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Linux for beginners on Iridis 4

April, 30th 2019

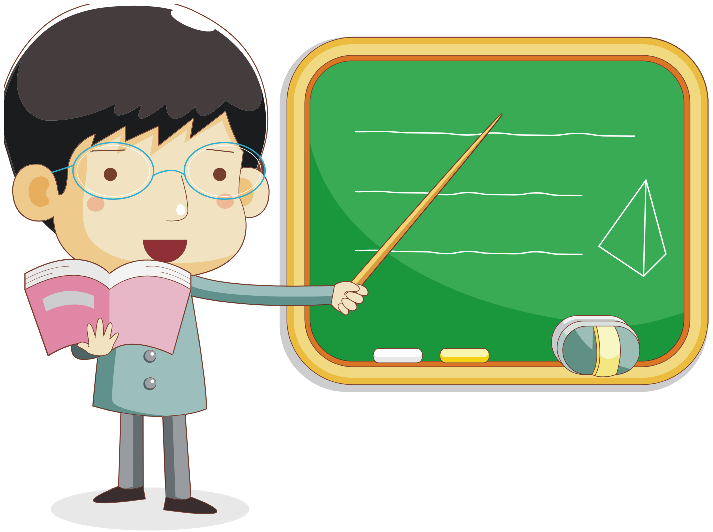
Administrative

- Fire Alarms/exits/toilets
- Coffee break
- Phones
- Handouts

Tutorial Objectives

By now participants are familiar with:

- How to login in to Iridis 4 cluster
- Linux File system
- How to find help
- File Editors
- How to run/monitor/kill job
- Linux processes
- Linux training resources



Lynda courses on Linux:

• Learning Linux Command Line	2h 18m
• Learning Bash Scripting	1h 25m
• Linux Tips Weekly	5h 46m

Linux/UNIX Resources

- Your hand-out
- Iridis wiki and forums
- Many internet resources:

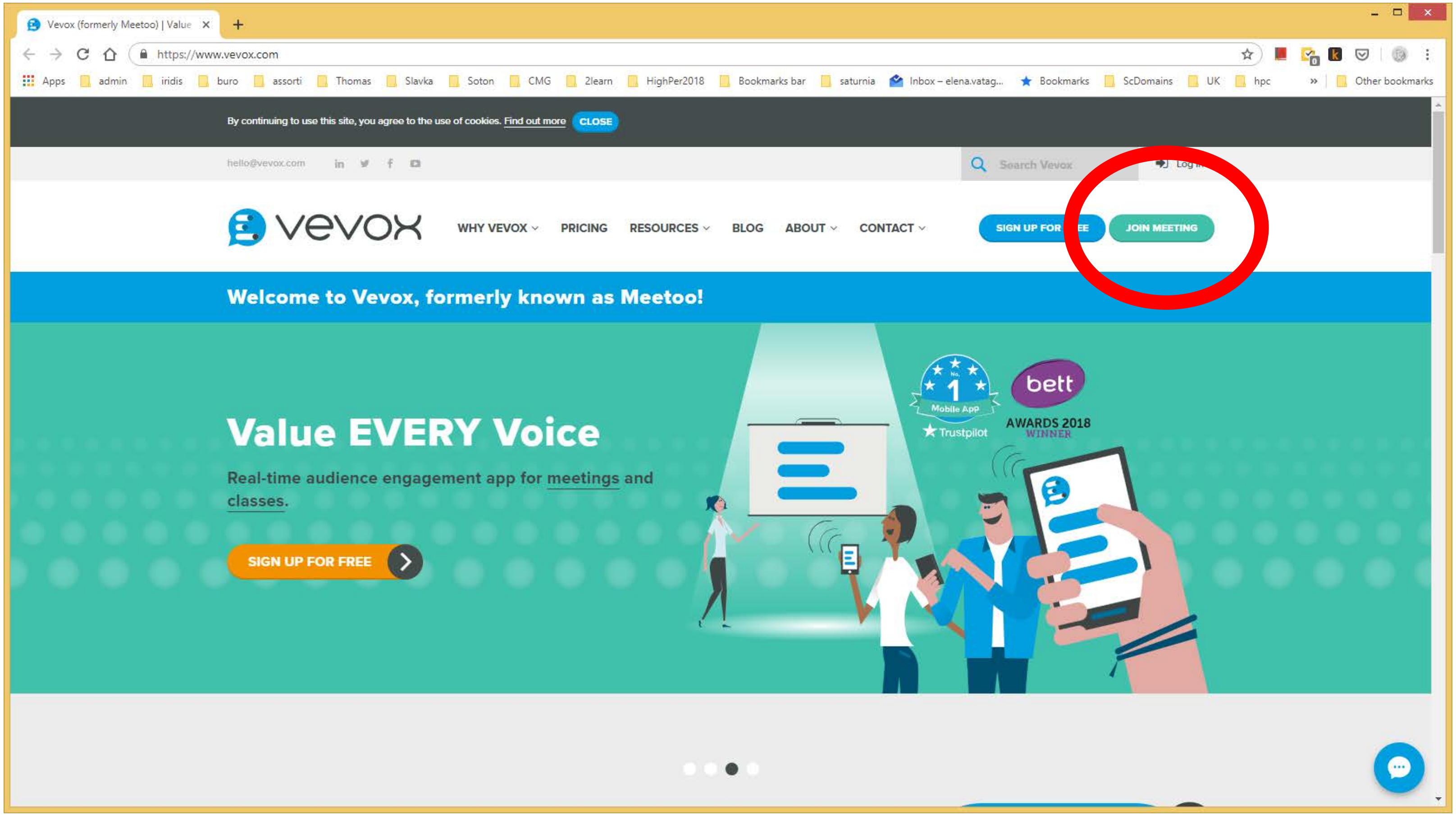
  http://www.ee.surrey.ac.uk/Teaching/Unix/

  http://www.ugu.com/sui/ugu/show?help.beginners

  http://swcarpentry.github.io/shell-novice/

Vevox: www.vevox.com

meeting ID: **120-030-383**



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Welcome to Vevox, formerly known as Meetoo!

Value EVERY Voice

Real-time audience engagement app for meetings and classes.

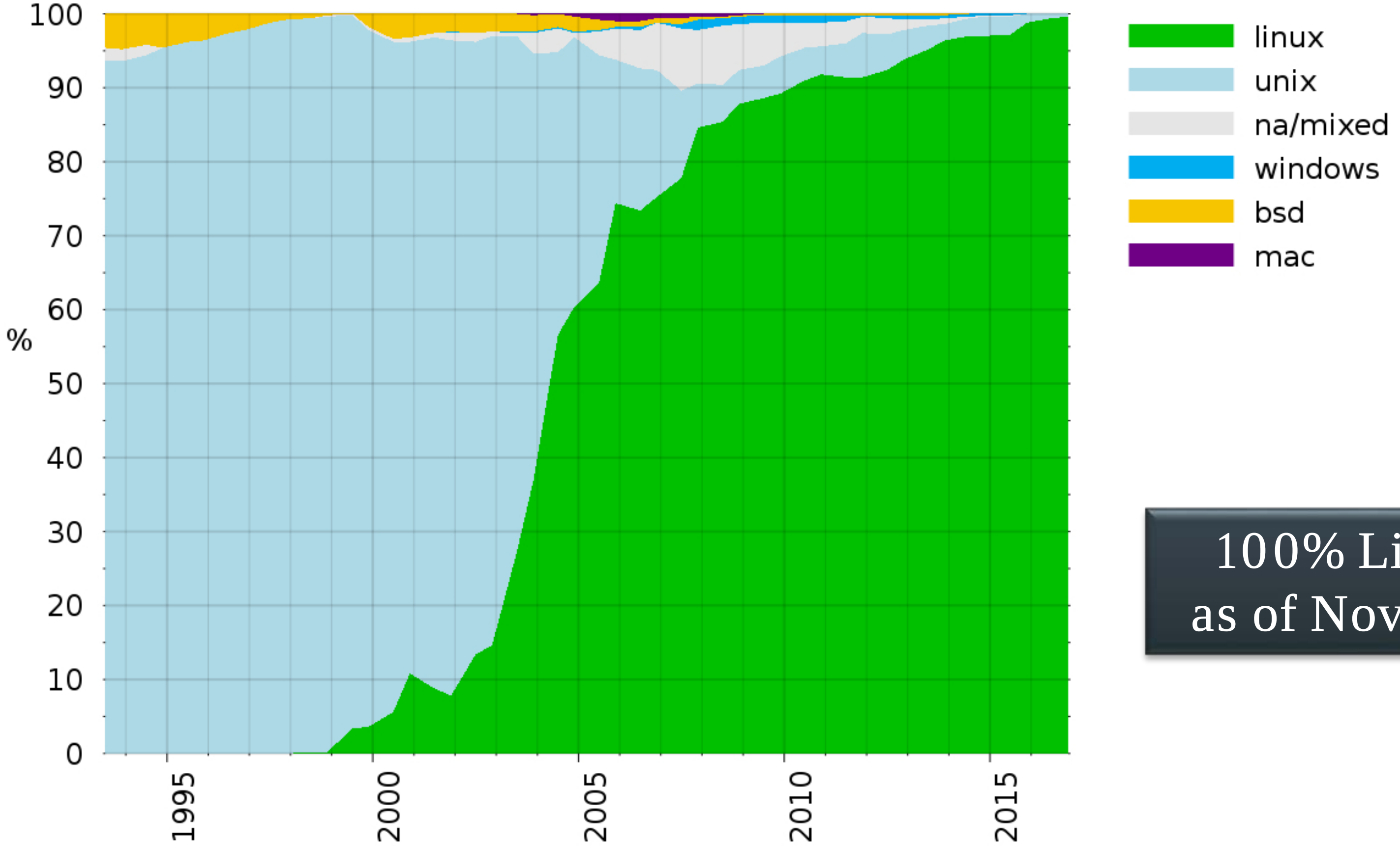
Why Linux?

