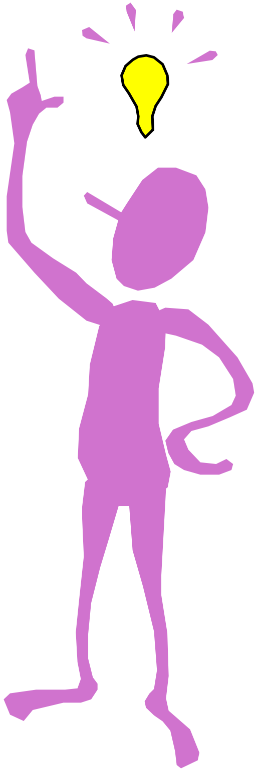
Introduction to Linux (Part I)



BUPT/QMUL

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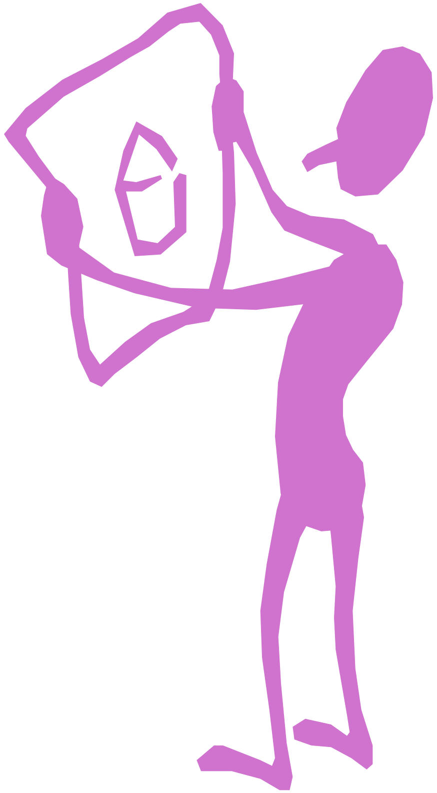
1. Background on Linux

1.1. What is Linux?

1.2. History

1.3. Why use Linux?



1.1. What is Linux?

- Linux [ˈ*lɪnəks*] **:** a Unix-like computer operating system but free and open-source.
- The Linux Operating System (OS) is a large program (mostly coded in C) that turns the computer into a useable machine.
- It provides a number of facilities:
  – management of hardware resources
  – directory and file system
  – loading / execution / suspension of programs

1.2. Brief History

- 1969 First UNIX at Bell Labs
- 1975 Bell Labs makes UNIX freeware
- 1970’s Berkeley UNIX (BSD)
- 1980’s TCP/IP
  MIT X-Windows
- 1990’s The Web,
  Linux Kernel (1991, by Linus Torvalds)
- 1993 Debian Linux
- 2003 Fedora Linux
- 2004 Ubuntu Linux, CentOS Linux

1.3. Why Use Linux?

- multi-tasking / multi-user
- lots of free software
- networking capability
- graphical (optional)
- easy to program
- stable
- portable (PCs, mainframes, super-computers)

continued

- free! (Ubuntu, CentOS, FreeBSD)
- open source
- popular
- not tied to one company
- active community
- lots of documents

2. Starting / Finishing

2.1. Your Account

2.2. Login to your Account

2.3. Password Tips

2.4. Logout from your Account

2.1. Your Account

- Each user has their own space, called their *account*.

- Type your login ID and password to enter your account.

- Only if the login ID and password match will you be let in.

2.2. Login to your Account

`login: ad`	You type your ID and RETURN.
`Password:`	You type your password and RETURN. It does not appear.
`$`	The Linux prompt (or similar). You can now enter commands.

`Access denied`
`Password:`
	Login ID and password not match

2.3. Password Tips

- NEVER tell anyone your password.
- Don’t write it down.
- A good password is:
  - 8 (or more) characters long
  - uses a mix of uppercase and lowercase letters, numbers, and symbols (e.g. #, %).
- You can change your password with the `passwd` command (see later).

