

A photograph of a server room. In the foreground, a long row of black server racks is visible, with some racks having mesh doors that show internal components and colorful cables. Above the racks, a large, red, 3D logo spelling "IDUN" is mounted. The room has a white tiled floor, white walls, and a ceiling with fluorescent lights and various pipes and conduits. In the background, more server racks and a large circular fan are visible.

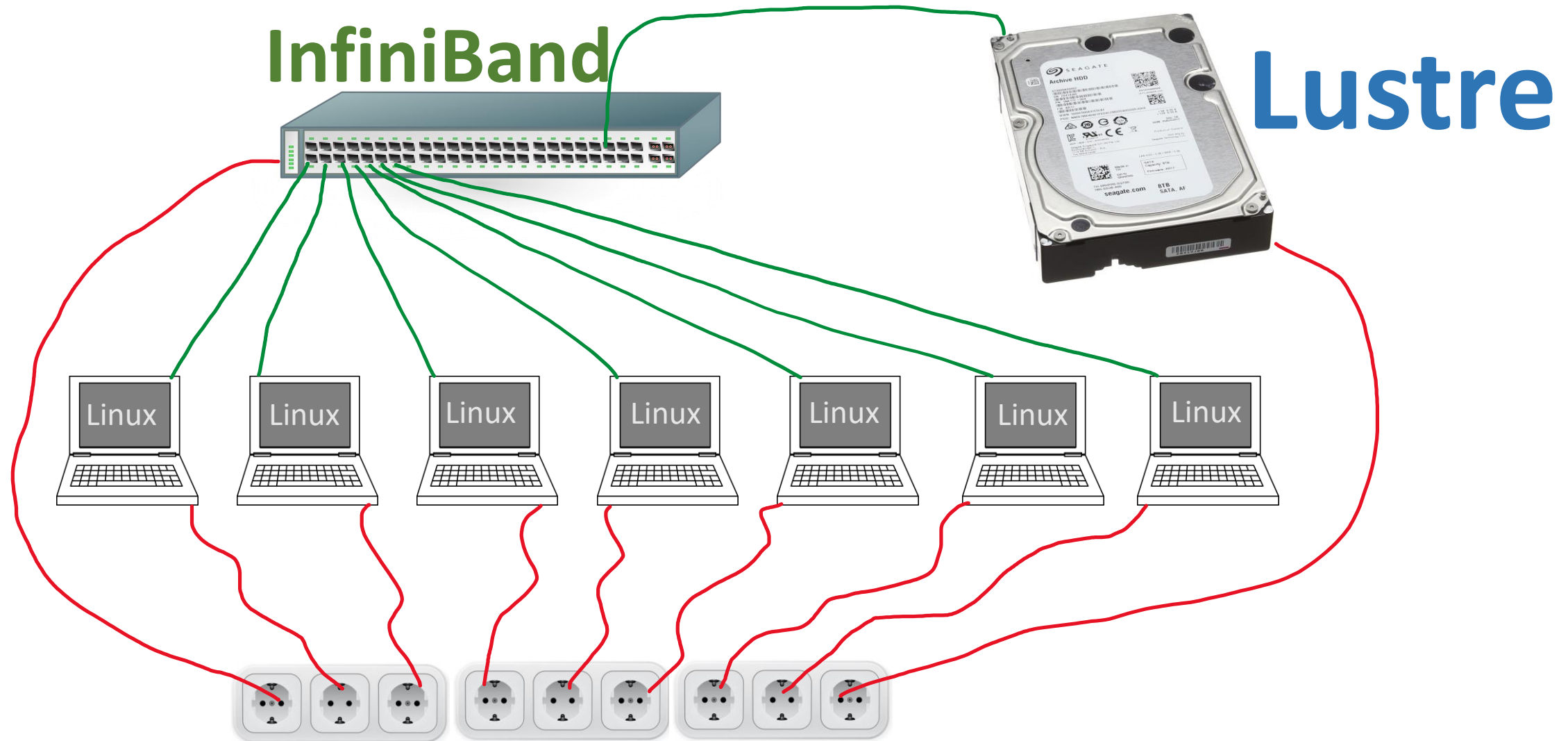
IDUN

IDUN Research Infrastructure
Pavlo Khmel

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)