- COST - Linux is (mainly) free
- STABILITY – made to keep on running
- MULTITASKING multi-user, multitasking environment
- (almost) Free from Viruses

very well-protected — but not immune

- Knowledge of Linux will expand your employment horizons

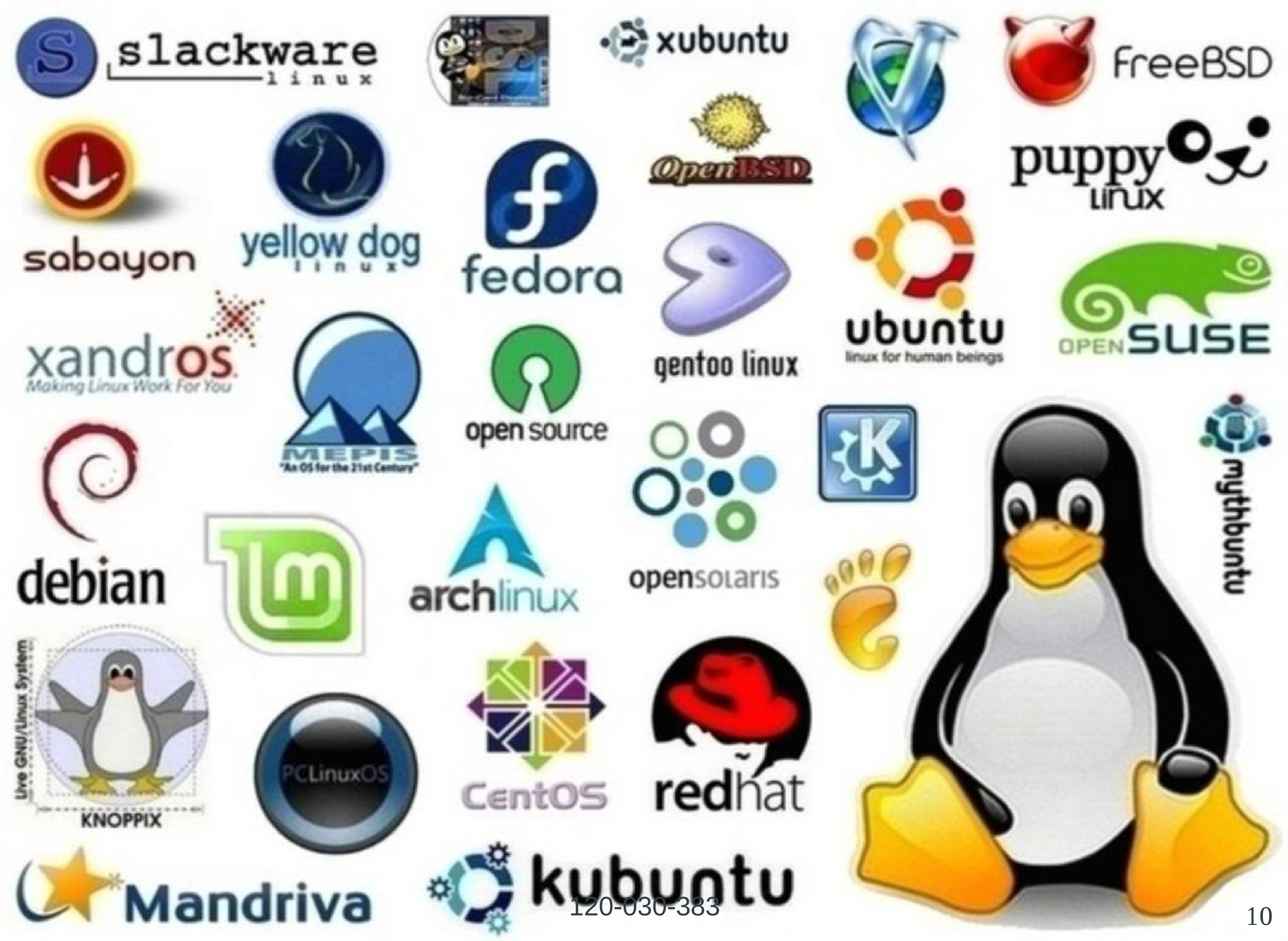
Linux on supercomputers



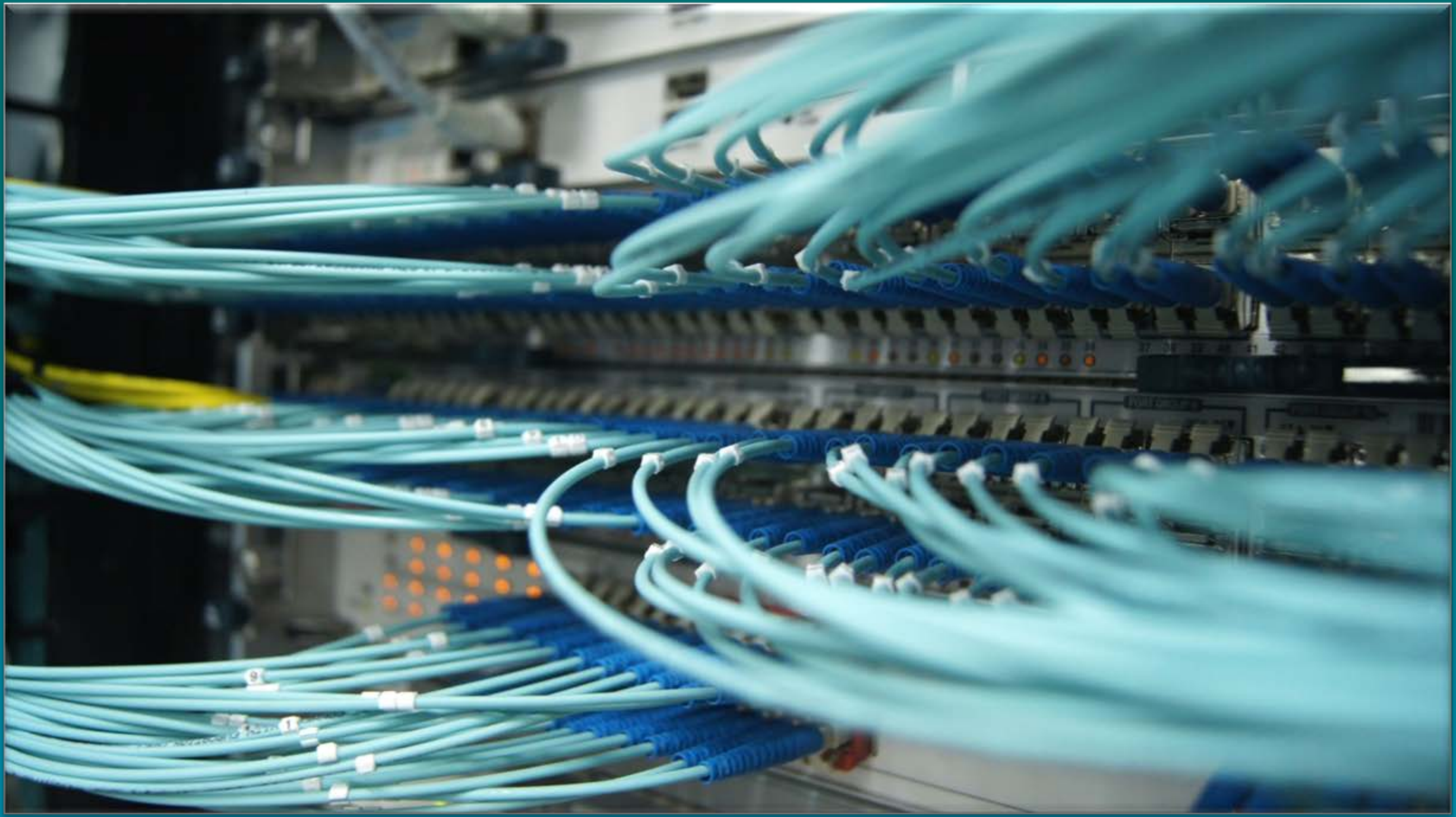
100% Linux
as of Nov 2018

Linux: brief history

- Linux is a variant of Unix
  - So is Mac OS, so much of this tutorial applies to Macs as well
- Linux is open source software
- The name "Linux" comes from the Linux kernel, originally written by Linus Torvalds in 1991 (at the age of 22!) Linus+Unix=Linux
- More then 200 Linux Distributions http://distrowatch.com/


slackware
linux
xubuntu
FreeBSD
OpenBSD
puppy
linux
sabayon
yellow dog
linux
fedora
ubuntu
linux for human beings
OPEN SUSE
xandros
Making Linux Work For You
gentoo linux
MEPIS
"An OS for the 21st Century"
open source
mythbuntu
opensolaris
debian
archlinux
Live GNU/Linux System
KNOPPIX
PCLinuxOS
CentOS
redhat
Mandriva
kubuntu

Getting ready to roll



know your neighbour!

Using Iridis: Security

(boring but very important)

