



Introduction to VSC Tier-1 Hortense

EMBL hackathon - 2 December 2024

Documentation & support



Vlaanderen
is supercomputing

- Extensive documentation available at
docs.vscentrum.be/gent/tier1_hortense.html
- Setup and configuration of VSC Tier-1 Hortense is very similar to HPC-UGent Tier-2 infrastructure, so see also docs.hpc.ugent.be
- In case of questions or problems, please contact compute@vscentrum.be

HPC-UGent in a nutshell



- Part of central ICT Department of Ghent University (DICT)
- Our mission:

*HPC-UGent provides centralised **scientific computing** services, training, and support for researchers from Ghent University, industry, and other knowledge institutes.*

- Our core values:
Empowerment - Centralisation - Automation - Collaboration

Centralised hardware in UGent datacenter (S10 @ Sterre)



Different “tiers” of supercomputers

VSC Tier-1 *Hortense*

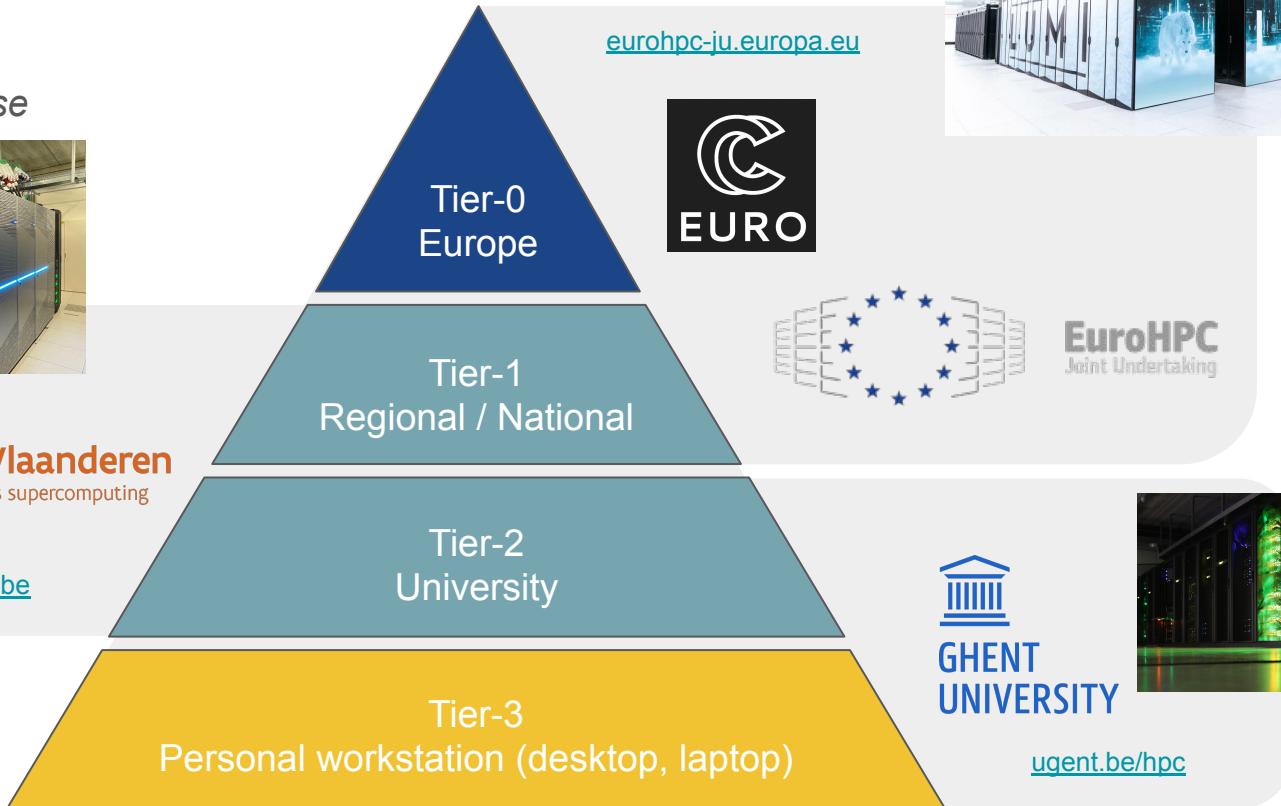


VLAAMS
SUPERCOMPUTER
CENTRUM



Vlaanderen
is supercomputing

vscentrum.be



ugent.be/hpc

VSC Tier-2 infrastructure

- You can use your VSC account to access HPC infrastructure provided by other VSC hubs
- Your `$VSC_HOME` and `$VSC_DATA` directories are available on each of these systems



