McKusick
    http://www.oreilly.com/catalog/opensources/book/kirkmck.html
  - The Evolution of the Unix Time-sharing System, by Dennis Ritchie
    http://cm.bell-labs.com/cm/cs/who/dmr/hist.html
  - The UNIX System – History and Timeline
    http://www.unix.org/what_is_unix/history_timeline.html
  - Unix History
    http://www.levenez.com/unix/
  - The Creation of the UNIX Operating System
    http://www.bell-labs.com/history/unix/

What do we learnt?

- UNIX is a philosophy
- UNIX is oriented towards scientists
- UNIX is a standard, not a system
- Linux? It is just a variant of UNIX.

UNIX Overview

UNIX Overview

- Unix is case sensitive!
  - VI and vi can be different commands
  - ReadMe.txt, readme.txt, README.TXT can be different files
- Shell has different favors
  - Bourne shell - AT&T
  - C shell - BSD
  - Bourne-again shell - Linux
  - Korn shell
  - zsh
- Command syntax:

  command [flags] argument1 argument2 ...

UNIX Overview

- Key strokes
  - Delete previous character: Del or BS
  - Delete the previous word: Ctrl-W
  - Delete the whole line: Ctrl-U
  - Stop scrolling: Ctrl-S
  - Resume scrolling: Ctrl-Q
  - Abort: Ctrl-C
  - Suspend: Ctrl-Z
  - Discard output: Ctrl-O

UNIX Overview

- Path name
  - Directory in Unix = Folder in Windows
  - Directory separator: slash, /
  - Absolute pathname start with /
  - Current directory: .
  - Parent directory: ..
  - Home directory: ~
- File name:
  - General rule for file and directory names: alphanumerals, dots, underscores
  - Actually: Nearly anything
  - Hidden files: Nothing is “hidden”
    - But files started with a dot is not shown by default and not matched by a wildcard

UNIX Overview

- Online manual sections:
  1. Commands
  2. System calls
  3. Library functions
  4. Devices and device drivers
  5. File formats
  6. Games
  7. Miscellaneous
  8. System maintenance
- Reading manual: man [section] topic
  - Example: man 1 sleep
- Searching index: apropos keyword

UNIX Overview

- Reference:
  UNIX is a Four Letter Word, by Christopher C. Taylor
  http://unix.t-a-y-l-o-r.com/index.html

