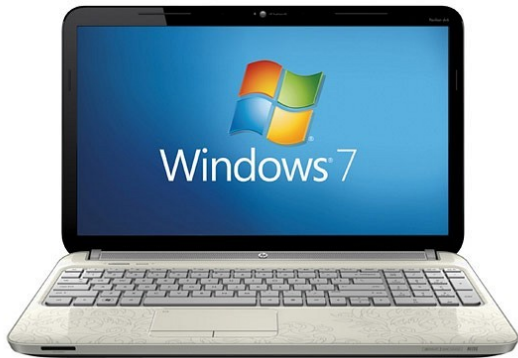


What is Linux?



- 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 in the foreground. The terminal window displays the output of the `ls -l` and `ping sand` commands.

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:~>
```

Terminal does not mean “hacking”

```
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

zkaufrman@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...
zkaufrman@sand:~/sp1/subjects>
```

≠



Tank: The "operator" of the Nebuchadnezzar, a "natural" human born outside of the Matrix

Terminal gives you access to your computer via typing commands rather than using the mouse and clicking

Terminal



```
ubuntu@ubuntu-VirtualBox: ~  
ubuntu@ubuntu-VirtualBox:~> ls -l  
Desktop  
Documents  
Downloads  
Music  
Pictures  
Public  
Templates  
Videos  
ubuntu@ubuntu-VirtualBox:~> █
```

File Browser



Home

Computer

- Home
- Desktop
- Documents
- Downloads
- Music
- Pictures
- Videos
- File System
- Trash

Network

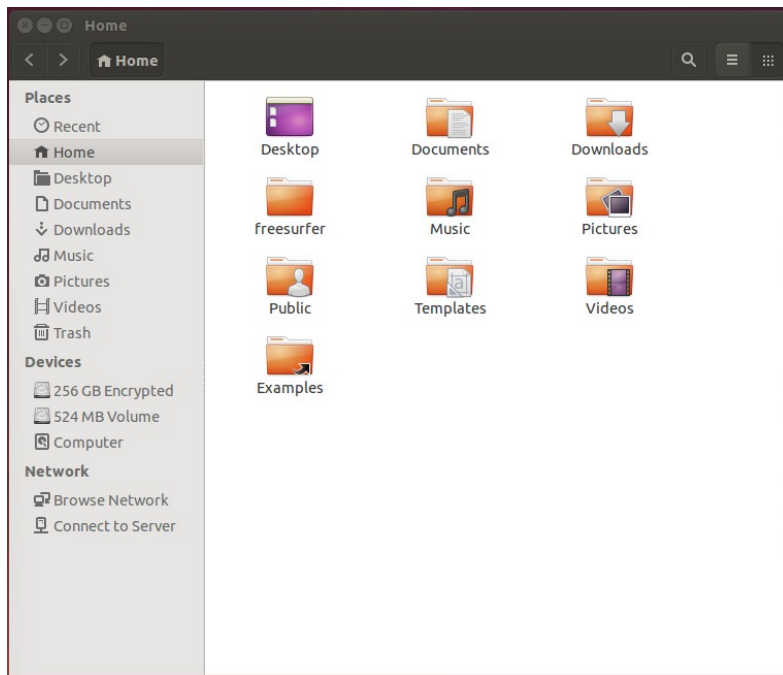
- Browse Net...

Home

- Desktop
- Documents
- Downloads
- Music
- Pictures
- Public
- Templates
- Videos

Demonstration of commands

Task: Navigate to the freesurfer directory, list its content, then create a new directory called Practice and create a simple text file called Notes.txt.



```
nmrclass1@nmrclass26: ~  
nmrclass1@nmrclass26:~> ls -l  
total 48  
drwxr-xr-x 2 nmrclass1 nmrclass1 4096 Apr  3 19:39 Desktop  
drwxr-xr-x 2 nmrclass1 nmrclass1 4096 Apr  3 19:39 Documents  
drwxr-xr-x 2 nmrclass1 nmrclass1 4096 Apr  3 19:39 Downloads  
-rw-r--r-- 1 nmrclass1 nmrclass1 8980 Apr  3 19:37 examples.desktop  
drwxr-xr-x 6 nmrclass1 nmrclass1 4096 Apr  3 19:41 freesurfer  
drwxr-xr-x 2 nmrclass1 nmrclass1 4096 Apr  3 19:39 Music  
drwxr-xr-x 2 nmrclass1 nmrclass1 4096 Apr  3 19:45 Pictures  
drwxr-xr-x 2 nmrclass1 nmrclass1 4096 Apr  3 19:39 Public  
drwxr-xr-x 2 nmrclass1 nmrclass1 4096 Apr  3 19:39 Templates  
drwxr-xr-x 2 nmrclass1 nmrclass1 4096 Apr  3 19:39 Videos  
nmrclass1@nmrclass26:~> pwd  
/home/nmrclass1  
nmrclass1@nmrclass26:~> |
```

Demo

Using Freesurfer

- Up to this point, we have not done anything freesurfer related
- Once Freesurfer is installed, many more commands become available to you
- With Freesurfer, certain variables must be set in order to use it correctly

FREESURER_HOME
SUBJECTS_DIR

Tells operating system where freesurfer is installed
Tells Freesurfer where your subject data is

Exercise: Use Freesurfer to display header information of an mri image file, then convert it to nifti format, then display the resulting image in the freeview application.

Exercise

Use FreeSurfer to display header information of an mri image file, and convert it to nifti:

```
$> export FREESURFER_HOME=/home/nmrclass/freesurfer
$> source $FREESURFER_HOME/SetUpFreeSurfer.sh
$> export SUBJECTS_DIR=$FREESURFER_HOME/subjects
$> 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:
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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>