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The Unix and GNU/Linux commands

Latest update: June 15, 2013,
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Training contents

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- Command line interpreters
- Handling files and directories
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Standard I/O, redirections, pipes

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Unix file system

Almost everything in Unix is a file!

- Regular files
- Directories : Directories are just files listing a set of files
- Symbolic links : Files referring to the name of another file

- Devices and peripherals
- Read & write from devices
  As with regular files
- Pipes Used to cascade programs
  (e.x) cat *.log | grep error
- Sockets (Inter process communication)

File names

File names

- **Case sensitive**
- No obvious length limit

Can contain any character (including whitespace, except /).
File types stored in the file ("magic numbers").
File name extensions not needed and not interpreted. Just
used for user convenience.

Examples: *README .bashrc Windows Buglist index.htm index.html index.html.old*

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File paths

A path is a sequence of nested directories with a file or directory at the end, separated by the / character

Relative path:

documents/fun/microsoft.html

Relative to the current directory

Absolute path:

/home/bill/bugs/crash94020311

/ : root directory.

Start of absolute paths for all files on the system (even for files on removable devices or network shared).

/tmp/ Temporary files

/usr/ Regular user tools (not essential to the system)

e.x /usr/bin/, /usr/lib/, /usr/sbin...

/usr/local/ Specific software installed by the sysadmin (preferred to /opt/)

/var/ Data used by the system/system servers

/var/log/, /var/spool/mail (incoming mail), /var/spool/lpd (print jobs)...

The Unix filesystem structure is defined by the Filesystem Hierarchy Standard (FHS):

http://www.pathname.com/fhs/

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GNU / Linux file system structure

Not imposed by the system. Can vary from one system to the other, even between two GNU/Linux installations!

/	Root directory
/bin/	Basic, essential system commands
/boot/	Kernel images, initrd and configuration files
/dev/	Files representing devices
/dev/hda:	First IDE hard disk
/etc/	System configuration files
/home/	User directories
/lib/	Basic system shared libraries
/lost+found	Corrupt files the system tried to recover
/media	Mount points for removable media: /media/usbdisk, /media/cdrom
/mnt/	Mount points for temporarily mounted filesystems
/opt/	Specific tools installed by the sysadmin
/usr/local/	often used instead
/proc/	Access to system information (/proc/cpuinfo, /proc/version ...
/root/	root user home directory
/sbin/	Administratoronly commands
/sys/	System and device controls (cpu frequency, device power)

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Shells and file handling

- Shells: tools to execute user commands
- Called “shells” because they hide the details on the underlying operating system under the shell's surface.
- Commands are input in a text terminal, either a window in a graphical environment or a text-only console.
- Results displayed on the terminal. No graphics needed at all.
- Shells can be scripted: provide all the resources to write complex programs (variable, conditionals, iterations...)

Well known shells

Most famous and popular shells

sh: The Bourne shell (obsolete)
Traditional, basic shell found on Unix systems, by Steve Bourne.

csh: The C shell (obsolete)
Once popular shell (Clike syntax)

tcsh: The TC shell (still very popular)
A C shell compatible implementation with evolved features(command completion, history editing & more...)

bash: The Bourne Again shell (most popular) An improved implementation of sh with lots of added features too.

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ls command

Lists the files in the current directory, in alphanumeric order, except files starting with the **“.”** character.

ls -a (all)
Lists all the files (including .* files)
ls -l (long)
Long listing (type, date, size, owner, permissions)
ls -t (time)
Lists the most recent files first

- **ls –S (size)**
  Lists the biggest files first
- **ls –r (reverse)**
  Reverses the sort order
- **ls –ltr (options can be combined)**
  Long listing, most recent files at the end

Better introduced by examples!
ls *txt
The shell first replaces *txt by all the file and directory names ending by txt (including .txt), except those starting with ., and then executes the ls command line.

ls –d .*
Lists all the files and directories starting with
-d tells ls not to display the contents of directories.

cat ?.log
Displays all the files which names start by 1 character and
end by .log

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Special directories

./
The current directory. Useful for commands taking a directory argument. Also sometimes useful to run commands in the current directory .

So ./readme.txt and readme.txt are equivalent.

../
The parent (enclosing) directory. Always belongs to the . directory (see ls a).
Only reference to the parent directory.

Typical usage:
cd ..

~/
Not a special directory indeed. Shells just substitute it by the home directory of the current user.
Cannot be used in most programs, as it is not a real directory.
~sydney/
Similarly, substituted by shells by the home directory of the sydney user.

cd <dir>
Changes the current directory to <dir>.
cd –
Gets back to the previous current directory.
pwd
Displays the current directory ("working directory").

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The cp command

cp <source_file> <target_file>
cp file1 file2 file3 ... dir
Copies the files to the target
cp –I (interactive)
Asks for user confirmation if the target file already exists
cp –r <source_dir> <target_dir> (recursive)
Copies the whole directory.

Creating and removing directories

mkdir dir1 dir2 dir3 ... (make dir)
Creates directories with the given names.
rmdir dir1 dir2 dir3 ... (remove dir)
Removes the given directories
Safe: only works when directories and empty.
Alternative: rm –r
(doesn't need empty directories).

mv and rm commands

- mv and rm commands
- **mv <old_name> <new_name> (move)**
- Renames the given file or directory.
- **mv –i (interactive**)
- If the new file already exits, asks for user confirm
- rm file1 file2 file3 ... (remove)
- Removes the given files.
- **rm –i (interactive)**
- Always ask for user confirm.
- **rm –r dir1 dir2 dir3 (recursive)**
- Removes the given directories with all their contents

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The head and tail commands

Displaying file contents

Displaying the contents of files.

- **cat file1 file2 file3 ... (concatenate)**

Concatenates and outputs the contents of the given files.

- **more file1 file2 file3 ...**

After each page, asks the user to hit a key to continue.Can also jump to the first occurrence of a keyword (/ command).