VSC Tier-1 compute cluster “Hortense”

(a.k.a. `dodrio`)

compute@vscentrum.be

- Hosted, operated, and supported by HPC-UGent team since 2021
- 2x 384 CPU-only nodes (128-core AMD Rome or Milan CPUs) + 40 GPU nodes (4x NVIDIA A100)
- **Over 100,000 CPU cores in total!**
- High-speed Infiniband network (HDR-100) + 6PB of dedicated scratch storage



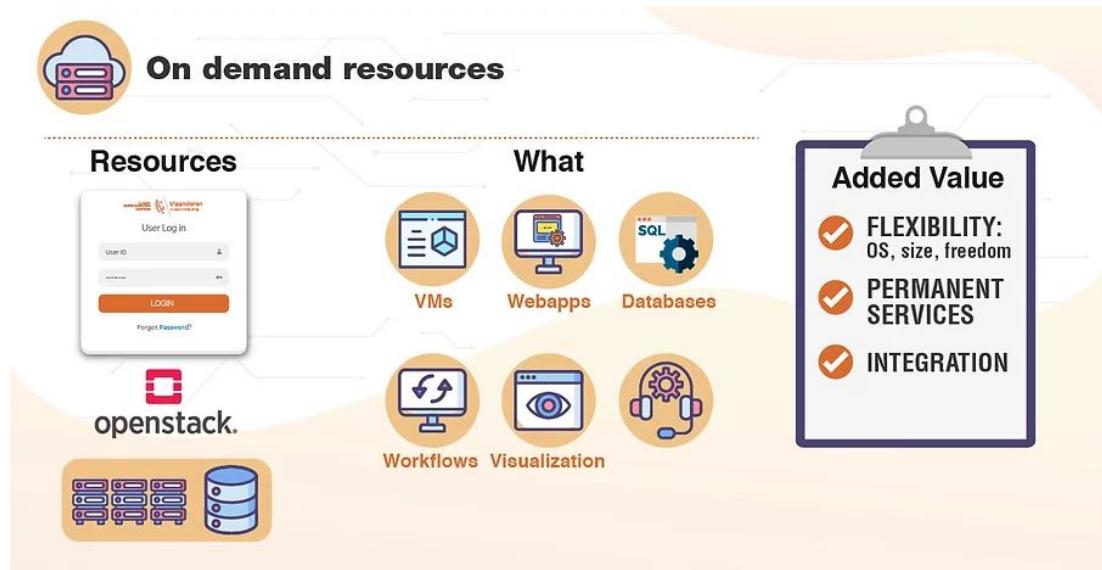
- **Project-based access** (free of charge, funded by FWO)
- 3 cut-off dates per year for submitting project proposals
- Project duration is typically 8 months
- 500k - 5M core hours (CPU-only) or 1k - 25k GPU hours

vscentrum.be/compute

docs.vscentrum.be/en/latest/gent/tier1_hortense.html

VSC Tier-1 cloud

- Project-based access
- Free of charge
- Self-managed virtual machines
- For use cases that are not a good fit for compute clusters
- More info: vscentrum.be/cloud
- Contact: cloud@vscentrum.be



Managing your VSC account



You can manage your VSC account via the VSC account page

account.vscentrum.be

Can be used to join/leave user groups, consult storage usage, request more storage quota, ...
manage your Virtual Organisation (VO), ...

The screenshot shows a web browser window titled "View account – VSC". The address bar displays the URL <https://account.vscentrum.be/django/>. The page header includes the Vlaams Supercomputer Centrum logo and the text "Vlaanderen is supercomputing". Below the header is a navigation menu with ten items: View Account, Edit Account, View Groups, New/Join Group, Edit Group, New/Join VO, View VO, Edit VO, Reservations, and Log Out. The "View Account" item is highlighted with a blue underline. The main content area is titled "View account" and contains a section titled "General information" with a yellow horizontal bar underneath. At the bottom of the page, there is footer text: "Uid: vsc40023" and "Institute: Gent".

