Linux Introduction

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Linux **Introduction**

You will not learn this now. Google it or look at lecture slides when you need it.

Practice makes perfect :)
The goal for you in this lecture is to:

1. See the basic Linux commands
2. Glimpse the underlying logic
3. Learn the Most Important Habit
UPPMAX

- Uppsala Multidisciplinary Center for Advanced Computational Science
  - Uppsala supercomputer center
- Clusters
  - Bianca
  - Rackham
- Uses Linux
Why Text?

- UPPMAX is best accessed through SSH (Secure Shell) for security and speed
  - Command Line Interface (CLI)

- Scary at first, but wonderful to work with
  - Automation and scripts
  - Supercomputing not possible without it
The Bash Prompt

[username@computer  directory]$ 
[marcusl@rackham1  ~]$ 

- Bash reads commands entered into the prompt and executes them.
- The first word is always a program to run. The following words are input given to the program.
- Words are separated by spaces.

$ touch /proj/g2020002/completed/xxx
Navigating the file system
Navigating the file system

- `ls` – list the content of a directory
Navigating the file system

- `ls` – list the content of a directory

[marcusl@rackham1 dir]$
Navigating the file system

- `ls` – list the content of a directory

```
[marcusl@rackham1 dir]$ ls
anotherFile.doc directory1 file1.txt file2.old secondDirectory
```
Navigating the file system

- `ls` – list the content of a directory

```
[marcusl@rackham1 dir]$ ls -l
total 192
-rw-r--r-- 1 marcusl uppmax  28214 Jan 5 13:44 anotherFile.doc
drwxr-xr-x 2 marcusl uppmax  4096 Jan 5 13:45 directory1
-rw-r--r-- 1 marcusl uppmax  36458 Jan 5 13:44 file1.txt
-rw-r--r-- 1 marcusl uppmax  2273 Jan 5 13:44 file2.old
drwxr-xr-x 2 marcusl uppmax  4096 Jan 5 13:45 secondDirectory
[marcusl@rackham1 dir]$```
Navigating the file system

- **cd** – change working directory
  - `cd <directory name>` = down
  - `cd ..` = up

```
[marcusl@rackham1 dir]$ cd directory1
[marcusl@rackham1 directory1]$
```
Navigating the file system

- `cd` – change working directory
  - `cd <directory name>` = down
  - `cd ..` = up

[marcusl@rackham1 dir]$ cd directory1
[marcusl@rackham1 directory1]$ ls -l
-rw-r–r-- 1 marcusl uppmax 56427 Jan 5 13:45 notes
-rw-r–r-- 1 marcusl uppmax 56427 Jan 5 13:45 test.txt
Navigating the file system

- `cd` – change working directory
  - `cd <path>` = go there

[marcusl@rackham1 directory1]$ cd ../secondDirectory
[marcusl@rackham1 directory1]$ ls -l
```bash
total 252
-rw-r--r-- 1 marcusl uppmax  28214 Jan 5 13:45 bird.jpg
-rw-r--r-- 1 marcusl uppmax 112853 Jan 5 13:45 tree.jpg
```
Navigating the file system

- You can use paths anywhere you specify a file or directory

```
[marcusl@rackham1 secondDirectory]$ ls -l ../directory1
total 184
-rw-r--r-- 1 marcusl uppmax  56427 Jan 5 13:45 notes
-rw-r--r-- 1 marcusl uppmax  25301 Jan 5 13:45 test.txt
```
Navigating the file system

- `pwd` – print working directory

[marcus1@rackham1 dir]$ pwd
/home/marcus1/uppmaxintro/dir
Navigating the file system

- `pwd` – print working directory