- our IT infrastructure is under constant attack by would-be intruders;
- Your data and research career are threatened by intruders;
- Big systems are big juicy targets;
- Don't let intruders in:
  - ➢ Keep your password safe.
  - ➢ Choose a strong password.
  - ➢ Don't share accounts

Connecting to Iridis: ssh

- Usually available out of the box on Linux or MAC

```
$ ssh –Y abc123@iridis4_a.soton.ac.uk
```

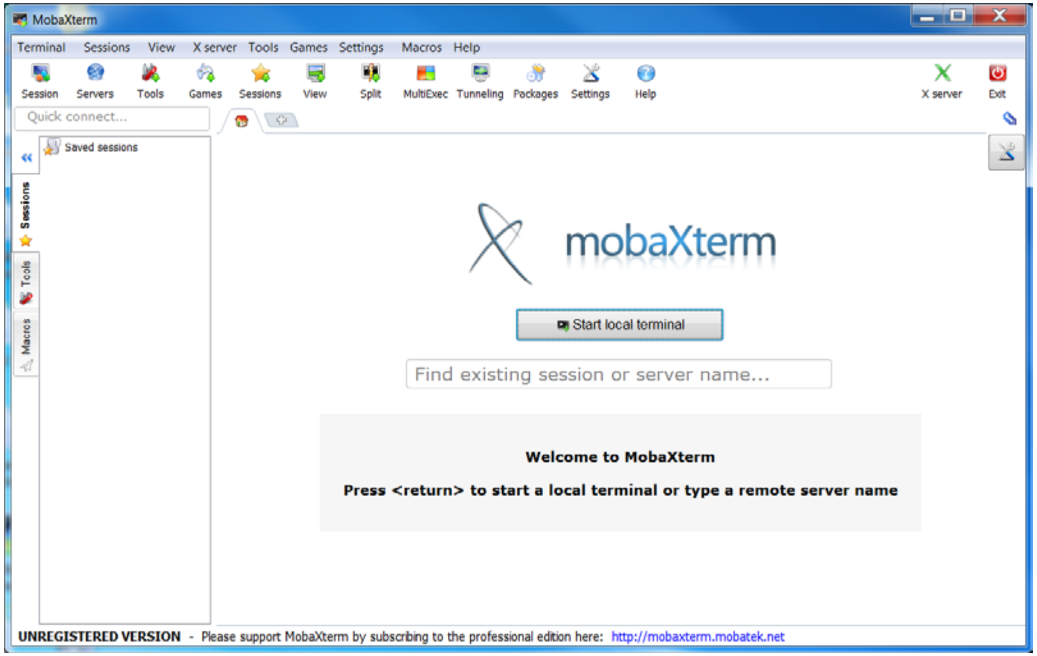
- Windows clients:
  - SSH client + Exceed
  - Cygwin

    http://cygwin.com/install.html

    Includes X server for displaying graphical applications running remotely.
  - MobaXterm
- Need to be on internal network or use VPN

SSH client - MobaXterm

- http://mobaxterm.mobatek.net/
- Go to Download – Portable edition


MobaXterm
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
X server Exit
Quick connect...
Saved sessions
Sessions
Tools
Macros
mobaXterm
Start local terminal
Find existing session or server name...

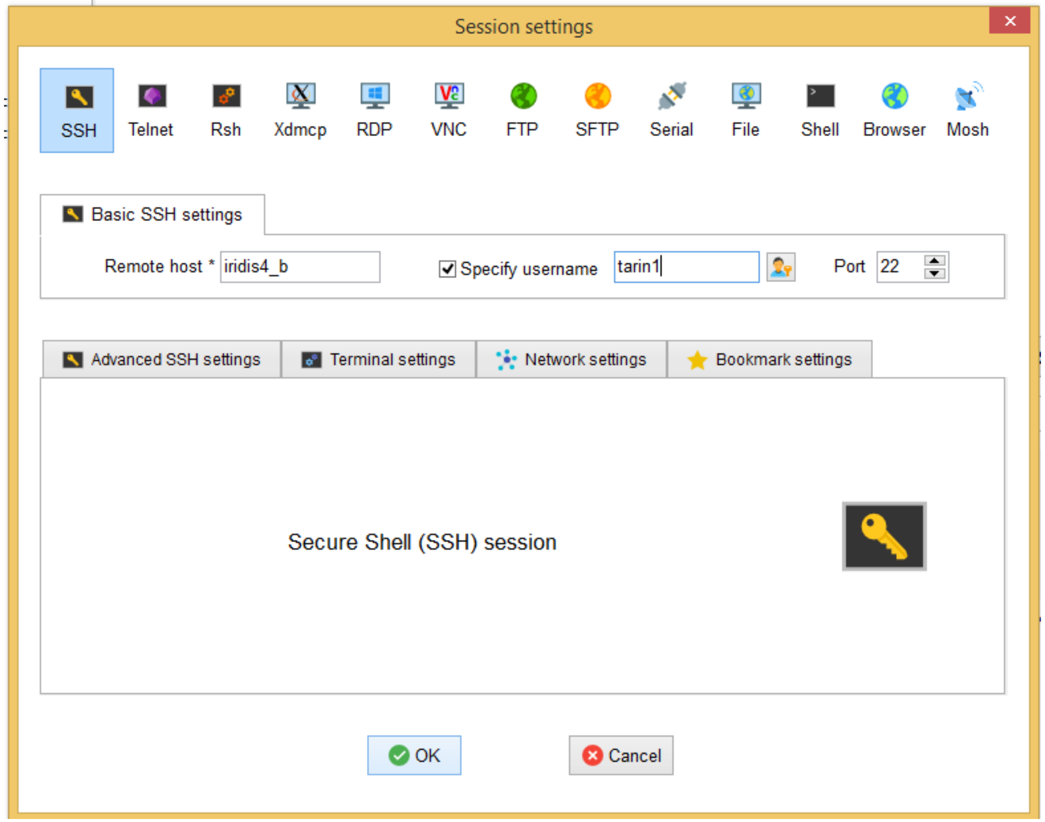
Welcome to MobaXterm

Press <return> to start a local terminal or type a remote server name

UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: http://mobaxterm.mobatek.net

