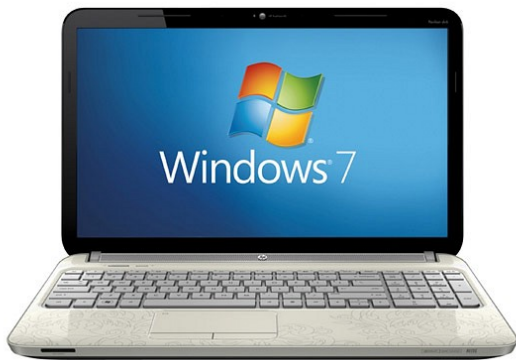


What is Linux?



- Most common household computer
- 90% of all internet traffic comes from Windows based machines*
- Especially popular in the gaming community



- 9% of all internet traffic comes from OSX based machines
- Especially popular in the photo, video, and music editing communities



- Open source operating system
- 1% of all internet traffic comes from Linux based machines
- Widely used in academia, supercomputers, and web servers

* https://en.wikipedia.org/wiki/Usage_share_of_operating_systems

Linux Desktop

The image shows a Linux desktop environment with a sidebar on the left containing various application icons. A red oval highlights the terminal icon, with an arrow pointing to a terminal window. The terminal window displays the output of the `ls -l` command and the output of a `ping` command.