Rack 0	Rack 1	Rack 2	Rack 3	Rack 4	Rack 5	Rack 6	Rack 7	Rack 8	Rack 9
	idun-vm2								
	idun-vm1								
	idun-gw				idun-05-10				
	HPE FlexNetwork 5130				idun-05-09	idun-05-05			
	idun-mds2				Idun-05-08	idun-04-17			
idun-login2	idun-mds1				idun-05-07	idun-04-16			
idun-login1	idun-oss4				idun-05-06	idun-04-15			
idun-samba2	idun-oss3				idun-06-09	idun-04-14			
idun-samba1	idun-oss2				idun-06-08	idun-04-13			
	idun-oss1			idun-05-14		idun-04-12			HPE FlexNetwork 5130
arm-1	ME4024	idun-vm3	idun-02-27			idun-04-11			HPE FlexNetwork 5130
idun-06-06			idun-02-26	idun-05-13	Mellanox QM8700				
idun-06-05	Mellanox SB7800	Mellanox SB7800	idun-02-25		HPE FlexNetwork 5130	Mellanox SX6025			Mellanox SX6025
	N3048	N3048	idun-02-24	idun-05-12				HPE FlexNetwork 5130	HPE FlexNetwork 5130
	idun-gw2		idun-02-23		idun-06-07	idun-04-10			
PowerVaultMD1220	ME424		idun-02-22	idun-05-11	idun-06-04	idun-04-09			
nas1	ME4024		idun-02-21	idun-06-03	idun-07-03	idun-04-08			
foreman			idun-02-20	idun-06-02	idun-07-02	idun-04-07			
idun-login4		idun-03-27	idun-02-19	idun-06-01	idun-07-01	idun-04-06			
idun-jump		idun-03-25	idun-02-18			idun-04-05			
lustre-controller		idun-03-23	idun-02-17			idun-04-04	Idun-05-04	idun-login3-old	
lustre-mds2		idun-03-20	idun-02-16			idun-04-03	idun-05-03	spare-idun-vm-node2	
lustre-mds1		idun-03-19	idun-02-15			idun-04-02	idun-05-02	spare-idun-vm-node1	
lustre-oss2		idun-03-17	idun-02-14			idun-04-01	idun-05-01	idun-perf	
lustre-oss1		idun-03-15	idun-02-13						
lustre-mdt		idun-03-13	idun-02-12						
		idun-03-11	idun-02-11						
		idun-03-09	idun-02-10						
		idun-03-07	idun-02-09						
		idun-03-05	idun-02-08						
		idun-03-03	idun-02-07						
		idun-03-01	idun-02-06						
			idun-02-05						
			idun-02-04						
			idun-02-03						
			idun-02-02						
			idun-02-01						
	ME4048								

Idun documentation

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



High Performance Computing Group

System Status & News ▾ Documentation ▾

Support

System	Email/Topdesk
Vilje/Fram/Saga/Betzy/NIRD	support@metacenter.no
Idun	help@hpc.ntnu.no Operatørgruppe: IT Utvikling Forskningsstøtte

- [Twitter](#)
- [Facebook](#)
- [Innsida channel](#)

Physical meetup

Sluppen:

[Sluppenveien 12, 3th floor, IT-drift.](#)

Gløshaugen:

[Mimes Brønn](#)

[2-105A \(2.etasje\) Materialtekniske laboratorier, Trondheim.](#)