- **less file1 file2 file3 ...**

Does more than more with less.
Doesn't read the whole file before starting.
Supports backward movement in the file (? command).

- **head [< n>] <file>**

Displays the first <n> lines (or 10 by default) of the given file. Doesn't have to open the whole file to do this!

- **tail [< n>] <file>**

Displays the last <n> lines (or 10 by default) of the given file.No need to load the whole file in RAM! Very useful for huge files.

- **tail –f <file> (follow)**

Displays the last 10 lines of the given file and continues to display new
lines when they are appended to the file.

- Examples

1) head windows_bugs.txt
2) tail –f outlook_vulnerabilities.txt

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grep command

- **grep <pattern> <files>**

Scans the given files and displays the lines which match the given pattern.

- **grep error *.log**

Displays all the lines containing error in the *.log files

- **grep –i error *.log**

Same, but case insensitive.

- **grep –ri error .**

Same, but recursively in all the files in . and its subdirectories

- **grep –v info *.log**

Outputs all the lines in the files except those containing info.

The sort command

sort <file>

Sorts the lines in the given file in character order and outputs them.

sort –r <file>

Same, but in reverse order.

sort –ru <file>

u: unique. Same, but just outputs identical lines once.

More possibilities described later!

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Symbolic links

A symbolic link is a special file which is just a reference to the name of another one (file or directory):
Useful to reduce disk usage and complexity when 2 files have the same content.

Example:
anakin_biography > darth_biagraphy

How to identify symbolic links:
ls –l displays -> and the linked file name.
GNU ls displays links with a different color.

Creating symbolic links

To create a symbolic link (same order as in cp):
- ln –s file_name link_name

To create a link with to a file in another directory, with the
same name:
- ln –s ../README.txt

To create multiple links at once in a given directory:
- ln –s file1 file2 file3 ... dir

To remove a link:
- rm link_name

Of course, this doesn't remove the linked file!

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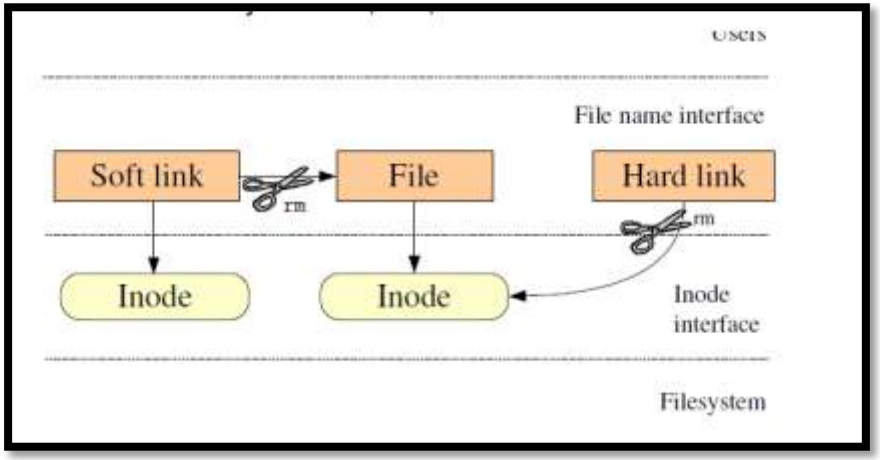
Files names and inodes

Hard links

- The default behavior for ln is to create *hard links*
- A *hard link* to a file is a regular file with exactly the same physical contents
- While they still save space, hard links can't be distinguished from the original files.
- If you remove the original file, there is no impact on the hard link contents.
- The contents are removed when there are no more files (hard links) to them.

Makes hard and symbolic (soft) links easier to understand!



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Command documentation

Command help

Some Unix commands and most GNU / Linux commands offer at least one help argument:
-h (- is mostly used to introduce 1 character options)
--help (-- is always used to introduce the corresponding “long” option name, which makes scripts easier to understand).

You also often get a short summary of options when you input an invalid argument.

Manual pages

man <keyword>
Displays one or several manual pages for <keyword>
man manS
Most available manual pages are about Unix commands, but some are also about C functions, headers or data structures,
or even about system configuration files!
man stdio.h
man fstab (for /etc/fstab)
Manual page files are looked for in the directories specified by
the MANPATH environment variable.

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Users and permissions

Use ls –l to check file access rights

3 types of access rights
Read access (r)
Write access (w)
Execute rights (x)

3 types of access levels

- User (u): for the owner of the file
- Group (g): each file also has a "group" attribute, corresponding to a given list of users
- Others (o): for all other users

Access right constraints

x is sufficient to execute binaries Both x and r and required for shell scripts. Both r and x permissions needed in practice for directories:
r to list the contents, x to access the contents.
You can't rename, remove, copy files in a directory if you don't have w access to this directory.
If you have w access to a directory, you CAN remove a file even if you don't have write access to this file (remember that a directory is just a file describing a list of files). This even lets you modify (remove + recreate) a file even without w access to it.

Access rights examples

-rw-r—r Readable
and writable for file owner, only readable for others
-rw-r------ Readable
and writable for file owner, only readable for users belonging to the file group.
Drwx------ Directory
only accessible by its owner
-------r-x
File executable by others but neither by your friends nor by
yourself. Nice protections for a trap...

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chmod: changing permissions

chmod <permissions> <files>

2 formats for permissions:

Octal format (abc):

a,b,c = r*4+w*2+x (r, w, x: booleans)

Example: chmod 644 <file>

(rw for u, r for g and o)

Or symbolic format. Easy to understand by examples:

chmod go+r: add read permissions to group and others.

chmod u-w: remove write permissions from user.

chmod a-x: (a: all) remove execute permission from all.

chmod R a+rX linux/

Makes linux and everything in it available to everyone!