2.4. Logout from your Account

```
logout
```

or

```
^D
```

Press CONTROL and D together

or

```
exit
```

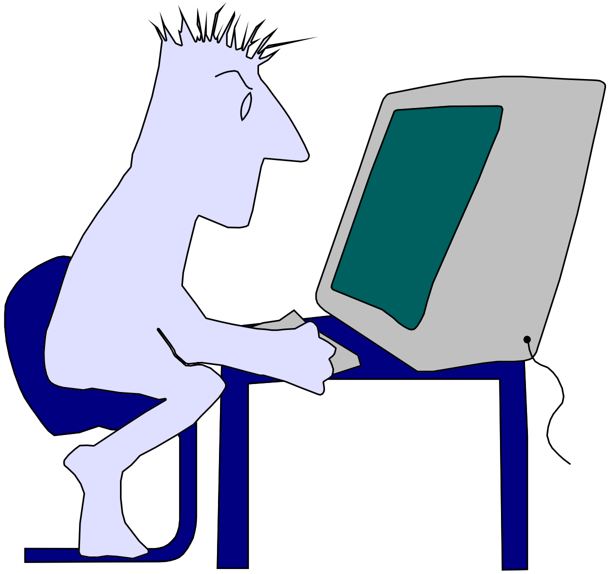
3. Typing Linux Commands

3.1. The Shell

3.2. Typing Commands

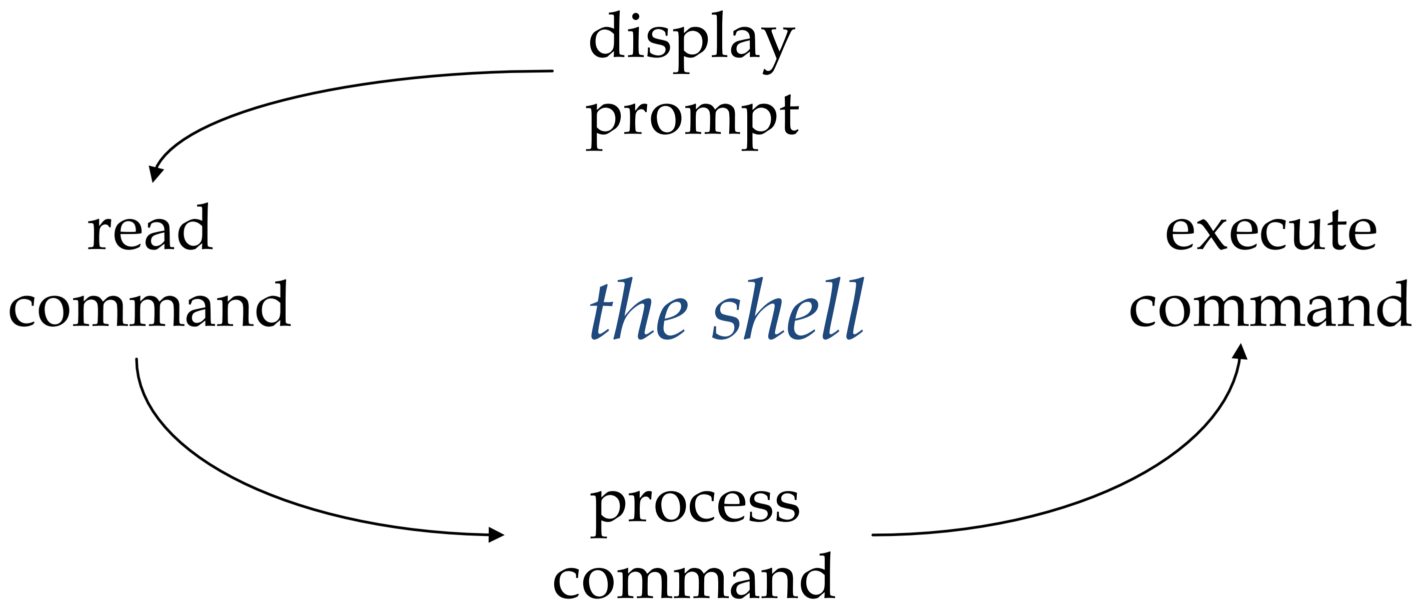
3.3. Control Characters

3.4. Changing your Password



3.1. The Shell

- The Linux user interface is called the *shell*.
- The shell does 4 jobs repeatedly:



display prompt

read command

the shell

execute command

process command

3.2. Typing Commands

- Try these:

```
date
cal 3 1997
who
ls
ifconfig
man cal
```

Press enter for next line;