Login and Logout

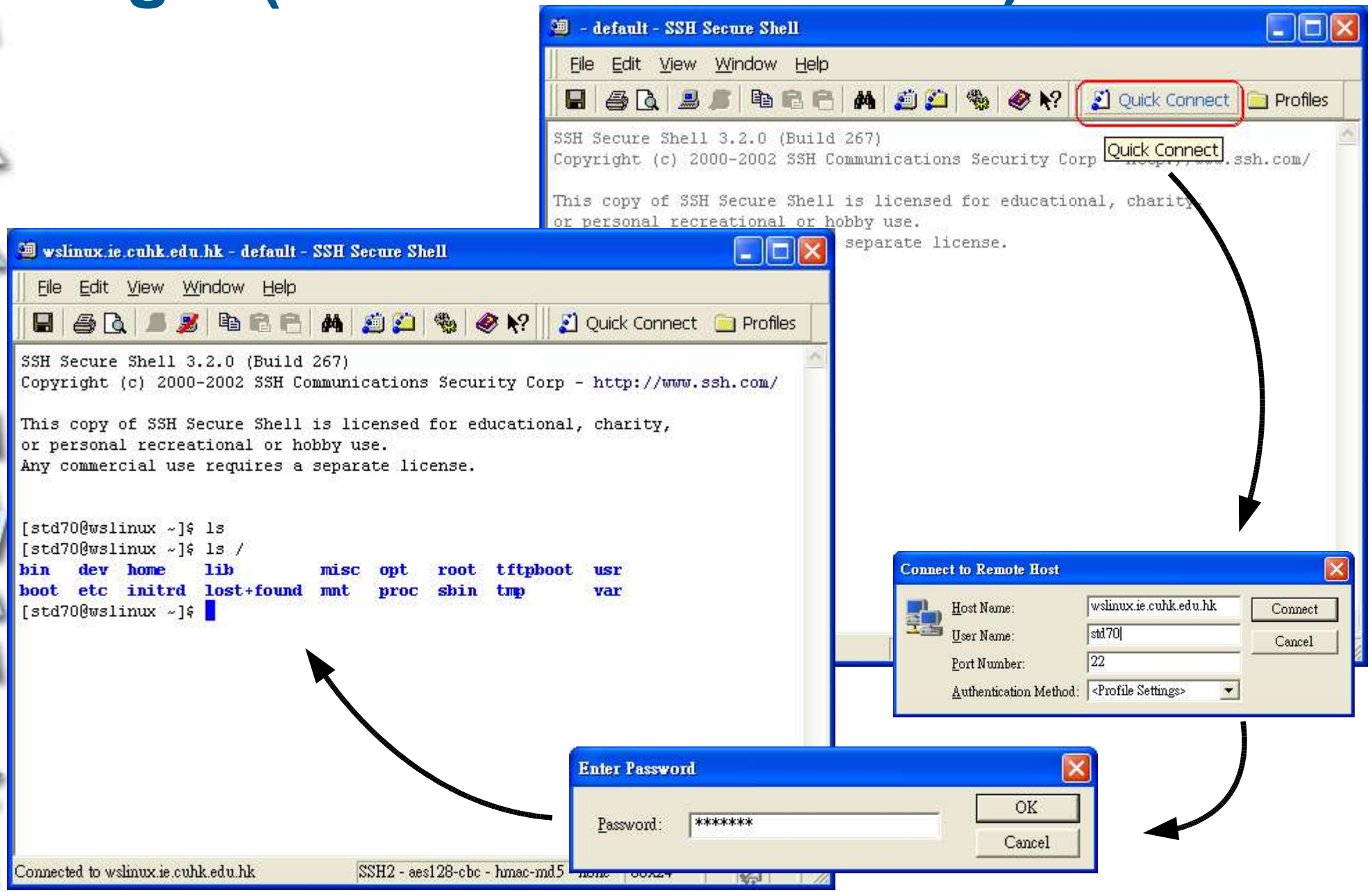
Login

- Console Login

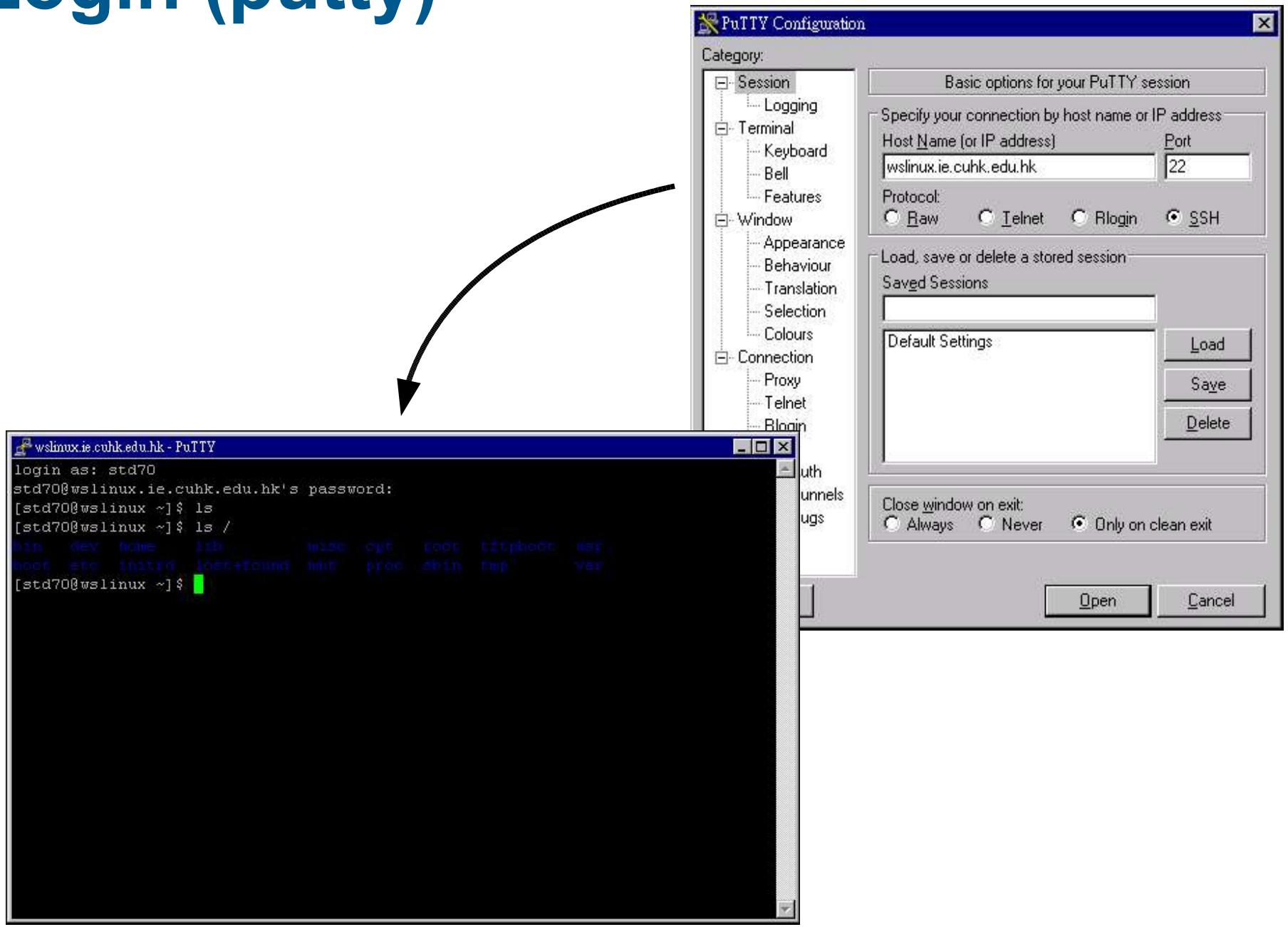
```
Debian GNU/Linux stable server1 tty1
server1 login: root
Password: xxxxx
Last login: Mon Sep 2 09:32:28 2002 on tty1
Linux server1 2.4.19 #24 Sun Aug 25 20:13:22 HKT 2002 i686 unknown unkn
server1:~#
```