High-level overview of VSC Tier-1 Hortense

Getting access

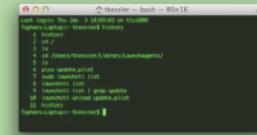


<https://login.hpc.ugent.be>

Web Portal (No SSH key required)



ssh tier1.hpc.ugent.be
Terminal (requires SSH key)



OR

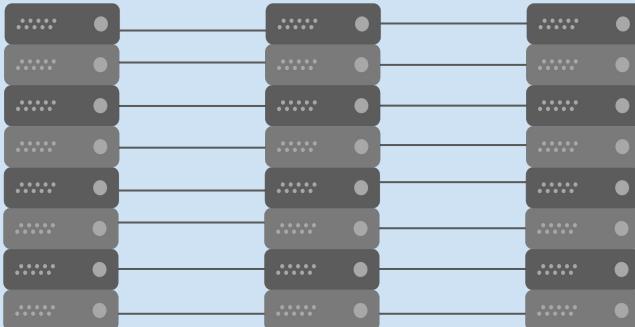
Login nodes



login55 or login56

File system

Compute nodes (where your jobs will run)



Data



Home



Data



Tier-1 scratch

Option 1: Connecting to VSC Tier-1 Hortense login nodes with SSH

```
$ ssh vsc40023@login.hpc.ugent.be
STEVIN HPC-UGent infrastructure status on Thu, 17 Nov 2022 20:30:01
cluster - full - free - part - total - running - queued
nodes nodes free nodes jobs jobs
-----
slaking      0    6    2   18      3     4
swallowt    19    0   94  118  1659  1172
skitty       33    0   35   72  1391   439
victini      7    0   87   96   588  30080
joltik       3    1    6   10     26   833
kirlia       7    0    9   16     23   40
doduo      50    0   67  128  1983  12695
accelgor    6    0    2    9     31   1267

Documentation is available at:
https://www.ugent.be/hpc/en/support/documentation.htm
For a full view of the current loads and queues see:
https://hpc.ugent.be/clusterstate/
Updates on current system status and maintenance can be found on:
https://www.ugent.be/hpc/en/infrastructure/status
To contact the support team, send an email to hpc@ugent.be

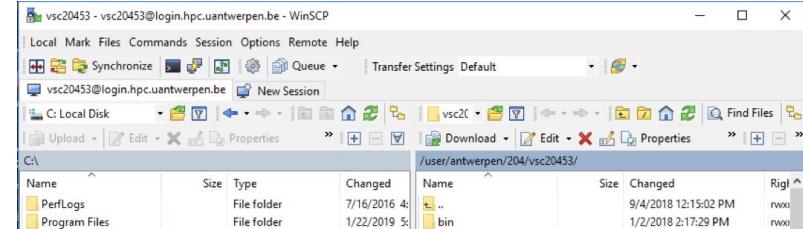
Last login: Thu Nov 17 20:30:34 2022 from 10.141.10.60
[vsc40023@gliigar07 ~]$ [vsc40023@gliigar07 ~]$ hostname
gliigar07.gastly.os
"
```

- See [dedicated section in HPC-UGent documentation](#)
- tier1.hpc.ugent.be
- Requires SSH client + SSH private key
- Windows: PuTTy - macOS/Linux: ssh command

- Transferring files to/from VSC Tier-1 Hortense

- **Done via the login nodes**
- Options:

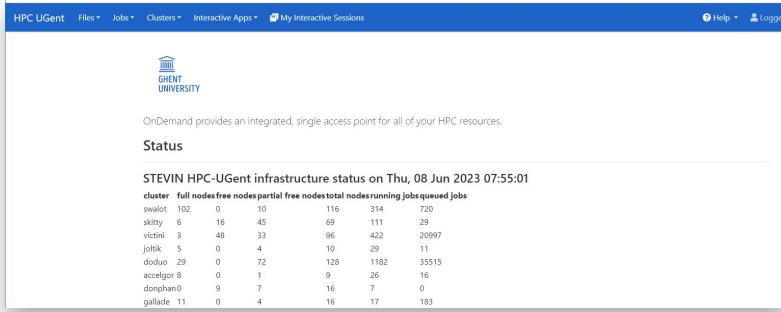
- On Linux or macOS:
 - Using `scp` or `rsync` command in terminal window
 - Using a graphical like the built-in file manager or [Cyberduck](#)



- On Windows: using [WinSCP](#) (left: own system, right: HPC; drag-and-drop)

Option 2: Connecting to VSC Tier-1 Hortense with web portal

Recommended!