Press spacebar for next page;
^C or q to stop

```
clear
```

3.3. Control Characters

- Erasing characters

`Backspace`	delete last character
`^H`	delete last character (press CONTROL and H together).
`^W`	delete last word
`^U`	delete the line

- Very useful control characters

`^C`	terminate command
`^S`	suspend output
`^Q`	resume output

3.4. Changing your Password

- The command is:

```
passwd
```

- It will ask you for the new password twice.

4. Command to Use Right Away

4.1. Date Commands

4.2. You and the System

4.3. Calculators

4.1. Date Commands

- **`date`** Gives time and date

- **`cal`** Calendar

```
cal
cal 1997
cal 3
cal 7 1962
cal 9 1752
```

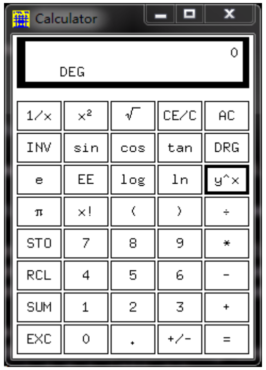
Not a mistake. Why?

4.2. You and the System

`uptime`	Machine’s ‘up’ time
`hostname`	Name of the machine
`whoami`	Your account name

4.3. Calculators

- `xcalc` Requires x11-apps (sudo apt-get install x11-apps)



- **`expr`** `e` Simple arithmetic

  ```
  expr 3 + 5 + 7
  ```

- **`bc`** Programmable Calculator

Using bc

- `bc`

```
3 + 5 + 7
   15          Output
^D
```

- `bc -l`   Use Maths library

```
scale=3        Set display to 3 dp
150/60
l(30)          natural log function
^D
```

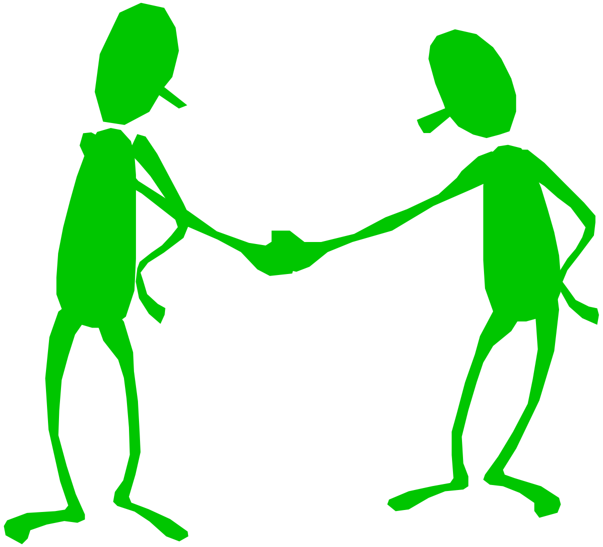
- `bc`

```
obase=2               Output base
ibase=16              Input base
FFC1
^D
```

5. Linux Help

5.1. On-line Help

5.2. Linux Reference



5.1. On-line Help

- **`man`** Manual pages

```
man cal
man man
```

- `apropos` *`topic`* Lists commands related to `topic`

```
apropos game
apropos help
```

man -k topic	Same as apropos
whatis cmd	One-line description
whatis find	
where cmd	Location of command
which cmd	Location

- **`locate`** `cmd` List files with `cmd` in their name (or path)

```
locate game
```

- Output of these commands can be very long. See one screenful at a time with: `| more`

```
locate game | more
apropos print | more
```

- Press enter/spacebar to go on; `^C/q` to stop.

