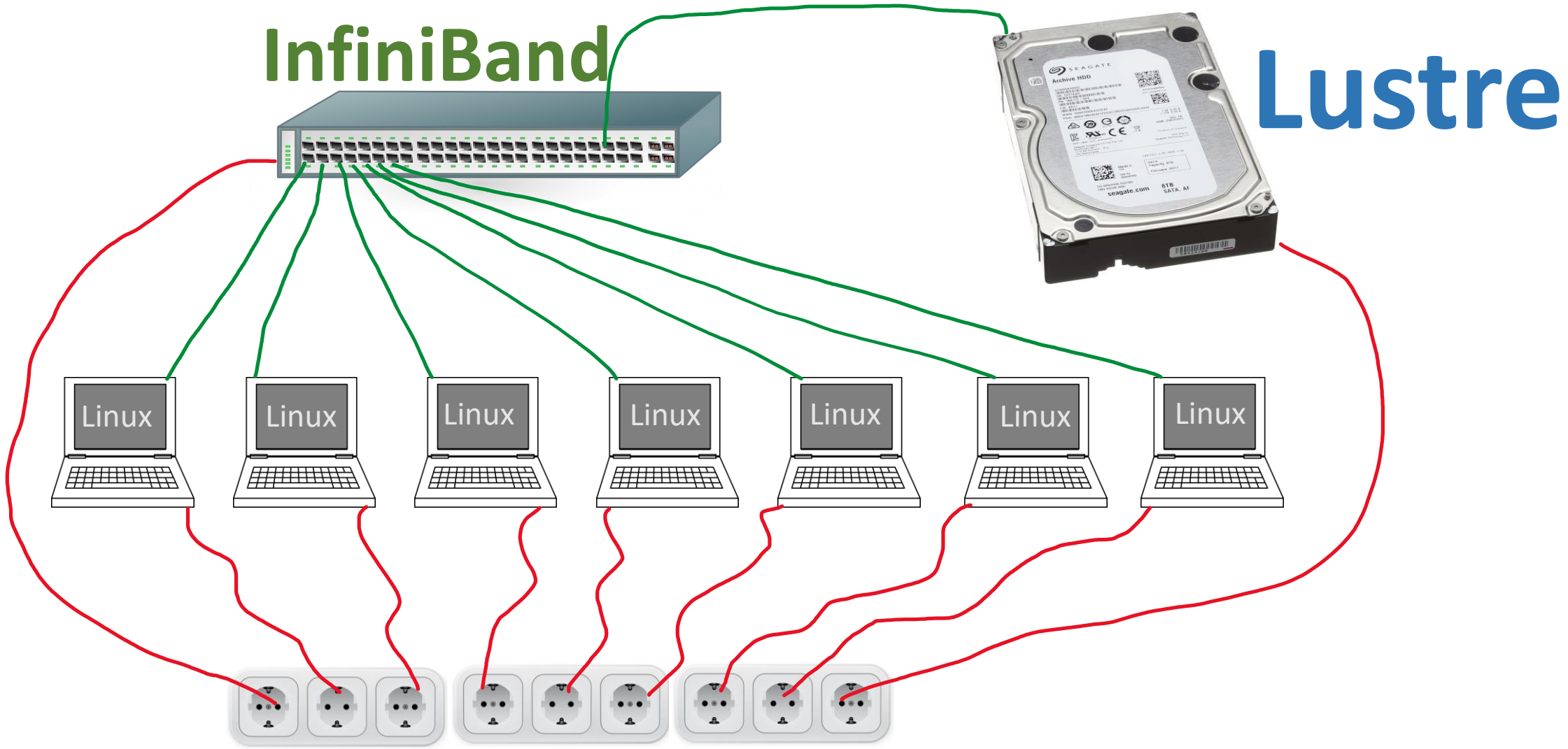
IDUN Research Infrastructure

IDUN – Shared Resource Infrastructure

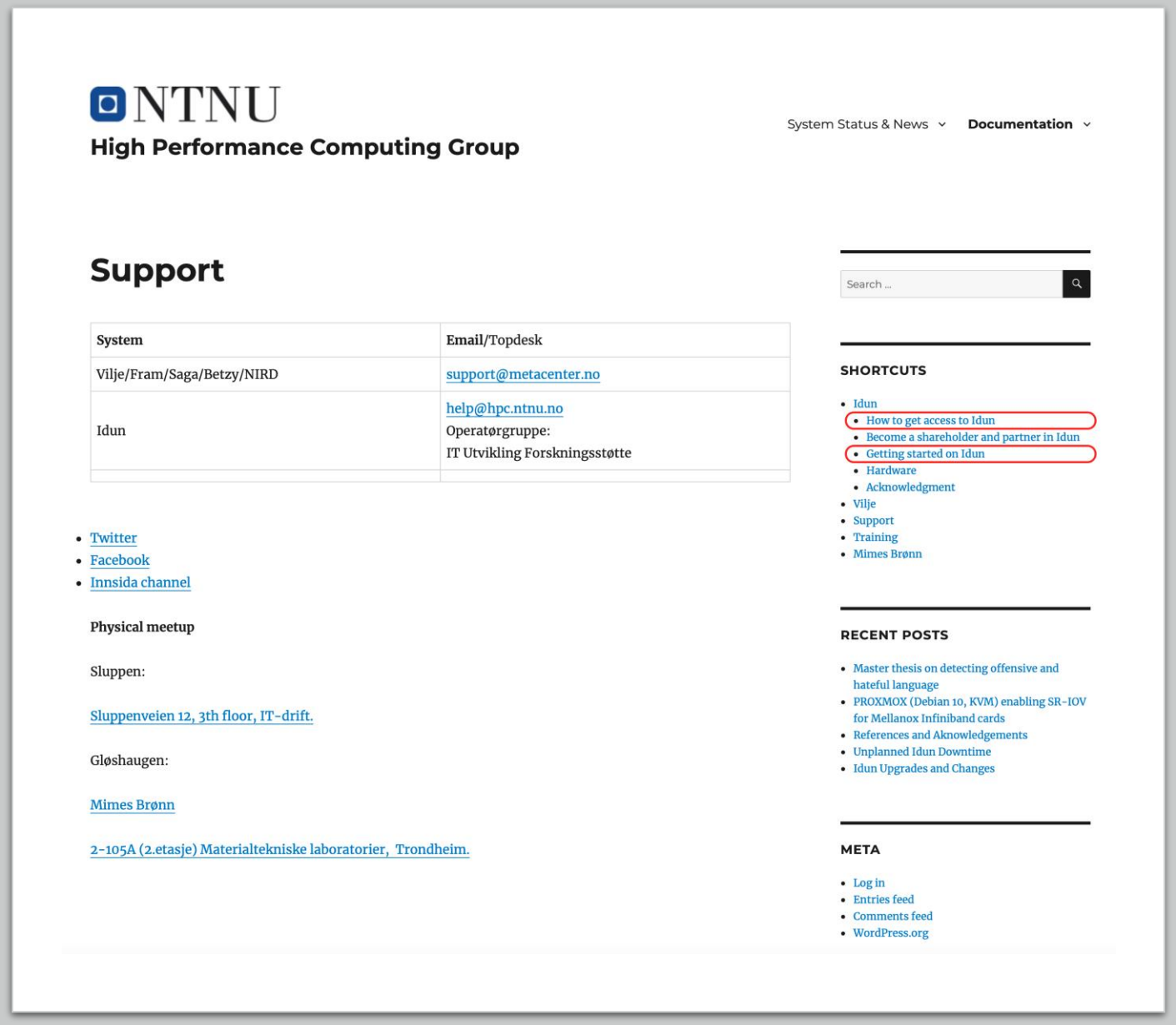
- A joint effort between NTNU IT department and faculties, institutes and research groups
- Partners buy into the machine, according to HPC group specifications, guaranteed share+optional available resources, plus support for either 3 or 5 years.
- IT department provides personell and infrastructure (network, storage, queueing system)

What is HPC cluster? – (**High Performance Computing**)