R: apply changes recursively

X: x, but only for directories and files already executable

Very useful to open recursive access to directories, without adding execution rights to all files.

chmod a+t /tmp

t: (sticky). Special permission for directories, allowing only the directory and file owner to delete a file in a directory.

Useful for directories with write access to anyone, like /tmp.

Displayed by ls –l with a t character.

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File ownership

Particularly useful in (embedded) system development when you create files for another system.

➢ **chown –R sco /home/linux/src**
(R: recursive)
Makes user sco the new owner of all the files in /home/linux/src.

chgrp –R empire /home/skywalker
Makes empire the new group of everything in /home/skywalker.

chown R borg:aliens usss_entreprise/
chown can be used to change the owner and group at the same time.

Beware of the dark side of root

- root user privileges are only needed for very specific tasks with security risks: mounting, creating device files, loading drivers, starting networking, changing file ownership, package upgrades...
- Even if you have the root password, your regular account should be sufficient for 99.9 % of your tasks (unless you are a system administrator).
- In a training session, it is acceptable to use root. In real life, you may not even have access to this account, or put your systems and data at risk if you do.

Using the root account

In case you really want to use root...

- If you have the root password:

su - (Switch User)

- in modern distributions, the sudo command gives you access to some root privileges with your own user password.

Example: sudo mount /dev/hda4 /home

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Standard I/O, redirections, pipes

More about command output

- All the commands outputting text on your terminal do it by writing to their *standard output.*
- Standard output can be written (redirected) to a file using the > symbol
- Standard output can be appended to an existing file using the >> symbol

Standard output redirection examples

```
ls ~adam/* > ~gwb/debug.txt
cat obiwan_kenobi.txt > starwars_biographies.txt
cat han_solo.txt >> starwars_biographies.txt
echo “README: No such file or directory” > README
```

Useful way of creating a file without a text editor.

Standard input

More about command input

Lots of commands, when not given input arguments, can take their input from *standard input.*

```
sort
windows
linux
[Ctrl][D]
linux
Windows
```

sort takes its input from the standard input: in this case, what you type in the terminal (ended by [Ctrl][D])

```
sort < participants.txt
```

The standard input of sort is taken from the given file.

Pipes

Unix pipes are very useful to redirect the standard output of a command to the standard input of another one.

Examples:- **cat *.log | grep -i error | sort**

- grep –ri error . | grep -v “ignored” | sort –u > serious_errors.log
- cat /home/*/homework.txt | grep mark | more

This one of the most powerful features in Unix shells!

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The tee command

tee [-a] file

The tee command can be used to send standard output to the screen and to a file simultaneously.

make | tee build.log

Runs the make command and stores its output to build.log.

make install | tee –a build.log

Runs the make install command and appends its output to build.log.

Standard error

Error messages are usually output (if the program is well written) to *standard error instead of standard output.*
Standard error can be redirected through 2> or 2>>
Example:
cat f1 f2 nofile > newfile 2> errfile
Note: 1 is the descriptor for standard output, so 1> is equivalent to >.
Can redirect both standard output and standard error to the same file using &> :
cat f1 f2 nofile &> wholefile

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The yes command

Useful to fill standard input with always the same string.

yes <string> | <command>

Keeps filling the standard input of <command> with <string> (y by default).

Examples

yes | rm –r dir/

bank> yes no | credit_applicant

yes "" | make oldconfig

(equivalent to hitting [Enter] to accept all default settings)

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Special devices

Device files with a special behavior or contents

/dev/null :- The data sink! Discards all data written to this file. Useful to get rid of unwanted output, typically log information:

mplayer black_adder_4th.avi &> /dev/null

/dev/zero

Reads from this file always return \0 characters

Useful to create a file filled with zeros:

dd if=/dev/zero of=disk.img bs=1k count=2048

/dev/full

Mimics a full device.

Useful to check that your application properly handles this kind of situation.

See man full for details.

/dev/random

Returns random bytes when read. Mainly used by cryptographic programs. Uses interrupts from some device drivers as sources of true randomness (“entropy”). Reads can be blocked until enough entropy is gathered.

/dev/urandom

For programs for which pseudo random numbers are fine. Always generates random bytes, even if not enough entropy is available (in which case it is possible, though still difficult, to predict future byte sequences from past ones).

See man random for details.

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Task control

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Full control on tasks

Processes

- Unix supports true preemptive multitasking.
- Ability to run many tasks in parallel, and abort them even if they corrupt their own state and data.
- Ability to choose which programs you run.
- Ability to choose which input your programs takes, and where their output goes.

"Everything in Unix is a file Everything in Unix that is not a file is a process"

Processes : Instances of a running programs
Several instances of the same program can run at the same time Data associated to processes: (Open files, allocated memory, stack, process id, parent, priority, state...)

Running jobs in background

Same usage throughout all the shells Useful

- For command line jobs which output can be examined later, especially for time consuming ones.
- To start graphical applications from the command line and then continue with the mouse.

Starting a task: add & at the end of your line:
find_prince_charming –cute --clever –rich &

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Background job control

jobs
Returns the list of background jobs from the same shell
[1] Running ~/bin/find_meaning_of_life withoutgod &
[2]+ Running make mistakes &
fg
fg %<n>
Puts the last / nth background job in foreground mode
Moving the current task in background mode:
[Ctrl] Z
bg
kill %<n>
Aborts the nth job.