5.2. Linux Reference

- **“Linux Documentation Project Guides”, include:**
  - “Introduction to Linux ”
  - “GNU/Linux Command-Line Tools Summary”
  - “The Linux System Administrators' Guide”
  - “Advanced Bash-Scripting Guide”
  - “Bash Guide for Beginners”
  - “The Linux Programmer's Guide”

  (website: http://tldp.org/guides.html)
- **“Linux Network Administrators Guide”**
  - website: http://www.faqs.org/docs/linux_network
- **“Beej's Guide to Network Programming”**
  - website: http://beej.us/guide/bgnet

6. The Linux File System

6.1. An upside-down Tree

6.2. Some System Directories

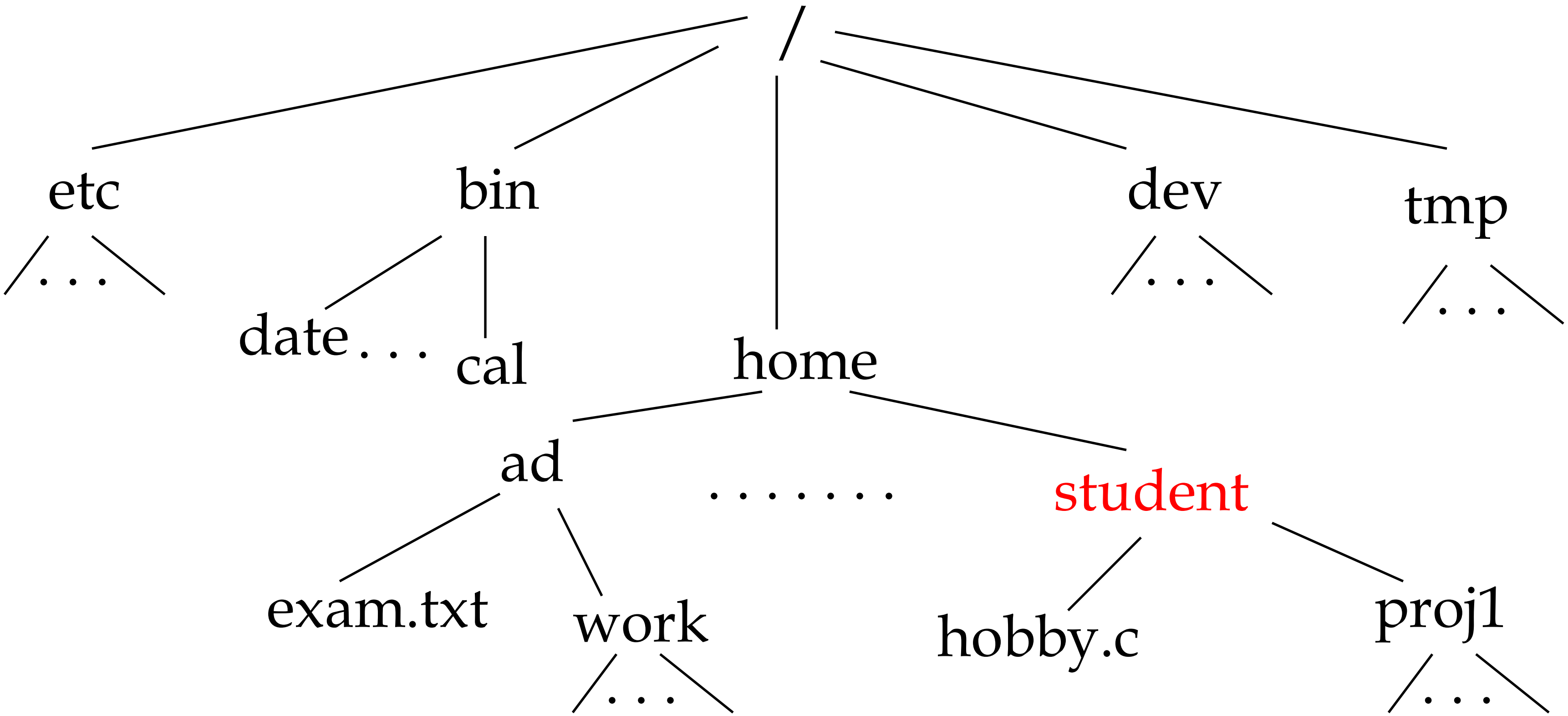
6.3. Where do you login?