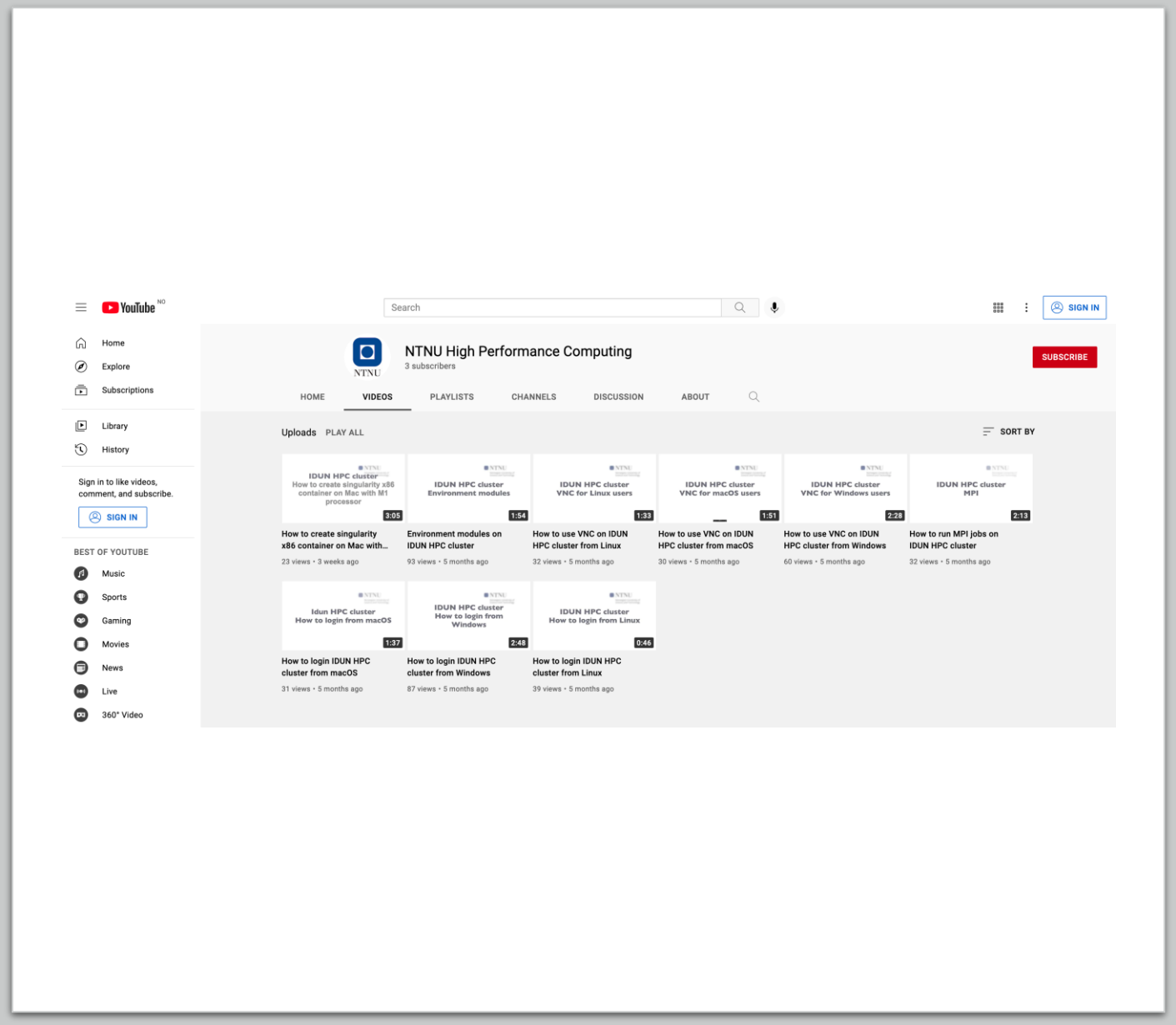
Idun documentation

- https://www.hpc.ntnu.no



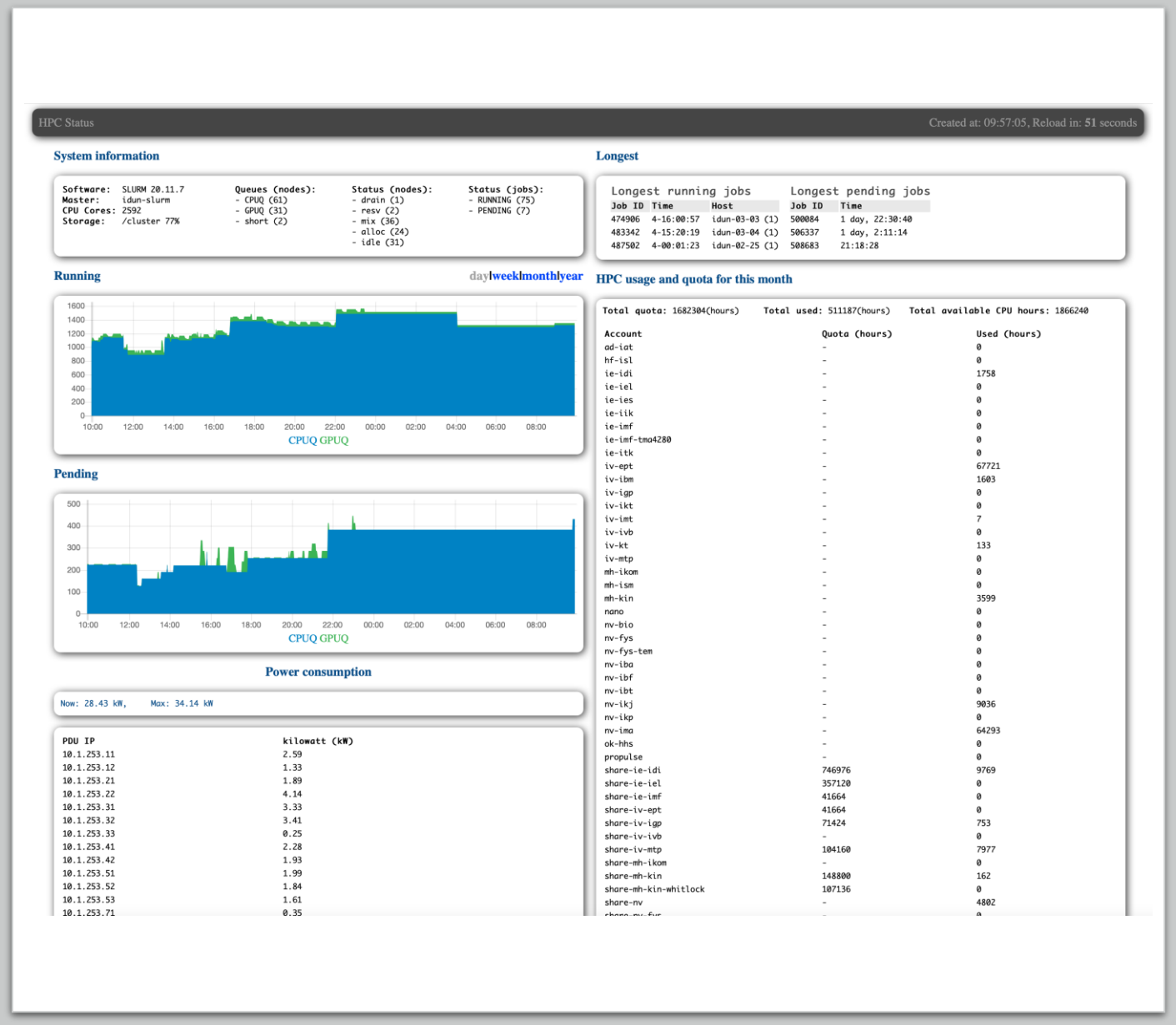
Youtube channel

- https://www.youtube.com/channel/UCA-MnuZtAC-weFBvRjPVCOA/videos



Idun status

- http://idun.hpc.ntnu.no



Hardware on Idun

Processors (2784 cores):