The screenshot shows the HPC UGent OnDemand interface. At the top, there's a navigation bar with links for HPC UGent, Files, Jobs, Clusters, Interactive Apps, and My Interactive Sessions. On the right, there are Help and Logged-in user links. Below the navigation is the Ghent University logo. A banner below the logo states: "OnDemand provides an integrated, single access point for all of your HPC resources." Underneath, there's a section titled "STEVIN HPC-UGent infrastructure status on Thu, 08 Jun 2023 07:55:01". It displays a table of cluster statistics:

cluster	full nodes	free nodes	partial free nodes	total nodes	running jobs	queued jobs
swallow	102	0	10	116	314	720
skity	6	16	45	69	111	29
victini	3	48	33	96	422	20997
joltik	5	0	4	10	29	11
doduo	29	0	72	128	1182	35515
aceceptor	8	0	1	9	26	16
donghan0	9	7		16	7	0
gallade	11	0	4	16	17	183

- See [dedicated section of HPC-UGent docs](#)
- <https://tier1.hpc.ugent.be>
- Powered by [Open OnDemand](#)

- **Works with a standard internet browser** (Firefox, Chrome, ...)
- **Does not require SSH key pair** (only login via university account)
- Provides file browser, shell session, desktop environment, interactive apps, ...

Option 2: Using the web portal file browser to view, edit, manage files

Recommended!

1

2

3

4

Creating and editing a file

1. Go to the file manager
2. Create a file
3. Edit file

Type	Name	Size	Modified at
Folder	AlphaFold	-	13/8/2021 16:16:46
Folder	cache	-	22/3/2023 10:10:22
Folder	cvmfs-tutorial-ingest-example-720k-files	-	13/8/2021 16:16:35
Folder	easybuild	-	22/5/2023 13:43:47

Type	Name	Size	Modified at
File	example.txt	-	13/8/2021 16:16:46
File	easybuild_tests	-	22/3/2023 10:10:22
File	example.txt	-	13/8/2021 16:16:35
File	easybuild_tests	-	22/5/2023 13:43:47
File	example.txt	-	7/6/2022 19:52:29

UGent web portal: interactive apps (Jupyter notebook)

1

2

3

4

5

Jupyter Notebook versions

Make sure that the toolchain of the notebook matches the toolchain of the modules that you load, and the kernels and/or virtual environments that you make!

HPC UGent Files Jobs Clusters Interactive Apps My Interactive Sessions

OnDemand provides:

Status

STEVIN HPC-UG

cluster	full nodes	free nodes	running jobs	queued jobs
skitty	2		74	2
joltik	4		9	76
doduo	39		996	5376
accelgor	6		21	5082
donphan	0	1	14	16
gallade	3	0	9	16
shinx	3	0	43	48
			351	811

Interactive Apps

Jupyter Notebook

This app will launch a Jupyter Notebook server on one or more nodes.

Cluster

donphan (interactive/debug)

Time (hours)

1 hour

Number of nodes

1 node

Number of cores (and default memory) per node

1 core (3.3 GiB mem)

JupyterNotebook version

7.2.0 GGCcore 13.2.0

Launch

* The Jupyter IPython Notebook session data for this session can be accessed under the data root directory.

Jupyter IPython Notebook (cluster/donphan-20004994)

Queued

Created at: 2023-06-07 14:51:43 CEST

Time Requested: 12 hours

Session ID: dd4a26c3-a09e-44f3-b8a4-a558a99bdfc9

Please be patient... Your job currently sits in queue. The wait time depends on the number of cores as well as time requested.

Jupyter IPython Notebook (cluster/donphan-20004994)

1 node | 4 cores | Starting

Created at: 2023-06-07 14:51:43 CEST

Time Remaining: 11 hours and 59 minutes

Session ID: dd4a26c3-a09e-44f3-b8a4-a558a99bdfc9

Your session is currently starting... Please be patient as this process can take a few minutes.