6.4. Pathnames

6.5. Commands and Pathnames

6.1. An upside-down Tree

- A simplified Linux directory/file system:

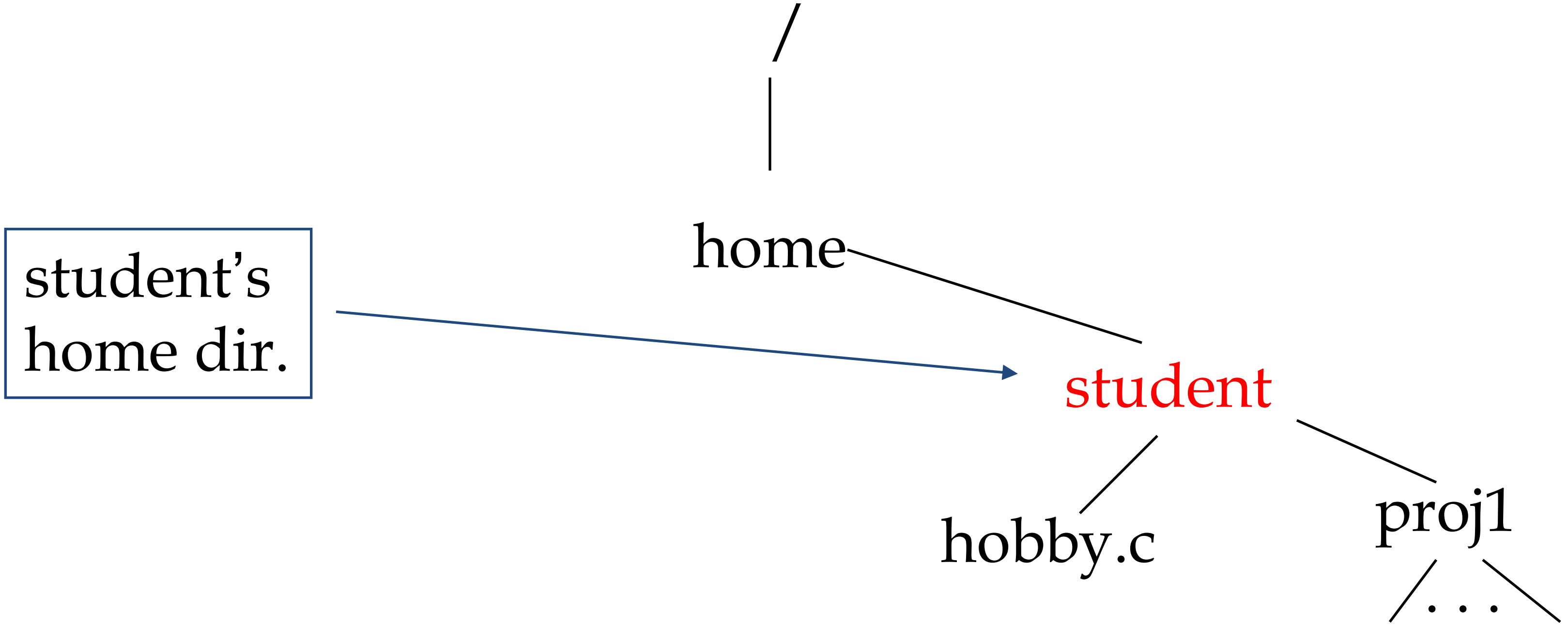


6.2. Some System Directories

- `/` *root* directory
- `/bin` commands
- `/etc` system data files
  (e.g. `/etc/passwd`)
- `/dev` files representing I/O devices

6.3. Where do you login?

- Your *home directory*, which is named after your login ID.
- **`pwd`** showing current directory



root Account

- root: super user, who has the full rights to all resources
- prompt: #
- home directory: /root
- changing to root account: $sudo -i
- add a new user account:

```
#adduser account-name
```

- open a new terminal window: ALT+F2
- switching among terminals: ALT+F1, ALT+F2, …
- try command who and whoami

6.4. Pathnames

- A *pathname* is a sequence of directory names (separated by /’s) which identifies the location of a directory.