Login to Iridis

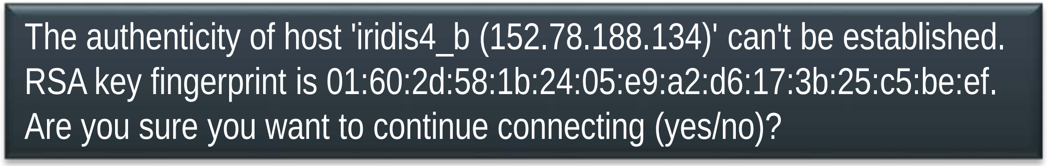
- Start ssh client MobaXterm
- Go to Sessions -> SSH
- Remote host =
  - iridis4_a
  - iridis4_b
  - iridis4_c
- Use your iSolutions username/password
- Press OK
- You may want to save password
- Try to log out (“exit”) and login again



Remote host * iridis4_b

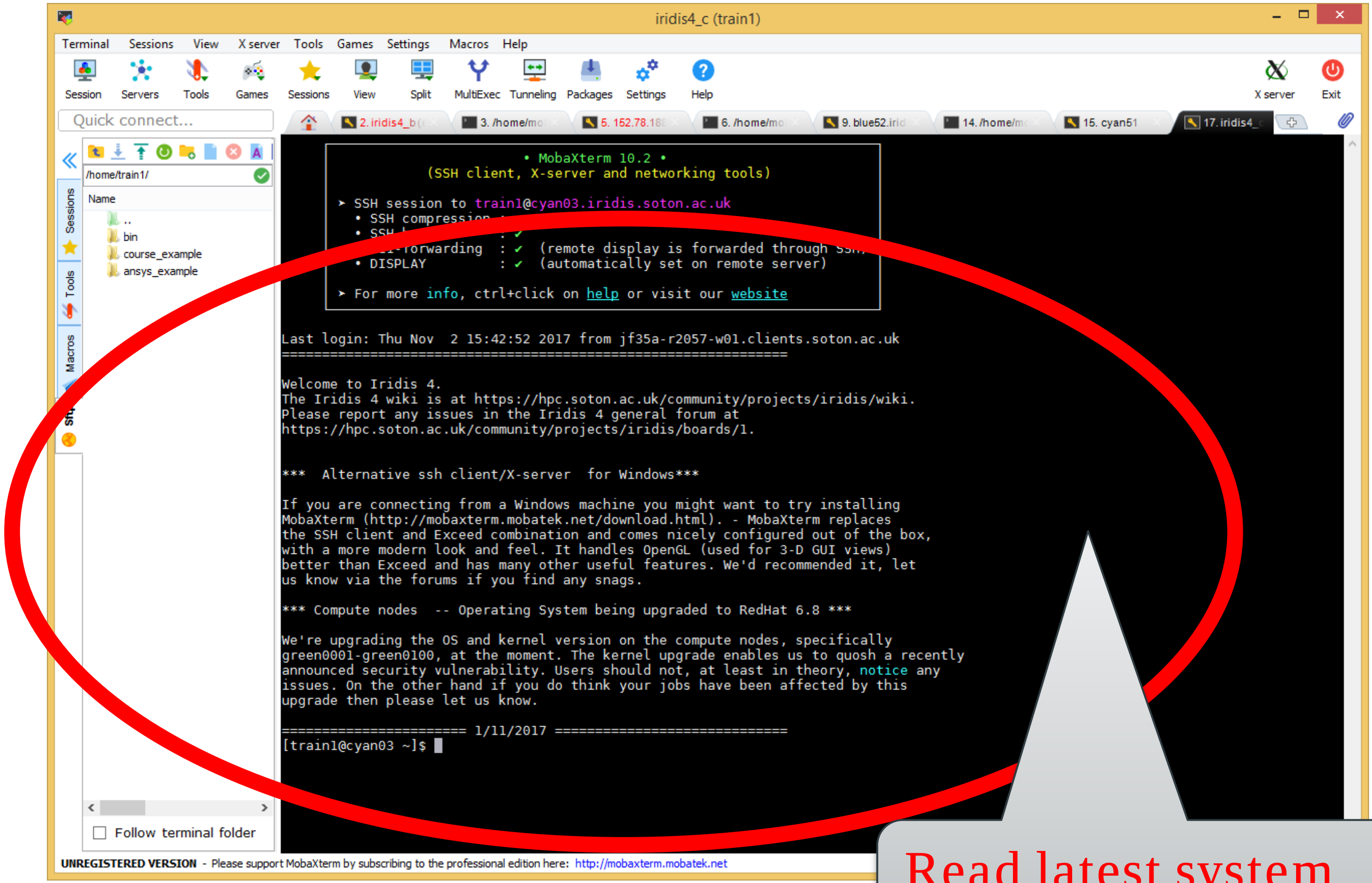
☑ Specify username tarin1

Port 22



```
The authenticity of host 'iridis4_b (152.78.188.134)' can't be established.
RSA key fingerprint is 01:60:2d:58:1b:24:05:e9:a2:d6:17:3b:25:c5:be:ef.
Are you sure you want to continue connecting (yes/no)?
```

MOTD= Message Of The Day

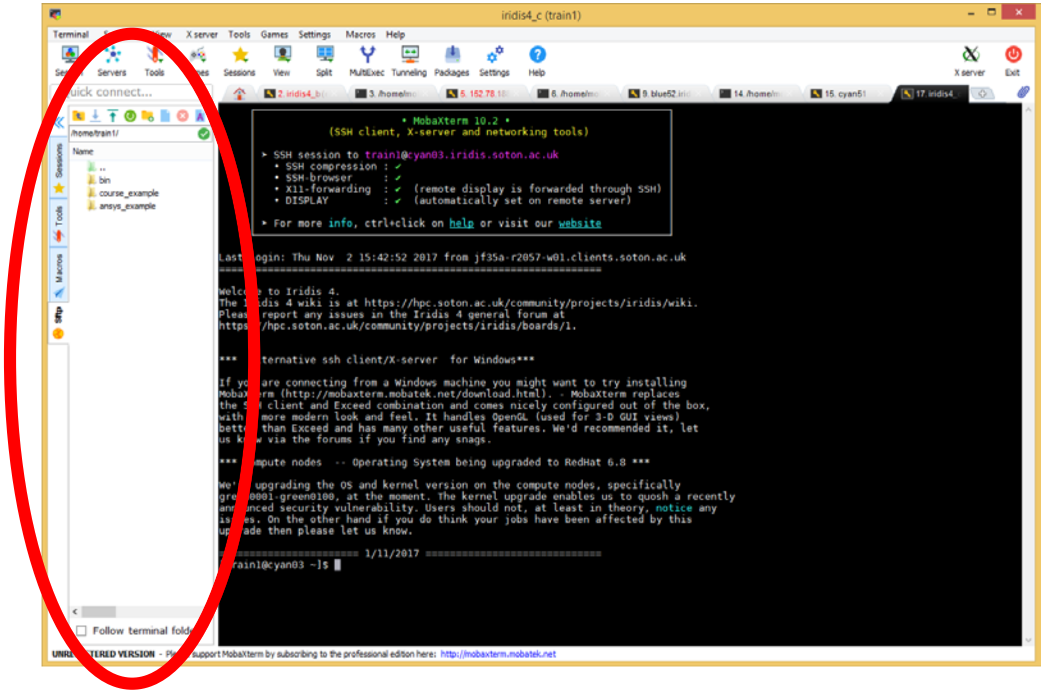


```
                  • MobaXterm 10.2 •
        (SSH client, X-server and networking tools)

 ➤ SSH session to train1@cyan03.iridis.soton.ac.uk
   • SSH compression :
   • SSH [illegible]  : ✓
   • X11-forwarding   : ✓  (remote display is forwarded through SSH)
   • DISPLAY          : ✓  (automatically set on remote server)

 ➤ For more info, ctrl+click on help or visit our website

Last login: Thu Nov  2 15:42:52 2017 from jf35a-r2057-w01.clients.soton.ac.uk
===============================================================

Welcome to Iridis 4.
The Iridis 4 wiki is at https://hpc.soton.ac.uk/community/projects/iridis/wiki.
Please report any issues in the Iridis 4 general forum at
https://hpc.soton.ac.uk/community/projects/iridis/boards/1.


***  Alternative ssh client/X-server  for Windows***

If you are connecting from a Windows machine you might want to try installing
MobaXterm (http://mobaxterm.mobatek.net/download.html). - MobaXterm replaces
the SSH client and Exceed combination and comes nicely configured out of the box,
with a more modern look and feel. It handles OpenGL (used for 3-D GUI views)
better than Exceed and has many other useful features. We'd recommended it, let
us know via the forums if you find any snags.

*** Compute nodes  -- Operating System being upgraded to RedHat 6.8 ***

We're upgrading the OS and kernel version on the compute nodes, specifically
green0001-green0100, at the moment. The kernel upgrade enables us to quosh a recently
announced security vulnerability. Users should not, at least in theory, notice any
issues. On the other hand if you do think your jobs have been affected by this
upgrade then please let us know.

======================= 1/11/2017 =============================
[train1@cyan03 ~]$
```

UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: http://mobaxterm.mobatek.net

Read latest system announcement/status/news

File transfer: sftp or scp



```
                    • MobaXterm 10.2 •
          (SSH client, X-server and networking tools)

 ➤ SSH session to train1@cyan03.iridis.soton.ac.uk
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Last  ogin: Thu Nov  2 15:42:52 2017 from jf35a-r2057-w01.clients.soton.ac.uk
=================================================================

Welc  e to Iridis 4.
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Pleas  report any issues in the Iridis 4 general forum at
https  /hpc.soton.ac.uk/community/projects/iridis/boards/1.


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up  ade then please let us know.

======================== 1/11/2017 ==============================
 rain1@cyan03 ~]$ █
```
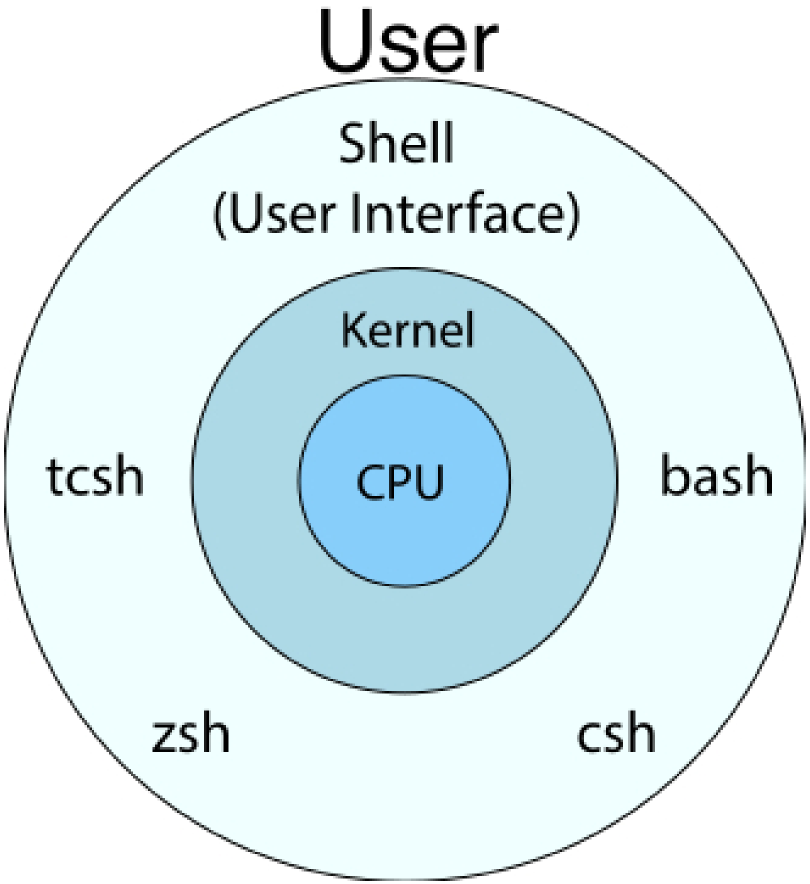

```
$ scp file_name my_account@iridis4_c:~/work/
```

What is a command shell?

- After logging in, Linux starts program called shell
- This program interprets user commands
- Allows a user to execute commands by
  - typing them manually at a terminal
  - automatically in programs called *shell script*
- Shell commands are **CASE SENSITIVE !**

Linux SHELL



- CLI vs GUI
- Many SHELL flavours - Iridis uses bash
- Command prompt:

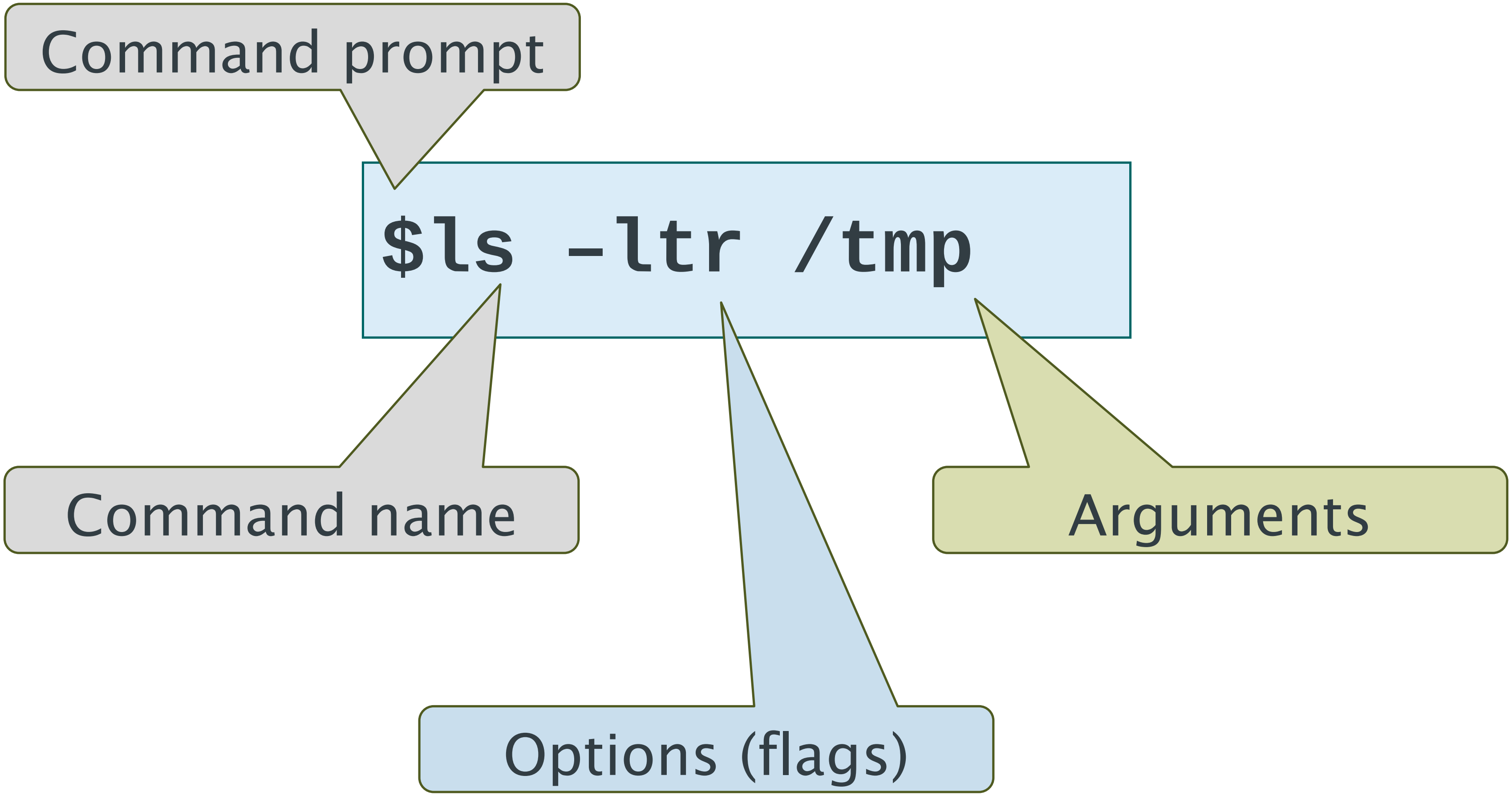
```
[train1@cyan01~]$
```

- Try your first Linux command:

```
$ uname
$ uname -a
$ whoami
```

Do you have any experience with CLI?

