



ilifu Online Training

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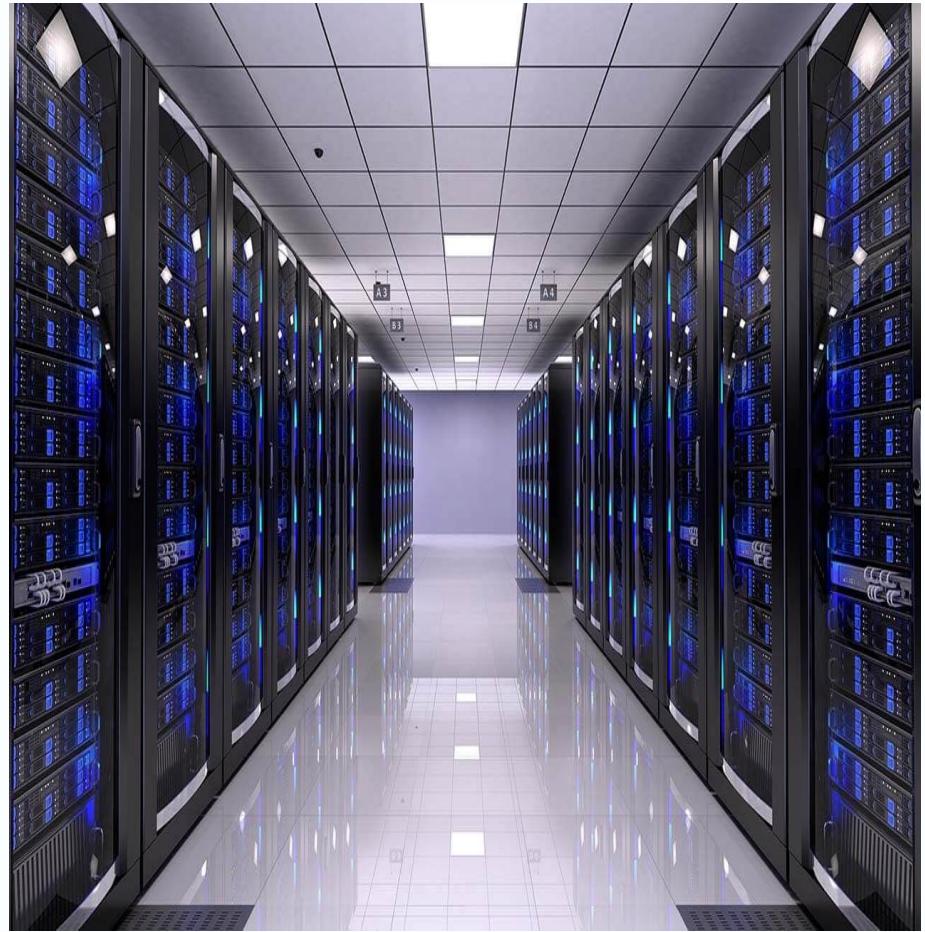
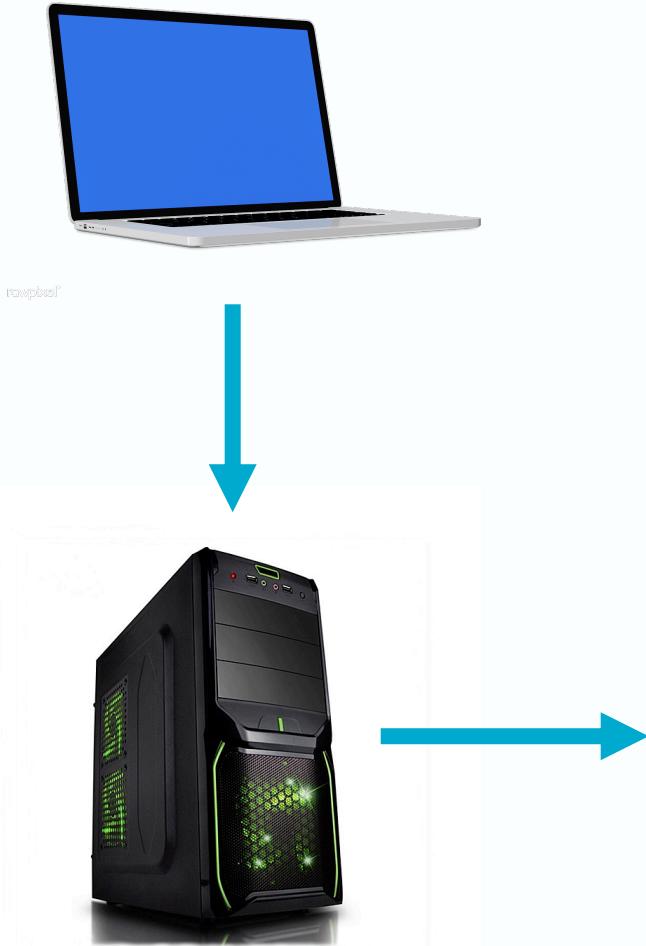