Search ... 🔍

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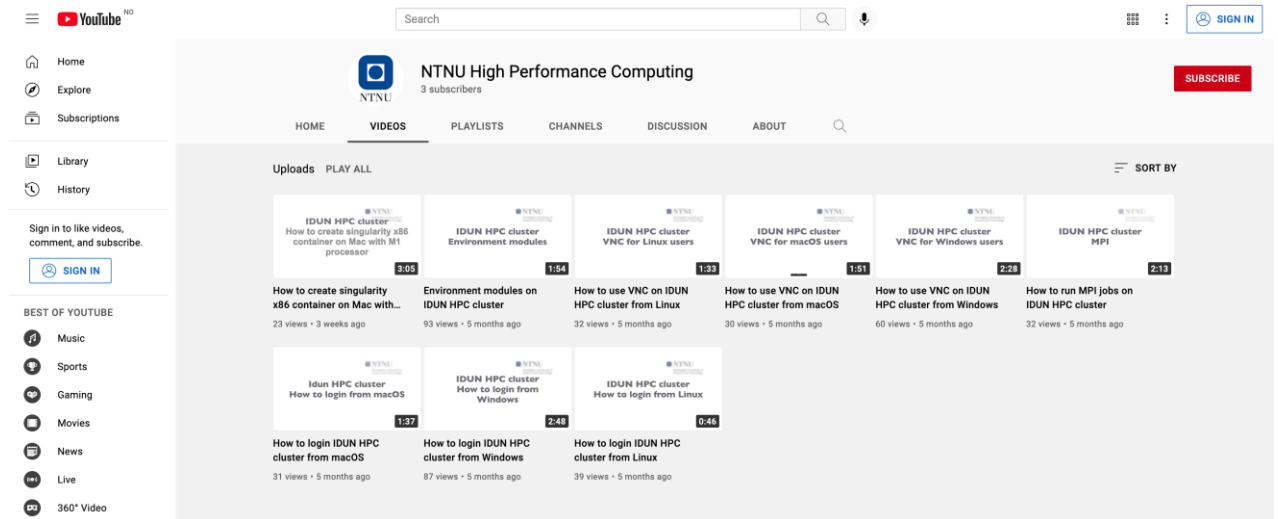
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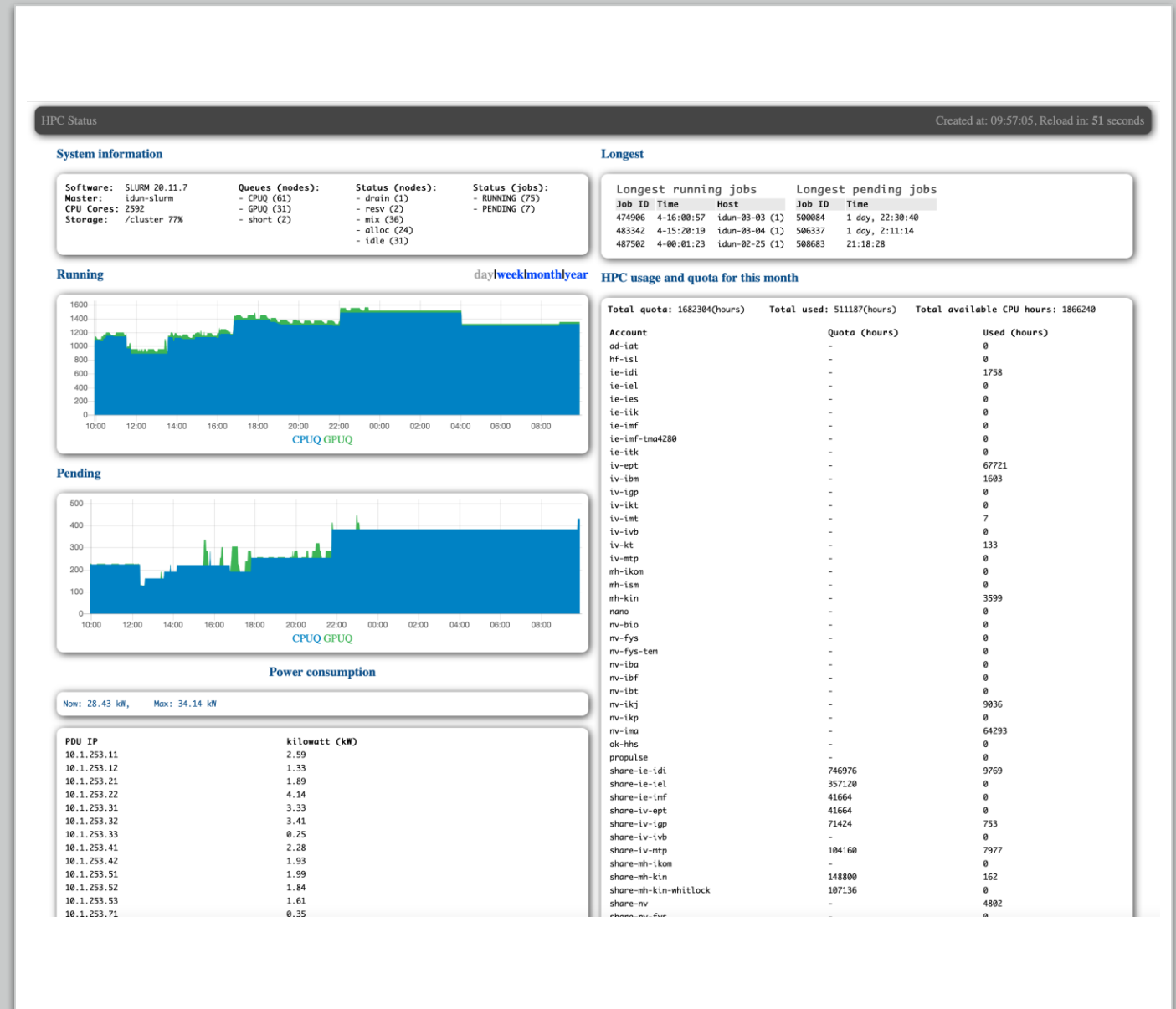
Youtube channel