Job control example

> jobs
[1]Running ~/bin/find_meaning_of_life withoutgod &
[2]+ Running make mistakes &
> fg
make mistakes
> [Ctrl] Z
[2]+ Stopped make mistakes
> bg
[2]+ make mistakes &
> kill %1
[1]+ Terminated ~/bin/find_meaning_of_life withoutgod

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Listing all processes

... whatever shell, script or process they are started from
ps –ux (Lists all the processes belonging to the current user)
ps –aux (Note: ps edf on System V systems)
Lists all the processes running on the system

ps -aux | grep bart | grep bash

```
USER   PID   %CPU   %MEM   VSZ    RSS   TTY    STAT  START  TIME
COMMAND
bart    3039 0.0      0.2      5916   1380 pts/2   S    14:35   0:00   /bin/bash
bart    3134 0.0      0.2      5388   1380 pts/3   S    14:36   0:00   /bin/bash
bart    3190 0.0      0.2      6368   1360 pts/4   S    14:37   0:00   /bin/bash
bart    3416 0.0      0.0      0         0    pts/2   RW   15:07   0:00    [bash]
```

PID: Process id
VSZ: Virtual process size (code + data + stack)
RSS: Process resident size: number of KB currently in RAM
TTY: Terminal
STAT: Status: R (Runnable), S (Sleep), W (paging), Z (Zombie)...

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Live process activity

top Displays most important processes, sorted by cpu percentage

```
top 15: 44:33 up 1:11, 5 users, load average: 0.98, 0.61, 0.59
Tasks: 81 total, 5 running, 76 sleeping, 0 stopped, 0 zombie
Cpu(s): 92.7% us, 5.3% sy, 0.0% ni, 0.0% id, 1.7% wa, 0.3% hi, 0.0% si
Mem: 515344k total, 512384k used, 2960k free, 20464k buffers
Swap: 1044184k total, 0k used, 1044184k free, 277660k cached

PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+
COMMAND
3809 jdoe 25 0 6256 3932 1312 R 93.8 0.8 0:21.49 bunzip2
2769 root 16 0 157m 80m 90m R 2.7 16.0 5:21.01 X
3006 jdoe 15 0 30928 15m 27m S 0.3 3.0 0:22.40 kdeinit
3008 jdoe 16 0 5624 892 4468 S 0.3 0.2 0:06.59 autorun
3034 jdoe 15 0 26764 12m 24m S 0.3 2.5 0:12.68 kscd
3810 jdoe 16 0 2892 916 1620 R 0.3 0.2 0:00.06 top
```

- You can change the sorting order by typing

M: Memory usage, P: %CPU, T: Time.

- You can kill a task by typing k and the process id.

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Killing processes

kill <pids> Sends an abort signal to the given processes. Lets processes save data and exit by themselves. Should be usedfirst.
Example: kill 3039 3134 3190 3416

kill -9 <pids>
Sends an immediate termination signal. The system itself terminates the processes. Useful when a process is really stuck (doesn't answer to kill 1).
kill -9 -1 Kills all the processes of the current user. 1:means all processes.

killall [-< signal>] <command>
Kills all the jobs running <command>. Example:
killall bash
xkill
Lets you kill a graphical application by clicking on it! Very quick! Convenient when you don't know the application command name.

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Environment variables

Shells let the user define *variables*. They can be reused in shell commands.
Convention: lower case names
You can also define *environment variables:* variables that are also visible within scripts or executable called from the shell.
Convention: upper case names.

env Lists all defined environment variables and their value.

Shell variables (bash)
projdir=/home/marshall/coolstuff
ls -la
$projdir; cd $projdir
Environment variables (bash)
cd $HOME
export DEBUG=1
./find_extraterrestrial_life
(displays debug information if DEBUG is set)

Main standard environment variables

Used by lots of applications!

LD_LIBRARY_PATH Shared library search path
DISPLAY Screen id to display X (graphical) applications on.
EDITOR Default editor (vi, emacs...)
HOME Current user home directory
HOSTNAME Name of the local machine
MANPATH Manual page search path
PATH Command search path
PRINTER Default printer name
SHELL Current shell name
TERM Current terminal type
USER Current user name

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PATH environment variables

PATH
Specifies the shell search order for commands
/
home/acox/bin:/usr/local/bin:/usr/kerberos/bi
n:
/usr/bin:/bin:/usr/X11R6/bin:/bin:/usr/bin
LD_LIBRARY_PATH
Specifies the shared library (binary code libraries shared by
applications, like the C library) search order for ld
/usr/local/lib:/usr/lib:/lib:/usr/X11R6/lib

MANPATH
Specifies the search order for manual pages
/usr/local/man:/usr/share/man

It is strongly recommended not to have the "." directory in your PATH environment variable, in particular not at the beginning:

- A cracker could place a malicious ls file in your directories. It would get executed when you run ls in this directory and could do naughty things to your data.
- If you have an executable file called test in a directory, this will override the default test program and some scripts will stop working properly.

- Each time you cd to a new directory, the shell will waste time updating its list of available commands.

Call your local commands as follows: ./test

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Alias Command

Shells let you define command *aliases: shortcuts for commands you*
use very frequently.
Examples

- **alias ls='ls la'**

Useful to always run commands with default arguments.

- **alias rm='rm i'**

Useful to make rm always ask for confirmation.

- **alias frd='find_ram_device asap --risky'**

Useful to replace very long and frequent commands.

- **alias cia='. /home/sydney/env/cia.sh'**

Useful to set an environment in a quick way
(. is a shell command to execute the content of a shell script).

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The which command

Before you run a command, which tells you where it is found

```
bash> which ls
alias ls='ls --color= tty'
/bin/ls

tcsh> which ls
ls: aliased to ls --color=tty

bash> which alias
/usr/bin/which: no alias in
(/usr/local/bin:/usr/bin:/bin:/usr/X11R6/bin)

tcsh> which alias
alias: shell builtin command.
```

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~/.bashrc file

- **~/.bashrc**

Shell script read each time a bash shell is started

You can use this file to define

- Your default environment variables (PATH, EDITOR...).
- Your aliases.
- Your prompt (see the bash manual for details).
- A greeting message.