IDIA Inter-University Institute
for Data Intensive Astronomy

WESTERN SYDNEY
UNIVERSITY

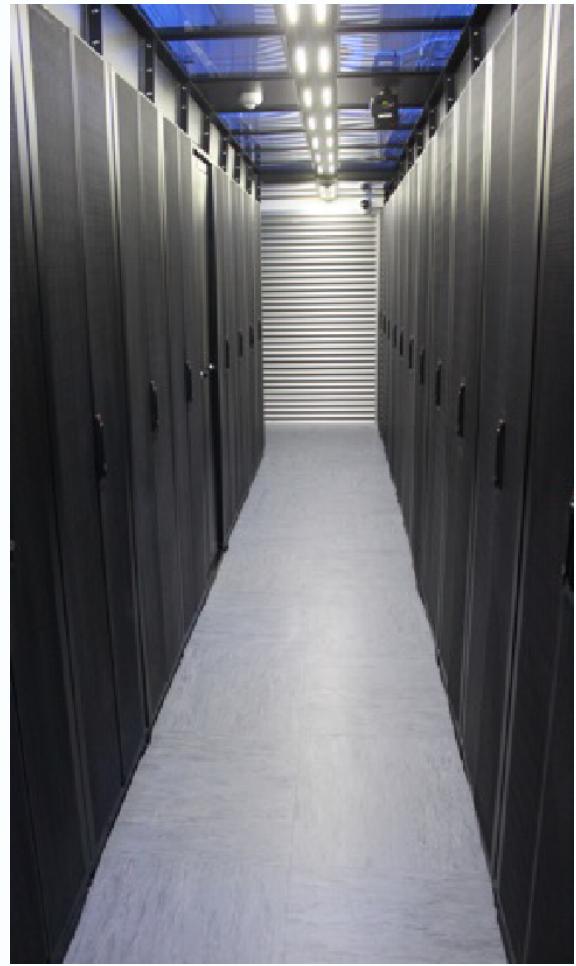


ilifu: from laptop to VM to cluster



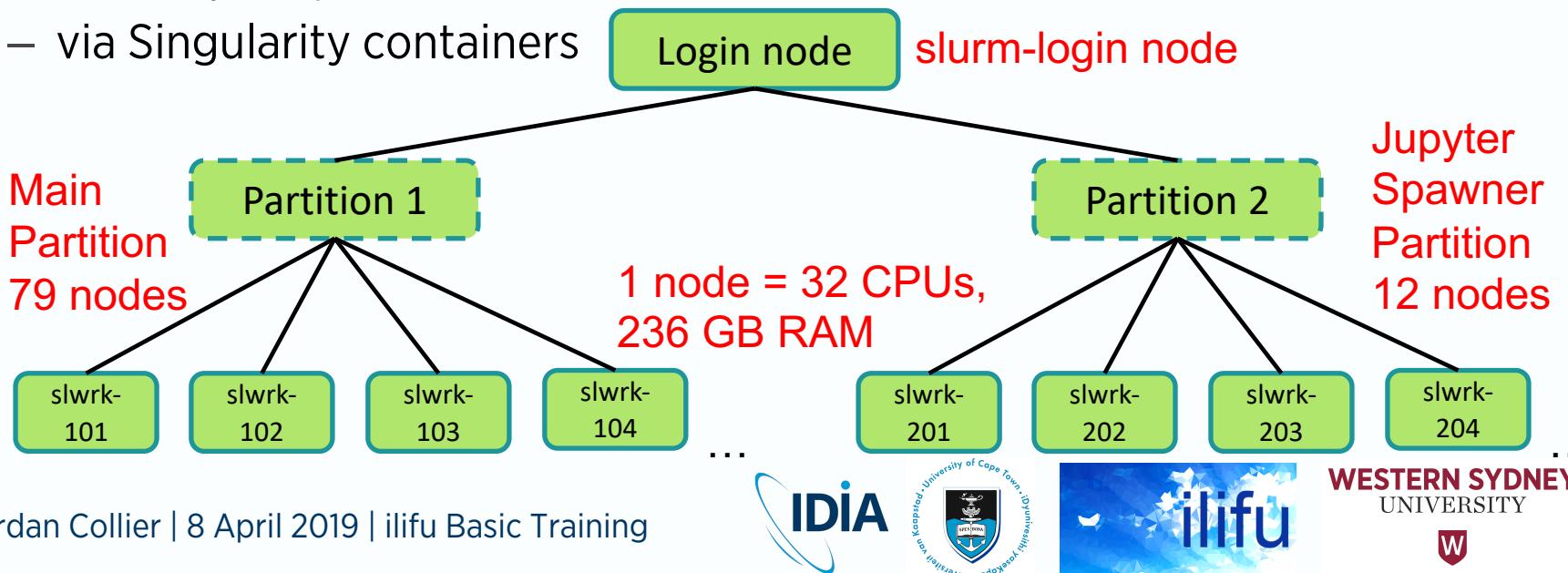
ilifu

- ilifu (<http://ilifu.ac.za>)
 - Tier 2 Data Intensive Research Facility
 - Joint Cloud Platform for Astronomy and Bioinformatics
 - Cluster w/ 96 nodes (32 cores, 256/512 GB)
 - ~2 PB usable storage (BeeGFS & CEPH)
 - 10 Gb/s network to South African National Research Network (SANReN)



SLURM

- http://docs.ilifu.ac.za/#/getting_started/submit_job_slurm
- Login node (job submission & management)
 - where you land when you log in (also known as “head node”)
 - run SLURM commands/submit jobs, but not software/heavy processes
- Compute nodes
 - Where your processes run (also known as “worker nodes”)
 - via Singularity containers



SLURM

- http://docs.ilifu.ac.za/#/getting_started/submit_job_slurm
- `ssh <username>@slurm.ilifu.ac.za`
- <https://jupyter.ilifu.ac.za>
- Partitions: Main (79 nodes), HighMem (2), GPU (3), Jupyter (12)

ssh - shell terminal

```
* Support: https://ubuntu.com/advantage
System information as of Fri Aug 23 11:36:57 SAST 2019
System load: 0.49      Users logged in: 8
Usage of /: 35.9% of 21.15GB  IP address for ens3: 192.168.100.39
Memory usage: 5%        IP address for ens4: 10.102.26.97
Swap usage: 0%          IP address for ens5: 10.102.28.133
Processes: 396

* Keen to learn Istio? It's included in the single-package MicroK8s.

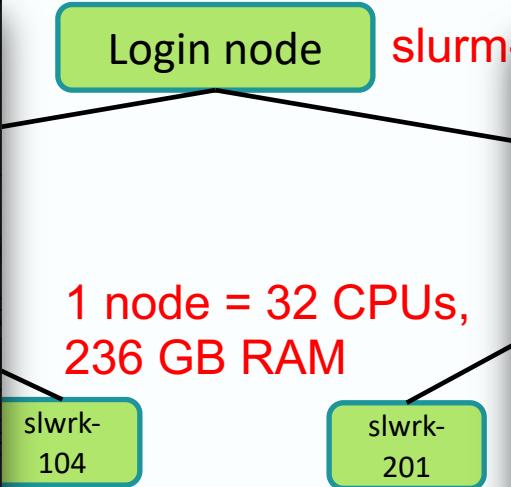
  https://snapcraft.io/microk8s

Get cloud support with Ubuntu Advantage Cloud Guest:
  http://www.ubuntu.com/business/services/cloud

* Canonical Livepatch is available for installation.
- Reduce system reboots and improve kernel security. Activate at:
  https://ubuntu.com/livepatch

170 packages can be updated.
75 updates are security updates.

Last login: Fri Aug 23 09:08:21 2019 from 196.11.235.232
jeremy@slurm-login:~$ sinfo
PARTITION      AVAIL TIMELIMIT NODES STATE Nodelist