- AMD EPYC 7543 32-Core Processor
- Intel(R) Xeon(R) CPU E5-2630 v4 @ 2.20GHz
- Intel(R) Xeon(R) CPU E5-2650 v4 @ 2.20GHz
- Intel(R) Xeon(R) CPU E5-2695 v4 @ 2.10GHz
- Intel(R) Xeon(R) Gold 6132 CPU @ 2.60GHz
- Intel(R) Xeon(R) Gold 6148 CPU @ 2.40GHz
- Intel(R) Xeon(R) Gold 6226 CPU @ 2.70GHz
- Intel(R) Xeon(R) Gold 6242 CPU @ 2.80GHz
- Intel(R) Xeon(R) Gold 6252 CPU @ 2.10GHz

GPUs:

- 50 x P100
- 14 x V100 (16 GB)
- 26 x V100 (32 GB)
- 48 x A100 (40 GB)
- 26 x A100 (80 GB)

Memory sizes:

- 55 GB
- 128 GB
- 192 GB
- 385 GB
- 772 GB
- 1031 GB
- 2063 GB

- 4 x FPGA (Xilinx)

NTNU vs Sigma2

- Idun
- Fram
- Betzy
- Saga
- NIRD storage services
- NIRD tool kit (https://apps.sigma2.no)

Hot to login IDUN HPC cluster

- Connect NTNU network
  - via SSH
    - ssh -X -l username login.stud.ntnu.no
    - ssh -X -l username login.ansatt.ntnu.no
  - via VPN
    - https://innsida.ntnu.no/wiki/-/wiki/English/Install+vpn

- Connect IDUN login server
  - ssh -X -l username idun-login1.hpc.ntnu.no
  - ssh -X -l username idun-login2.hpc.ntnu.no

Storage

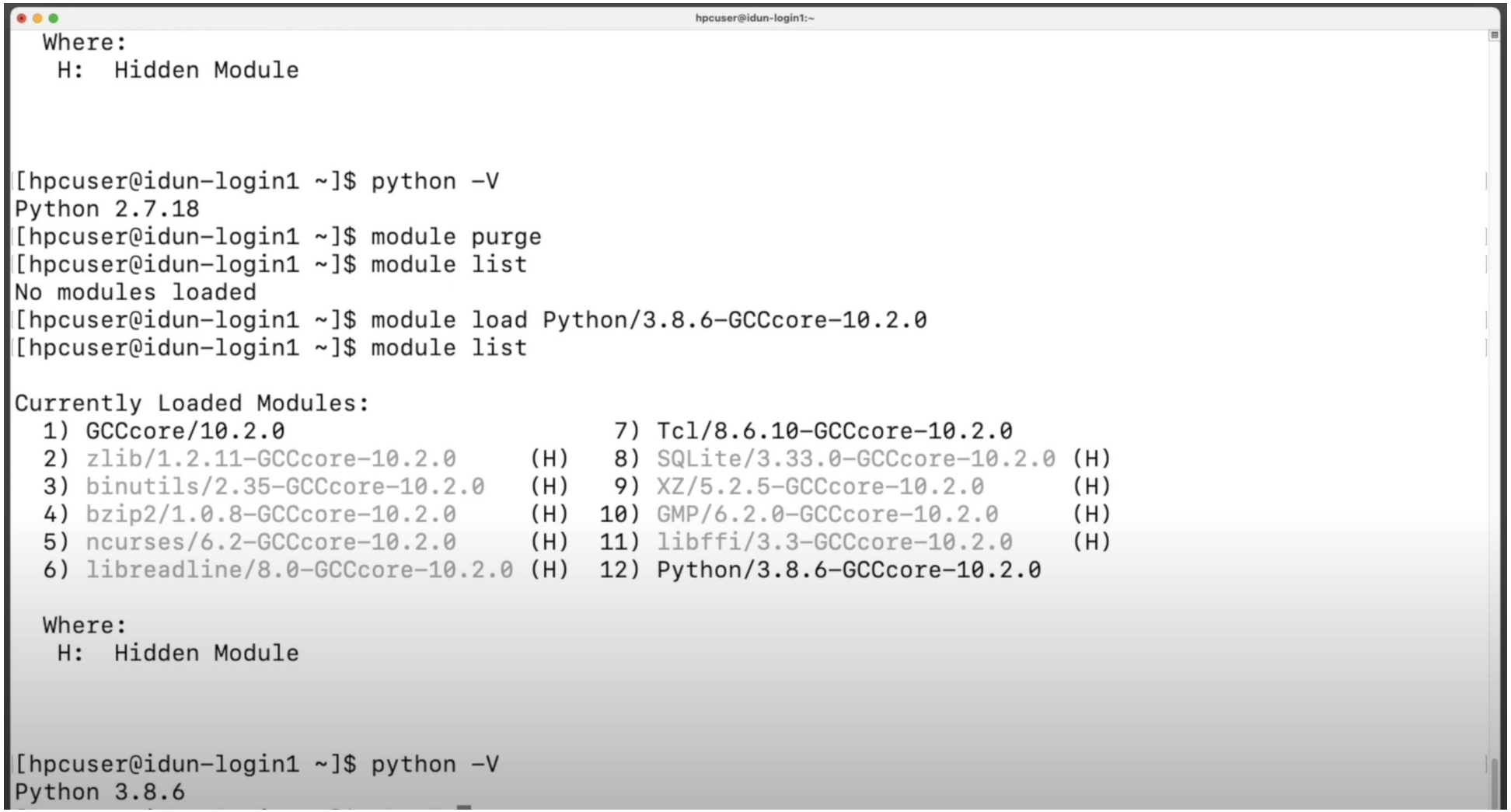
- /cluster/home/Your_Login_Name/ - start directory after login
- /cluster/work/Your_Login_Name/ - recomended directory for files