Linux command



```
$ls -ltr /tmp
```

Command prompt

Command name

Options (flags)

Arguments

Help!

- Whenever you need help with a command type

```
$ man ls
```

- “Page Up” “Page Down” to navigate
- “q” to quit man
- “/<pattern>” to search manual pages
- There are 1000s of commands available – can’t possibly learn them all!
- Almost every command has a numerous options(switches/flags) to use
- Another useful commands:
  - `$ ls --help`

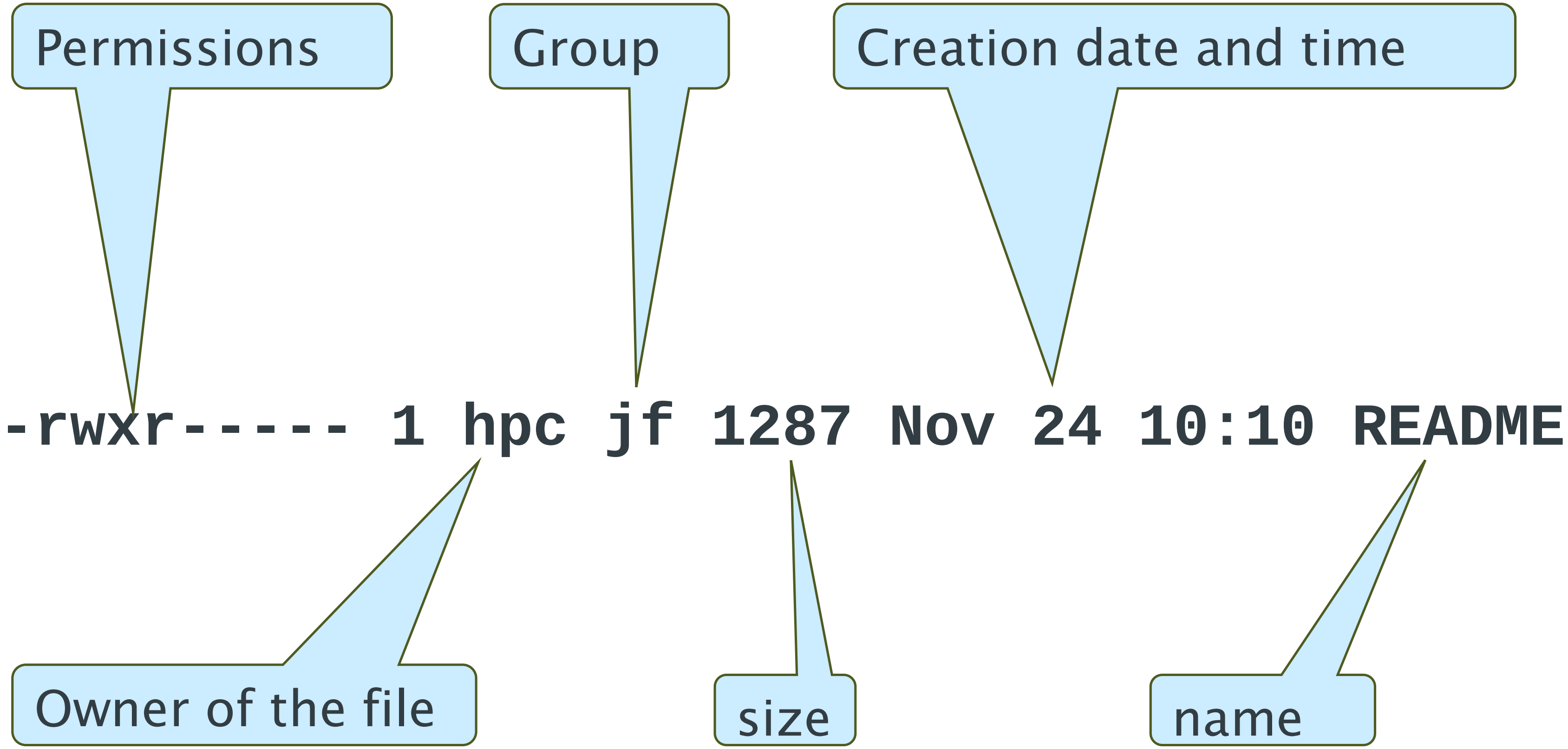
Listing files and directories: ls

Try:

```
$ ls –a
$ ls -1
$ ls –l
$ ls –help
$ ls –l –a
$ ls -la
```

```
$ ls –lS  /tmp
$ ls -lSr /tmp
$ ls –lt  /tmp
$ ls –ltr /tmp
```

File attributes



Permissions

Group

Creation date and time

```
-rwxr----- 1 hpc jf 1287 Nov 24 10:10 README
```

Owner of the file

size

name

How to find the largest file in the directory?

Control Characters and special symbols

- ***Linux Can Read Your Mind!***
  - **<Tab>** key completes commands and filenames

- $ history
- Use **Up/Down** arrow keys to scroll through your command history

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Linux File System

Navigating Filesystem

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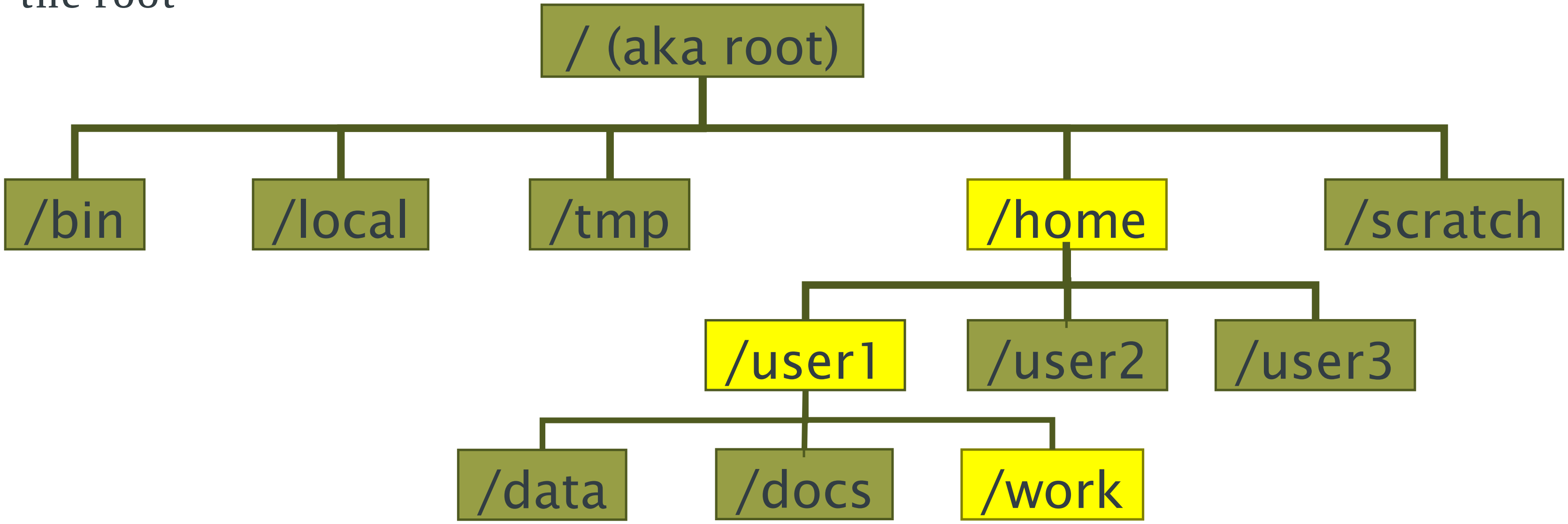
- The Linux file system is a tree-like hierarchy.
- The top level directory is called the root directory – special meaning of "/"
- Your *home directory* is the directory you are in when you first open the terminal.
- The full path to a Linux directory or file is the series of directories, starting at the root



Navigating the file system

- To find your current directory: `$ pwd`
- To change to a specific directory: `$ cd` *`dir_name`*
- To return to home directory: `$ cd`
- Try:
  - `$ pwd`
  - `$ cd /scratch/<train1>`
  - `$ pwd`

The special directories

- .
- ..
- ~

Making and changing files/directories

- `$ mkdir  work`
- `$ cd work`
- `$ date > date.txt`
- `$ cat date.txt`

- `$ cp date.txt old_date.txt`
- `$ mv old_date.txt very_old_date.txt`
- `$ cd ..`
- `$ rm work`

Starting from /scratch/amanda,
which of the following commands could Amanda use to navigate to her home directory, which is /home/amanda?