Main*           up 14:00:00:0    8  mix slwrk-[106-113]
Main*           up 14:00:00:0   14  allow slwrk-[101,104-105,114-124]
Main*           up 14:00:00:0   38  idle slwrk-[102-103,125-160]
JupyterSpawnerONLY up infinite  4  mix slwrk-[201-202,205,209]
JupyterSpawnerONLY up infinite  4  alloc slwrk-[206-208,210]
JupyterSpawnerONLY up infinite  2  idle slwrk-[203-204]
jeremy@slurm-login:~$ sbatch compute_job.sh
```



```
test_concurrer memory_matrix compare_plots casa_sim_plot example-notebook Untitled5.ipynb README.md layout_meerkat
In [298]: from simutil import *
In [299]: mystill = simutil()

In [301]: import pylab as pl
rawfile = 'sim_example_3d_dor/sim_example_3d_dor.mearket.ms'
if os.path.exists(rawfile):
    tb.open(rawfile)
    tb.read()
    tb.close()
    tb.done()

pl.ion()
maxbase = max([max(rawdata[0,:]),max(rawdata[1,:])])
xlam_m = 100*(qa.convert(model_spereval, 'GHz')[value])

pl.plot(rawdata[0,:]/xlam_m, rawdata[1,:]/xlam_m,'b.')
pl.plot(-rawdata[0,:]/xlam_m, -rawdata[1,:]/xlam_m,'b.')

ax = pl.gca()
ax.set_xlim(-40,40)
ax.set_ylim(-40,40)
pl.xlabel('x (km)')
pl.ylabel('y (km)')
pl.title('Analyze and Image Simulation')
pl.xscale('log')
pl.yscale('log')

Out[301]: (-44.0, 45.0, -30.0, 30.0)
```

```
# Benchmark
# A benchmark tool used for performance measurement.
## Prerequisites
# Python 2.7
# - Python 3.6
# - ipython 3.0
## Running benchmark tool
# ...
# Import Benchmark from benchmark module
# ...
# mybenchmark = Benchmark()
# ...
# an = 'image_script_welcome.ipynb'
# tb = 'tb_welcome.ipynb'
# dees = 'dees_welcome.ipynb'
# exec = 'exec_welcome.ipynb'
# logterm = 'logterm_welcome.ipynb'
# tild = 'tild_welcome.ipynb'
# ...
# mybenchmark.execute(script_name=an,
#                     notebook_name='tb_welcome.ipynb',
#                     logterm_name='logterm_welcome.ipynb',
#                     dees_name='dees_welcome.ipynb',
#                     exec_name='exec_welcome.ipynb')
# See example notebook for detailed information.
```