Jupyter IPython Notebook (cluster/donphan-20004994)

1 node | 4 cores | Running

Host: 7_node016.donphan.be

Created at: 2023-06-07 14:51:43 CEST

Time Remaining: 11 hours and 59 minutes

Session ID: dd4a26c3-a09e-44f3-b8a4-a558a99bdfc9

Connect to Jupyter Notebook

jupyter

Files Running Clusters

Select items to perform actions on them

0 examples ondemand

Upload New Name Last Modified File size

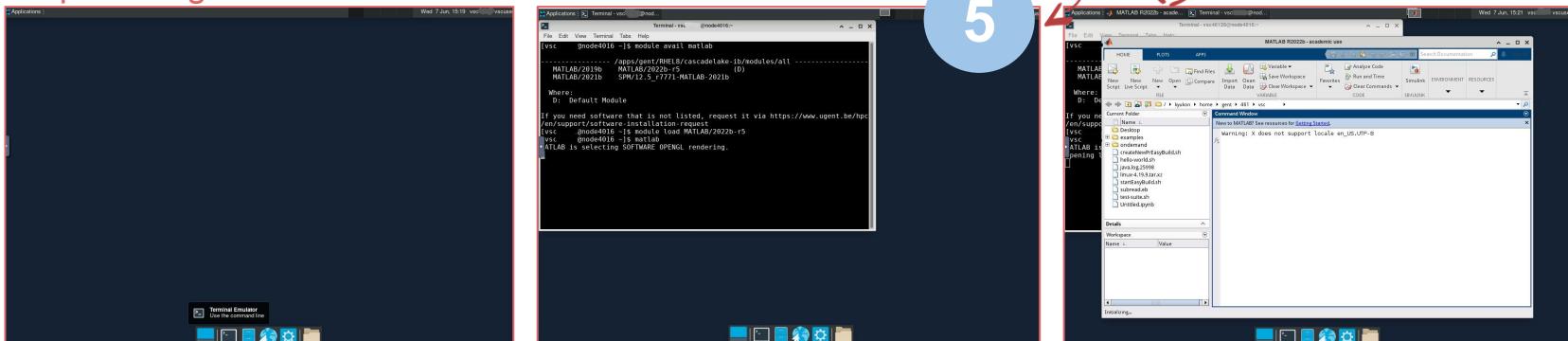
6 days ago 16 minutes ago

UGent web portal: interactive apps (desktop for GUI apps)

The figure illustrates a five-step process for launching an interactive desktop session:

- Step 1:** The "Interactive Apps" page shows a list of available desktop environments. "Cluster Desktop" is highlighted with a red circle and circled by a dashed red arrow pointing to the second step.
- Step 2:** The "Cluster Desktop" configuration page. The "Cluster" dropdown is set to "donphan (interactive/debug)". The "Number of nodes" is set to 1, and "Number of cores per node" is set to 4. The "Launch" button is highlighted with a red circle and circled by a dashed red arrow pointing to the third step.
- Step 3:** The "Cluster Desktop (cluster/donphan-20005003)" session details page. It shows the session was created at 2023-06-07 15:14:59 CEST, has 1 node, 4 cores, and is starting. A red arrow points from the "Starting" status to the fourth step.
- Step 4:** The "Cluster Desktop (cluster/donphan-20005003)" session details page after launch. The session is now running. The "Launch Cluster Desktop" button is highlighted with a red circle and circled by a dashed red arrow pointing to the fifth step.
- Step 5:** The "MATLAB R2022b - academic site" application window, showing the MATLAB interface and workspace.

Example Using MATLAB





Connection restrictions

For security reasons, some connection restrictions have been put in place.

Connecting to VSC Tier-1 Hortense is only possible when if one of the following applies:

- Using a university network (WiFi in UGent building, UGent VPN, ...)
- Using a Belgian commercial internet provider (take this into account when you're travelling!)
- Your IP address has been whitelisted
 - Automatically (and temporary) via the VSC firewall app: <https://firewall.vscentrum.be>
 - By exception (for example for corporate networks)

You need to connect to [the firewall app](#) in new tab and wait up to 30s.

Keep the tab open while you are connected.

GHENT UNIVERSITY

Sign in

Email

Can't access your account?

Back

Next

Authorize hpc-firewall?

Application requires following permissions

- Read scope

Cancel Authorize

(Lara)

Keep this browser tab open!

HPC Firewall

IP Whitelist | Info

Logged on successfully as vsc40023.

109.132.67.206 is granted access since 2022-11-17 20:36:23 [valid until 20:47:26] (will be refreshed).

1234:dead:5678:beef:1234:dead:6789:beef is granted access since 2022-11-17 20:36:24 [valid until 20:47:26] (will be refreshed).

Getting shell access via web portal

1. Click on the 'Clusters' tab

2. Click on Login Shell Access

3. Use the shell environment

OnDemand provides an integrated, single access point for all of your HPC resources.