```
$ pwd
/home/marcusl/uppmaxintro/dir
$ cd directory1/
$ pwd
/home/marcusl/uppmaxintro/dir/directory1
```
Navigating the file system

- **Summary**
  - `ls` – list content of directory
  - `cd` – change working directory
  - `pwd` – print working directory

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Type</th>
<th>Date Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>dir</td>
<td></td>
<td>folder</td>
<td>2012-01-05 13:44:47</td>
</tr>
<tr>
<td>directory1</td>
<td></td>
<td>folder</td>
<td>2012-01-05 13:45:43</td>
</tr>
<tr>
<td>secondDirectory</td>
<td></td>
<td>folder</td>
<td>2012-01-05 13:46:21</td>
</tr>
<tr>
<td>bird.jpg</td>
<td>27.6 KB</td>
<td>JPEG Image</td>
<td>2012-01-05 13:46:21</td>
</tr>
<tr>
<td>tree.jpg</td>
<td>110.2 KB</td>
<td>JPEG Image</td>
<td>2012-01-05 13:46:09</td>
</tr>
<tr>
<td>anotherFile.doc</td>
<td>27.6 KB</td>
<td>Word document</td>
<td>2012-01-05 13:44:47</td>
</tr>
<tr>
<td>file1.txt</td>
<td>35.6 KB</td>
<td>plain text document</td>
<td>2012-01-05 13:44:15</td>
</tr>
<tr>
<td>file2.old</td>
<td>2.2 KB</td>
<td>backup file</td>
<td>2012-01-05 13:44:33</td>
</tr>
</tbody>
</table>
Interacting with files

• Copy a file

    cp <original> <copy>
Interacting with files

- Copy a file

```
cp myText.txt copy_of_my_text.txt
```
Interacting with files

- Copy a file

```bash
cp /home/dahlo/test.txt ../../myDocs/
```
Interacting with files

- Move or rename a file
  
  mv <original> <destination>

  mv myText.txt copy_of_my_text.txt
Interacting with files

- Move a file

```bash
mv <original> <destination>
mv /home/dahlo/test.txt ../../myDocs/
```
Interacting with files

- Uploading/downloading files to/from Rackham

```
scp <original> <destination>
```

Upload:
```
scp myfile marcusl@rackham.uppmax.uu.se:~/
```

Download:
```
scp marcusl@rackham.uppmax.uu.se:~/myfile .
```

Alternatively:
FileZilla, MobaXterm, sftp, any other program that works through SSH or SFTP protocol.
Interacting with files

- View content of a file
  
  ```
  less <file name>
  less readme.txt
  ```
Interacting with files

• View content of a file

  less <file name>
  less readme.txt

This is the content of readme.txt

readme.txt (END)
Interacting with files

- View content of a file
  
  `less <file name>`
  
  `less readme.txt`

(q to exit)
Interacting with files

- Using `less`
  - Search with `/mysearchterm`
  - `n` scan forward through hits
  - `N` scan backwards through hits
  - `q` to quit
Interacting with files

- View the first rows of a file
  - head <filename>
Interacting with files

- View the first rows of a file
  - `head <filename>`

```
[marcusl@r1 test]$ head slurm-123.out
Starting test script
1%
2%
3%
4%
5%
6%
7%
8%
9%
[marcusl@r1 test]$
```
Interacting with files

- View the first n rows of a file
  - `head -n <nr of lines> <filename>`
Interacting with files

- View the first n rows of a file
  - `head -n <nr of lines> <filename>`

```
[marcusl@r1 test]$ head -n 3 slurm-123.out
Starting test script
1%
2%
[marcusl@r1 test]$
```
Interacting with files

- View the last rows of a file
  - `tail <filename>`

```
[marcusl@r1 test]$ tail slurm-123.out
91%
92%
93%
94%
95%
96%
97%
98%
ERROR 42: something went wrong, process aborted
[marcusl@r1 test]$
```
Interacting with files

- View the last n rows of a file
  - `tail -n <nr of lines> <filename>`

```
[marcusl@r1 test]$ tail -n 2 slurm-123.out
99%
ERROR 42: something went wrong, process aborted.
[marcusl@r1 test]$
```
Interacting with files

• Edit content of a file

  nano <file name>

  nano readme.txt
Interacting with files

- Other editors
  - *gedit* or *nedit*
    - Work like "wordpad"
    - Require login with X-forwarding ("ssh -X")
    - Invoke with "gedit &"
  - *vim*
    - A little different
    - Need a command reference to learn/use it
    - Very quick and friendly
  - *emacs*
    - A more powerful "nano"
Interacting with files

- Remove a file
  
  \texttt{rm <file name>}

  \textbf{Ex.}
  
  \texttt{rm readme.txt}
  
  \texttt{rm ../../../file1.txt}
  
  \texttt{rm /home/marcusl/test.txt}

- There is no trash bin in Linux! Gone is gone..
Wildcards

- *  

- Works with most Linux commands