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Command history

history :- Displays the latest commands that you ran and their number. You can copy and paste command strings.
You can recall the latest command:
!!
You can recall a command by its number
!1003
You can recall the latest command matching a starting string:
!cat

You can make substitutions on the latest command:
^more^less
You can run another command with the same arguments:
more !*

Text editors

Graphical text editors
Fine for most needs
- **nedit**
- **Emacs, Xemacs**
- **Kate, Gedit**

Textonly text editors
Often needed for sysadmins and great for power users
- vi, vim
- nano

The nedit text editor

http://www.nedit.org/
Best text editor for non vi or emacs experts
Feature highlights:
- **Very easy text selection and moving**
- **Syntax highlighting for most languages and formats. Can be tailored for your own log files, to highlight particular errors and warnings.**
- **Easy to customize through menus**

Not installed by default by all distributions

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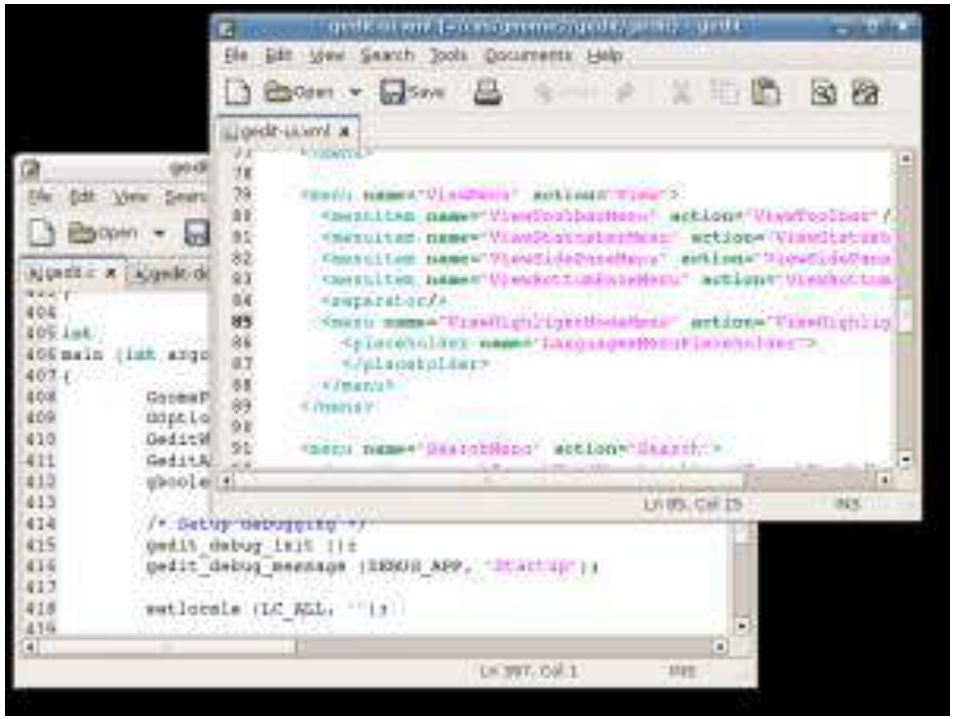
Kate and gedit

Kate is a powerful text editor dedicated to programming activities, for KDE http://kate.kde.org

Gedit is a text editor for the Gnome environment http://projects.gnome.org/gedit/



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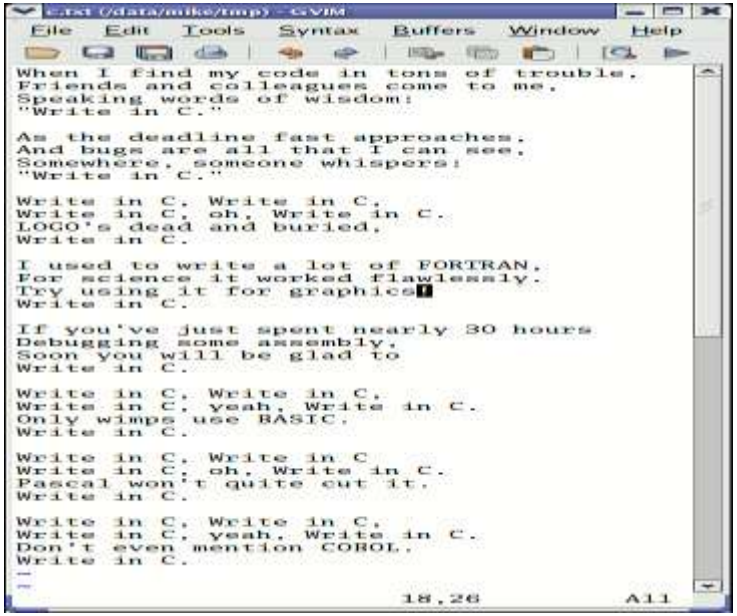
Vi Editor

Textmode text editor available in all Unix systems. Created before computers with mice appeared.

- **Difficult to learn for beginners used to graphical text editors.**
- **Very productive for power users.**
- **Often can't be replaced to edit files in system administration or in Embedded Systems, when you just have a text console.**

vim vi improved



vi implementation now found in most GNU / Linux host systems

- **Implements lots of features available in modern editors: syntax highlighting, command history, help, unlimited undo and much much more.**
- **Cool feature example: can directly open compressed text files.**
- **Comes with a GTK graphical interface (gvim)**
- **Unfortunately, not free software (because of a small restriction in freedom to make changes)**

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Measuring disk usage

Caution: different from file size!

- **du -h <file> (disk usage)**

-h: returns size on disk of the given file, in human readable format: K (kilobytes), M (megabytes) or G (gigabytes), .

Without -h, du returns the raw number of disk blocks used by the file (hard to read).

Note that the -h option only exists in GNU du.

- **du -sh <dir>**

-s: returns the sum of disk usage of all the files in the given directory.

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Measuring disk space

df -h <dir>

Returns disk usage and free space for the filesystem containing the given directory.
Similarly, the –h option only exists in GNU df.

Example:

- **df -h .**

Filesystem Size Used Avail Use% Mounted on
/dev/hda5 9.2G 7.1G 1.8G 81% /

- **df -h**

Returns disk space information for all filesystems available in the system. When errors happen, useful to look for full filesystems.