Important: No Backups for files

Module

list loaded modules:	`module list`
load foo module:	`module load foo`
find all modules:	`module avail`
find foo module:	`module avail foo`
show description:	`module whatis foo`
unload all modules:	`module purge`

Module


hpcuser@idun-login1:~
Where:
H: Hidden Module
[hpcuser@idun-login1 ~]$ python -V
Python 2.7.18
[hpcuser@idun-login1 ~]$ module purge
[hpcuser@idun-login1 ~]$ module list
No modules loaded
[hpcuser@idun-login1 ~]$ module load Python/3.8.6-GCCcore-10.2.0
[hpcuser@idun-login1 ~]$ module list
Currently Loaded Modules:
1) GCCcore/10.2.0
2) zlib/1.2.11-GCCcore-10.2.0 (H)
3) binutils/2.35-GCCcore-10.2.0 (H)
4) bzip2/1.0.8-GCCcore-10.2.0 (H)
5) ncurses/6.2-GCCcore-10.2.0 (H)
6) libreadline/8.0-GCCcore-10.2.0 (H)
7) Tcl/8.6.10-GCCcore-10.2.0
8) SQLite/3.33.0-GCCcore-10.2.0 (H)
9) XZ/5.2.5-GCCcore-10.2.0 (H)
10) GMP/6.2.0-GCCcore-10.2.0 (H)
11) libffi/3.3-GCCcore-10.2.0 (H)
12) Python/3.8.6-GCCcore-10.2.0
Where:
H: Hidden Module
[hpcuser@idun-login1 ~]$ python -V
Python 3.8.6

Containers and notebooks

- Supported container formats
  - Podman
  - Singularity
  - Docker (convert to singularity)

- Jupyter notebook
  - Tutorial, example setup:
  - https://www.hpc.ntnu.no/idun/getting-started-on-idun/lessons-from-a-former-masters-student/

What is Slurm?

- Main application on HPC cluster. It controls where jobs are running.