SLURM – user commands

- <https://slurm.schedmd.com/>

```
$ sinfo #shows partitions and resources  
$ squeue #shows all jobs in SLURM queue  
$ squeue -u <username> #shows your jobs  
$ sbatch slurm_job_script.sh #submit job to  
SLURM queue  
$ sbatch --help #describes input parameters  
$ scancel <jobid> #cancels job  
$ sacct #shows status of recent jobs that have  
run, or are running
```

SLURM - running a job

```
$ cat slurm_job_script.sh  
#!/bin/bash  
  
#SBATCH --job-name='demo_job'  
  
#SBATCH --time=01:00:00  
  
#SBATCH --mem=4GB  
  
#SBATCH --output=demo-job-%j.out  
#SBATCH --error=demo-job-%j.err  
#SBATCH --account=b03-idia-ag  
  
echo "Submitting demo SLURM job"  
  
singularity exec /idia/software/containers/SF-PY3-bionic.simg python myscript.py
```



Describe job parameters/resources

container

software

script

```
$ sbatch slurm_job_script.sh #submit job to SLURM queue
```

what's being executed with above parameters

SLURM - running a job

```
$ cat slurm_job_script.sh  
  
#!/bin/bash  
  
#SBATCH --job-name='demo_job'  
  
#SBATCH --time=01:00:00  
  
#SBATCH --mem=4GB  
  
#SBATCH --output=demo-job-%j.out  
  
#SBATCH --error=demo-job-%j.err  
  
#SBATCH --account=b03-idia-ag  
  
echo "Submitting demo SLURM job"  
  
singularity exec /idia/software/containers/casa-stable.img casa -c myscript.py
```



Describe job parameters/resources

container

software

script

```
$ sbatch slurm_job_script.sh #submit job to SLURM queue
```

what's being executed with above parameters

SLURM - running an interactive job

- http://docs.ilifu.ac.za/#/getting_started/submit_job_slurm?id=interactive-slurm-session

```
$ srun --pty bash #opens bash shell session on compute  
#node with default 3 days and ~7GB RAM
```

```
$ srun --pty --time=01:00:00 --mem=64GB singularity exec  
/idia/software/containers/casa-stable.simg casa
```

#opens interactive CASA session on compute node,
#with 1 hour walltime, 64GB RAM,
#using Singularity CASA container

```
$ srun --help
```

#view srun help docs for input parameters

SLURM - running an interactive job

- With X11 support for viewing GUI

```
$ ssh-add -K / -k #this may need to be run before ssh, if you've  
copied keys from an old machine (-K for Mac OS X, -k for Linux)
```

```
$ ssh -YA <username>@slurm.ilifu.ac.za
```

```
#important to include the -YA parameters when  
logging into the SLURM login node
```

```
$ salloc #opens bash shell session on compute node  
#with X11 support; default 3 days, ~7GB RAM
```

```
$ salloc --time=00:10:00 --mem=1GB --qos qos-interactive
```

Demo Time!