```
[marcusl@rackham1 dir]$ ls
anotherFile.doc directory1 file1.txt file2.old secondDirectory
```
Wildcards

- *
- Works with most Linux commands

[marcus1@rackham1 dir]$ ls
anotherFile.doc directory1 file1.txt file2.old secondDirectory
[marcus1@rackham1 dir]$
[marcus1@rackham1 dir]$
[marcus1@rackham1 dir]$ ls *.txt
file1.txt
Wildcards

- *

- Works with most Linux commands

```
[marcusl@rackham1 dir]$ ls
anotherFile.doc directory1 file1.txt file2.old secondDirectory
[marcusl@rackham1 dir]$
[marcusl@rackham1 dir]$ ls *.txt
file1.txt
[marcusl@rackham1 dir]$
[marcusl@rackham1 dir]$ ls *.txt
file1.txt
[marcusl@rackham1 dir]$
[marcusl@rackham1 dir]$ ls file*
file1.txt file2.old
```
Wildcards

- *

- Works with most Linux commands

- Examples:
  - `cp *.txt directory1/
  - `rm *.tmp
  - `eog *.png
Useful Commands

- How much is the computer working?
  
  `top`

```plaintext
top - 21:27:48 up 37 days,  7:34,  2 users,  load average: 6.38, 6.09, 6.03
Tasks: 278 total,  4 running, 274 sleeping,  0 stopped,  0 zombie
Cpu(s): 73.5%us,  1.5%sy,  0.0%ni, 24.3%id,  0.6%wa,  0.0%hi,  0.0%si,  0.0%st
Mem: 24598372k total, 17703556k used, 6894816k free,  83596k buffers
Swap: 25165816k total,  29704k used, 25136112k free, 15403636k cached

<table>
<thead>
<tr>
<th>PID</th>
<th>USER</th>
<th>PR</th>
<th>NI</th>
<th>VIRT</th>
<th>RES</th>
<th>SHR</th>
<th>S</th>
<th>%CPU</th>
<th>%MEM</th>
<th>TIME+</th>
<th>COMMAND</th>
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<td>0</td>
<td>1531m</td>
<td>45m</td>
<td>9492</td>
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<td>100.0</td>
<td>0.2</td>
<td>679:58.20</td>
<td>invaperco</td>
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<td>43m</td>
<td>9492</td>
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<td>0</td>
<td>1531m</td>
<td>43m</td>
<td>9480</td>
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<td>0</td>
<td>1531m</td>
<td>44m</td>
<td>9492</td>
<td>S</td>
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<td>679:21.84</td>
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<td>20</td>
<td>0</td>
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<td>3356</td>
<td>R</td>
<td>100.0</td>
<td>1.6</td>
<td>668:47.67</td>
<td>cretin</td>
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<td>roca</td>
<td>20</td>
<td>0</td>
<td>3114m</td>
<td>88m</td>
<td>4188</td>
<td>R</td>
<td>99.7</td>
<td>0.4</td>
<td>8:26.15</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>S</td>
<td>0.7</td>
<td>0.0</td>
<td>0:13.69</td>
<td>flush-8:0</td>
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<td>0</td>
<td>0</td>
<td>S</td>
<td>0.3</td>
<td>0.0</td>
<td>17:26.31</td>
<td>ktpmiod</td>
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<tr>
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<td>root</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>S</td>
<td>0.3</td>
<td>0.0</td>
<td>1:24.46</td>
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<td>dahlo</td>
<td>20</td>
<td>0</td>
<td>13384</td>
<td>1292</td>
<td>884</td>
<td>R</td>
<td>0.3</td>
<td>0.0</td>
<td>0:00.03</td>
<td>top</td>
</tr>
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<td>root</td>
<td>20</td>
<td>0</td>
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<td>0.0</td>
<td>0:01.70</td>
<td>init</td>
</tr>
<tr>
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<td>0.0</td>
<td>0:00.03</td>
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<td>0</td>
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<td>0</td>
<td>S</td>
<td>0.0</td>
<td>0.0</td>
<td>0:00.14</td>
<td>migration/0</td>
</tr>
<tr>
<td>4</td>
<td>root</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>S</td>
<td>0.0</td>
<td>0.0</td>
<td>0:01.40</td>
<td>ksoftirqd/0</td>
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<td>5</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>S</td>
<td>0.0</td>
<td>0.0</td>
<td>0:00.00</td>
<td>migration/0</td>
</tr>
</tbody>
</table>
```
Useful Commands

- It's easy to forget syntax
  - Manual pages