- 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)

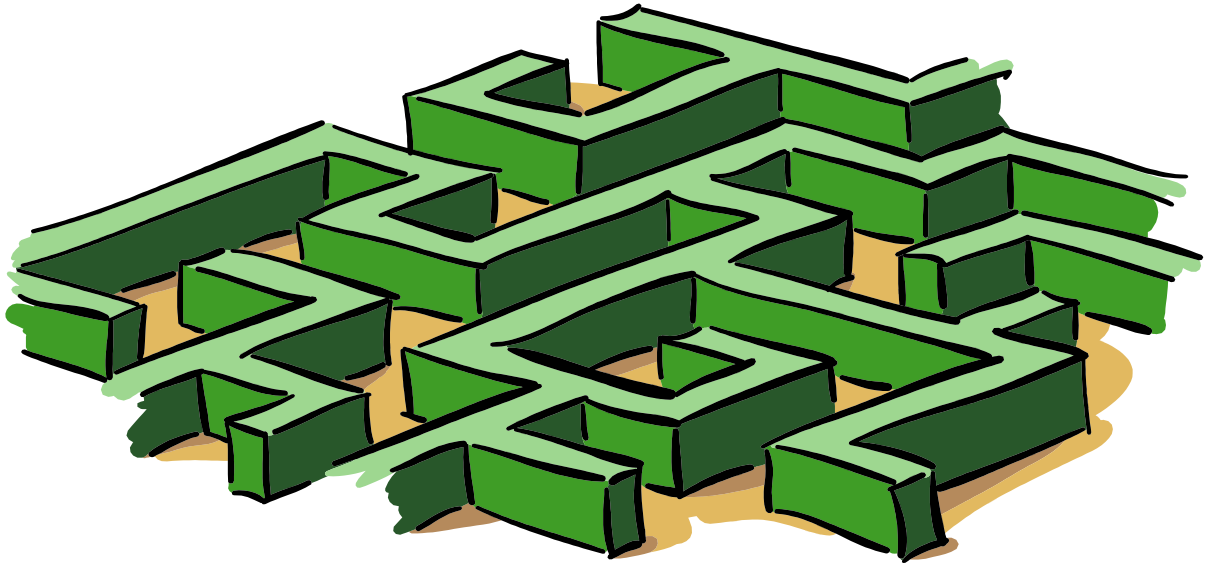

PuTTY Configuration
Category:
Session
Logging
Terminal
Keyboard
Bell
Features
Window
Appearance
Behaviour
Translation
Selection
Colours
Connection
Proxy
Telnet
Rlogin
Basic options for your PuTTY session
Specify your connection by host name or IP address
Host Name (or IP address)
Port
wslinux.ie.cuhk.edu.hk
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

- If you own the machine, you can shutdown the system, but only if you're root
  - shutdown -h now
  - halt