Status

STEVIN HPC-UGent infrastructure status on Thu, 19 Sep 2024 12:40:02

cluster	full nodes	free nodes	partial nodes	total nodes	running jobs	queued jobs
skirty	2	2	52	68	74	2
joltik	4	0	5	10	9	76
doduo	39	0	65	128	996	5376
accelgor	6	0	0	9	21	5082
donphan	0	1	14	16	14	19
gallade	3	0	9	16	39	132
shinx	3	0	43	48	351	811

Host: gligar08.genty.be

STEVIN HPC-UGent infrastructure status on Thu, 08 Jun 2023 14:00:01

cluster	full nodes	free nodes	partial nodes	total nodes	running jobs	queued jobs
swallow	97	0	15	110	307	640
skitty	5	19	42	69	90	29
victini	10	42	32	96	397	20997
joltik	9	0	0	10	35	38
doduo	23	0	77	128	888	30258
accelgor	9	0	0	9	27	33
donphan	0	6	10	16	10	0
gallade	12	0	3	16	19	180

Documentation is available at:
<https://www.ugent.be/hpc/en/support/documentation.htm>
For a full view of the current loads and queues see:
<https://hpc.ugent.be/clusterstate/>
Updates on current system status and maintenance can be found on:
<https://www.ugent.be/hpc/en/infrastructure/status>
To contact the support team, send an email to hpc@ugent.be

Two new clusters have been added to the HPC-UGent Tier-2 infrastructure:

- * donphan, our new debug/interactive cluster (replacing slaking)
- * gallade, our new large-memory cluster (replacing kirilia)

*** Clusters slaking and kirilia were both retired on Monday 22 May 2023. ***

More information is available via <https://docs.hpc.ugent.be/2023/donphan-gallade>.

Last login: Thu Jun 8 08:54:23 2023 from 10.141.10.142

[vsc @gligar08 ~]\$

Linux command line interface (shell)

- **Linux shell environment** is standard way of using HPC systems
- Involves typing to run shell commands, or using (bash) scripts
- Example commands: ls, cd, mkdir, cp, mv, rm, export, echo, ...
- Commands can be “piped” together to do more complex operations
- May feel archaic, but is actually **very powerful**...
- Same scripting language (bash) is used in job scripts
- **Learning the basics of the Linux shell is strongly recommended!**
- See separate basic Linux tutorial at docs.hpc.ugent.be/linux-tutorial

```
$ mkdir hpc_demo
$ cd hpc_demo
$ ls
$ echo science > results.txt
$ ls -l
total 1
-rw-rw-r-- 1 vsc40023 vsc40023 8 Nov 17 20:57 results.t
$ cat results.txt
science
$ echo $VSC_DATA
/data/gent/400/vsc40023
$ █
```

Submitting and managing jobs on VSC Tier-1 Hortense

- VSC Tier-1 Hortense runs [Slurm](#) as resource manager + job scheduler
- **Torque (PBS) frontend is (still) available and recommended** (via *jobcli* project)
 - `qsub` command to submit jobs, `qdel` command to delete jobs
 - `qstat` command to list queued + running jobs
 - `qalter` command to change jobs (before they start running)
 - `qhold` command to put jobs on hold, `qrsl` to release them again
- Use `--help` option to get list of available options for each command
- Use `--debug` option to get more information about what's going on behind the scenes
- Use `--dryrun` option to inspect what will be done (without actually doing it)

What is a job script?

```
#!/bin/bash  
echo "I am a minimal job script"
```

A job script is (bash) shell script, a text file that includes shell commands, that specifies:

- The **resources** that are required by the calculation
(number of nodes & cores, amount of memory, how much time is required, ...)
- The **software** that is used for the calculation (usually via `module load` commands)
- The steps that should be done to execute the calculation (starting from home dir.),
specified as **shell commands**, typically:
 - 1) Staging in of input files
 - 2) Running the calculation
 - 3) Staging out of results

Required resources are specified via #PBS directives

```
#!/bin/bash

#PBS -N solving_42          # job name
#PBS -l nodes=1:ppn=4        # single-node job, 4 cores
#PBS -l walltime=10:00:00    # max. 10h of wall time
#PBS -l vmem=50gb           # 50GB of (virtual) memory required
# rest of job script goes here ...
```

- Required resources can be specified via #PBS lines in job script
- Or via options to job submission command (`qsub -l ...`)
- **Maximum walltime of jobs on HPC-UGent clusters: 72 hours (3 days)**
- For longer calculations: break it up in shorter jobs, use a different (faster) cluster, use more cores (if software scales), use some form of “checkpointing”, ...