Terminal

Web browser

File browser

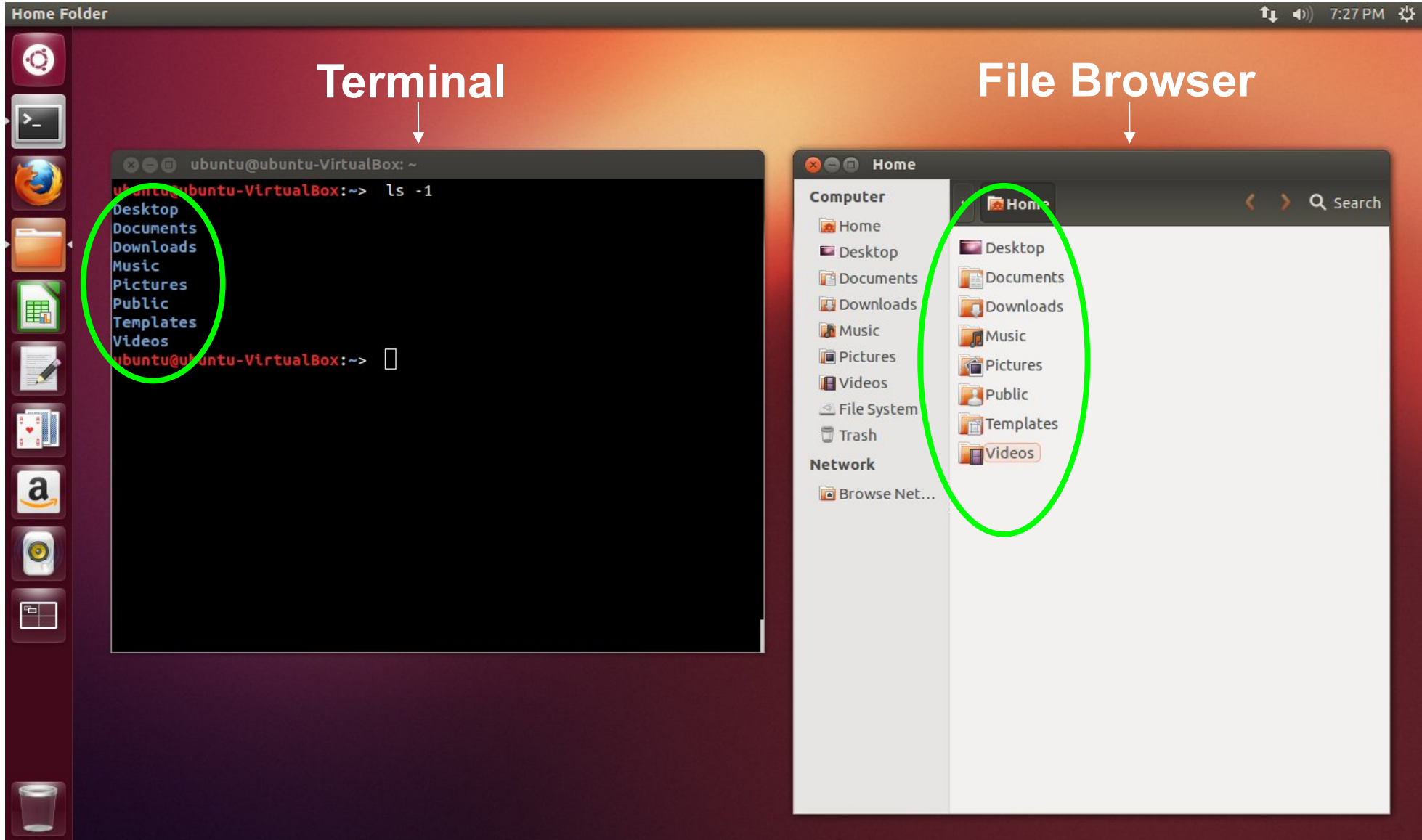
Spreadsheet

Text Editor

Games

Music

```
ubuntu@ubuntu-VirtualBox: ~  
ubuntu@ubuntu-VirtualBox:~> ls -l  
total 44  
drwxr-xr-x 2 ubuntu ubuntu 4096 Oct 23 2012 Desktop  
drwxr-xr-x 2 ubuntu ubuntu 4096 Oct 23 2012 Documents  
drwxr-xr-x 2 ubuntu ubuntu 4096 Oct 23 2012 Downloads  
-rw-r--r-- 1 ubuntu ubuntu 8445 Oct 23 2012 examples.desktop  
drwxr-xr-x 2 ubuntu ubuntu 4096 Oct 23 2012 Music  
drwxr-xr-x 2 ubuntu ubuntu 4096 Oct 23 2012 Pictures  
drwxr-xr-x 2 ubuntu ubuntu 4096 Oct 23 2012 Public  
drwxr-xr-x 2 ubuntu ubuntu 4096 Oct 23 2012 Templates  
drwxr-xr-x 2 ubuntu ubuntu 4096 Oct 23 2012 Videos  
ubuntu@ubuntu-VirtualBox:~> ping sand  
PING sand.nmr.mgh.harvard.edu (172.20.82.51) 56(84) bytes of data.  
64 bytes from sand.nmr.mgh.harvard.edu (172.20.82.51): icmp_req=1 ttl=63 time=0.403 ms  
64 bytes from sand.nmr.mgh.harvard.edu (172.20.82.51): icmp_req=2 ttl=63 time=0.681 ms  
64 bytes from sand.nmr.mgh.harvard.edu (172.20.82.51): icmp_req=3 ttl=63 time=0.647 ms  
^C  
--- sand.nmr.mgh.harvard.edu ping statistics ---  
3 packets transmitted, 3 received, 0% packet loss, time 2002ms  
rtt min/avg/max/mdev = 0.403/0.577/0.681/0.123 ms  
ubuntu@ubuntu-VirtualBox:~>
```



List of Commonly Used Commands

Command	Action	Example use case
<code>pwd</code>	Print name of current/working directory	<code>pwd</code>
<code>cd</code>	Change directory	<code>cd freesurfer</code> (change directory into freesurfer) <code>cd ..</code> (change directory up one level) <code>cd ~</code> (change directory back to home directory)
<code>ls</code>	List directory contents	<code>ls</code> (list contents of current directory) <code>ls -l</code> (list contents of current directory with details) <code>ls -lt</code> (list contents of current directory sort by time)
<code>mkdir</code>	Make directory	<code>mkdir Practice</code> (create a directory called Practice)
<code>gedit</code>	Open the 'gedit' program	<code>gedit Notes.txt</code> (opens – or creates – a file called Notes.txt)
<code>cp</code>	Copy files and directories	<code>cp Notes.txt Notes.bkp</code> (copy file Notes.txt to Notes.bkp)
<code>cat</code>	Print file to screen	<code>cat Notes.bkp</code> (prints the contents of Notes.bkp to the screen)

Anatomy of a Command

```
Command -option1 -option2 file
```

```
Command --help
```

or

```
man Command
```

man is short for “manual”

Try:

```
man ls
```

Save Some Time

Filename completion

Is Docu

*hit TAB key
should see*

Is Documents

History

history

should see

*or the ↑
arrow*

Is Documents

Things to Know

- Case sensitive
- Does not like spaces in file names (e.g. filename.txt vs. file name.txt)
- Ctrl+c kills a process & brings back command prompt • Type 'q' to quit the program 'less'
- Highlight & middle click to copy & paste
- Use '&' to open a program in the background
Cannot open a 2nd program if do not have a command prompt

Using Freesurfer

- Up to this point, we have not done anything Freesurfer related
- To use Freesurfer we must define environment variables

<code>FREESURFER_HOME</code>	Tells operating system where freesurfer is installed
<code>SUBJECTS_DIR</code>	Tells freesurfer where your subject data is

```
export    FREESURFER_HOME    /path/to/freesurfer
export    SUBJECTS_DIR       /path/to/data
```