Command Line Basics



Command Line Basics

- Root Prompt: #
- User Prompt: $

Command Line Basics

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

Changing Your Password

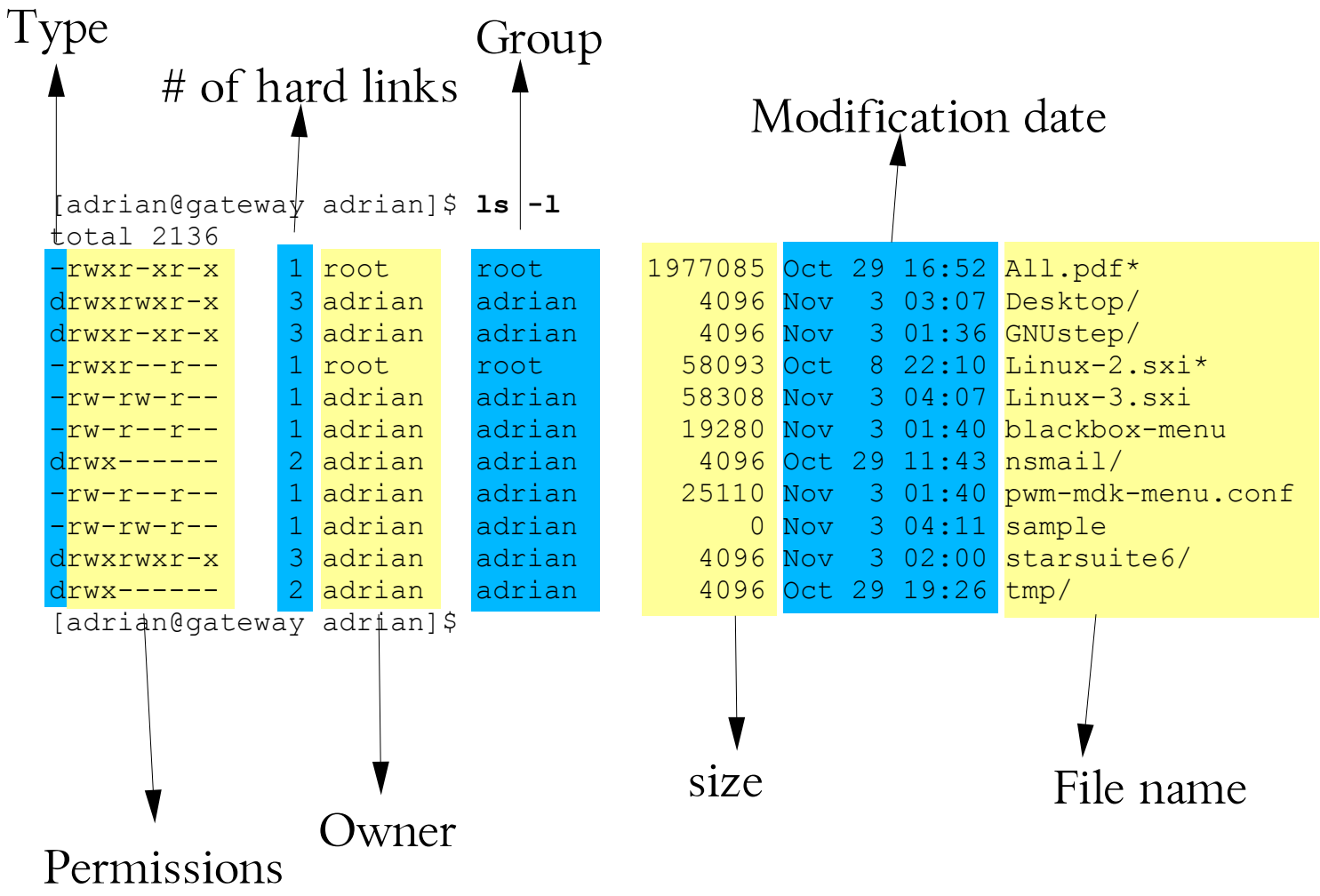
- Command: passwd

```
$ passwd
Changing password for adrian
(current) UNIX password: my_old_password
Enter new UNIX password: my_new_password
Retype new UNIX password: my_new_password
passwd: password updated sccessfully
```

Show me the files

- Listing directories: ls
  - Long listing: ls -l
  - Include hidden file: ls -a
  - With color: ls --color
  - With mark: ls -F
  - Recurrsive: ls -R
  - Sort by time: ls -t
- Limiting the scope of list: use wildcards
  - ls q*

Show me the files



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

and much more.....