Central software stack via modules [1/2]



- **Scientific software is made available via *environment modules***
- An env. module prepares the environment for using a particular software application
- Module naming scheme: <name>/<version>-<toolchain>[-<suffix>]
- Interacting with module files is done via the `module` command ([Lmod](#))
- Load a module to prepare the session or job environment for using the software:

```
module load SciPy-bundle/2023.07-gfbf-2023a
```

- Modules that are required as dependencies will be loaded automatically
- To see list of currently loaded modules, run `module list` (or `ml`)

Central software stack via modules [2/2]



- To get an overview of *all* available modules, run `module avail` (or `ml av`)
- To see available versions for specific software, run `module avail soft_name/`
- To unload all currently loaded modules, run `module purge`
- Modules are installed using a particular toolchain (`foss`, `intel`, ...), which includes C/C++/Fortran compilers, MPI library, BLAS/LAPACK/FFT libraries
- **You should only combine modules that were installed with the same toolchain**, or a subtoolchain thereof (for example `foss/2023a + GCC/12.3.0`)
- See also [dedicated section in HPC-UGent documentation](#)

Central software stack via modules (example)



```
$ python -V; which python
Python 3.6.8
/usr/bin/python
$ python -c 'import numpy; print(numpy.__version__)'
Traceback (most recent call last):
  File "<string>", line 1, in <module>
ModuleNotFoundError: No module named 'numpy'

$ module load SciPy-bundle/2023.07-gfbf-2023a
$ python -V; which python
Python 3.11.3
/apps/gent/RHEL8/zen2-ib/software/Python/3.11.3-GCCcore-12.3.0/bin/python
$ python -c 'import numpy; print(numpy.__version__)'
1.25.1
```

Useful environment variables for job scripts

(these are only defined in the context of a running job!)

- **\$PBS_JOBID**: job id of running job
- **\$PBS_O_WORKDIR**: directory from which job was submitted on login node
 - It is common to use `cd $PBS_O_WORKDIR` at beginning of a job script
- **\$PBS_ARRAYID**: array id of running job
 - Only relevant when submitting array jobs (`qsub -t`)
- **\$TMPDIR**: unique *local* directory specific to running job
 - Cleaned up automatically when job is done, so make sure to copy result files!
- **\$EBROOTXYZ, \$EBVERSIONXYZ**: root directory/version for software package XYZ
 - Only available when module for XYZ is loaded

Scratch filesystem on VSC Tier-1 Hortense

- See also docs.vsczentrum.be/gent/tier1_hortense.html#project-scratch-directories
- Only accessible from VSC Tier-1 Hortense login and worker nodes
- Other shared filesystems (`$VSC_HOME`, `$VSC_DATA`) available, but *should be avoided*
- Use project scratch directory: `$VSC_SCRATCH_PROJECTS_BASE/2024_300`
- Access read-only data (incl. software installations) via `/readonly` mount
See also docs.vsczentrum.be/gent/tier1_hortense.html#accessing-data-via-readonly
- Check quota usage via `my_dodrio_quota` command

Full example job script (single-core job)

```
#!/bin/bash

#PBS -N count_example          # job name
#PBS -l nodes=1:ppn=1          # single-node job, single core
#PBS -l walltime=2:00:00        # max. 2h of wall time

# load Python 3.11, with batteries included (extra PyPI packages)
module load SciPy-bundle/2023.11-gfbf-2023b

# copy input data from location where job was submitted from
cp $PBS_O_WORKDIR/input.txt $TMPDIR

# go to temporary working directory (on local disk) & run Python code
cd $TMPDIR

python -c "print(len(open('input.txt').read()))" > output.txt

# copy back output data, ensure unique filename using $PBS_JOBID
cp output.txt $VSC_SCRATCH_PROJECTS_BASE/2024_300/output_${PBS_JOBID}.txt
```

Full example job script (multi-node MPI job)

```
#!/bin/bash

#PBS -N mpi_hello          # job name
#PBS -l nodes=2:ppn=4       # 2 nodes, 4 cores per node
#PBS -l walltime=2:00:00    # max. 2h of wall time

module load foss/2023a
module load vsc-mympirun

# go to working directory, compile and run MPI hello world program
cd $PBS_O_WORKDIR
# C code for MPI Hello: https://mpitutorial.com/tutorials/mpi-hello-world
mpicc mpi_hello.c -o mpi_hello
mympirun ./mpi_hello
```

Job output files

- Your job script may produce informative, warning, and/or error messages.
 - Two output files are created for each job: stdout (* .o*) + stderr (* .e*)
 - Located in directory where job was submitted from (by default)
 - Messages produced by a particular command in the job script can be "caught" and redirected to a particular file instead:

```
example > out.log 2> err.log
```

(see [dedicated section of our Linux tutorial for more details](#))
- In addition, the software used for the calculation may have generated additional output or result files (which is very software-specific).