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



Idun status

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



Hardware on Idun

Processors 310 (6304 cores):

```
2 AMD EPYC 7543 32-Core Processor
6 AMD EPYC 75F3 32-Core Processor
48 Intel(R) Xeon(R) CPU E5-2630 v4 @ 2.20GHz
32 Intel(R) Xeon(R) CPU E5-2650 v4 @ 2.20GHz
8 Intel(R) Xeon(R) CPU E5-2695 v4 @ 2.10GHz
2 Intel(R) Xeon(R) CPU E5-2697 v3 @ 2.60GHz
36 Intel(R) Xeon(R) Gold 6132 CPU @ 2.60GHz
6 Intel(R) Xeon(R) Gold 6148 CPU @ 2.40GHz
4 Intel(R) Xeon(R) Gold 6226 CPU @ 2.70GHz
20 Intel(R) Xeon(R) Gold 6242 CPU @ 2.80GHz
14 Intel(R) Xeon(R) Gold 6248R CPU @ 3.00GHz
20 Intel(R) Xeon(R) Gold 6252 CPU @ 2.10GHz
112 Intel(R) Xeon(R) Gold 6348 CPU @ 2.60GHz
```

Memory sizes (Total 50 TB):

```
55 GB
128 GB
192 GB
256 GB
376 GB
772 GB
1031 GB
1509 GB
2063 GB
```

GPUs (Total 170):

```
36 P100-PCIE-16GB
14 V100-PCIE-16GB
26 V100-PCIE-32GB
48 A100-PCIE-40GB
30 A100-PCIE-80GB
16 A100-SXM4-80GB
```

- 4 x FPGA (Xilinx)

NTNU VS Sigma2

Idun

Fram

Betzy

Saga

NIRD storage services

NIRD tool kit (<https://apps.sigma2.no>)

