university of groningen / center for information technology

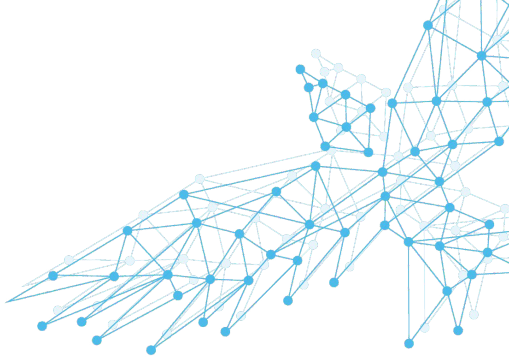
Part I

CIT Academy

Using the Peregrine cluster

Fokke Dijkstra
Bob Dröge
Cristian Marocico

Outline of the course



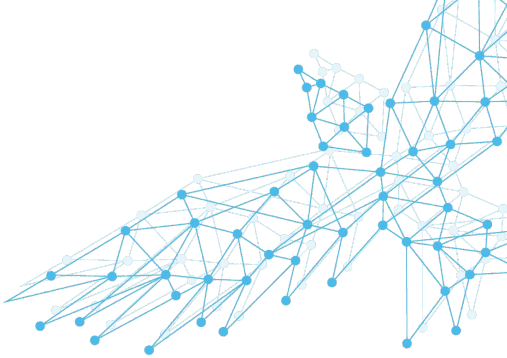
1. Connecting to Peregrine
2. Linux command-line environment
3. Editing files

4. Exercises + break

5. Introduction about clusters
6. Software modules and file systems
7. Introduction scheduler and job submission

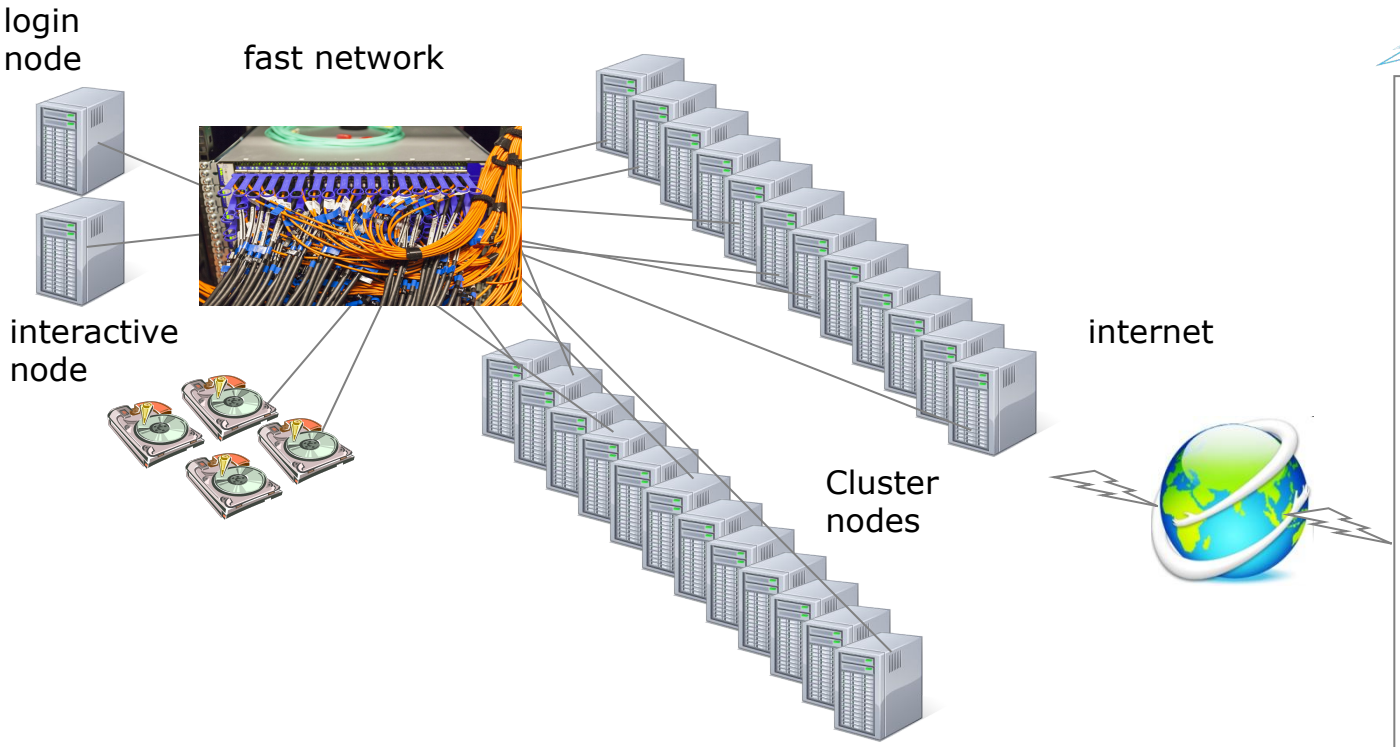
8. Exercises

General Introduction



- Course aimed at beginners
- No knowledge about clusters or Linux necessary
- Examples based on UWP Windows installation
- Some pointers for Linux or macOS user

The Peregrine Cluster

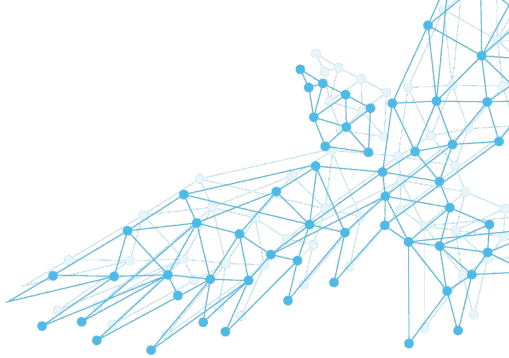


Office somewhere

Accessing the System

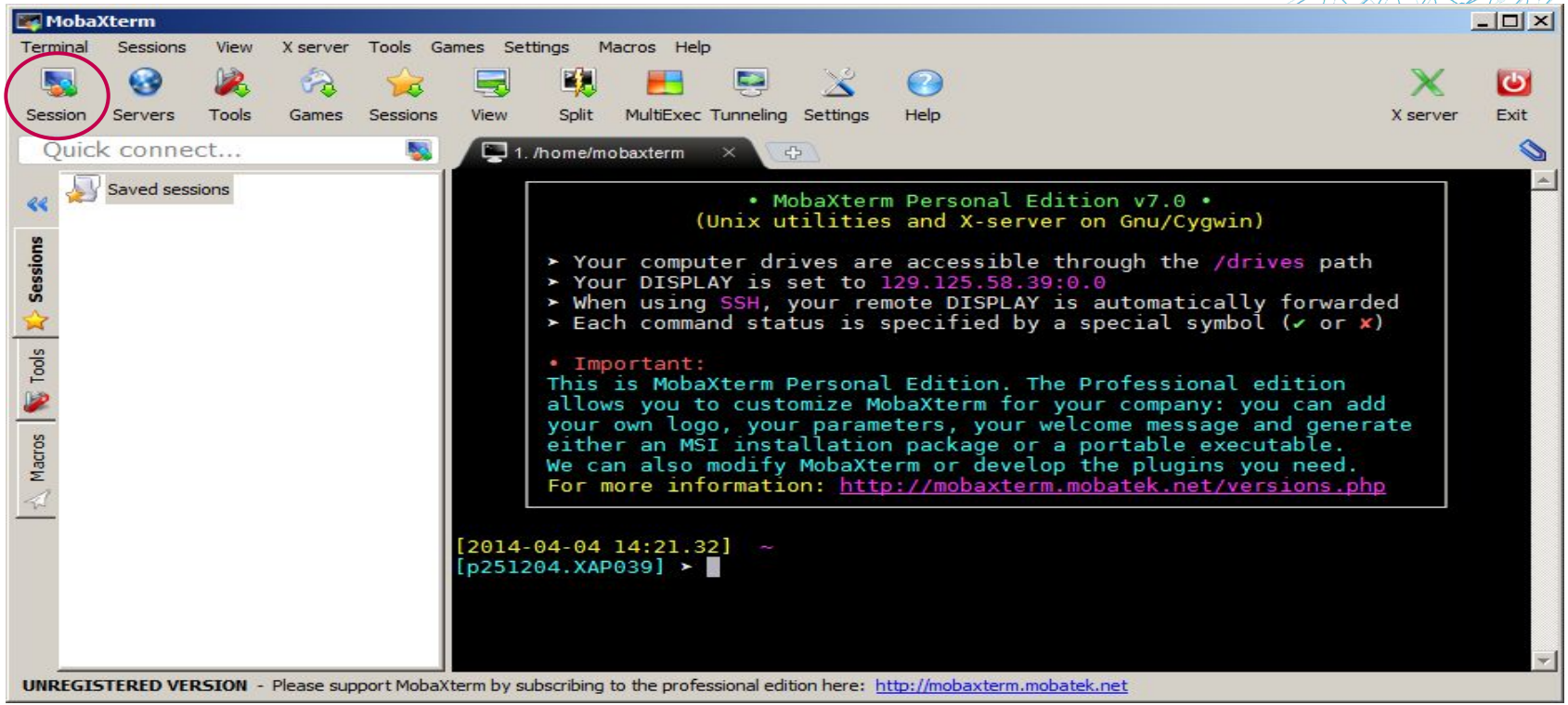
- How do I get onto the system?

Accessing the System

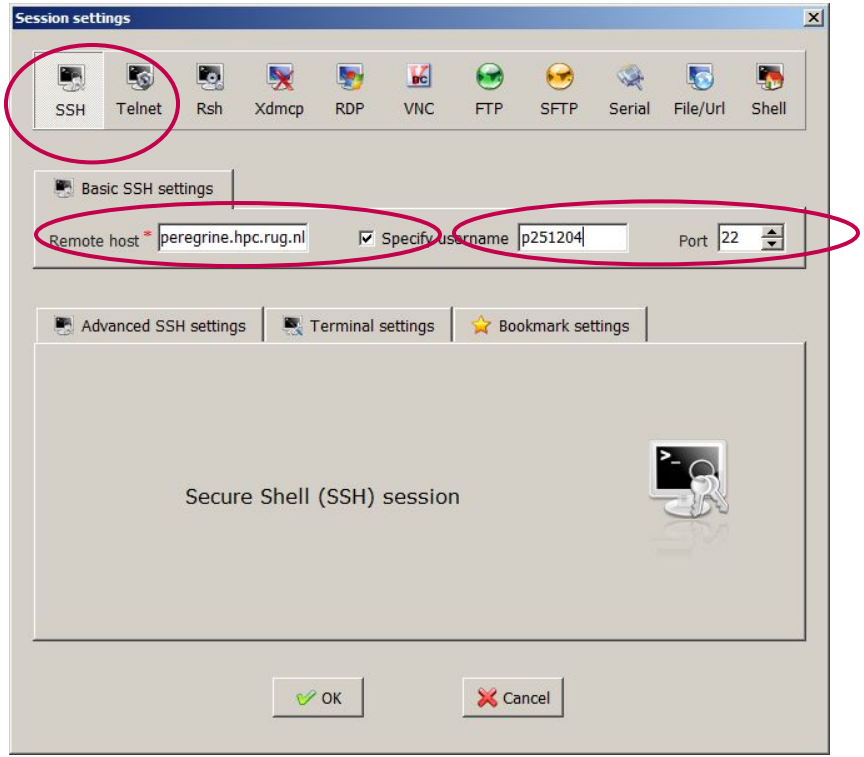


- University P/S/F account and password
- Request Peregrine account
- Hostname login node: **peregrine.hpc.rug.nl**
- Interactive node**: pg-interactive.hpc.rug.nl**
- SSH protocol used to connect to the cluster
  - Standard interface for Unix systems
  - Encrypted network traffic
- Software for Windows called MobaXterm:
  - http://mobaxterm.mobatek.net/
  - Freely available for personal use, already installed on UWP