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

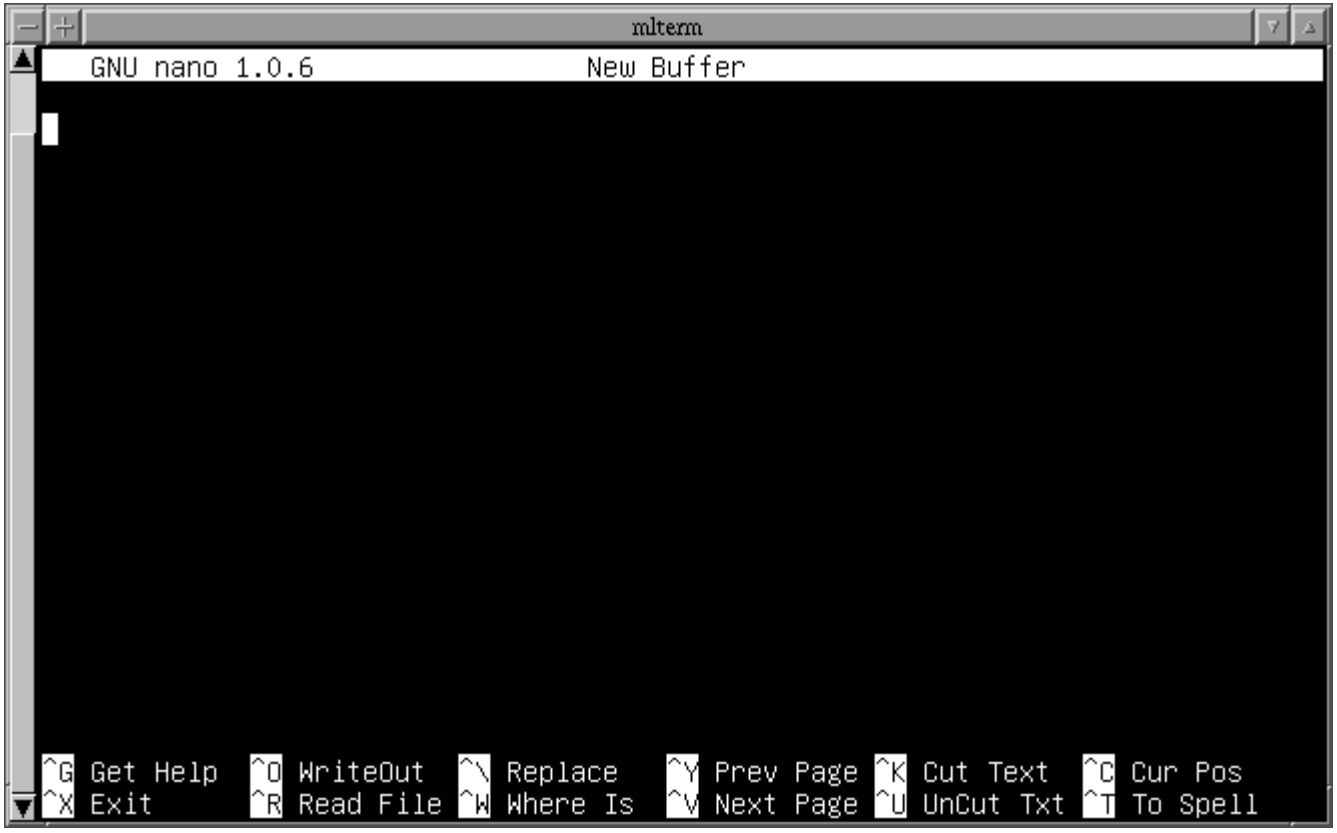
- echo $((5*4*3*2*1))
- ps aux | grep apache | awk '{print $6;}'
- echo hello | sed -e 's/$/+/'
- echo $((` ps aux | grep apache | awk '{print $6;}' | sed -e 's/$/+/' ; echo 0`))

