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
  - (Milou)
- 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
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

[dahlo@kalkyl4 dir]$
Navigating the file system

- `ls` – list the content of a directory

```
[dahlo@kalkyl4 dir]$ ls
anotherFile.doc  directory1  file1.txt  file2.old  secondDirectory
```

<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>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>
Navigating the file system

- `ls` – list the content of a directory

```
[dahlo@kalkyl4 dir]$ ls -l
total 192
-rw-r--r-- 1 dahlo uppmax 28214 Jan 5 13:44 anotherFile.doc
drwxr-xr-x 2 dahlo uppmax  4096 Jan 5 13:45 directory1
-rw-r--r-- 1 dahlo uppmax  36458 Jan 5 13:44 file1.txt
-rw-r--r-- 1 dahlo uppmax  2273 Jan 5 13:44 file2.old
drwxr-xr-x 2 dahlo uppmax  4096 Jan 5 13:46 secondDirectory
```
Navigating the file system

- cd – change working directory
  - cd <directory name> = down
  - cd .. = up
Navigating the file system

- cd – change working directory
  - cd <directory name> = down
  - cd .. = up
Navigating the file system

- `cd` – change working directory
  - `cd <directory name>` = down
  - `cd ..` = up
Navigating the file system

- `cd` – change working directory
  - `cd <directory name>` = down
  - `cd ..` = up
  - `cd -` = back
Navigating the file system

- `pwd` – print working directory

```
[dahlo@kalkyl4 dir]$ pwd
/home/dahlo/glob/work/testarea/temp/dir
```
Navigating the file system

- `pwd` – print working directory

```
[dahlo@kalkyl4  dir]$ pwd
/home/dahlo/glob/work/testarea/temp/dir
[dahlo@kalkyl4  dir]$ cd directory1/
[dahlo@kalkyl4 directory1]$ pwd
/home/dahlo/glob/work/testarea/temp/dir/directory1
```
Navigating the file system

- Summary
  - `ls` – list content of directory
  - `cd` – change working directory
  - `pwd` – print working directory
Interacting with files

- Copy a file

    `cp <name of original> <name of copy>`
Interacting with files

- Copy a file
  
  ```
  cp myText.txt copy_of_my_text.txt
  ```
Interacting with files

- Copy a file
  
  ```
  cp /home/dahlo/test.txt ../..../myDocs/
  ```
Interacting with files

- Move a file

```
mv <name of original> <name of destination>
mv myText.txt copy_of_my_text.txt
```
Interacting with files

- Move a file

\[ \text{mv} \ <\text{name of original}> \ <\text{name of copy}> \]
\[ \text{mv} \ /\text{home}/\text{dahlo}/\text{test.txt} \ ../..../\text{myDocs}/ \]
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

This is the content of readme.txt

readme.txt (END)

(q to exit)
Interacting with files

- Using **less**
  - Search with *Imysearchterm*
  - '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>
Interacting with files

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

```bash
[dahlo@dahlo dahlo]$ ls -l
total 57
drwxrwxrwx 1 root root  4096 2012-09-14 10:16 ...
..  36 2012-09-13 15:16 README
-rwxrwxrwx 1 root root 53027 2012-09-12 10:31 test.txt
[dahlo@dahlo dahlo]$ [dahlo@dahlo dahlo]$ head test.txt
```
Interacting with files

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

```
[dahlo@dahlo dahlo]$ ls -l
total 57
drwxrwxrwx 1 root root 4096 2012-09-14 10:16 ...
-rwxrwxrwx 1 root root  0 2012-01-17 08:28 ...
-rwxrwxrwx 1 root root  0 2012-01-28 21:41 ...
-rwxrwxrwx 1 root root  0 2012-08-22 17:06 ...
-rwxrwxrwx 1 root root  0 2012-01-29 01:10 ...
-rwxrwxrwx 1 root root  36 2012-09-13 15:16 readme.txt
-rwxrwxrwx 1 root root 53027 2012-09-12 10:31 test.txt
[dahlo@dahlo dahlo]$ [dahlo@dahlo dahlo]$ head test.txt
This file contains any messages produced by compilers while running configure, to aid debugging if configure makes a mistake.

It was created by PSNC DRMAA for SLURM configure 1.0.5, which was generated by GNU Autoconf 2.67. Invocation command line was