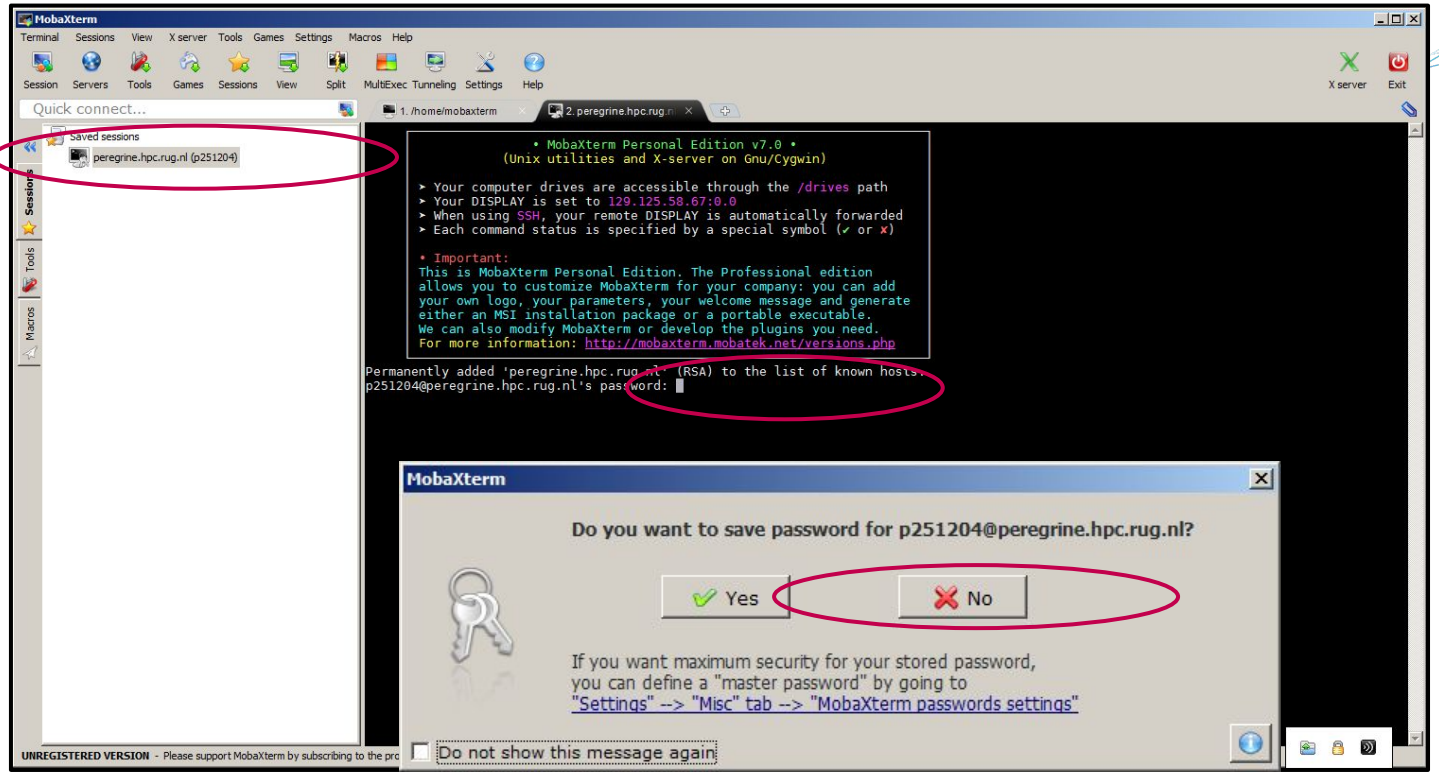
Accessing the System



Accessing the System

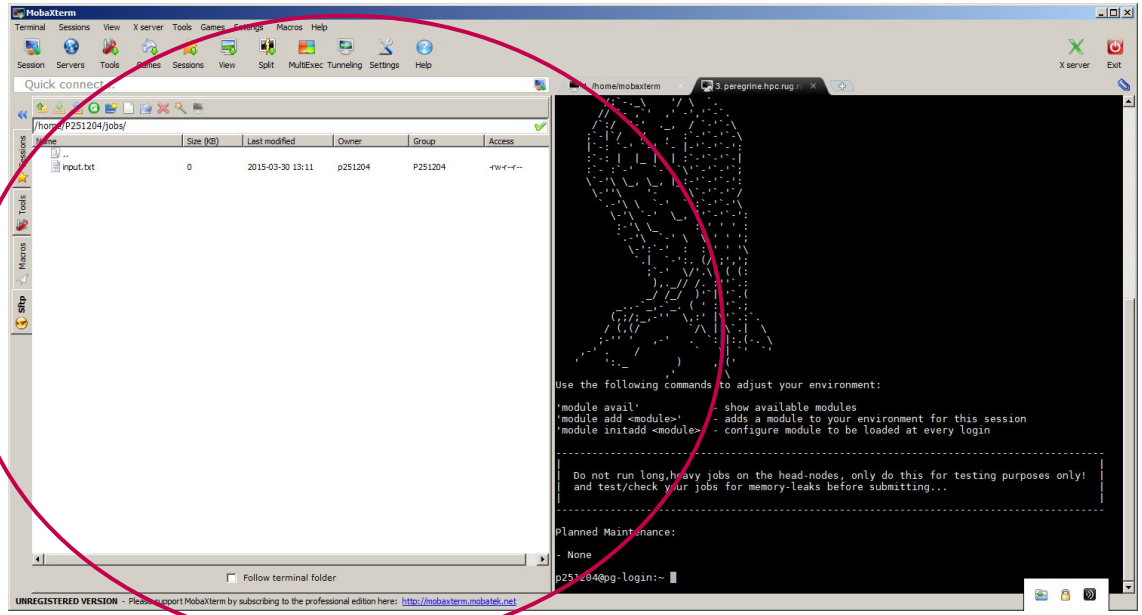


Accessing the System

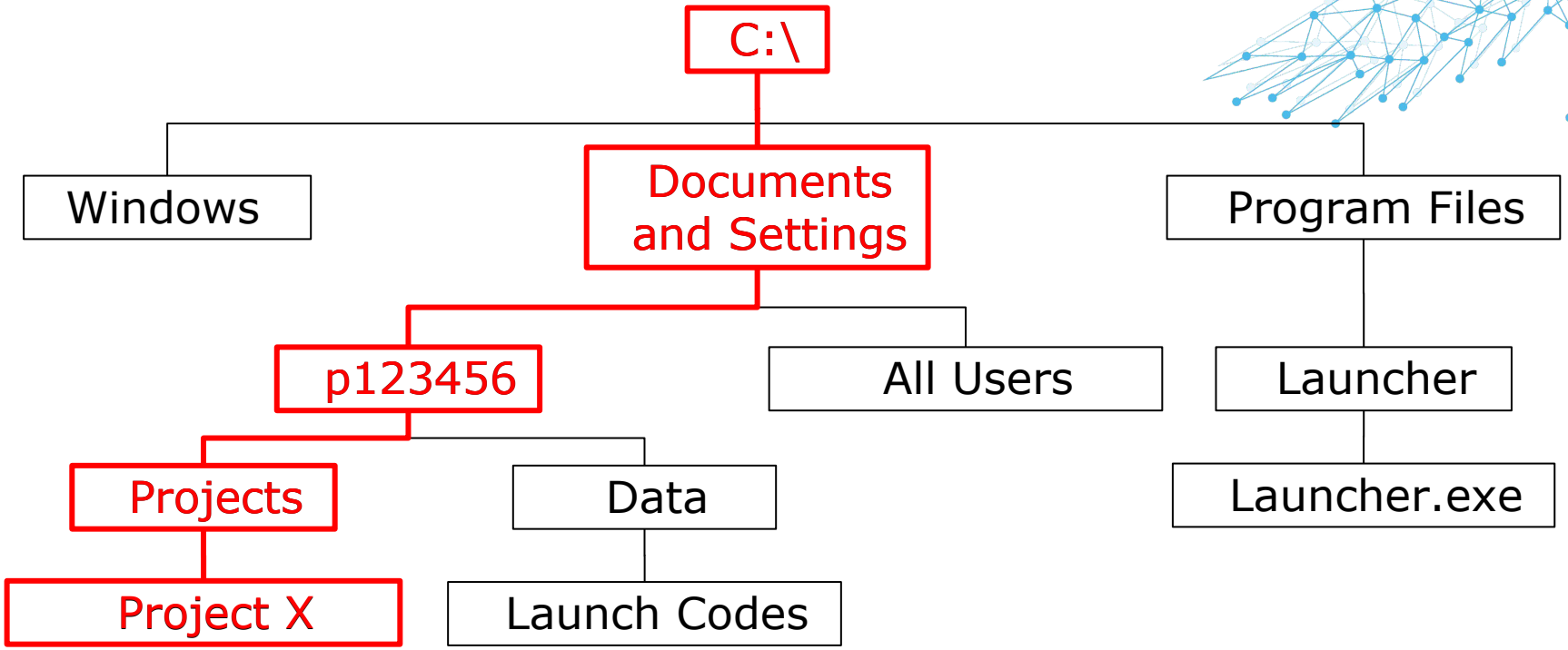


Accessing the System

- Basic file management
- Drag-and-drop support for copying files

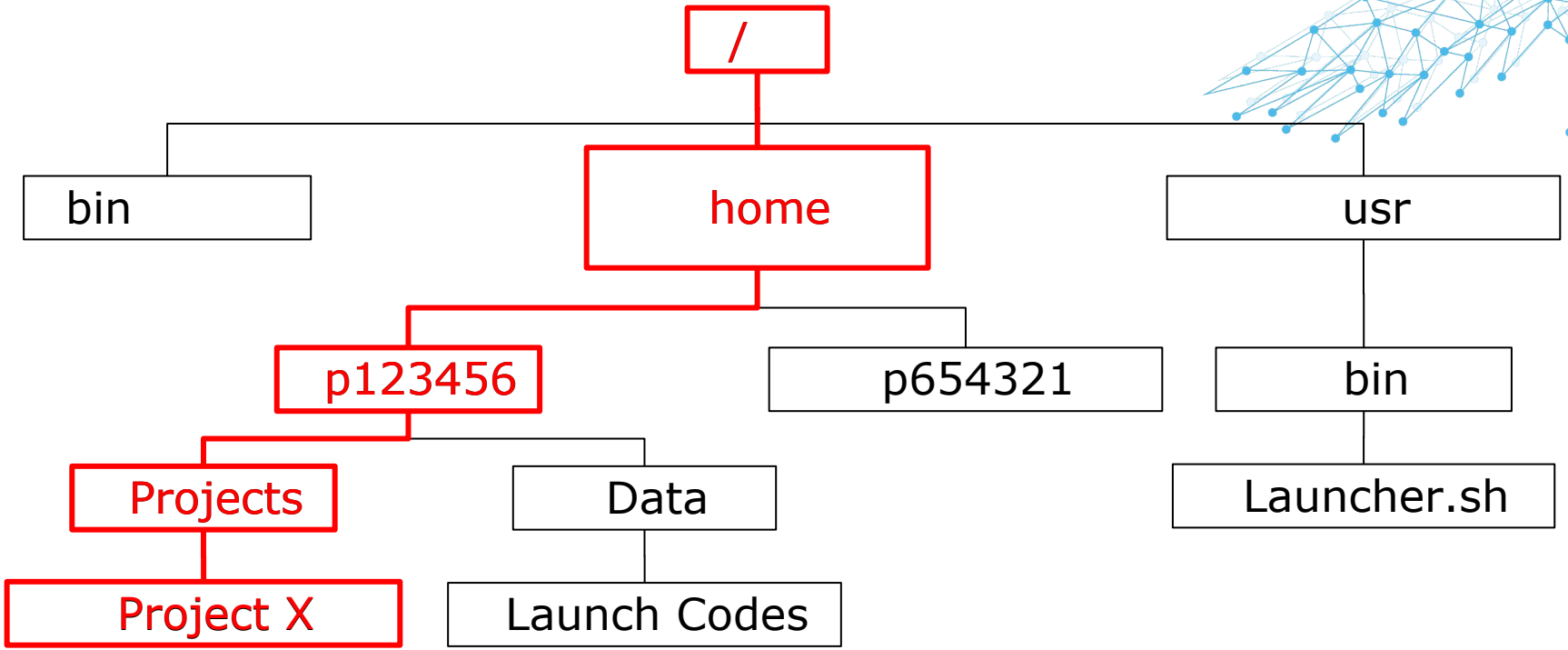


File Organization: Windows



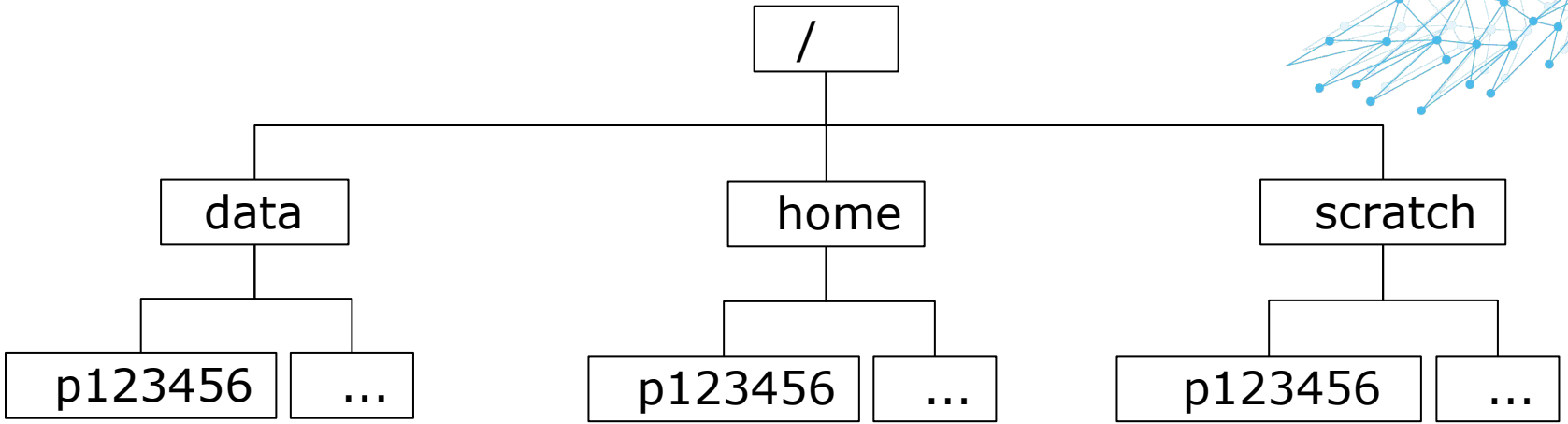

```
C:\Documents and Settings\p123456\Projects\Project X\
```