Job submission and management workflow

- Submit job scripts from a login node to a cluster for execution using `qsub` command:

```
$ module swap cluster/dodrio/gpu_rome_a100  
$ qsub example.sh
```

12345

- An overview of the active jobs is available via the `qstat` command:

```
$ qstat
```

Job ID	Name	User	Time Use	S	Queue
12345	example	vsc40000	1:32:57	R	gpu_rome_a100

- To remove a job that is no longer necessary, use the `qdel` command: `qdel 12345`

Job submission: GPU reservation for EMBL hackathon

- Dedicated reservation of 5 GPU nodes (20 A100 GPUs in total) is available
- To submit a job into the reservation:

```
$ module swap cluster/dodrio/gpu_rome_a100
```

```
$ qsub example.sh --pass=reservation=EMBL
```

12345

- You will only have access to an A100 GPU if you actually request one!
 - `qsub example.sh --pass=reservation=EMBL -l nodes=1:gpus=1`
- See also docs.vsczentrum.be/gent/tier1_hortense.html#requesting-gpu-resources

Interactive session via Tier-1 Hortense web portal

The screenshot shows the 'Interactive Apps' section of the Hortense web portal. The 'Cluster Desktop' option is selected. A green box highlights the 'Cluster' dropdown, which contains 'dodrio gpu_rome_a100'. A red box highlights the 'Number of cores (and default memory) per node' dropdown, which contains '12 cores (62.1 GiB mem) (quarter)'. Below it, the 'Number of GPUs per node' dropdown is set to '1'. A yellow box highlights the 'Reservation id' dropdown, which contains 'EMBL'. The page also includes a 'Time (hours)' dropdown set to '1 hour' and a 'Number of nodes' dropdown set to '1 node'.

Clusters ▾ Interactive Apps ▾ My Interactive Sessions

Home / My Interactive Sessions / Cluster Desktop

Interactive Apps

- Desktops
 - Bioimage ANalysis Desktop
 - Cluster Desktop**
 - Neurodesk
- Servers
 - Jupyter Lab
 - Jupyter Notebook
 - RStudio server
 - Shell (tmux)
 - VS Code Tunnel
- Testing
 - Cluster desktop v2
 - Code Server

Cluster Desktop

This app will launch an interactive desktop on one or more compute nodes. You will have full access to the resources these nodes provide. This is analogous to an interactive batch job.

Cluster

dodrio gpu_rome_a100

Time (hours)

1 hour

Number of nodes

1 node

Number of cores (and default memory) per node

12 cores (62.1 GiB mem) (quarter)

Number of GPUs per node

1

Number of cores per node must be a multiple of number of GPUs

Reservation id

EMBL

Running containers via Apptainer

- Apptainer is available to run (Docker/Singularity/Apptainer) container images
- Quick example with NVIDIA container for TensorFlow:

```
mkdir -p $VSC_SCRATCH_PROJECTS_BASE/2024_300/$USER
cd $VSC_SCRATCH_PROJECTS_BASE/2024_300/$USER

unset APPTAINER_TMPDIR
export APPTAINER_CACHEDIR=/tmp/$USER/apptainer-cache

apptainer build example.sif docker://nvcr.io/nvidia/tensorflow:24.11-tf2-py3
apptainer shell --nv /readonly/$PWD/example.sif

nvidia-smi      # check that GPU is available in container
python
>>> from tensorflow.python.client import device_lib
>>> device_lib.list_local_devices()
```

- See also docs.hpc.ugent.be/apptainer

Documentation & support



Vlaanderen
is supercomputing

- Extensive documentation available at
docs.vscentrum.be/gent/tier1_hortense.html
- Setup and configuration of VSC Tier-1 Hortense is very similar to HPC-UGent Tier-2 infrastructure, so see also docs.hpc.ugent.be
- In case of questions or problems, please contact compute@vscentrum.be