```
$ ./configure --with-slurm-inc=/usr/include/slurm --with-slurm-lib=/usr/lib64/slurm --prefix=/bubo/sw/apps/bubolinux3.6.0-1.0.5
```
```
## -------- ##
## Platform. ##
[dahlo@dahlo dahlo]$
```
Interacting with files

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

```
[dahlo@dahlo dahlo]$ ls -l
total 57
drwxrwxrwx 1 root root 4096 2012-09-14 10:16 ..
 drwxrwxrwx 1 root root 0 2012-01-17 08:28 ..
 drwxrwxrwx 1 root root 0 2012-01-28 21:41 ..
 drwxrwxrwx 1 root root 0 2012-08-22 17:06 ..
 drwxrwxrwx 1 root root 0 2012-01-29 01:10 ..
-rwxrwxrwx 1 root root 36 2012-09-13 15:16 ..
-rwxrwxrwx 1 root root 53027 2012-09-12 10:31 ..
[dahlo@dahlo dahlo]$ [dahlo@dahlo dahlo]$ head -n 3 test.txt
This file contains any messages produced by compilers while running configure, to aid debugging if configure makes a mistake.
[dahlo@dahlo dahlo]$
```
**Interacting with files**

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

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

```bash
[dahlo@dahlo dahlo]$ ls -l
total 57
-rw-rwxrwx 1 root root 4096 2012-09-14 10:16 glob
-rw-rwxrwx 1 root root 53027 2012-09-12 10:31 test.txt

[dahlo@dahlo dahlo]$ tail -n 3 test.txt
#define HAVE_VASPRINTF 1
configure: exit 0
[dahlo@dahlo dahlo]$
```
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 "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

  `rm <file name>`

  Ex.
  `rm readme.txt`
  `rm ../../../file1.txt`
  `rm /home/dahlo/test.txt`

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

- *
- Works with most Linux commands

```
[dahlo@dahlo dir]$ ls -l
total 68
-rwxrwxrwx 1 root root 28214 2012-01-05 13:44 anotherFile.doc
-rwxrwxrwx 1 root root 0 2012-01-17 08:28 Directory1
-rwxrwxrwx 1 root root 36458 2012-01-05 13:44 file1.txt
-rwxrwxrwx 1 root root 2273 2012-01-05 13:44 file2.old
-drwxrwxrwx 1 root root 0 2012-01-17 08:28 SecondDirectory
[dahlo@dahlo dir]$
```
Wildcards

- *
- Works with most Linux commands

```
[dahlo@dahlo dir]$ ls -l
total 68
-rwxrwxrwx 1 root root 28214 2012-01-05 13:44 anotherFile.doc
drwxrwxrwx 1 root root 0 2012-01-17 08:28 Directory1
-rwxrwxrwx 1 root root 36458 2012-01-05 13:44 file1.txt
-rwxrwxrwx 1 root root 2273 2012-01-05 13:44 file2.old
drwxrwxrwx 1 root root 0 2012-01-17 08:28 SecondDirectory
[dahlo@dahlo dir]$
[dahlo@dahlo dir]$ ls -l *.txt
-rwxrwxrwx 1 root root 36458 2012-01-05 13:44 file1.txt
[dahlo@dahlo dir]$
```
Wildcards

- *
- Works with most Linux commands
**Wildcards**

- *
- Works with most Linux commands
- Ex: `cp * .txt directory1/`
Wildcards

- *
- Works with most Linux commands
- Ex: `rm * .tmp`