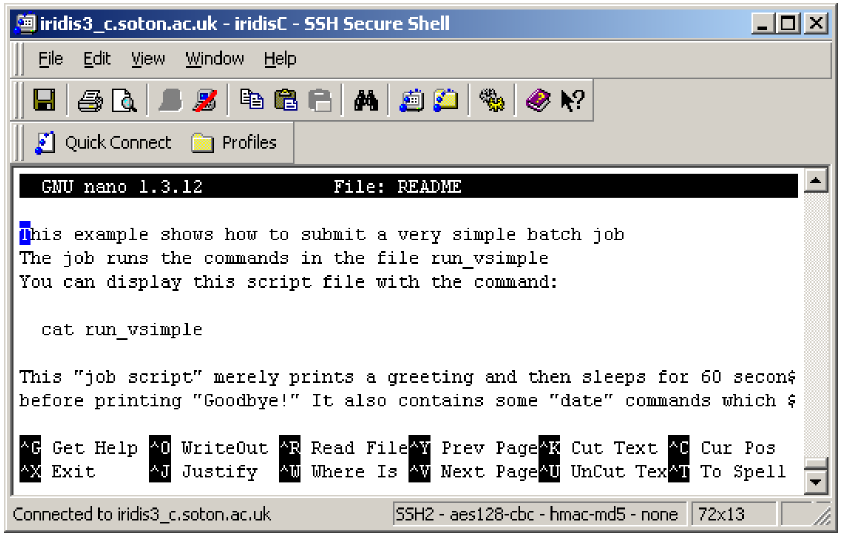
Exercise – navigating Files and Directories

- `$ copy_example linux_course`
- `$ cd linux_course_example`
- `$ ls -R`
- `$ tree`
- QUIZ: Inside linux_course_example there is a file data-shell/writing/haiku.txt

  Find an absolute path to the file haiku.txt

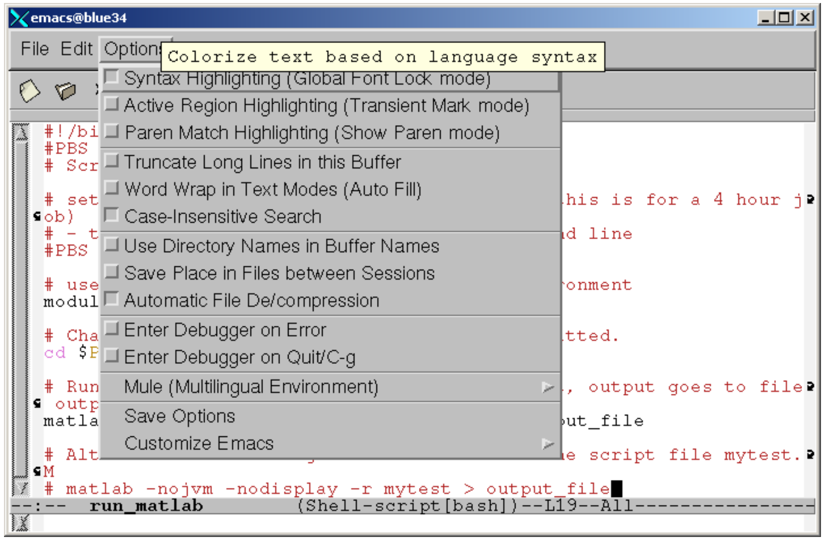
Creating and editing files

- Suggested editors:
  - nano (for small edits)
  - emacs (for code development)



```
  GNU nano 1.3.12                 File: README

This example shows how to submit a very simple batch job
The job runs the commands in the file run_vsimple
You can display this script file with the command:

  cat run_vsimple

This "job script" merely prints a greeting and then sleeps for 60 secon$
before printing "Goodbye!" It also contains some "date" commands which $

^G Get Help  ^O WriteOut  ^R Read File^Y Prev Page^K Cut Text  ^C Cur Pos
^X Exit      ^J Justify   ^W Where Is ^V Next Page^U UnCut Tex^T To Spell
```

Connected to iridis3_c.soton.ac.uk
SSH2 - aes128-cbc - hmac-md5 - none
72x13


emacs@blue34
File
Edit
Options
Colorize text based on language syntax
□ Syntax Highlighting (Global Font Lock mode)
□ Active Region Highlighting (Transient Mark mode)
□ Paren Match Highlighting (Show Paren mode)
□ Truncate Long Lines in this Buffer
□ Word Wrap in Text Modes (Auto Fill)
□ Case-Insensitive Search
□ Use Directory Names in Buffer Names
□ Save Place in Files between Sessions
□ Automatic File De/compression
□ Enter Debugger on Error
□ Enter Debugger on Quit/C-g
Mule (Multilingual Environment)
Save Options
Customize Emacs

```
#!/bi
#PBS
# Scr

# set                                  his is for a 4 hour j
ob)
# - t                                  d line
#PBS

# use                                  onment
modul

# Cha                                  tted.
cd $P

# Run                                  , output goes to file
 outp
matla                                  ut_file

# Alt                                  e script file mytest.
M
# matlab -nojvm -nodisplay -r mytest > output_file
--:--  run_matlab        (Shell-script[bash])--L19--All----------------
```

Exercise: creating a new file

- Create a working directory and navigate there:

```
$ mkdir work
$ cd work
$ nano draft.txt
```

- Write few words and exit nano with <Ctrl>X
- Display content of draft.txt with `$cat draft.txt`
- Delete draft.txt with `$rm -i draft.txt`
- Remember: rm is forever!

Wildcards

- You can replace any number of characters in any filename by *
- If you type just * after a command, it stands for all files in the current directory:
  - `$ ls *`
- You can mix the * with other characters to form a search pattern:
  - `$ ls data-shell/data/a*.txt`
- the “?” wildcard stands for any single character

```
$ ls data-shell/molecules/*ethane.pdb
$ ls data-shell/molecules/?ethane.pdb
```

- `rm draft?.txt` *will remove file* `draft1.txt` *but not* `draftFinal.txt`

Suppose that you created a .txt file in your current directory to contain a list of the statistical tests you will need to do to analyze your data, and named it:
statstics.txt

After creating and saving this file you realize you misspelled the filename!
You want to correct the mistake, which of the following commands could you use to do so?