- Then “source” the Freesurfer setup script

```
source    $FREESURFER_HOME/SetUpFreeSurfer.sh
```

‘\$’ means take the value of the variable

```
cd    $SUBJECTS_DIR
      aka
cd    /path/to/data
```


Exercise

Source Freesurfer, then display header information of an mri image file, convert it to nifti and view with freeview

```
export FREESURFER_HOME /Applications/freesurfer
source $FREESURFER_HOME/SetUpFreeSurfer.sh
```

```
cd $SUBJECTS_DIR
mri_info sample-001.mgz
mri_convert sample-001.mgz sample-001.nii
freeview sample-001.nii
```

```
/usr/local/bin/bash
/usr/local/bin/bash 84x59
zkaufman@sand:~> export FREESURFER_HOME=/usr/local/freesurfer/dev
zkaufman@sand:~> source $FREESURFER_HOME/SetUpFreeSurfer.sh
----- freesurfer-Linux-centos6_x86_64-dev-20160322 -----
Setting up environment for FreeSurfer/FS-FAST (and FSL)
FREESURFER_HOME /usr/local/freesurfer/dev
FSFAST_HOME /usr/local/freesurfer/dev/fsfast
FSF_OUTPUT_FORMAT nii.gz
SUBJECTS_DIR /homes/1/zkaufman/sp1/subjects
MNI_DIR /usr/local/freesurfer/dev/mni
FSL_DIR /usr/pubsw/packages/fsl/current
zkaufman@sand:~> export SUBJECTS_DIR=~/.sp1/subjects
zkaufman@sand:~> cd $SUBJECTS_DIR
zkaufman@sand:~/sp1/subjects> mri_info sample-001.mgz
Volume information for sample-001.mgz
  type: MGH
  dimensions: 256 x 256 x 128
  voxel sizes: 1.000000, 1.000000, 1.328125
  type: SHORT (4)
  fov: 256.000
  dof: 0
  xstart: -128.0, xend: 128.0
  ystart: -128.0, yend: 128.0
  zstart: -85.0, zend: 85.0
  TR: 7.25 msec, TE: 3.22 msec, TI: 600.00 msec, flip angle: 7.00 degrees
  nframes: 1
  PhEncDir: UNKNOWN
  FieldStrength: 0.000000
ras xform present
  xform info: x_r = -0.0000, y_r = -0.0000, z_r = -1.0000, c_r = 5.3607
             : x_a = -1.0000, y_a = 0.0000, z_a = 0.0000, c_a = 44.3249
             : x_s = -0.0000, y_s = -1.0000, z_s = 0.0000, c_s = -6.1644
talairach xfm :
Orientation : PIL
Primary Slice Direction: sagittal
voxel to ras transform:
-0.0000 -0.0000 -1.3281 90.3607
-1.0000 0.0000 0.0000 172.3249
-0.0000 -1.0000 0.0000 121.8356
0.0000 0.0000 0.0000 1.0000
voxel-to-ras determinant -1.32812
ras to voxel transform:
-0.0000 -1.0000 -0.0000 172.3249
-0.0000 -0.0000 -1.0000 121.8356
-0.7529 -0.0000 -0.0000 68.0363
-0.0000 -0.0000 -0.0000 1.0000
zkaufman@sand:~/sp1/subjects> mri_convert sample-001.mgz sample-001.nii
mri_convert.bin sample-001.mgz sample-001.nii
$Id: mri_convert.c,v 1.226 2016/02/26 16:15:24 mreuter Exp $
reading from sample-001.mgz...
TR=7.25, TE=3.22, TI=600.00, flip angle=7.00
i_ras = (-0, -1, -0)
j_ras = (-0, 0, -1)
k_ras = (-1, 0, 0)
writing to sample-001.nii...
zkaufman@sand:~/sp1/subjects>
```

Demo

More Help

\$> mri_info --help

USAGE: mri_info fname1 <fname2> <options>

\$> man pwd

NAME

pwd - print name of current/working directory

UNIX Tutorial For Beginners:

<http://www.ee.surrey.ac.uk/Teaching/Unix/>

Linux in a Nutshell:

http://docstore.mik.ua/oreilly/linux/lnut/ch01_01.htm

UNIX Cheat Sheet:

http://tux.cs.unlv.edu/refs/linux_commands.html

Command Line Tutorial:

<http://surfer.nmr.mgh.harvard.edu/fswiki/FsTutorial/CommandLineNavigation>