- There are two sorts of pathnames
  - absolute pathnames
  - relative pathname

Absolute Pathnames

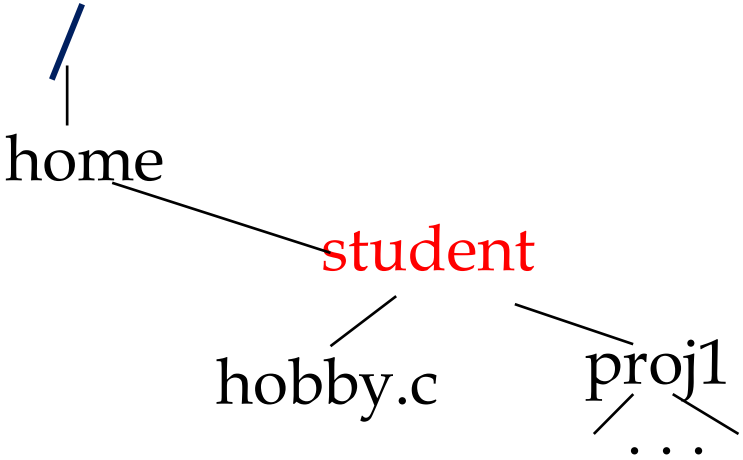
- The sequence of directory names between the top of the tree (the *root*) and the directory of interest.
- For example:

```
/bin
/etc/terminfo
/home/ad
/home/student/proj1
```

Relative Pathnames

- The sequence of directory names below the directory where you are now to the directory of interest.
- If you are interested in the directory `proj1`:

`proj1`	if you are in `student`
`student/proj1`	if you are in `home`



6.5. Commands and Pathnames

- Commands often use pathnames.

- For example:

```
cat /etc/passwd
```

List the password file

7. Working with Directories

7.1. Moving between Directories

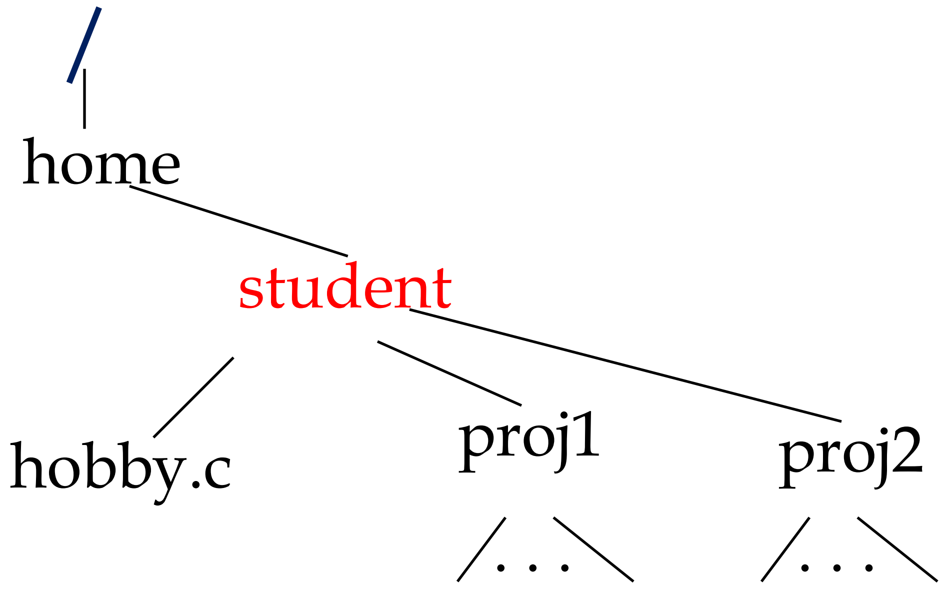
7.2. Special Directory Names

7.3. Investigate the System

7.4. Making / Deleting / Renaming Directories

7.1. Moving between Directories

- student's home directory:



- If you are in directory `student` how do you move to directory `proj1`?

```
cd proj1
```

- You are now in `proj1`. This is called the *current working directory*.