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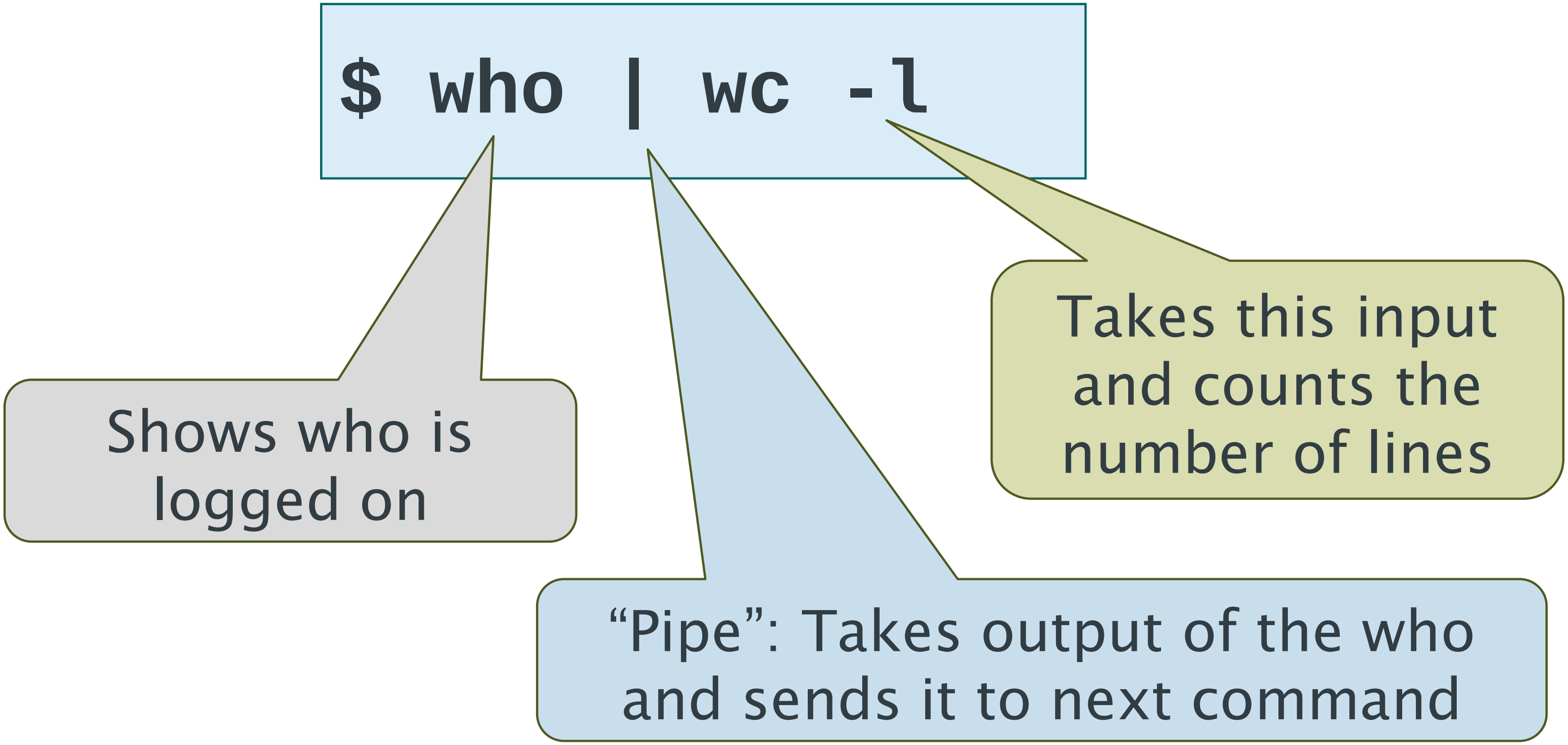
Redirection

Redirection

- Most of processes write to the standard output (terminal screen) and many take input from the standard input (keyboard)
- There is also the standard error for error messages (terminal screen by default)
- “>” redirects the output:
  - `$ who > full_list`
  - `$ cat full_list`
- “>>” appends standard output to a file
- “<” redirect the input

Pipes

Connecting commands with pipes



```
$ who | wc -l
```

Shows who is logged on

“Pipe”: Takes output of the who and sends it to next command

Takes this input and counts the number of lines

Control Characters

- You type Control characters by holding down the <Ctrl> key while also pressing the specified character.
- Control commands:
  - **<Ctrl>-c** will abort any program
  - **<Ctrl>-d** “exit”
  - **<Ctrl>-z** pauses (stops) an on-going operation
- Reminder: use **Up/Down** arrow keys to scroll through your command history

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Processes and Jobs

Processes

- A process is an executing program identified by a unique **PID** (process identifier). To see information about your processes, with their associated PID and status, type $ps
- Foreground
  - When a co
  - mmand is executed from the prompt and runs to completion at which time the prompt returns is said to run in the foreground
- Background
  - When a command is executed from the prompt with the token "&" at the end of the command line, the prompt immediately returns while the command continues is said to run in the background

Processes and Jobs

A process is an execu ting program
identified by a unique **PID** (process identifier).
To see information about your processes,
with their associated PID and status, type

```
$ ps
```

A process may be in the foreground, in the background, or be suspended:

```
$ top # type q to exit
$ sleep 10
$ sleep 10 &
$ jobs
```

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Running a program (aka job)

- Make sure the program has executable permissions
- Use "`./programm_name`" or full path to run the program
- To end a program: `<Ctrl>-c`
- To view the processes that you are running:
  - `$ ps -u user_name`
- To view the CPU usage of all processes:
  - `$ top`
- To terminate a process use `$kill` *`PID`*

Exercise

- Try following commands:

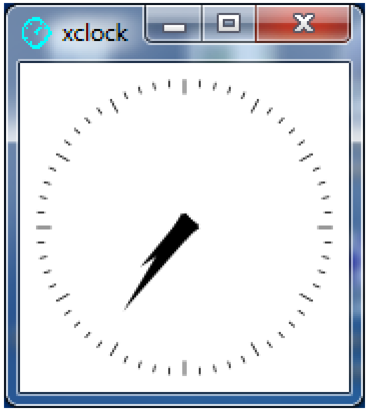
```
$ top # type q to exit
$ sleep 10
$ sleep 10 &
$ jobs
$ sleep 1000&
$ kill <PID>
```

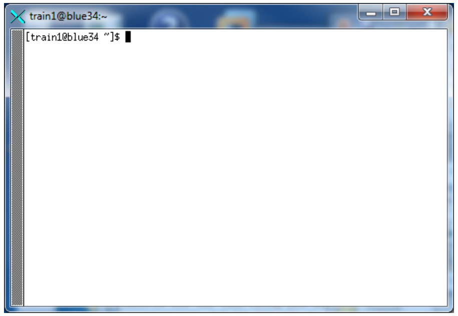
- Open a new window by typing

```
$ xterm &
$ xclock &
```

- Try to kill those processes using their process ID

```
$ kill <PID>
```





```
[train1@blue34 ~]$
```

Environment Variables

- Variables are a way of passing information from the shell to programs when you run them;
- Programs look "in the environment" for particular variables and if they are found will use them;
- Can be set by the system, you or program;
- Try:

```
$ printenv

$ printenv PWD

$ printenv PATH
```

Shell script

```
$ pwd
    /home/train1/linux_course_example
$ cat simple_job
$ bash simple_job
```

Other useful commands

- `$ file` *`file_name`* to determine file type
- `$ grep` *`something somewhere`* to search files in a directory for a specific string
- `$ sort` sort lines of text files
- `$ diff` *`file1 file2`* to compare two files for differences
- `$ wc` world count

Further training

- Follow links in this slides and handout
- Ask questions on Iridis Forum
- Request training on Iridis forum
- Follow one of Software Carpentry courses:
  - http://rsg.soton.ac.uk/training

Tutorial Outcome

- Unix/Linux shell and CLI
- Finding help and navigating/creating/removing directories/files

```
$ ls; pwd; man; ls –help; cd; mkdir; rm;
```

- Browsing/editing files

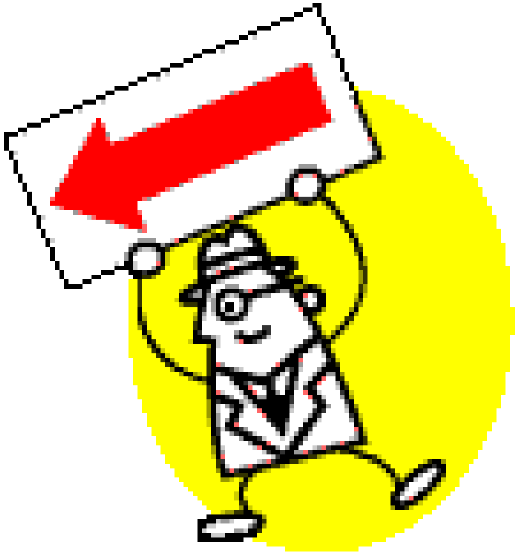
```
$ cat; less; head; tail
$ nano; vim; emacs etc
```

- Linux File Structure: Relative and Absolute Paths

```
/home/user/work/data
work/data
```

- Linux shortcuts and special symbols
- Pipe and Filters
- Monitoring running processes and resources:

```
$ps; top; free
```



File permissions

- Each file in Linux has an associated permission level. This allows the users to control access, allow/prevent others [from] reading/executing their files or directories, make scripts executable.
- `$ info 'file permissions'`
- Use `$ ls -l` *`filename`* to find permission level.
  - **“r”** means “read” permission
  - **“w”** means “write” permission
  - **“x”** means “execute” permission
    - In case of directory **“x”** grants permission to list directory contents

```
-rw------- 1 train1 cz 0 Dec  1 14:18 Turtles
```