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Compressing and decompressing

Very useful for shrinking huge files and saving space

- **g[un]zip <file>**

GNU zip compression utility. Creates .gz files. Ordinary performance (similar to Zip).

- **b[un]zip2 <file>**

More recent and effective compression utility. Creates .bz2 files. Usually 2025% better than gzip.

- **[un]lzma <file>**

Much better compression ratio than bzip2 (up to 10 to 20%). Compatible command line options.

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Archiving

Useful to backup or release a set of files within 1 file

- **tar: originally "tape archive"**

- Creating an archive:

tar cvf <archive> <files or directories>
c: create
v: verbose. Useful to follow archiving progress.
f: file. Archive created in file (tape used otherwise).

- Example:

tar cvf /backup/home.tar /home
bzip2 /backup/home.tar

- Viewing the contents of an archive or integrity check:

tar tvf <archive>
t: test

- Extracting all the files from an archive:

tar xvf <archive>

- Extracting just a few files from an archive:

tar xvf <archive> <files or directories>
Files or directories are given with paths relative to the archive root directory.

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Extra options in GNU tar

tar = gtar = GNU tar on GNU / Linux

Can compress and uncompress archives on the fly. Useful to avoid creating huge intermediate files Much simpler to do than with tar and bzip2!

- j option: [un]compresses on the fly with bzip2
- z option: [un]compresses on the fly with gzip
- --lzma option: [un]compresses on the fly with lzma

- Examples (which one will you remember?)
- gtar jcvf bills_bugs.tar.bz2 bills_bugs
- tar cvf bills_bugs | bzip2 > bills_bugs.tar.bz2

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Unix printing

Multiuser, multijob, multiclient, multiprinter

- In Unix / Linux, printing commands don't really print. They send jobs to printing queues, possibly on the local machine, on network printing servers or on network printers.

- Printer independent system:

Print servers only accept jobs in PostScript or text. Printer drivers on the server take care of the conversion to each printers own format.

- Robust system:

Reboot a system, it will continue to print pending jobs.

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Printing commands

Useful environment variable: PRINTER Sets the default printer on the system.
Example:
export PRINTER=lp

- **lpr [P<queue>] <files>**

Sends the given files to the specified printing queue The files must be in text or PostScript format. Otherwise, you only print garbage.

- **a2ps [P<queue>] <files>**

"Any to PostScript" converts many formats to PostScript and send the output to the specified queue. Useful features:
several pages / sheet, page numbering, info frame...

Print job control

lpq [P<queue>] Lists all the print jobs in the given or default queue.
lp is not ready
Rank Owner Job File(s) Total Size
1st asloane 84 nsa_windows_backdoors.ps 60416 bytes
2nd amoore 85 gw_bush_iraq_mistakes.ps 65024000 bytes
cancel <job#> [<queue>] Removes the given job number from the default queue.

Comparing files and directories

- **diff file1 file2**

Reports the differences between 2 files, or nothing if the files are identical.

- **diff –r dir1/ dir2/**

Reports all the differences between files with the same name in the 2 directories.

- These differences can be saved in a file using the redirection, and then later reapplied using the patch command.

- To investigate differences in detail, better use graphical tools!

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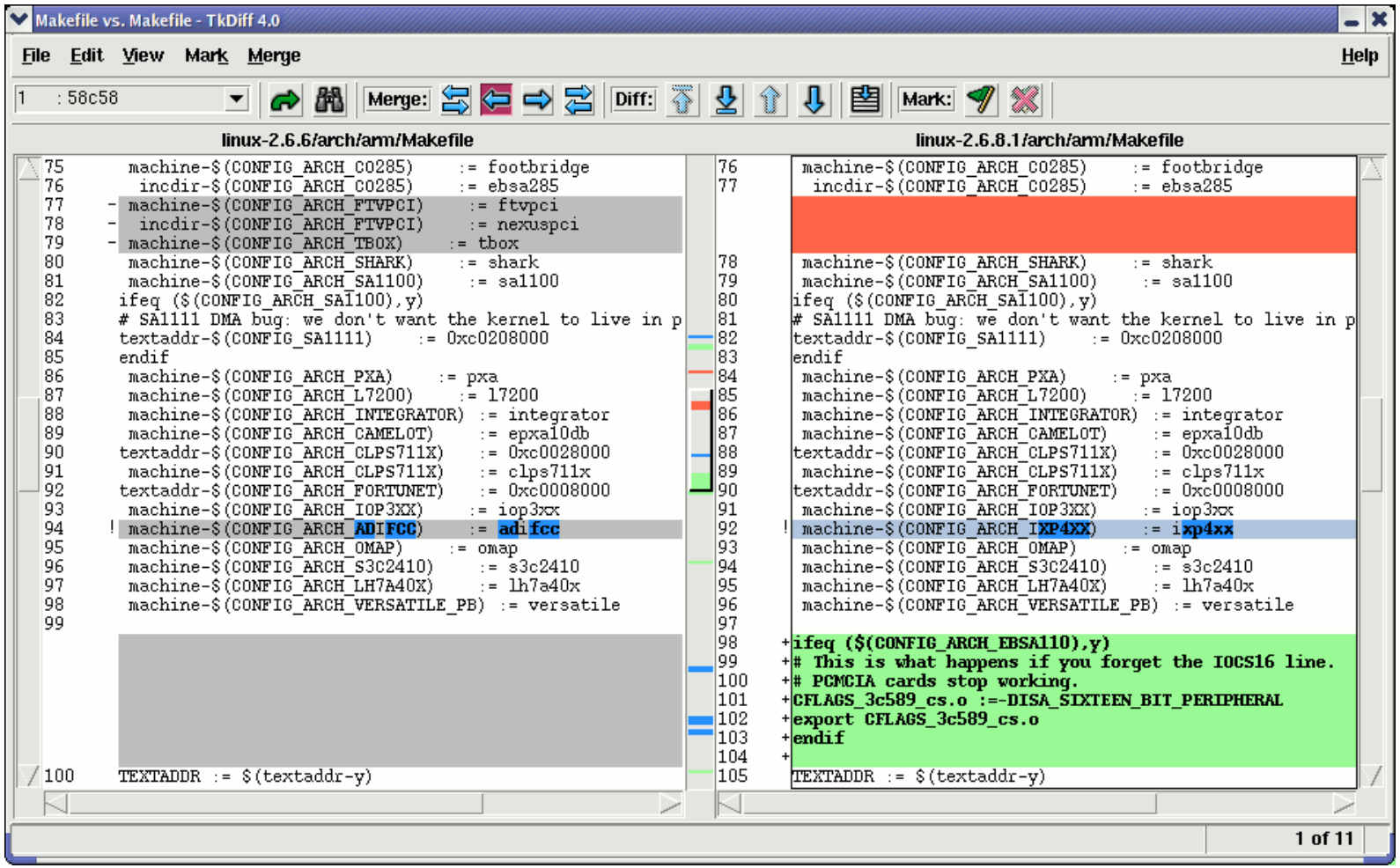
tkdiff