Jordan Collier | 8 April 2019 | ilifu Basic Training



Data Transfers

- http://docs.ilifu.ac.za/#/data/data_transfer
- Do not use login node!
- Don't write large files to /users, only scripts/config files
- transfer.ilifu.ac.za
 - For cp, scp and rsync (internal ilifu transfers, or external transfers)
 - e.g. \$ scp /path/to/file/<filename> <username>@transfer.ilifu.ac.za:/idia/users/<username>/scripts/
- Globus
 - Faster than scp and rsync
 - Uses dedicated data transfer node (DTN)

Data Transfers: Globus

- GridFTP transfer service setup between SARAQ and IDIA
 - Used by collaborators in UK, Netherlands, Italy, India, etc
- User-friendly globus connect built on top of gridFTP
 - GUI/web app or CLI
- Can connect any arbitrary end points
 - Server (DTN), desktop, etc for Mac OS X, Windows & Linux
 - Offers user-friendly but computationally efficient transfer service



Data Transfers: SARAO archive

- Can push data to IDIA if given permission by PI
 - First register for archive then PI request access with archive@ska.ac.za
- Must have an existing ilifu project
 - Contact support@ilifu.ac.za to request

53 matching observations				
Download	Observer Proposal ID	Schedule Block Capture Block	Target/s	Description
	Marisa Geyer SCI-20180516-KH-01	20200404-0009 1586016787	J0408-6545 J0521+1638 J1037+0223 J1008+0740 ...	MIGHTEE COSMOS_10 856 MHz to 1712 MHz Run at 2020-04-04 16:13:27 UTC
	Ian Heywood SCI-20180516-KH-01	20200325-0013 1585928757	J0408-6545 J0521+1638 J1037+0223 J1008+0740 ...	MIGHTEE COSMOS_9 856 MHz to 1712 MHz Run at 2020-04-03 15:46:14 UTC
	Ian Heywood SCI-20180516-KH-01	20200325-0012 1585844155	J0408-6545 J0521+1638 J1037+0223 J1008+0740 ...	MIGHTEE COSMOS_8 856 MHz to 1712 MHz Run at 2020-04-02 16:16:15 UTC
	Ian Heywood SCI-20180516-KH-01	20200325-0011 1585671638	J0408-6545 J0521+1638 J1037+0223 J1008+0740 ...	MIGHTEE COSMOS_7 856 MHz to 1712 MHz Run at 2020-03-31 16:20:53 UTC
	Ian Heywood SCI-20180516-KH-01	20200325-0010 1585498873	J0408-6545 J0521+1638 J1037+0223 J1008+0740 ...	MIGHTEE COSMOS_6 856 MHz to 1712 MHz Run at 2020-03-29 16:21:28 UTC
	Ian Heywood SCI-20180516-KH-01	20200325-0009 1585413022	J0408-6545 J0521+1638 J1037+0223 J1008+0740 ...	MIGHTEE COSMOS_5 856 MHz to 1712 MHz Run at 2020-03-28 16:30:37 UTC
	Sharmila Goedhart SCI-20180516-KH-01	20191230-0018 1578317762	J1939-6342 J0211-1132 XMMLSS_12 J0521+1638	MIGHTEE first 32K observation: XMM_LSS_12 856 MHz to 1712 MHz Run at 2020-01-06 13:36:45 UTC
	Marisa Geyer SCI-20180516-KH-01	20190823-0005 1566542621	J0408-6545 J0521+1638 J1008+0740 COSMOS_1 ...	MIGHTEE June COSMOS: COSMOS_1 - Reobservation copy 856 MHz to 1712 MHz Run at 2019-08-23 06:43:49 UTC

Best practices

- Don't run software / heavy processes / scp on the login node
 - Only submit jobs and run SLURM commands (sbatch, srun, squeue, etc)
 - Use transfer.ilifu.ac.za to transfer data (external/internal), not login node
- Before running a large job, identify the available resources
 - Use sinfo. Don't hog the cluster. Reduce your allocation if possible
 - Increase likelihood of jobs running with less memory and less walltime
- Use sbatch (srun / salloc / screen / tmux are volatile)
- Cleanup files that aren't needed
 - Old raw data, temporary products, /scratch data, etc
- Don't place large files in your home directory (/users)
- Use Singularity (you cannot install software on the nodes)

THANK YOU

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Inter-University Institute
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