File Organization: Linux




```
/home/p123456/Projects/Project X/
```

File Organization: Peregrine




```
/home/p123456/
```

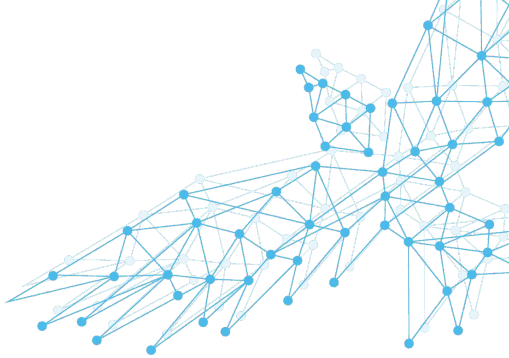
File Organization: Differences

- In Windows directory structure separated by \
- Drive letter included
  - `C:\Documents and Settings\p123456\Projects\testfile.txt`

- In Linux directories separated by /
- Drive letters not used, everything appears as a directory name
  - `/home/p123456/ProjectX/testfile.txt`

- Note that the use of “spaces” is difficult on the command line
- Use quotes if you really need spaces
  - `”/home/p123456/Project X/testfile.txt”`
- Case-sensitive:
  - `Myfile.txt ≠ MyFile.txt`

The home directory

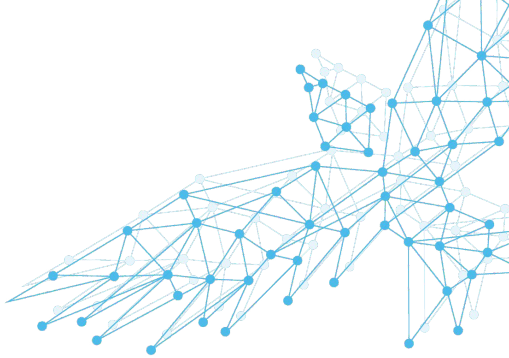


- A unique home directory for each user.
- The ssh session starts in this directory.
- Application and profile settings are stored in this directory.

- On Peregrine, it looks like:
  `/home/username`, e.g. `/home/p123456`

- Shortcuts: `~` or `$HOME`

Connecting to Peregrine: summary



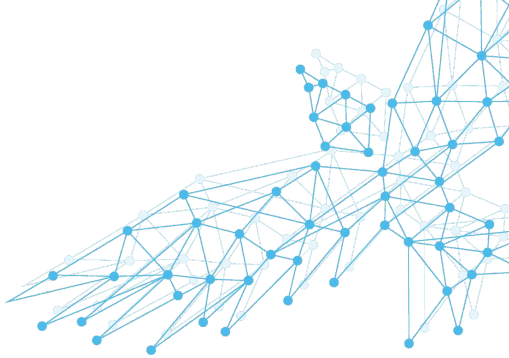
- University P/S/F account and password
- Request Peregrine account
- Hostname login node: **peregrine.hpc.rug.nl**
- Interactive node**: pg-interactive.hpc.rug.nl**
- Home folder on Peregrine:

  `/home/<username>`, e.g. `/home/p123456`

  Shortcuts: `~` or `$HOME`
- Also `/data/p123456` and `/scratch/p123456`
- Questions?

The Linux command line

The Linux command line

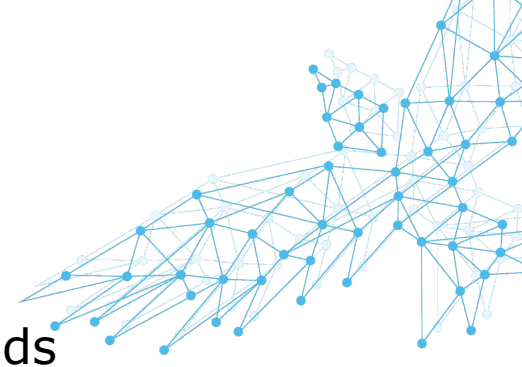


- The Command Line Interface (CLI)
- Control the system by issuing text commands
- Typical structure of a command:

  `command [<OPTIONS>] [<ARGUMENTS>]`

  - `command`: name of the command (e.g. mkdir)
  - `[<OPTIONS>]`: optional "flags" that change the behaviour of the command (e.g. -p)
  - `[<ARGUMENTS>]`: usually filenames or data needed by the command (e.g. data/test)
- `mkdir -p data/test`
- Get help from CLI: `man <command>`

The Linux command line



- Commands also produce `OUTPUT` and `ERROR`
- These can be redirected to files or other commands
- Send output to file with “>”:

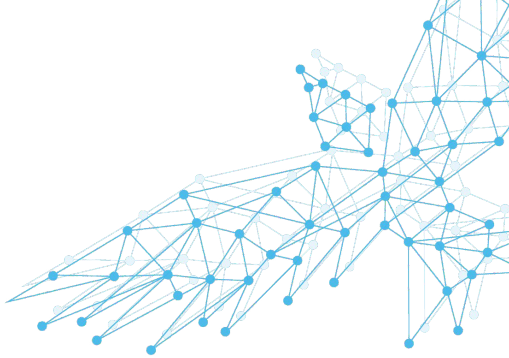
  ```
  echo “Hello” > files.txt
  ```
- Append output to file with “>>”

  ```
  echo “ world!” >> files.txt
  ```
- Read input from file with “<”

  ```
  myprog < inputfile.txt
  ```
- Concatenate commands:

  ```
  squeue | less
  ```

list



- ls lists directory contents:

  `ls [<OPTIONS>] [<FILE/DIRECTORY>]`
- Useful options:

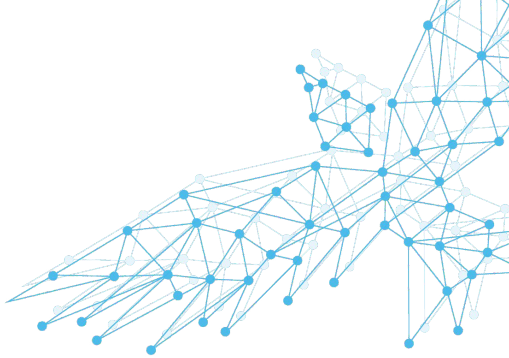
  `-l` show more details

  `-a` show hidden files/directories

  `-R` show recursively (possibly LOTS of output)

  `-h` show human-readable sizes (MB, GB)

change directory



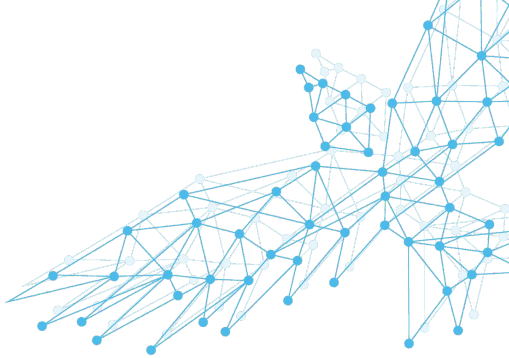
- cd changes to a directory:
  cd [<OPTIONS>] [<DIRECTORY>]
- Useful shortcuts:

  cd, cd ~ and cd $HOME change to the home directory

  cd .. changes to the directory above

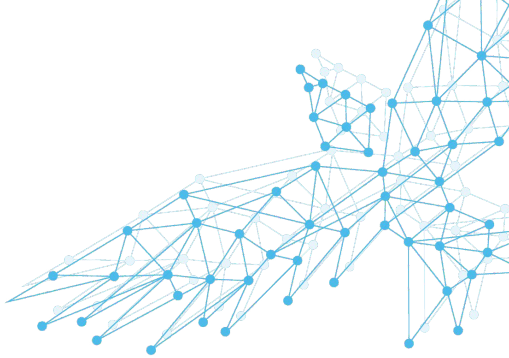
  cd . "changes" to the current directory

make directory



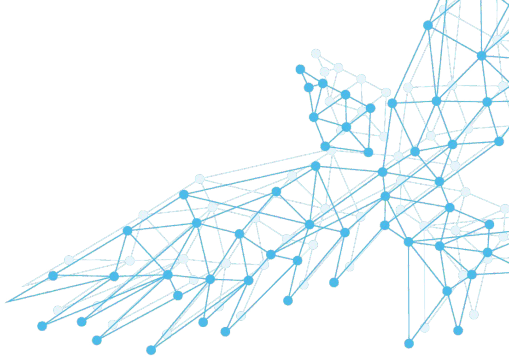
- `mkdir` creates a new directory:
  `mkdir [<OPTIONS>] <DIRECTORY>`
- Useful option:
  `-p` creates lower level directories
- Example:
  `mkdir -p data/test`
  Creates directory `data`, and within it, directory `test`

remove directory



- `rmdir` removes an empty directory:
  `rmdir [<OPTIONS>] <DIRECTORY>`
- Useful option:
  `-p` removes a directory and its parent
- Example:
  `rmdir -p data/test`
  Removes directory `test`, and its parent `data`

copy

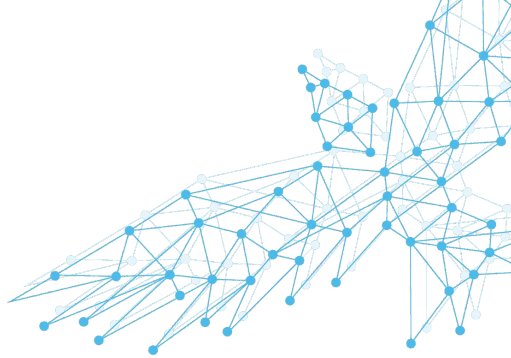


- `cp` copies files and/or directories:
  `cp [<OPTIONS>] <SOURCE> <DEST>`
- Useful options:
  `-r` copy directory recursively
  `-i` ask before overwriting
- Can copy multiple SOURCES to a DIRECTORY with
  `cp -t <DIRECTORY> <SOURCE1> <SOURCE2>...`
- Examples:

```
cp /tmp/file.txt ~/myfile.txt
cp /tmp/file.txt /data/p123456/
cp -r /data/p123456/documents/ $HOME/MyDocs
```

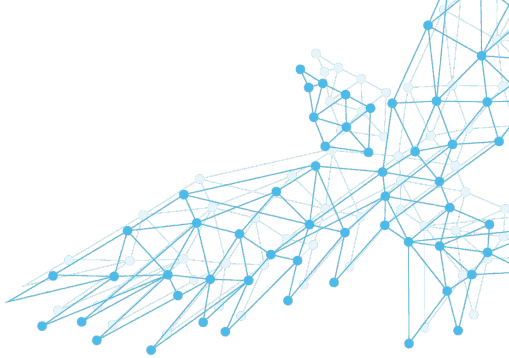
remove

- `rm` removes files and/or directories:
  `rm [<OPTIONS>] <FILE/DIRECTORY>`
- Useful options
  `-r` remove directories recursively
  `-f` do not ask for confirmation
- How to remove a non-empty directory:
  `rm -rf <DIRECTORY>`
- How to remove multiple files:
  `rm *.txt`



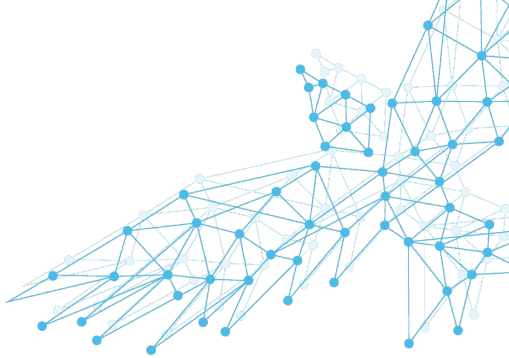
WARNING:
› No trash
› `rm -r *`

move



- `mv` moves/renames files and/or directories:
  `mv [<OPTIONS>] <SOURCE> <DEST>`
- Useful options
  `-i` ask before overwriting
- Can move multiple `SOURCES` to a `DIRECTORY` with:
  `mv -t <DIRECTORY> <SOURCE1> <SOURCE2>..`

Other useful commands



- `pwd` prints current/working directory

  ```
  pwd
  ```

- `echo` puts some text on the screen

  ```
  echo Hello World!
  ```

- `less` inspect the contents of a file (exit using q)

  ```
  less <FILE>
  ```

- `man` get help about a command (exit using q)

  ```
  man <COMMAND>
  ```

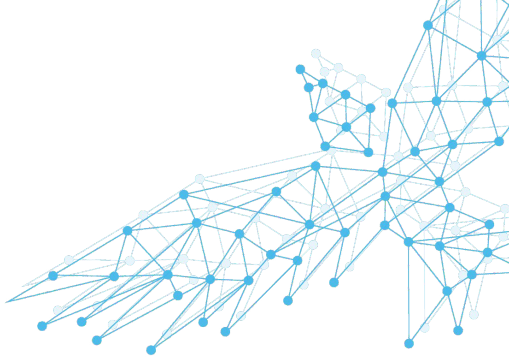
- `mc` graphical file manager in text mode

  Very useful once mastered

Useful tricks

- `TAB` autocompletes filenames
- `UpArrow, DownArrow` scroll through command history
- `Ctrl+C` interrupts the current program
- `Ctrl+Ins/Shift+Ins` Copy/Paste