Bash basics

File bash_script.sh

```
$ cat bash_script.sh
#!/bin/bash
# this line is a comment
##### this line is a comment as well
echo "Hello World"
python3 my_script.py
```

```
$ bash bash_script.sh
```

```
$ chmod +x ./bash_script.sh
```

```
$ ./bash_script.sh
```

Slurm script basics

```
$ cat my_job_sctipt.slurm
#!/bin/bash
#SBATCH --partition=CPUQ
#SBATCH --account=share-nv-fys
#SBATCH --time=00:05:00
#SBATCH --ntasks=1
#SBATCH --mem=12000                          # Default units are megabytes.
#SBATCH --job-name="hello_test"
#SBATCH --output=hello_test.out
#SBATCH --mail-user=<your_email@ntnu.no>
#SBATCH --mail-type=ALL
module purge
module load Python/3.8.6-GCCcore-10.2.0
python -V
```

Run slurm script

```
[idun-login1 ~]$ sbatch my_job_sctipt.slurm
Submitted batch job 1060210

[idun-login1 ~]$ squeue -u your_login_name
             JOBID PARTITION     NAME     USER ST       TIME  NODES NODELIST(REASON)
           1060210     short hello_te  pavlokh PD       0:00      1 (None)

[idun-login1 ~]$ scontrol show job 1060210
JobId=1060210 JobName=hello_test
   UserId=hpcuser(1313333) GroupId=ntnudefault(1000) MCS_label=N/A
   Priority=3037918 Nice=0 Account=support QOS=highest
   JobState=COMPLETED Reason=None Dependency=(null)
   . . . .
   . . . .

[idun-login1 ~]$ cat hello_test.out
Python 3.8.6
```

MPI USE CASE

```
#!/bin/sh
#SBATCH --partition=CPUQ
#SBATCH --account=<account>
#SBATCH --time=00:15:00
#SBATCH --nodes=2                  # 2 compute nodes
#SBATCH --ntasks-per-node=1        # 1 mpi process each node
#SBATCH --mem=12000                # 12 GB
#SBATCH --job-name="hello_test"
#SBATCH --output=test-srun.out
#SBATCH --mail-user=<email>
#SBATCH --mail-type=ALL
module purge
module load intel/2020b
module list
mpirun myprogram
```

GPU USE CASE

```
#!/bin/sh
#SBATCH --partition=GPUQ
#SBATCH --account=<account>
#SBATCH --time=00:30:00
#SBATCH --nodes=2
#SBATCH --ntasks-per-node=2
#SBATCH --gres=gpu:1
#SBATCH --job-name="LBM_CUDA"
#SBATCH --output=lbm_cuda.out

module purge
module load fosscuda/2018b
mpirun hostname

mpirun ./my cudacode
```

--gres=gpu:P100:2
--gres=gpu:V100:6
--gres=gpu:V10032:1
--gres=gpu:A100:2

Interactive Job

```
[idun-login1 ~]$ srun --nodes=1 --partition=CPUQ --time=00:02:00 --pty bash
[idun-90-01 ~]$ whoami
hpcuser
```

Cancel job

One job

```
$ scancel 111111111111
```

All my jobs

```
$ scancel -u my_login_name
```

Slurm partitions

CPUQ – for jobs to run on CPU
GPUQ – for jobs to run on GPU
short – for test jobs to test job scripts. Has GPU P100

```
[username@idun-login1 ~]$ sinfo
PARTITION AVAIL  TIMELIMIT  NODES  STATE NODELIST
CPUQ*        up 7-00:00:00      6   resv idun-02-[23-26],idun-06-[05-06]
CPUQ*        up 7-00:00:00      7    mix idun-03-[14,16,24,27,29,31-32]
CPUQ*        up 7-00:00:00     48  alloc idun-02-[01-22,27],idun-03-[01-13,15,17-23,25-26,28,30]
GPUQ         up 7-00:00:00     29    mix idun-04-[01-17],idun-05-[01-05,08],idun-06-[01-02,04,07-09]
GPUQ         up 7-00:00:00      2  alloc idun-05-[06-07]
GPUQ         up 7-00:00:00      3   idle idun-05-[09-10],idun-06-03
```