http://tkdiff.sourceforge.net/
Useful tool to compare files and merge differences



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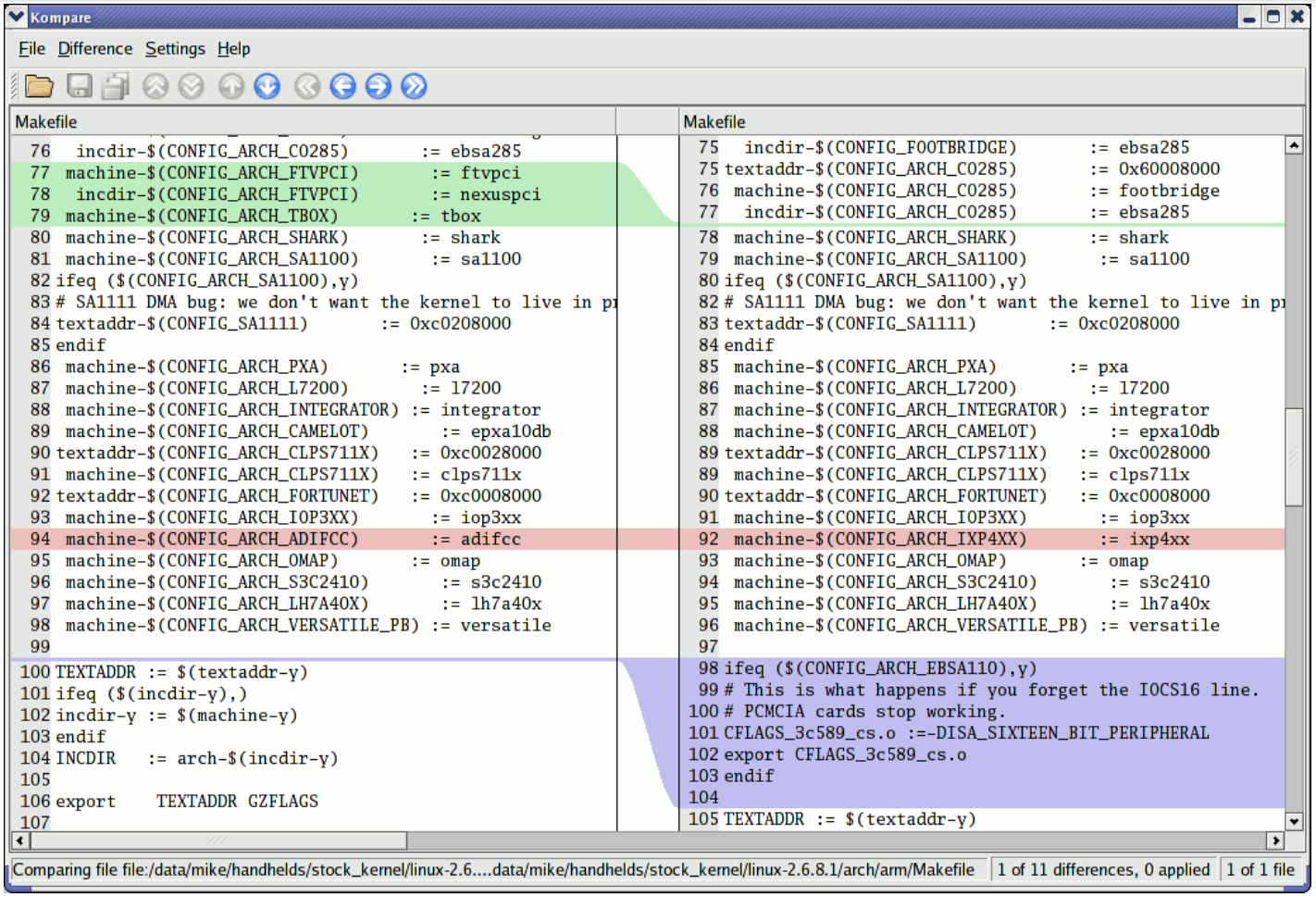
kompare

Another nice tool to compare files and merge differences
Part of the kdesdk package (Fedora Core)