Environment variables



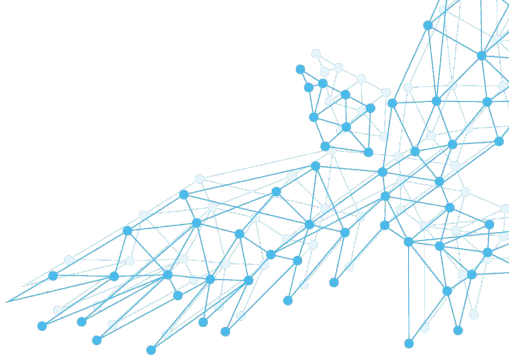
- System variables of the form `$VARIABLE` or `${VARIABLE}`
- Expanded when the command is run
- Examples:

```
cd $HOME        = cd /home/p123456

echo $USER = echo p123456
```

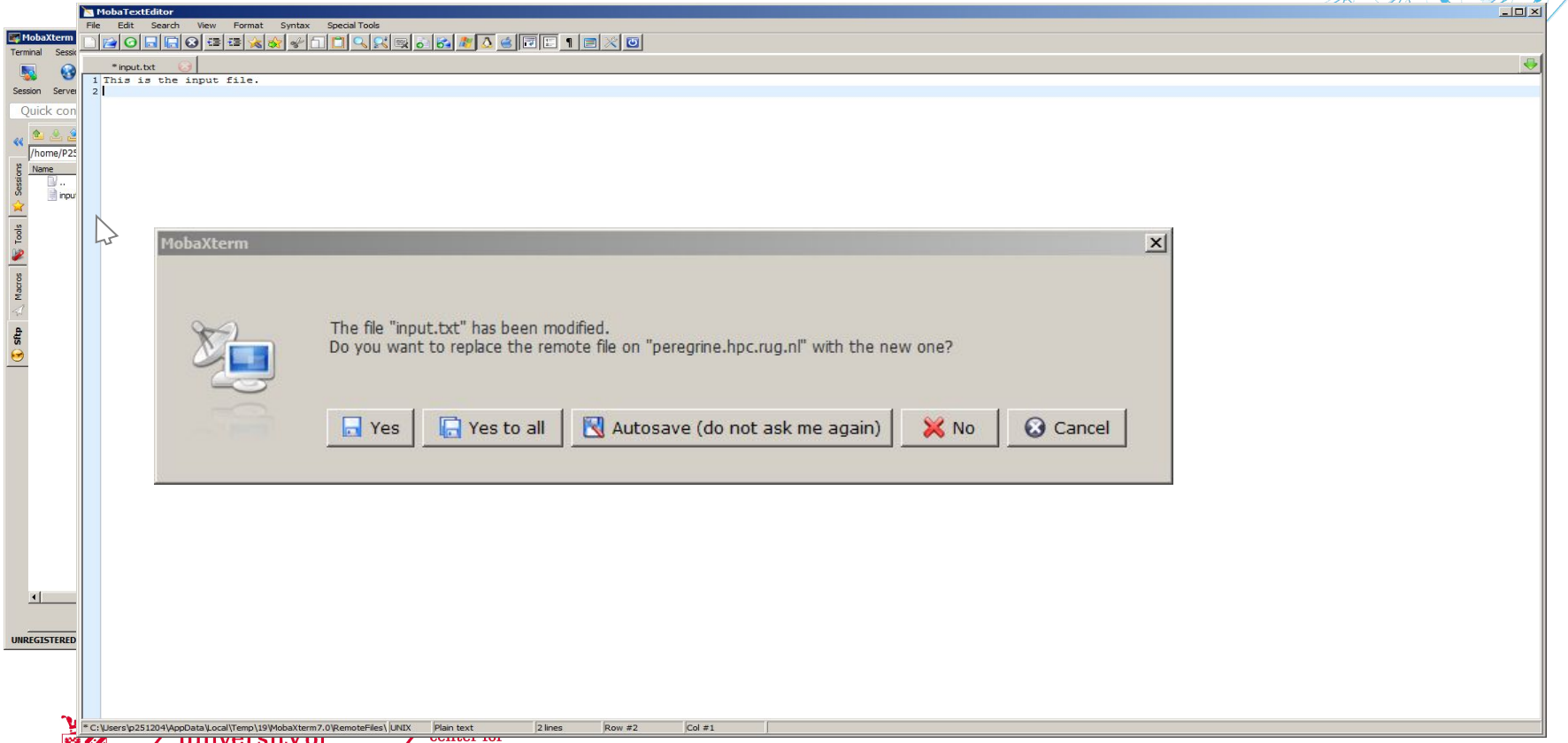
- If ambiguity can arise: use `${VARIABLE}`

The Command Line: summary



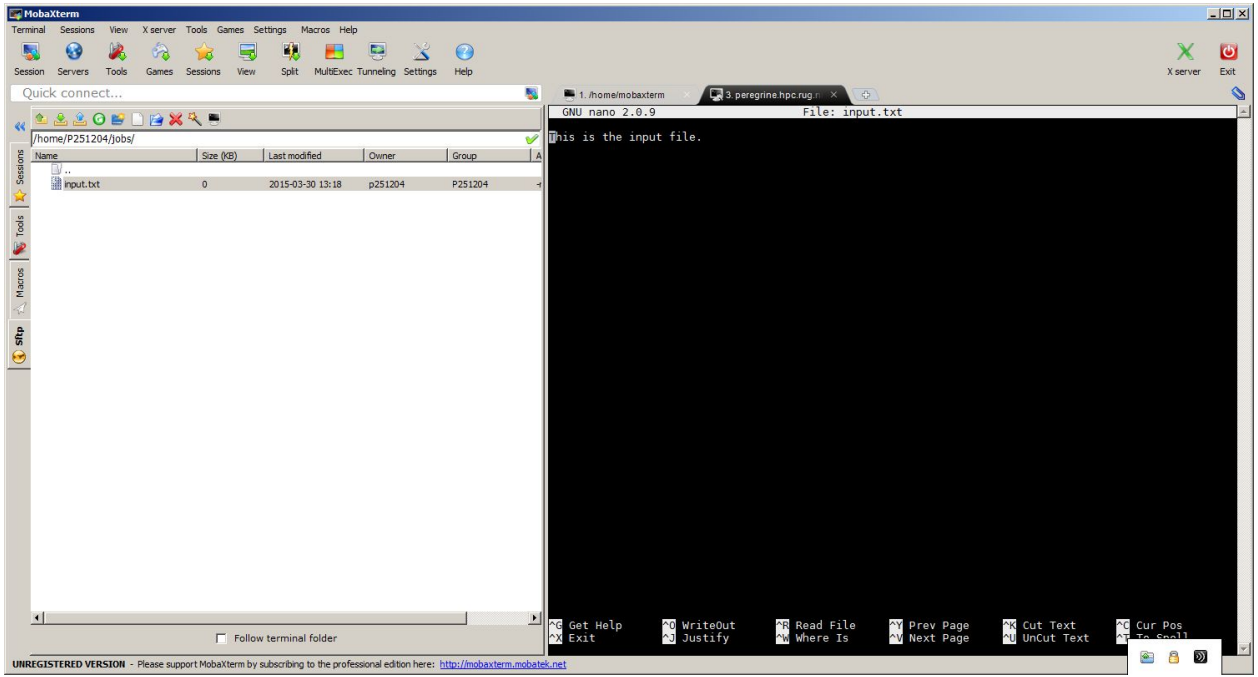
- Typical structure of a command:
  `command [<OPTIONS>] [<ARGUMENTS>]`
- Useful commands for file management:
  `ls, cd, cp, mv, rm, mkdir, rmdir, pwd, …`
- Other useful commands:
  `man, echo, less, mc, …`
- Keyboard tricks:
  `Tab, Arrows, Ctrl+C, Ctrl+Ins/Shift+Ins`
- Environment variables:
  `$HOME, ${USER}, ...`
- Questions?

Editing files: The Moba Way

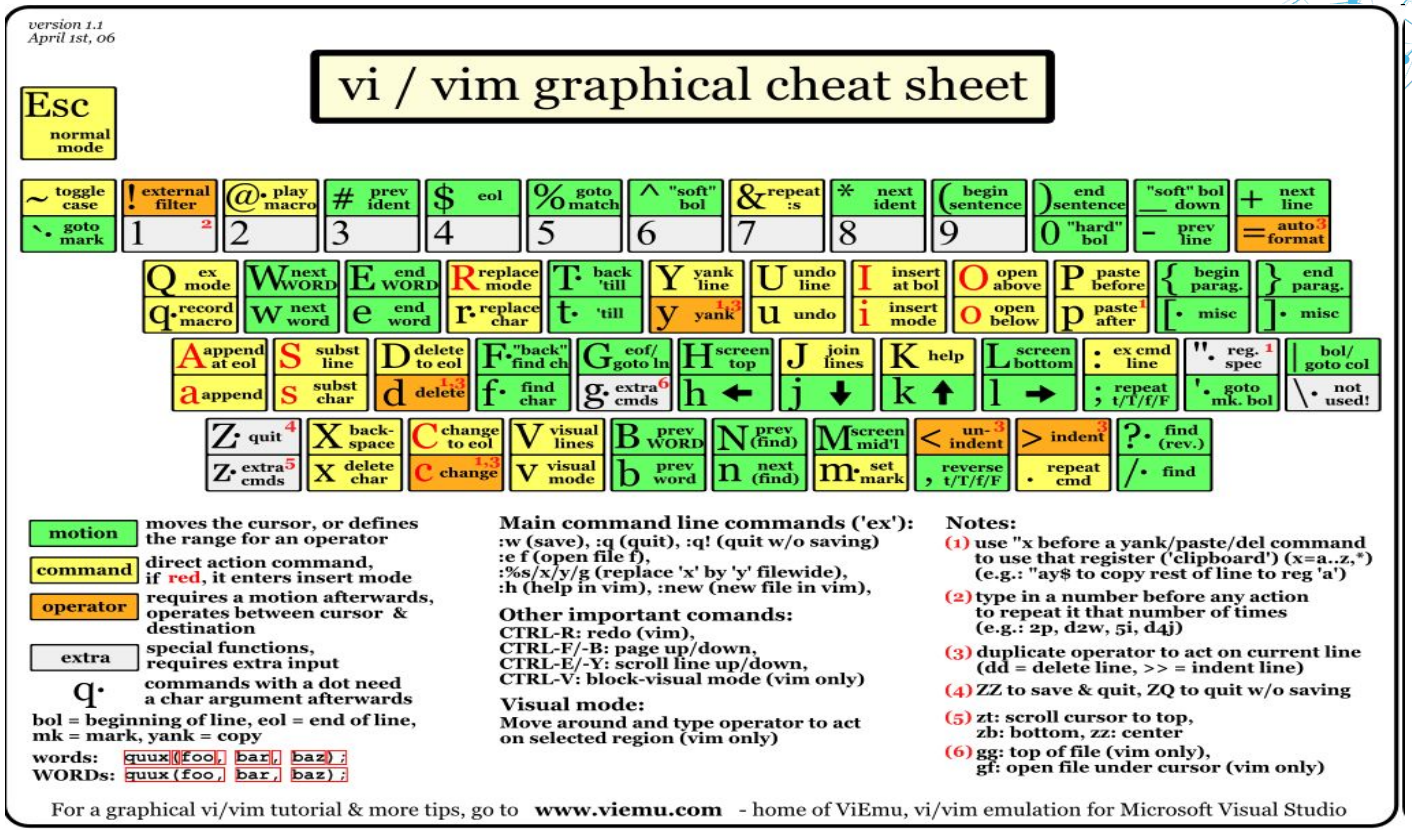


Editing files: The nano Way

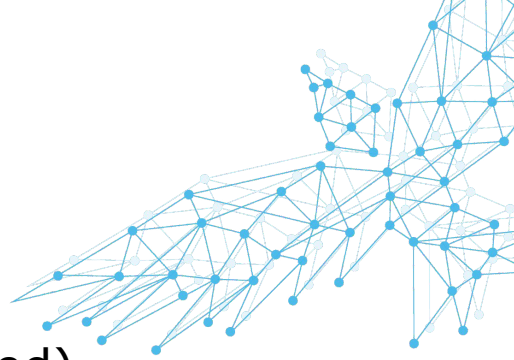
```
nano <filename>
```



Editing files: The Hard Way



Linux and Windows text



End of line differences

- Windows: two characters (carriage return, linefeed)
- Linux and macOS: one character (linefeed)

This may sometimes give you problems

- Tools dos2unix & unix2dos can convert text if necessary

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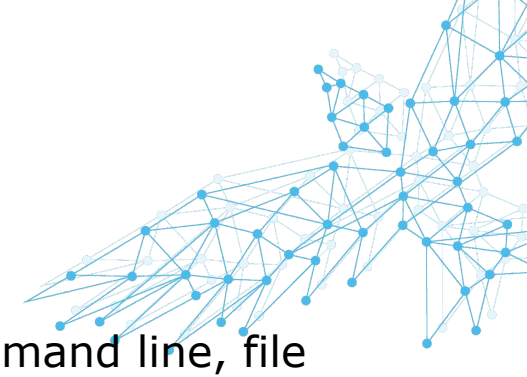
Part II