Transferring Data

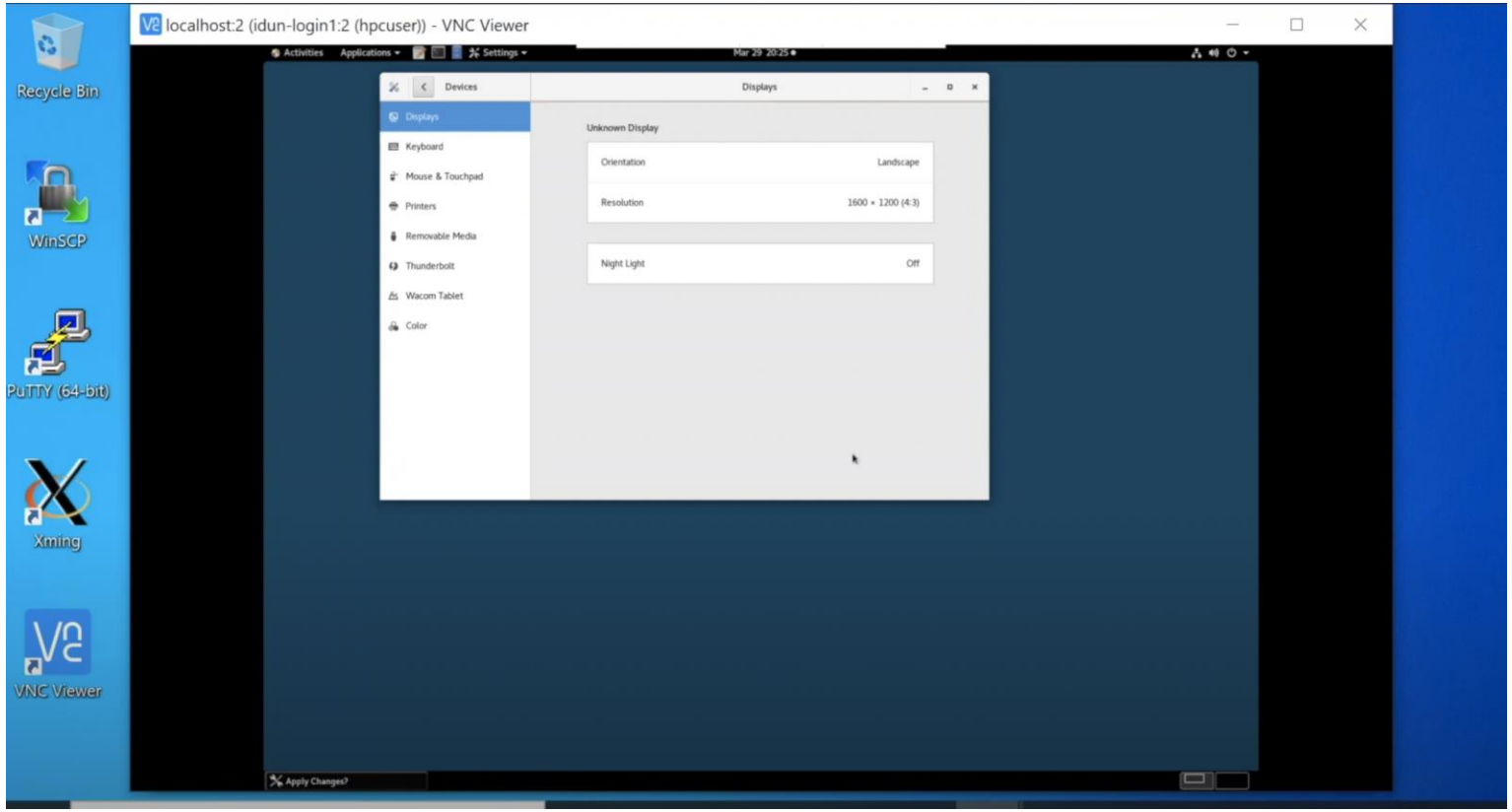
- https://www.hpc.ntnu.no/idun/getting-started-on-idun/transferring-data

Linux? Mac? Windows?

- Use scp or sftp command
- Use WinSCP or FileZilla
- Use Windows share on server idun-samba1.hpc.ntnu.no

VNC

https://www.youtube.com/watch?v=aXD1ZRg2Ado
https://www.hpc.ntnu.no/idun/getting-started-on-idun/vnc



Support

help@hpc.ntnu.no

Diskcord:

https://discord.gg/TWzWKAcu


Night mode