- 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

Text Editing

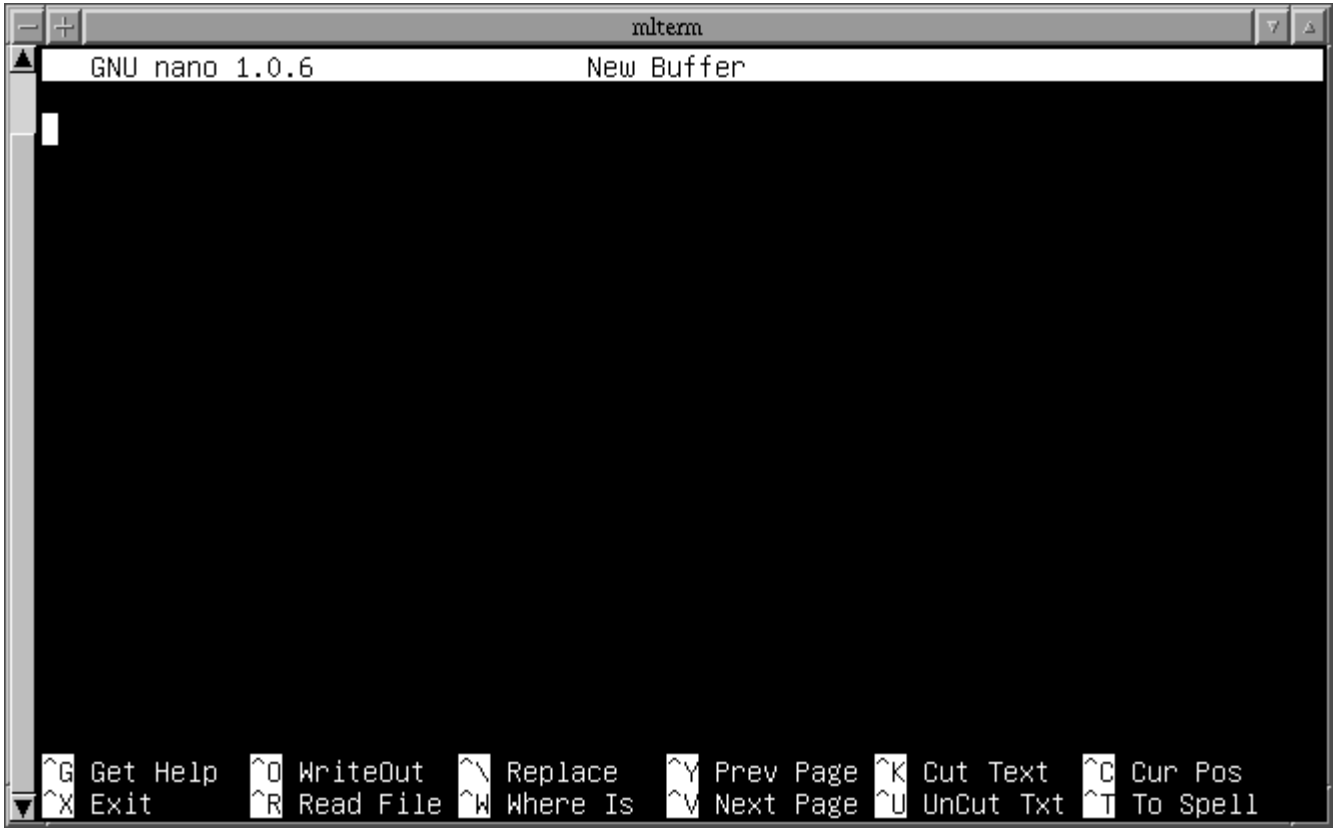
pico / nano

- pico: Originated from pine, as an email editor
  - For non-scientists
  - Simple and lacking
- nano: The GNU's clone of pico



pico / nano

- ^X = Ctrl-X
- All commands are keys of Control-Something



vi / vim

- vi = Visual Interface
  - Written by Bill Joy
- Use only 50+ keys on keyboard: alphabets, numbers, punctuations
- Two modes of operation:
  - Command mode: keys are commands
  - Insert mode: keys are texts
- Command-to-insert: i, or a
- Insert-to-command: ESC

vi / vim

- hjkl = left, down, up, right
- 0 = beginning of a line
- ^ = start of text
- $ = end of a line
- G = end of file
- 1G = top of file
- Ctrl-F = down one screen
- Ctrl-B = up one screen

vi / vim

- x = Delete a character
- dd = Delete a line
- 3dd = Delete 3 lines (replace 3 with any number)
- yy = Yank a line
- 3yy = Yank 3 lines (replace 3 with any number)
- p = Paste

- :w = save to disk
- ZZ = save and quit
- :q! = quit without save

vi / vim

- /pattern = Search
- / = Search again
- :s/pattern/replacement/ = Replace
- :s/pattern/replacement/g = Global replacement

- Reference:
  - Find a vi/vim cheatsheet, e.g. http://tnerual.eriogerg.free.fr/vimqrc.pdf
  - vi is a Two Letter Abbreviation, by Christopher C. Taylor http://unix.t-a-y-l-o-r.com/Vi.html

Thank you very much