CIT Academy

Using the Peregrine cluster

Fokke Dijkstra
Bob Dröge
Cristian Marocico

General Introduction



- Course aimed at beginners
  - This part assumes knowledge about the Linux command line, file transfers and editing files

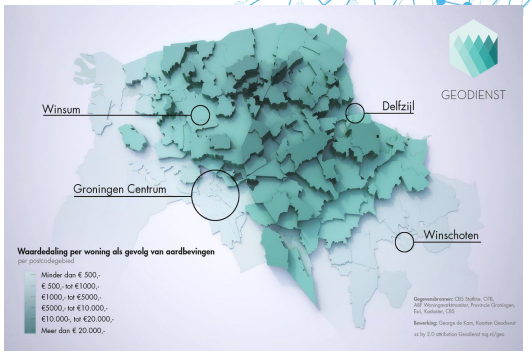
- Topics – Part II
  - What is a cluster
  - Cluster storage
  - Module environment
  - Submitting jobs

Research and Innovation Support

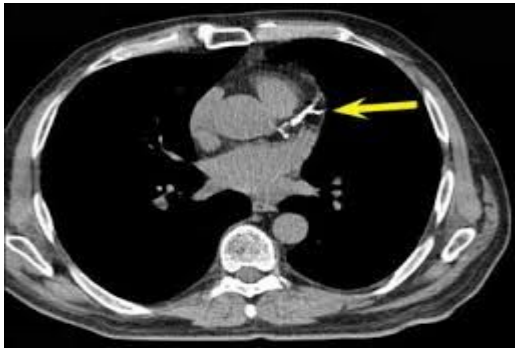
HPC Facilities

Visualization

Geo Services



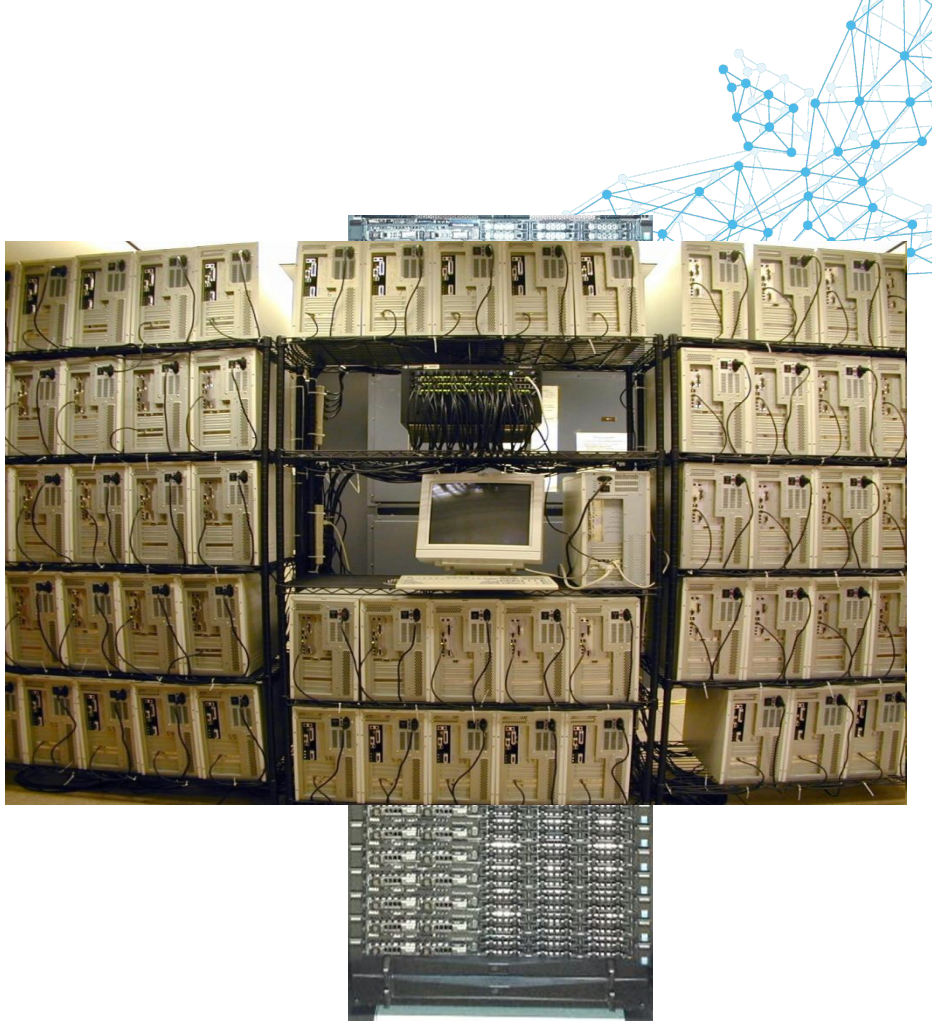
Data Science



Research Support

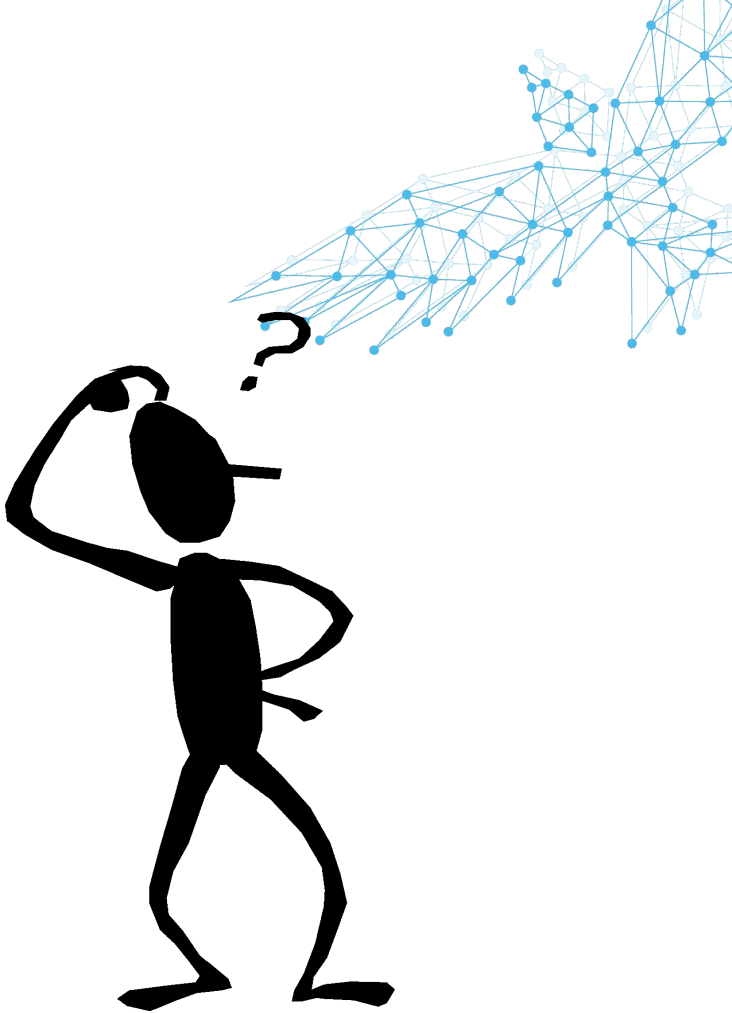
Computer Cluster

- A collection of computers connected by a network
- A single front-end
- Lots of computers in the background for running tasks
- 1994 first cluster of commodity PCs at NASA



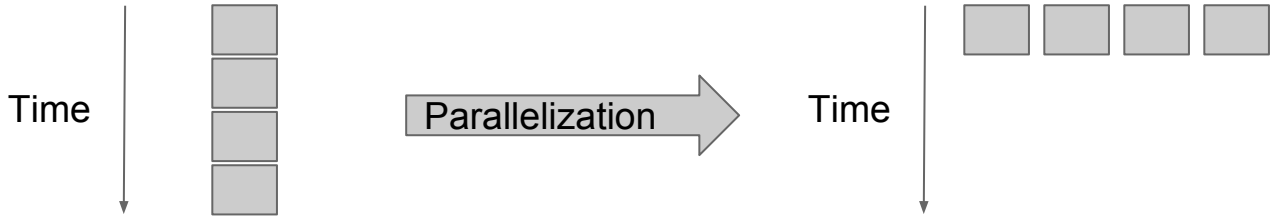
- Peregrine cluster today
- Most clusters run on Linux

What can it do for me?

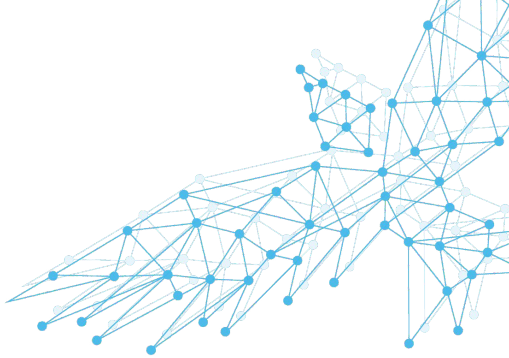


General Use Cases

- Long-running calculations
- Parallel calculations
- Many calculations



What do I need for access?

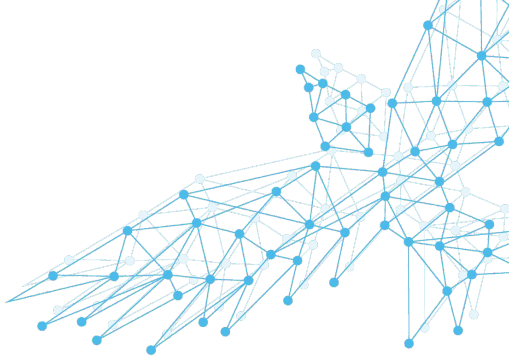


- University P/S/F account and password
- Request Peregrine account
  - Undergraduate students through supervisor/teacher
  - Provide contact details and short description of planned use

- Hostname login node: **peregrine.hpc.rug.nl**
- Interactive node**: pg-interactive.hpc.rug.nl**

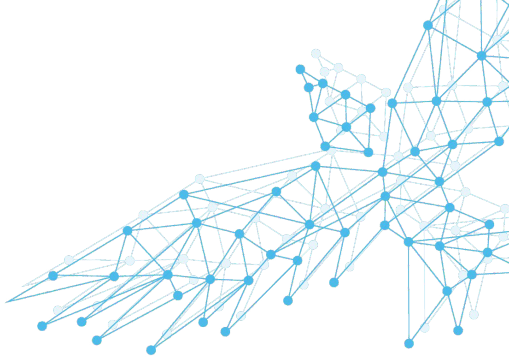
- SSH protocol used to connect to the cluster
  - Standard encrypted network traffic interface for Unix systems

Necessary tools



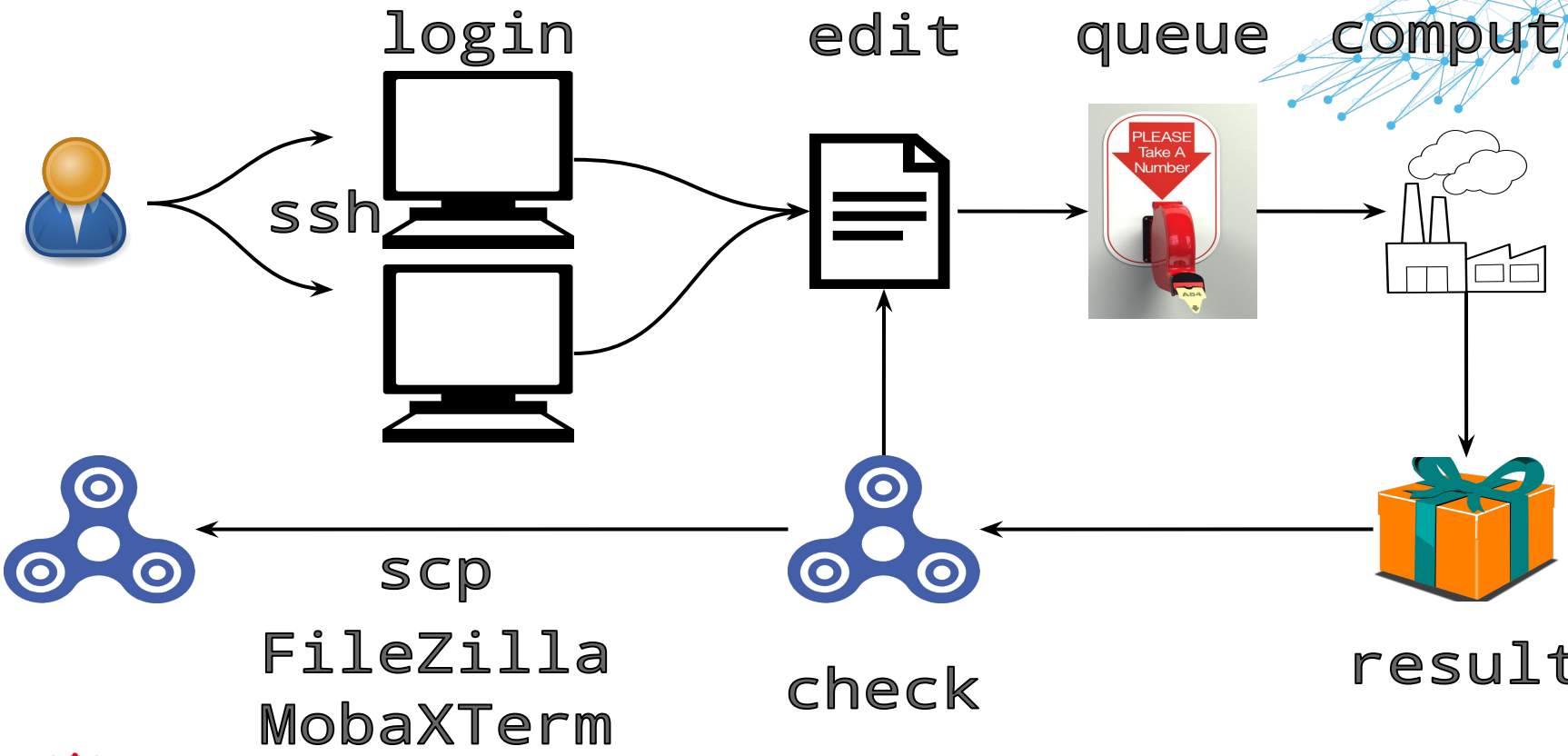
- SSH Client
  - CLI only for bandwidth and batching reasons
  - Windows: MobaXTerm, Putty
    - Freely available for personal use, already installed on UWP
  - Linux and macOS: terminal
- File Transfer Client
  - Windows: MobaXTerm, WinSCP, FileZilla
  - Linux and macOS: FileZilla, scp, sftp, etc.