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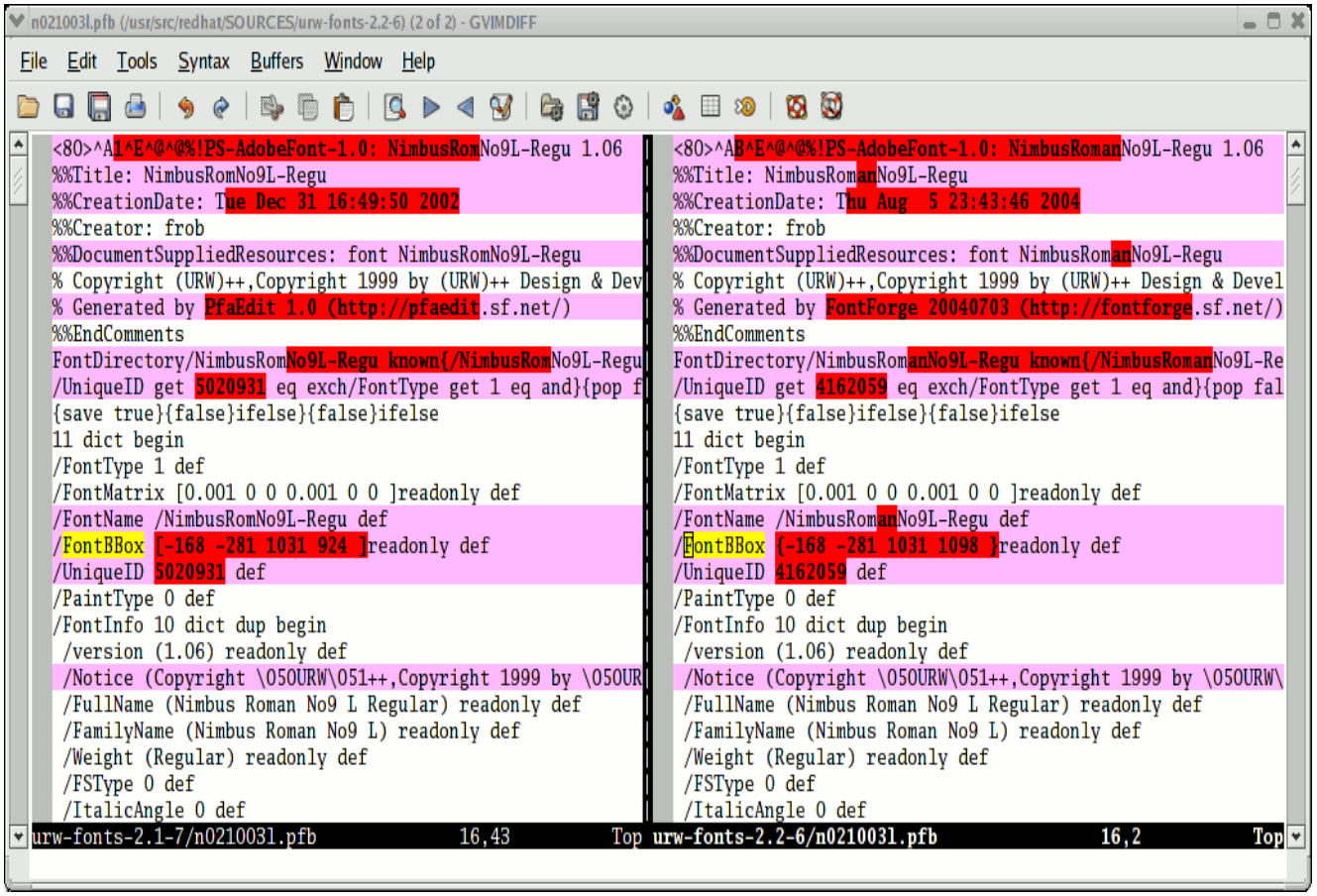
gvimdiff

Another nice tool to view differences in files Available in most distributions with gvim Apparently not using diff.
No issue with files with binary sections!



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The find command

- **find . Name “*.pdf”**

Lists all the *.pdf files in the current (.) directory or subdirectories. You need the double quotes to prevent the shell from expanding the * character.

- **find docs name "*.pdf" exec xpdf {} ';‘**

Finds all the *.pdf files in the docs directory and displays one after the other.

- Many more possibilities available! However, the above 2 examples cover most needs.

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The locate command

Much faster regular expression search alternative to find locate keys
Lists all the files on your system with keys in their name.

- **locate "*.pdf"**

Lists all the *.pdf files available on the whole machine

- **locate "/home/fridge/*coke*"**

Lists all the *coke* files in the given directory (absolute path)

- locate is much faster because it indexes all files in a dedicated database, which is updated on a regular basis.

find is better to search through recently created files.

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Changing users

You do not have to log out to log on another user account!

- su hyde

(Rare) Change to the hyde account, but keeping the environment variable settings of the original user.

- su jekyll

(More frequent) Log on the jekyll account, with exactly the same settings as this new user.

- **su -** When no argument is given, it means the root user.

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The wget command

Instead of downloading files from your browser, just copy and paste their URL and download them with wget!

wget main features

- http and ftp support
- Can resume interrupted downloads
- Can download entire sites or at least check for bad links
- Very useful in scripts or when no graphics are available (system administration, embedded systems)
- Proxy support (http_proxy and ftp_proxy env. variables)

wget –c http://microsoft.com/customers/dogs/winxp4dogs.zip
Continues an interrupted download.
wget –m http://lwn.net/
Mirrors a site.
wget -r –np http://www.xml.com/ldd/chapter/book/
Recursively downloads an online book for offline access.
-np: "noparent". Only follows links in the current directory.

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Misc commands

- **sleep 60**

Waits for 60 seconds (doesn't consume system resources).

- **wc report.txt** (word count)

438 2115 18302 report.txt

Counts the number of lines, words and characters in a file or in standard input.

Compiling simple applications

The compiler used for all Linux systems is GCC
http://gcc.gnu.org

- To compile a singlefile application, developed in C :

gcc –o test test.c

Will generate a test binary, from the test.c source file For C++ :
g++ -o test test.cc
The –Wall option enables more warnings
To compile sources files to object files and link the application :

gcc –c test1.c
gcc –c test2.c
gcc –o test test1.o test2.o
gcc automatically calls the linker ld

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Thank You

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