```
[dahlo@dahlo dir]$ ls -l
total 68
-rwxrwxrwx 1 root root 28214 2012-01-05 13:44 anotherFile.doc
drwxrwxrwx 1 root root 0 2012-01-17 08:28 Directory1
-rwxrwxrwx 1 root root 36458 2012-01-05 13:44 file1.txt
-rwxrwxrwx 1 root root 2273 2012-01-05 13:44 file2.old
drwxrwxrwx 1 root root 0 2012-01-17 08:28 SecondDirectory
[dahlo@dahlo dir]$ ls -l *.txt
-rwxrwxrwx 1 root root 36458 2012-01-05 13:44 file1.txt
[dahlo@dahlo dir]$ ls -l file*
-rwxrwxrwx 1 root root 36458 2012-01-05 13:44 file1.txt
-rwxrwxrwx 1 root root 2273 2012-01-05 13:44 file2.old
[dahlo@dahlo dir]$ 
```
Useful Commands

TAB

COMPLETION

Never write a path or filename without it!
Useful Commands

TAB COMPLETION

Never write a path or filename without it!
Useful Commands

TAB COMPLETION

Never write a path or filename without it!
Useful Commands

TAB COMPLETION

Never write a path or filename without it!
Useful Commands

TAB COMPLETION

Never write a path or filename without it!
Useful Commands

- How much is the computer working?

```bash
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>
</tr>
</thead>
<tbody>
<tr>
<td>5751</td>
<td>zhibing</td>
<td>20</td>
<td>0</td>
<td>1531m</td>
<td>45m</td>
<td>9492</td>
<td>S</td>
<td>100.0</td>
<td>0.2</td>
<td>679:58.20</td>
<td>invaperco</td>
</tr>
<tr>
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<td>zhibing</td>
<td>20</td>
<td>0</td>
<td>1531m</td>
<td>43m</td>
<td>9492</td>
<td>S</td>
<td>100.0</td>
<td>0.2</td>
<td>679:49.38</td>
<td>invaperco</td>
</tr>
<tr>
<td>5759</td>
<td>zhibing</td>
<td>20</td>
<td>0</td>
<td>1531m</td>
<td>43m</td>
<td>9480</td>
<td>S</td>
<td>100.0</td>
<td>0.2</td>
<td>679:56.71</td>
<td>invaperco</td>
</tr>
<tr>
<td>5779</td>
<td>zhibing</td>
<td>20</td>
<td>0</td>
<td>1531m</td>
<td>44m</td>
<td>9492</td>
<td>S</td>
<td>100.0</td>
<td>0.2</td>
<td>679:21.84</td>
<td>invaperco</td>
</tr>
<tr>
<td>6212</td>
<td>nicusor</td>
<td>20</td>
<td>0</td>
<td>451m</td>
<td>377m</td>
<td>3356</td>
<td>R</td>
<td>100.0</td>
<td>1.6</td>
<td>668:47.67</td>
<td>cretin</td>
</tr>
<tr>
<td>2822</td>
<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>
<td>seward.exe</td>
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<td>20</td>
<td>0</td>
<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>
</tr>
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<td>19</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>S</td>
<td>0.3</td>
<td>0.0</td>
<td>17:26.31</td>
<td>kipmio</td>
</tr>
<tr>
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<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>S</td>
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<td>0.0</td>
<td>1:24.46</td>
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<td>dahlo</td>
<td>20</td>
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<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>
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<td>448</td>
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<td>0.0</td>
<td>0:01.70</td>
<td>init</td>
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<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>0:00.03</td>
<td>kthreadd</td>
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<td>root</td>
<td>RT</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>S</td>
<td>0.0</td>
<td>0.0</td>
<td>0:00.14</td>
<td>migration/0</td>
</tr>
<tr>
<td>4</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>0:01.40</td>
<td>ksoftirqd/0</td>
</tr>
<tr>
<td>5</td>
<td>root</td>
<td>RT</td>
<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

- Exits only the current terminal
Useful Commands

- Summary
  - cp – copy a file
  - mv – move a file
  - less – view a file
  - Nano/gedit/vim/emacs – view and edit a file
  - rm – remove a file
  - head / tail
  - wildcards
  - tab completion – use it
  - top – see active processes
  - man – manual pages
  - exit – Log out current terminal
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 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.