- **`pwd`** Print name of current working directory

- Move back to directory `student` (the parent directory):

```
cd ..
```

- When in `proj1`, move to `proj2` with one command:

```
cd ../proj2
```

- `../proj2` is a *relative* pathname

7.2. Special Directory Names

• /	The root directory
• .	The current working directory
• ..	The parent directory (of your current directory)
• ~	Your home directory
• `~user`	Home directory of `user`

Examples

• `cd /`	Change to root directory
• `cd ~`	Change to home directory
• `cd`	(Special case; means `cd ~`)
• `cd ~ad`	Change to ad’s home dir.
• `cd ../..`	Go up two levels.

7.3. Investigate the System

- Use `cd`
- **`cat`** `file` List `file`

```
cd /etc
cat passwd
```

- **`ls`** Directory listing

`ls`	List current dir.
`ls /etc`	List `/etc`
`ls -F`	-F option shows types

```
          a.tcl*          ns-allinone-2.29/
```

7.4. Making / Deleting / Renaming Directories

- Usually, you can only create directories (or delete or rename them) in your home directory or directories below it.

`mkdir`	Make a directory
`rmdir`	Delete a directory
`mv`	Rename a directory

- Create a `lab` directory in your home directory:

```
cd ~
mkdir lab
```

- Create two directories inside the `lab` directory:

```
cd lab
mkdir week1
mkdir week2
```

- Delete the `week1` directory:

```
rmdir week1
```

- Change the name of `week2` to `all-weeks`

```
mv week2 all-weeks
```

8. Working with Files

8.1. Creating a Text File

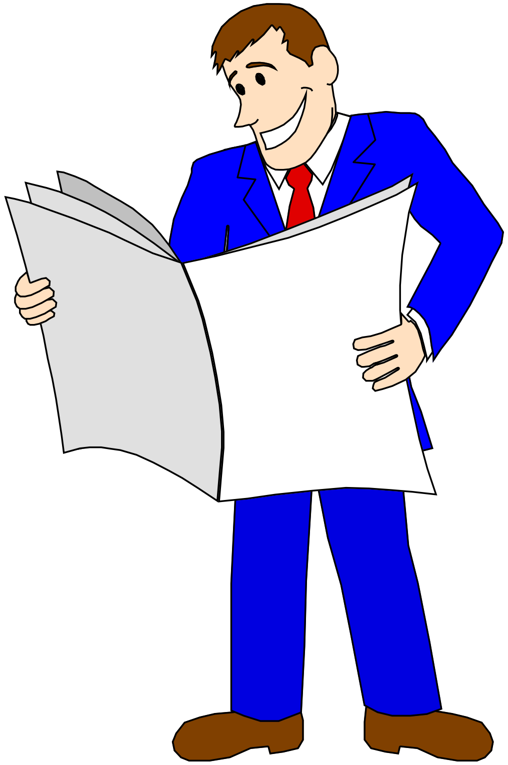
8.2. Listing Files

8.3. Filename Conventions

8.4. Other Basic Commands

8.5. Printing

8.6. I/O Redirection



8.1. Creating a Text File

- A quick way:

```
cal > file
```

- This will feed the text you type at the keyboard into `file` until you type `^D` (CONTROL and a D together).

- A more powerful way is to use **`vi`**, a full screen editor (see later).

8.2. Listing Files

- **`cat`** `file` List the file

```
cat hobby.c
cat /etc/passwd
```

- **`more`** `file` List the file a screen at a time. Type spacebar to go on; `^C` to stop

- **`less`** `file` Like `more` but more powerful
- **`head`** `file` List the *first* few lines
- **`tail`** `file` List the *last* few lines

8.3. Filename Conventions

- Many files have a name and an extension:

`file.c`	A C program
`file.cpp`	A C++ program
`file.txt`	A text file

- However, you can call a file *anything*. It doesn't have to have an extension.