When can I use Peregrine?



- Applications must be able to run under Linux
  - Compile the application yourself
  - Preinstalled applications
    - MATLAB, R, gromacs, …
  - Run anywhere languages
    - Java, Python, Perl, ….
- No user interaction
- Input/output through files
- No graphical interface

Peregrine: Workflow



Peregrine: Access

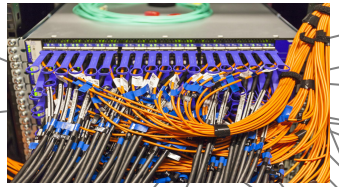
user

Office somewhere

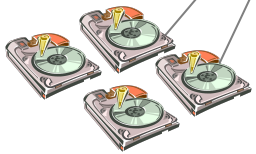
internet

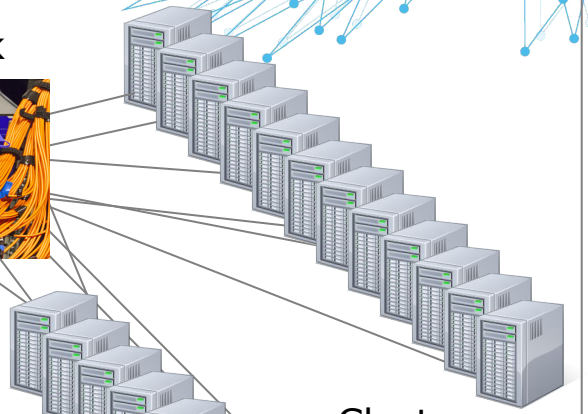
login node

fast network



interactive node





Cluster nodes

DUO

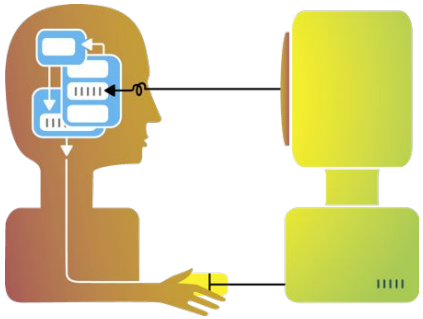
university of groningen / center for information technology

Login node

- Front-end node
  `peregrine.hpc.rug.nl`
- Used for access to the cluster
  - Login
  - Data transfers
  - Job submission
  - Editing & Compiling programs
  - (Very) small tests

Interactive node

- Interactive node: `pg-interactive.hpc.rug.nl`
- Used for access to the cluster
  - Testing and porting software
  - Data transfers
  - Job submission
  - Editing & Compiling programs
- Shared machine, be careful about what you do!



Compute nodes

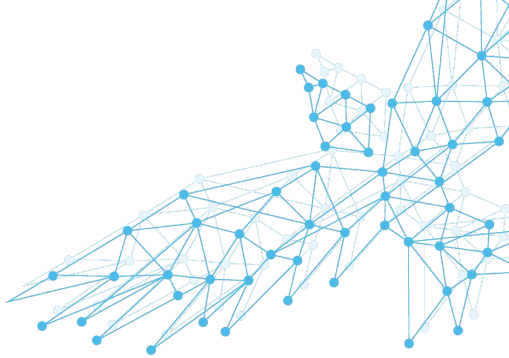
	CPU	Memory	Internal disk	Network	Accelerator
159 Regular nodes	2x Intel Xeon E5 2680v3: 24 cores @ 2.5 GHz	128 GB	1 TB	56 Gbps Infiniband + 10 Gbps ethernet	-
48 Regular nodes extra	2x Intel Xeon E5 2680v4: 28 cores @ 2.4 GHz	128 GB		56 Gbps Infiniband	
6 GPU nodes	2x Intel Xeon E5 2680v3: 24 cores @ 2.5 GHz	128 GB	1 TB	10 Gbps ethernet	2x Nvidia K40
7 Big memory nodes	4x Intel Xeon E7 4860v2: 48 cores @ 2.6 GHz	1024 or 2048 GB	1 TB	56 Gbps Infiniband, 10 Gbps ethernet	-
Standard desktop PC	~4-8 cores	~4-16GB	~1 TB	1 Gbps ethernet	Desktop GPU

5640 CPU cores, 34560 CUDA cores

Storage

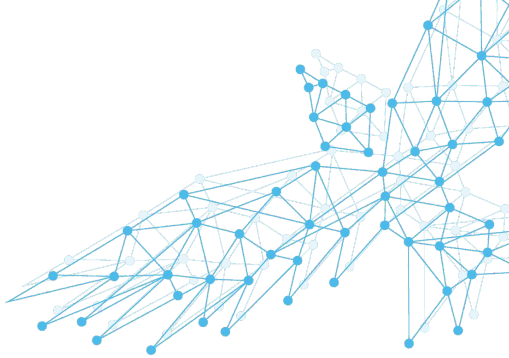
File system	Space	Quota	Backup	Shared	Cleanup	Use case
/home	26 TB	20 GB	yes	yes	No	Programs Code Small data sets
/data	283 TB	250 GB	no	yes	No	Large reused data sets
/scratch	308 TB	50 TB	no	yes	Yes, 30 days retention	Temporary data shared between nodes
/local	1 TB	-	no	per node	Yes, automatically after job	Temporary data for single node

Available Software: modules



- Only a few applications available at login
- Vast majority installed as pluggable modules
- Available through the module command:
  - `module [<OPTS>] <sub-com> [<ARGS >...]`
- sub-commands:
  - `help, avail, spider, list`
  - `load/add, unload/del, purge`
  - `save, restore`
- Don’t be afraid to use man module

The `module` system

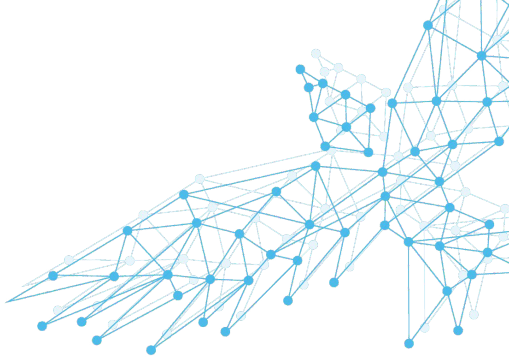


- Software built using toolchains:
  - foss (free and open-source software):
    - GNU compilers, OpenMPI, OpenBLAS, Lapack, FFTW, CUDA
  - intel:
    - Intel compilers, MKL, Intel MPI
- Module name contains name of toolchain used
- Dependencies automatically loaded

Module examples (1)

```
> module avail
...
-------------------------------- /software/modules/bio ------------------------
   ABCtoolbox/1.0
   ABySS/1.9.0-foss-2016a
   ADMIXTURE/1.3.0
   BCFtools/1.3-foss-2016a
   BEDTools/2.23.0-foss-2016a
   BEDTools/2.25.0-foss-2016a                              (D)
...
-------------------------------- /software/modules/math -----------------------
   CPLEX/12.6.2
   Eigen/3.2.3-foss-2016a
...

> bedtools
-bash: bedtools: command not found
> module add BEDTools/2.25.0-foss-2016a
> bedtools --version
bedtools v2.25.0
```

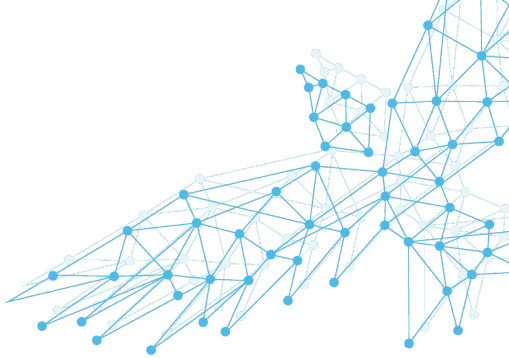
Module examples (2)



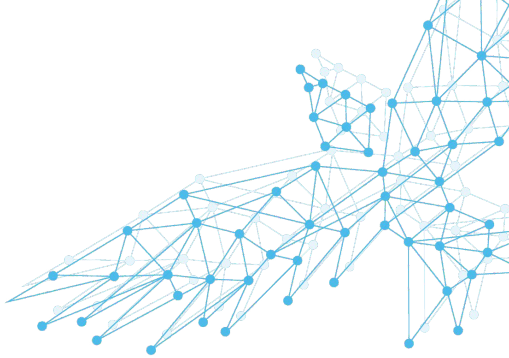
```
> module list
Currently Loaded Modules:
      1) GCCcore/4.9.3
      2) binutils/2.25-GCCcore-4.9.3
      3) GCC/4.9.3-2.2
      ....
      9) FFTW/3.3.4-gompi-2016a
     10) ScaLAPACK/2.0.2-gompi-2016a-OpenBLAS-0.2.15-LAPACK-3.6.0
     11) foss/2016a
     12) BEDTools/2.25.0-foss-2016a
> module del BEDTools
> module list
Currently Loaded Modules:
      1) GCCcore/4.9.3
      2) binutils/2.25-GCCcore-4.9.3
      3) GCC/4.9.3-2.25
      ....
      9) FFTW/3.3.4-gompi-2016a
     10) ScaLAPACK/2.0.2-gompi-2016a-OpenBLAS-0.2.15-LAPACK-3.6.0
     11) foss/2016a
```

Module examples (3)

```
> module purge
> module list
No modules loaded
```



Installation of new software

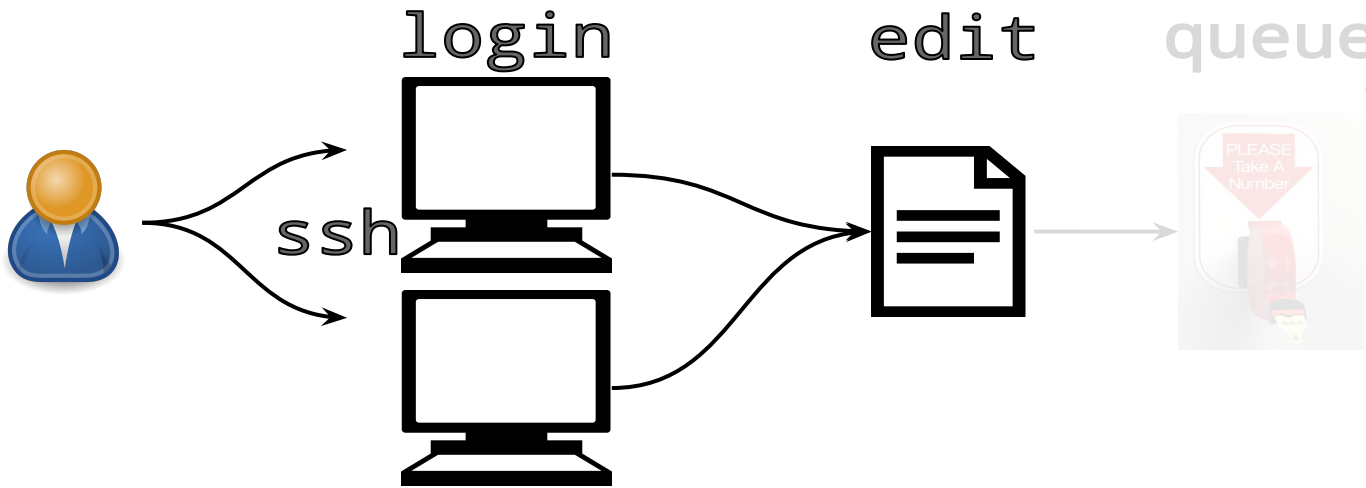


- Into your own home directory:
  + Keep control over the software yourself
  + No special privileges required
  – Cannot be used by other users (unless you grant permission)

- Into a new module:
  + Can be used by other users
  – Installation requires special privileges