```
man <program name>
```

Ex:
```
man ls
```
(q to quit)
Useful Commands

• Using `man` is a lot like `less`

• Search using `/mysearchterm`
  - 'n' to scan forward through hits
  - 'N' to scan back
  - 'q' to quit
Useful Commands

- How do I stop something that I regret starting?
  - Ctrl-C sends a signal that interrupts the current process
  - top has a 'k'ill command. Type 'k' and then the PID of the process you want
  - Logging out of the terminal kills all processes spawned from that terminal
Useful Commands

- How do I log out?
  - Exit
  - Ctrl-D

- Exits only the current terminal
Useful Commands

- **Summary**
  - `cp` – copy a file
  - `mv` – move or rename a file
  - `less` – view a file
  - Nano/gedit/vim/emacs – view and edit a file
  - `rm` – remove a file
  - `head` / `tail`
  - **Wildcard** *
  - Tab completion – use it
  - `top` – see active processes
  - `man` – manual pages
  - `exit` – Log out current terminal
Useful Commands

TAB

COMPLETION

Never write a path or filename without it!
Useful Commands

TAB COMPLETION

Never write a path or filename without it!

[marcus1@rackham1 dir]$ ls
anotherFile.doc directory1 file1.txt file2.old secondDirectory
[marcus1@rackham1 dir]$ less fi
Useful Commands

**TAB COMPLETION**

*Never* write a path or filename without it!

```
[marcusl@rackham1 dir]$ ls
anotherFile.doc directory1 file1.txt file2.old secondDirectory
[marcusl@rackham1 dir]$ less file
file1.txt file2.old
[marcusl@rackham1 dir]$ less file
```
Useful Commands

**TAB COMPLETION**

*Never* write a path or filename without it!

```
[marcusl@rackham1 dir]$ ls
anotherFile.doc directory1 file1.txt file2.old secondDirectory
[marcusl@rackham1 dir]$ less file
file1.txt file2.old
[marcusl@rackham1 dir]$ less file1
```
Useful Commands

TAB COMPLETION

Never write a path or filename without it!

[marcusl@rackham1 dir]$ ls
anotherFile.doc directory1 file1.txt file2.old
secondDirectory
[marcusl@rackham1 dir]$ less file
file1.txt file2.old
[marcusl@rackham1 dir]$ less file1.txt
Connect to UPPMAX

- Secure SHell connection (ssh)

  - ssh -X username@rackham.uppmax.uu.se
    - Ex: ssh -X dahlo@rackham.uppmax.uu.se

- Terminal in Linux and Mac
  - for some graphics (X11) on Mac, install Xquartz. Go to www.xquartz.org

- MobaXterm in Windows (http://mobaxterm.mobatek.net/)
  - Putty also alternative, but not as good..
Customising your startup

- Every time you log in, the file `~/.bashrc` is executed
- The `. in front of the name makes it hidden
- You can put handy stuff there, e.g.:
  - alias ll="ls -l"
  - Load your standard modules
  - Start with a clean slate: `rm -r *`
  - (The above is a joke!!!)
• Laboratory time!
  - Instructions on course webpage
  - Have some fika and do chapter 1
  - If you have time, do chapter 2
  - Then have some lunch

• Tip for the lab: don't copy-and-paste from the PDF file. Write out each command (with tab completion) instead.