How 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/ - recommended 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_script.slurm
#!/bin/bash
#SBATCH --partition=short
#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 1111111111111111
```

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>

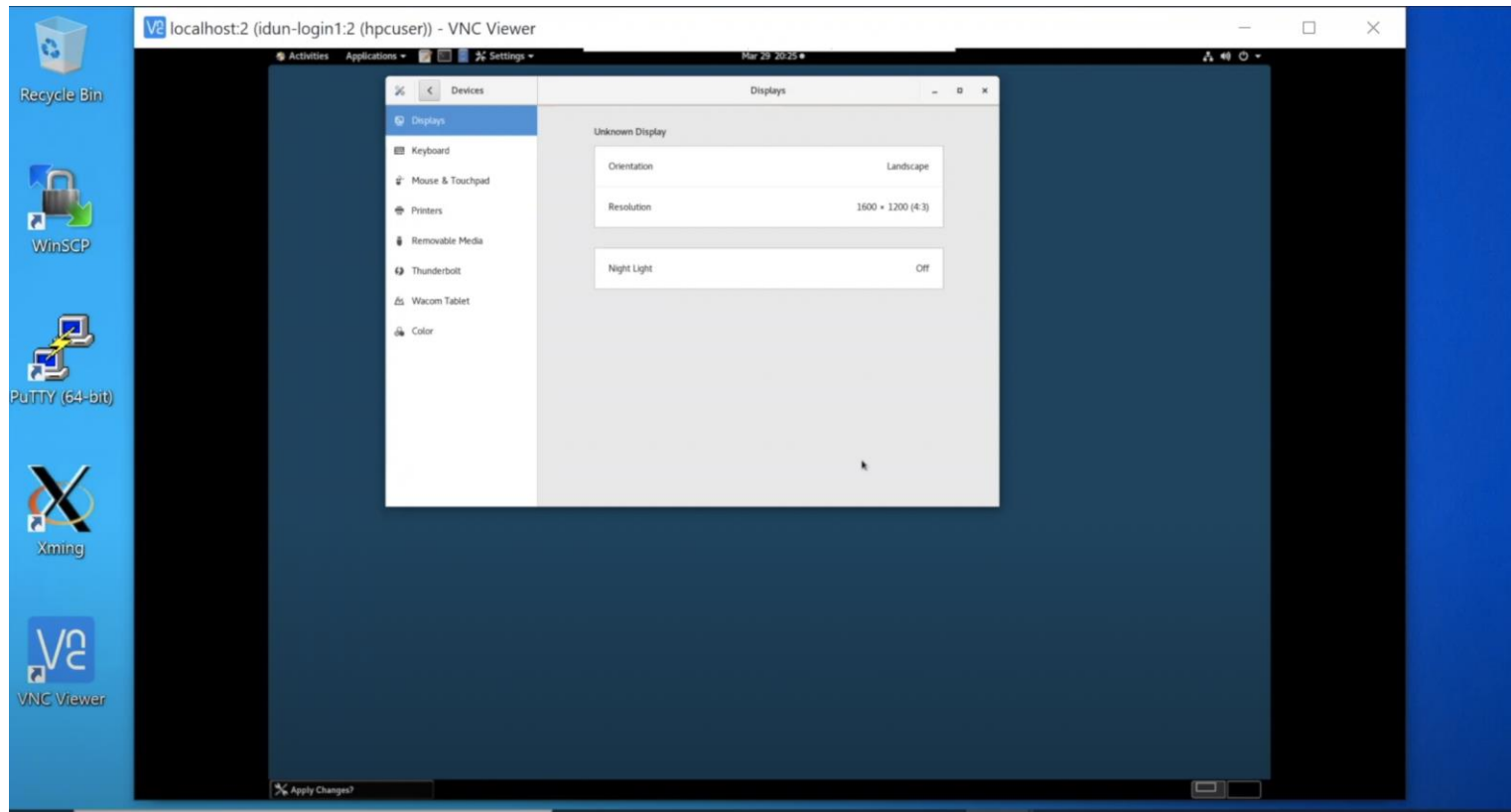
Linux? Mac? Windows?

- 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



Night mode