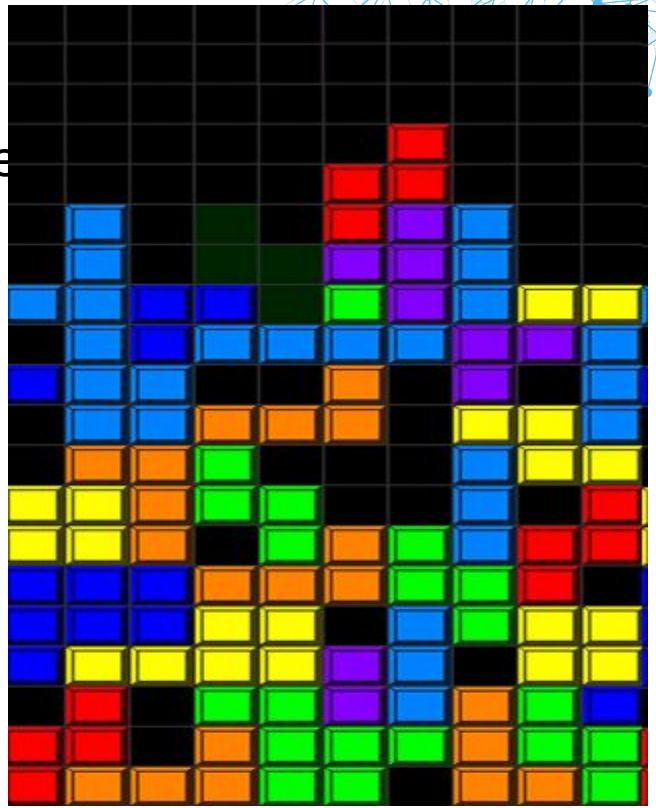
  Contact us, see “Support” slide

Peregrine: Workflow



Peregrine: Queuing (Scheduling)

- Users write job descriptions
- Scheduler finds matching resource
- Scheduler tries to make optimal use of the
- No resources: wait in a queue
- Priority determined by usage of system in
- SLURM: http://slurm.schedmd.com
  - Scheduler
  - Resource manager



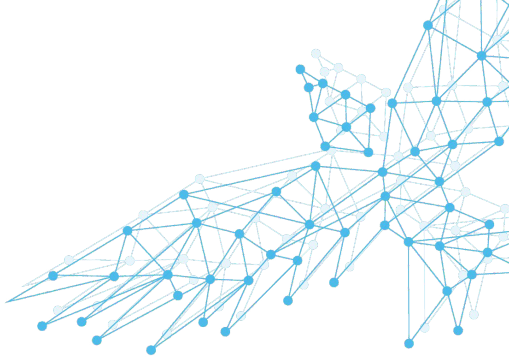
slurm
workload manager

Scheduler: partitions

- Only about half of the cluster's capacity can be used for long jobs (> 3 days)

	Name	Max walltime	Max # jobs per user
Regular nodes	regular (default)	10 days	<= 3 days: 4000 > 3 days: 1000
Big memory	himem	10 days	<= 3 days: 400 > 3 days: 100
GPU	gpu	3 days	<= 1 day: 400 > 1 day: 100
Short	short	30 minutes	1000

Job scripts



- Tells the system what you want to do
- Anatomy of a job script:
  - First line always points to the right interpreter that will run your script
    `#!/bin/bash`
  - Includes requirements needed to be able to run it:
    Memory, no. of nodes/cores, running time, etc.
  - List of steps / commands to run

Anatomy of a job script

- Tells the system what you want to do

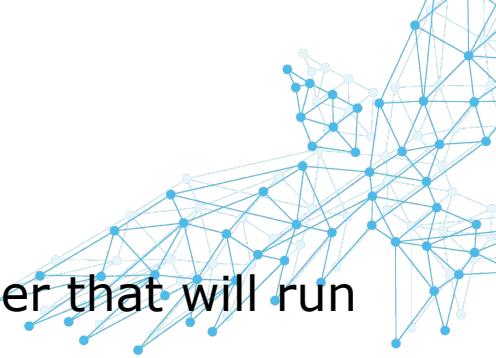
```
#!/bin/bash
#SBATCH --job-name=R_job
#SBATCH --time=00:01:00
#SBATCH --cpus-per-task=1
#SBATCH --mem=1000
#SBATCH --partition=short

pwd
module load R/3.3.1-foss-2016a
module list
Rscript myscript.r
```

Shebang!

Requirements

Commands

Job scripts: Shebang!



- First line should always point to the right interpreter that will run your script
  - Examples:

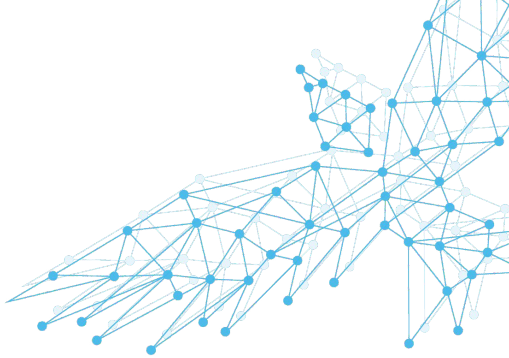
    ```
    #!/bin/bash
    #!/usr/bin/env python
    ```

Job scripts: requirements/options

- Can be put in job script using lines that start with `#SBATCH`
- These lines should be at the top of the script, right after the `#!/bin/bash` line!

```
#!/bin/bash
#SBATCH <some_requirement>
#SBATCH <another_requirement>
#SBATCH <option>
```

Job scripts: requirements/options



- Wall clock time

```
#SBATCH --time=<days-hh:mm:ss>
#SBATCH --time=12:00:00
#SBATCH --time=3-12:00:00
```

- Choose a specific partition:

```
#SBATCH --partition=<name>
#SBATCH --partition=himem
```

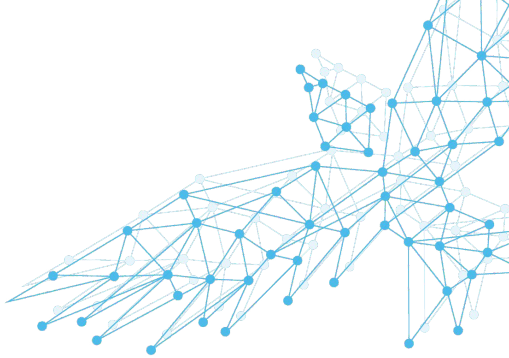
Job requirements: Cores/nodes

- The default is: one core on one node per job
- Requesting more resources only makes sense if your application supports it!

- For applications that support multithreading you can request more cores on a single node:
  - `#SBATCH --cpus-per-task=<N>`

- For MPI applications you can request more nodes:
  - `#SBATCH --nodes=<X>`
  - `#SBATCH --ntasks-per-node=<Y>`
  - X*Y should match the total number of MPI processes

Job requirements: Memory



- Memory requirements can be specified using:

  `#SBATCH --mem=<n>`

  <n> is the total amount of memory per node (!) in MB

  or:

  `#SBATCH --mem-per-cpu=<n>`

  <n> is the amount of memory per CPU core in MB

- Suffix K or KB, M or MB, G or GB, T or TB for other units
- Default memory limit: 2000MB per core
- **Exceeding the limit will kill your application/job**

Job properties

- Also using #SBATCH lines or on the command line
- Name of the job

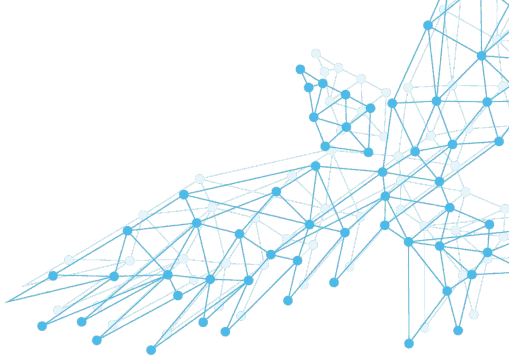
```
#SBATCH --job-name=<name>
```

- Name of the output file of the job

```
#SBATCH --output=<filename>
```

  - Default is: slurm-<jobid>.out
- Email notifications and more: see wiki:
  - https://redmine.hpc.rug.nl/redmine/projects/peregrine/wiki

Job scripts: Steps/commands



- Contains Linux commands
  - `cd`, `mkdir`, etc.
- Run some application

```
pwd
module load R/3.3.1-foss-2016a
module list
Rscript myscript.r
```

Job scripts: Full example

- Tells the system what you want to do

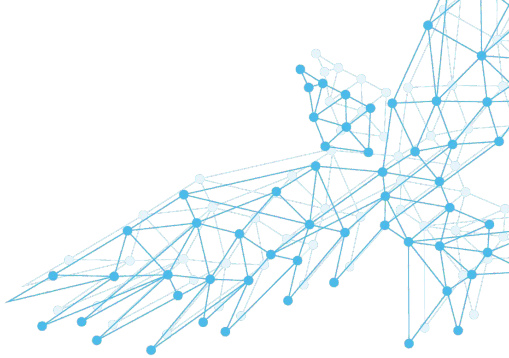
```
#!/bin/bash
#SBATCH --job-name=R_job
#SBATCH --time=00:01:00
#SBATCH --cpus-per-task=1
#SBATCH --mem=1000
#SBATCH --partition=short

pwd
module load R/3.3.1-foss-2016a
module list
Rscript myscript.r
```

Shebang!

Requirements

Commands

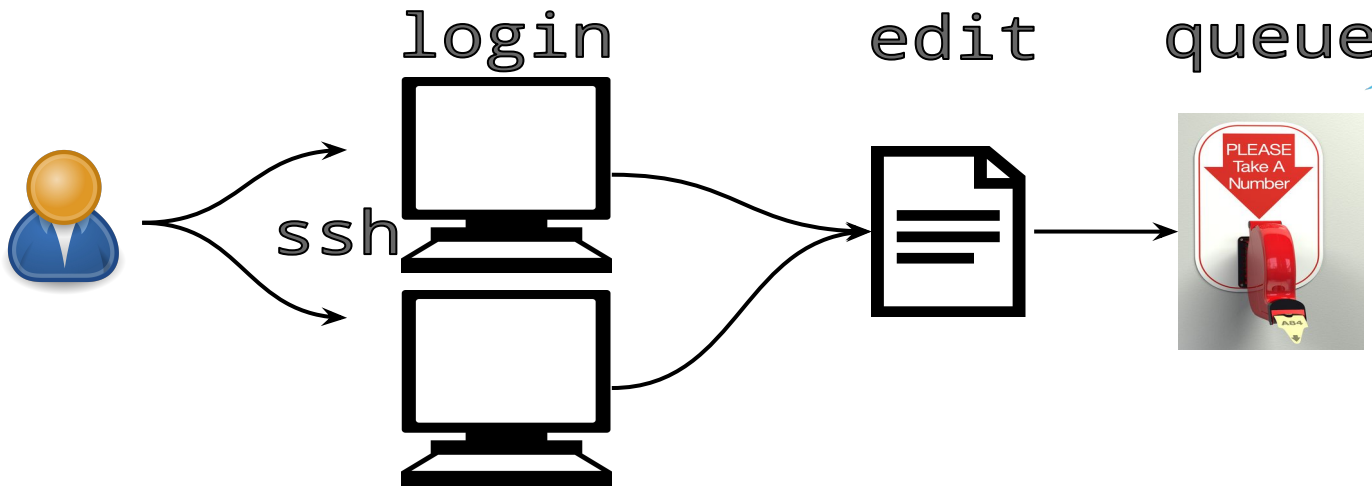
Job scripts: Environment variables



`$HOME`	Your home directory
`$USER`	Your username
`$SCRATCHDIR`	Temporary directory created for your job on `/scratch`. Removed after your job has finished!
`$TMPDIR`	Temporary directory created for your job on `/local`. Removed after your job has finished!
`$SLURM_JOB_ID`	Id of job, useful for creating unique files or directories for a job i

...