8.4. Other Basic Commands

• **`cp`** `file1 file2`	Copy `file1`, making `file2`
• **`mv`** `file1 file2`	Rename `file1` as `file2`
• **`rm`** `file` `rm -i file`	Delete `file` check first

- **`wc`** `file` Counts the lines, words, characters in `file`

- **`grep`** `string file` Search `file` for `string`

  e.g., `grep abc test`

- List lines containing ‘Andrew’ in `/etc/passwd`

```
grep Andrew /etc/passwd
```

- Lines containing ‘printf(‘ in `hobby.c`

```
grep ‘printf(‘ hobby.c
```

- Lines starting with ‘loca’ in `/usr/dict/words`

```
grep ^loca /usr/dict/words
```

8.5. Printing

- `lpr file` Print `file`

- `lpq` List the print queue. Each print job has a number.

- `lprm job-number` Remove that print job

- You may have to name the printer with the `-P` option:

```
lpr -Plj5 hobby.c
```

- `lpq` and `lprm` understand the `-P` option

8.6. I/O Redirection

- Most commands output to the screen

```
ls
```

- Output can be *redirected* to a file with‘>‘:

```
ls > dir.txt
cal 1997 > year1997
```

- Output can be *appended* to a file with ‘>>‘

```
cal 1997 > years
cal 1998 >> years
```

- Concatenate two files:

```
cat f1 f2 > fs
```

- Input redirection (less common) uses ‘<‘

```
wc < years
```

- Combine input and output redirection:

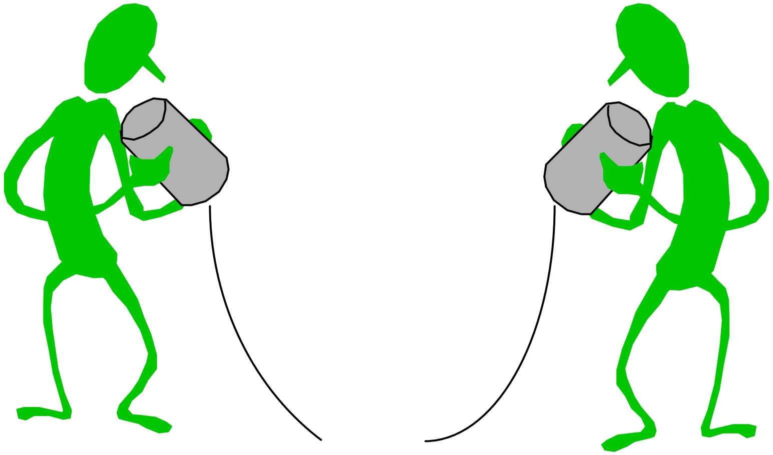
```
wc < years > year-counts
```

9. Communicating with People

9.1. Information on Others

9.2. Fingering People

9.3. Talking



9.1. Information on Others

- **`users`** Who else is logged on?
- **`who`** Information on current users
- **`ps`** What are people doing?

- **`w`** What are people doing?

  `w -sh` A shorter report

- Examine password info:

```
more /etc/passwd
grep s38 /etc/passwd
```

9.2. Fingering People

• **`finger`**	Info. on current users
`finger -l`	Longer information
• `finger user`	Information on `user` (need not be logged in)
`finger ad`	

- `finger @machine-name` User info. for that machine

```
finger @catsix
finger @ratree.psu.ac.th
```

- **`ping`** `machine-name` Is machine alive (on)?

```
ping catsix
```

(`^C` to stop)

Your Finger Information

- `chfn`   Change your finger entry
- `finger` also prints the contents of the `.plan` and `.project` files in your home directory. List '.' files with:

```
 ls -a
```

9.3. Talking

- `talk user` Talk to `user` (on any machine)

```
talk ad
talk bill-gates@ratree.psu.ac.th
```

Get out by typing `^C`