Peregrine: Workflow



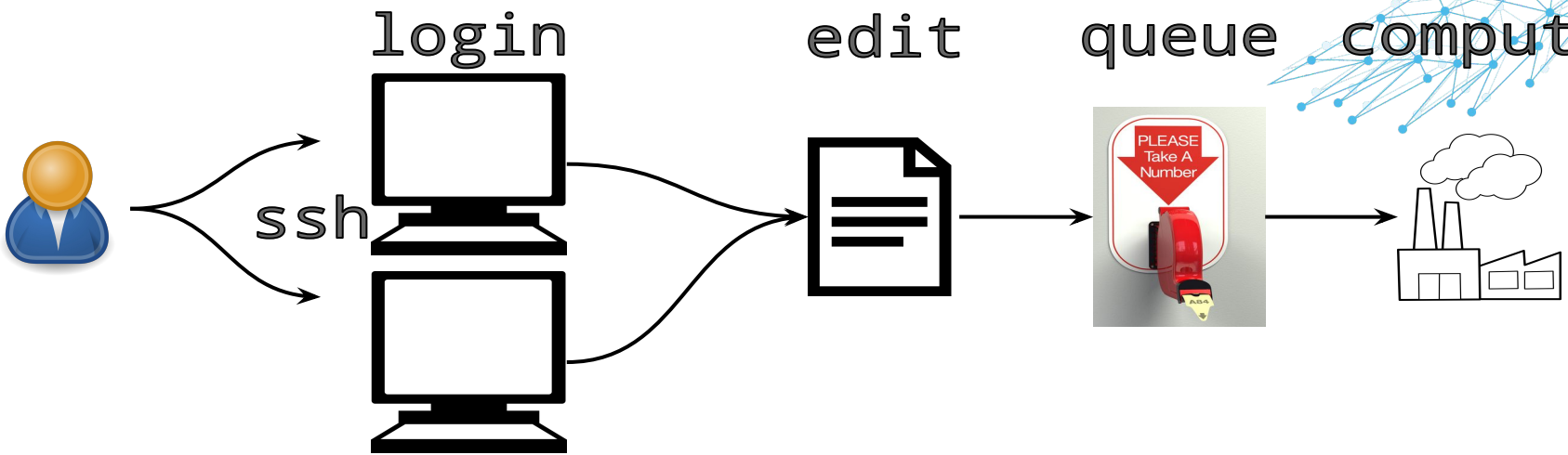
Submitting jobs

- At the command line:
  `sbatch <jobscript>`

```
sbatch testjob.sh
Submitted batch job 2865
```

- Job will start in the directory from which it was submitted
- Your complete environment will be transferred to the job; this includes all loaded modules.
  - But we recommend to load the required modules in your jobscript

Peregrine: Workflow

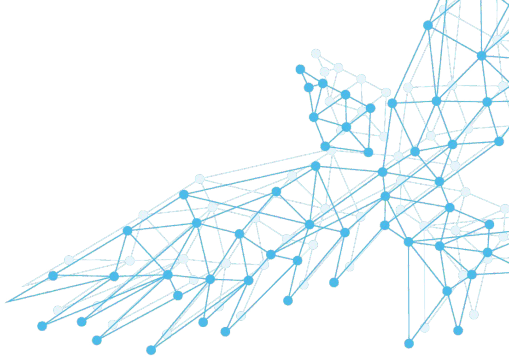


Checking job status (1)

- At the command line
  `squeue [<OPTIONS>] [<ARGUMENTS>]`

```
JOBID PARTITION     NAME     USER ST       TIME  NODES NODELIST(REASON)
 4983     nodes  testjob  p456789 PD       0:00     20 (Resources)
 4984     nodes  testjob  p456789 PD       0:00     20 (Priority)
 4985     nodes  testjob  p456789 PD       0:00     20 (Priority)
 4986     nodes  testjob  p456789 PD       0:00     20 (Priority)
 4987     nodes  testjob  p456789 PD       0:00     20 (Priority)
 4978     nodes  testjob  p456789  R       0:01     20 pg-node[041-060]
 4979     nodes  testjob  p456789  R       0:01     20 pg-node[061-080]
 4980     nodes  testjob  p456789  R       0:01     20 pg-node[081-100]
 4981     nodes  testjob  p456789  R       0:01     20 pg-node[101-120]
 4982     nodes  testjob  p456789  R       0:01     20 pg-node[121-140]
 4976     nodes  testjob  p456789  R       0:04     20 pg-node[001-020]
 4977     nodes  testjob  p456789  R       0:04     20 pg-node[021-040]
```

Checking job status (2)



```
squeue -u p456789

     JOBID   PARTITION     NAME       USER     ST  TIME  NODES   NODELIST(REASON)
     3018    nodes         hpl.128.   p456789  R   3:26    128   pg-node[001-120,122-129]
```

Status:

PD: pending

R: running

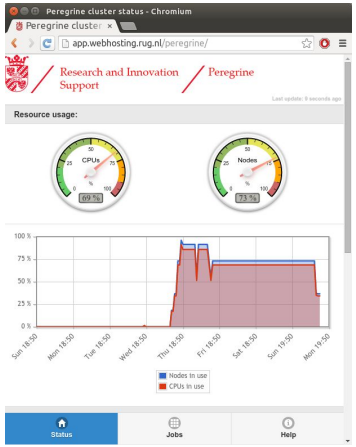
Checking job status (3)

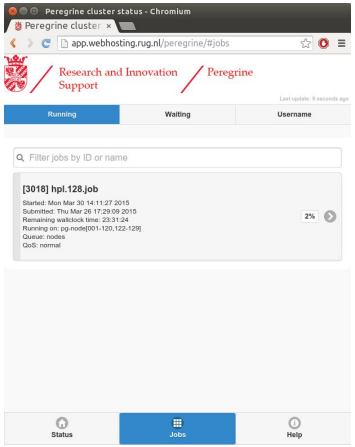
- More information about a particular job, including accounting information: `jobinfo <jobid>`
- Works for completed, running and waiting jobs
- Also written to job's output file

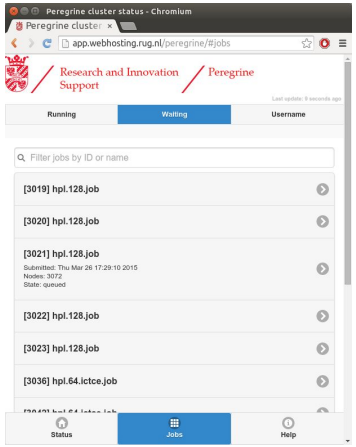
```
> jobinfo 999999
Name                : 4A6T_2-lpAs201a-V
User                : p123456
Partition           : nodes
Nodes               : pg-node096
Cores               : 16
State               : COMPLETED
Submit              : 2015-10-01T10:36:05
Start               : 2015-10-01T11:15:28
End                 : 2015-10-01T12:03:38
Reserved walltime   : 02:00:00
Used walltime       : 00:48:10
Used CPU time       : 06:25:37
% User (Computation): 99.53%
% System (I/O)      :  0.47%
Mem reserved        : 2000M/core
Max Mem used        : 22.57M (pg-node096)
Max Disk Write      : 28.00M (pg-node096)
Max Disk Read       : 26.00M (pg-node096)
```

Checking job status: web app

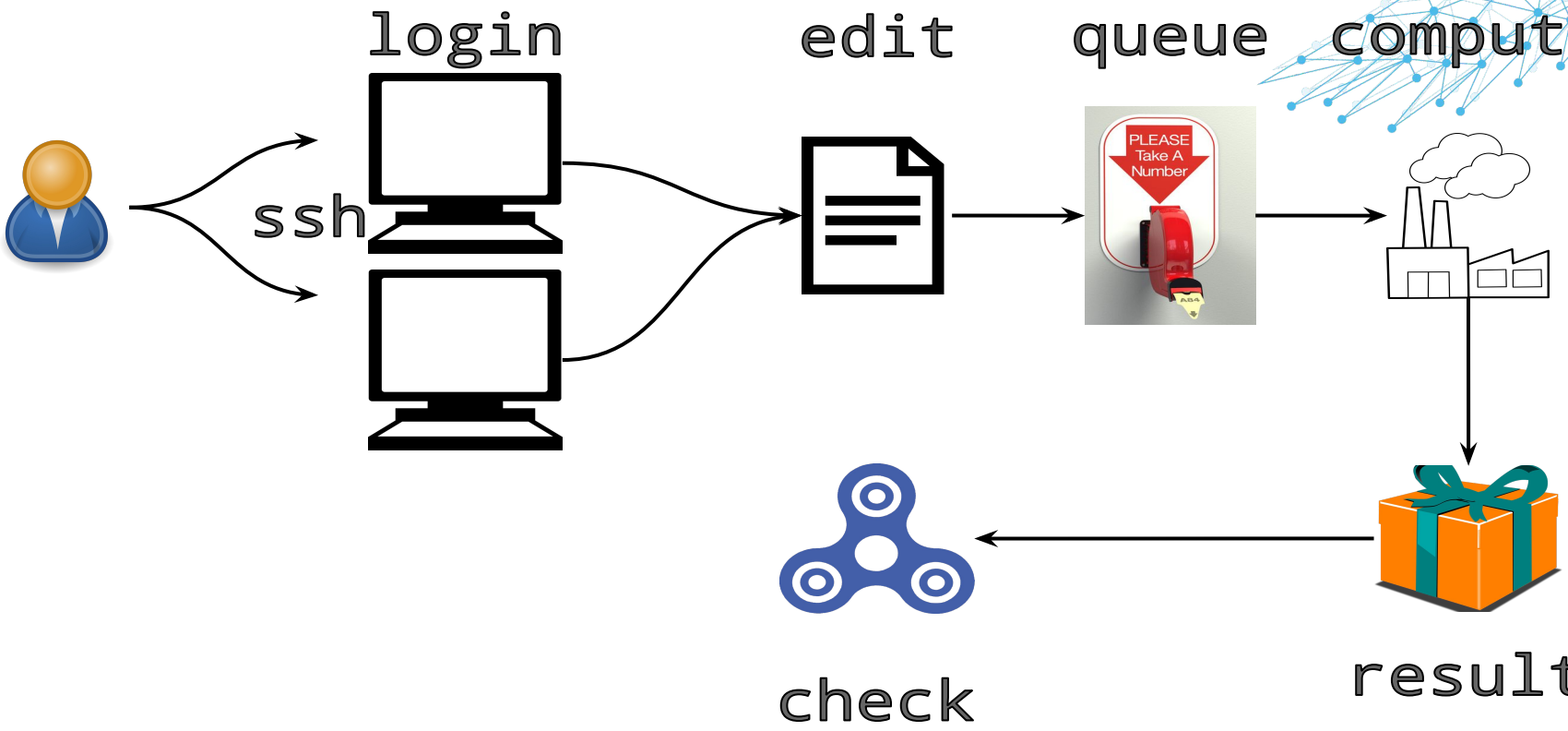
- http://app.webhosting.rug.nl
- Monitor cluster status and usage
- Monitor job status, progress and information
- Intended for smartphones, but also works on desktop
- Also available as MyUniversity widget







Peregrine: Workflow



Checking the results

- Unless specified otherwise, output file is written to same directory as from which the job was submitted
  - `slurm-<jobid>.out`, e.g. `slurm-123456.out`
- Created when job starts running
- While job is running, new output gets appended
- At the end, some job information is printed to the file (including jobinfo output)

- If the job has disappeared from squeue, it has finished

Oops, I didn’t want to run that!

- At the command line:
  `scancel <jobid>`

```
> sbatch testjob.sh
Submitted batch job 2870

> squeue -u p123456
JOBID PARTITION     NAME     USER     ST  TIME  NODES    NODELIST(REASON)
2870  nodes         testjob  p123456  R   0:03      1    pg-node021

> scancel 2870
```

- Cancel multiple jobs at once:
  `> scancel --state=PENDING --partition=short`

Another example

- A job script that runs Matlab code:

```
#!/bin/bash
#SBATCH --job-name=matlab_job
#SBATCH --time=00:02:00
#SBATCH --cpus-per-task=1
#SBATCH --mem=1000
#SBATCH --partition=short

module load MATLAB/2016b-GCC-4.9.3-2.25
module list
matlab -nodisplay -r mycode
```

Code in file mycode.m

Support

- Email support: hpc@rug.nl
- Online documentation and account request form:
  - https://redmine.hpc.rug.nl/redmine/projects/peregrine/wiki
- Comments and questions are always welcome

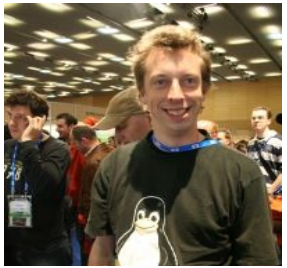
Useful links

- Online lessons about the Linux shell (and other topics): https://software-carpentry.org/lessons/
- Introduction to Linux by Machteld Garrels: http://tldp.org/LDP/intro-linux/html/index.html
- Bash shell guide by Machteld Garrels: http://tldp.org/LDP/Bash-Beginners-Guide/html/index.html
-
- Documentation and more details about SLURM: http://slurm.schedmd.com
- Online manual pages for all SLURM commands: http://slurm.schedmd.com/man_index.html

Peregrine team

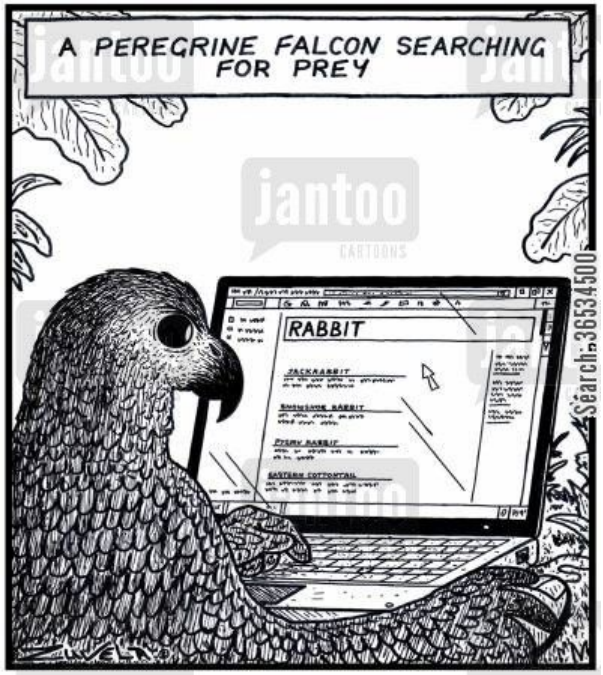
Fokke Dijkstra, Niels Idsinga, Ger Strikwerda, Robin Teeninga, Bob Dröge, Wim Nap, Laurent Jensma, Henk-Jan Zilverberg

Cristian Marocico



Wietze Albers

Questions?



http://www.jantoo.com/cartoon/36534500