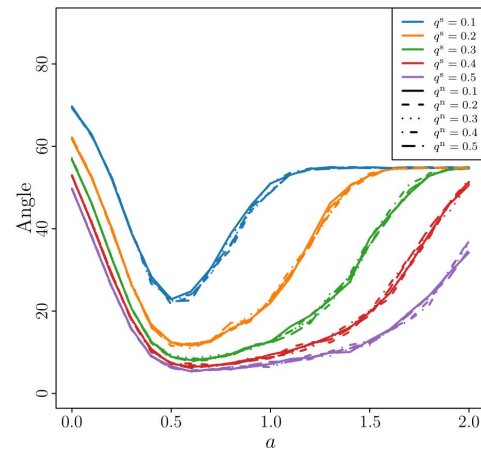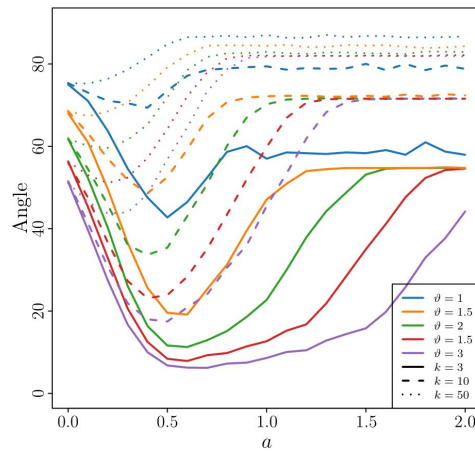# Some simulation tips

Tengyao Wang
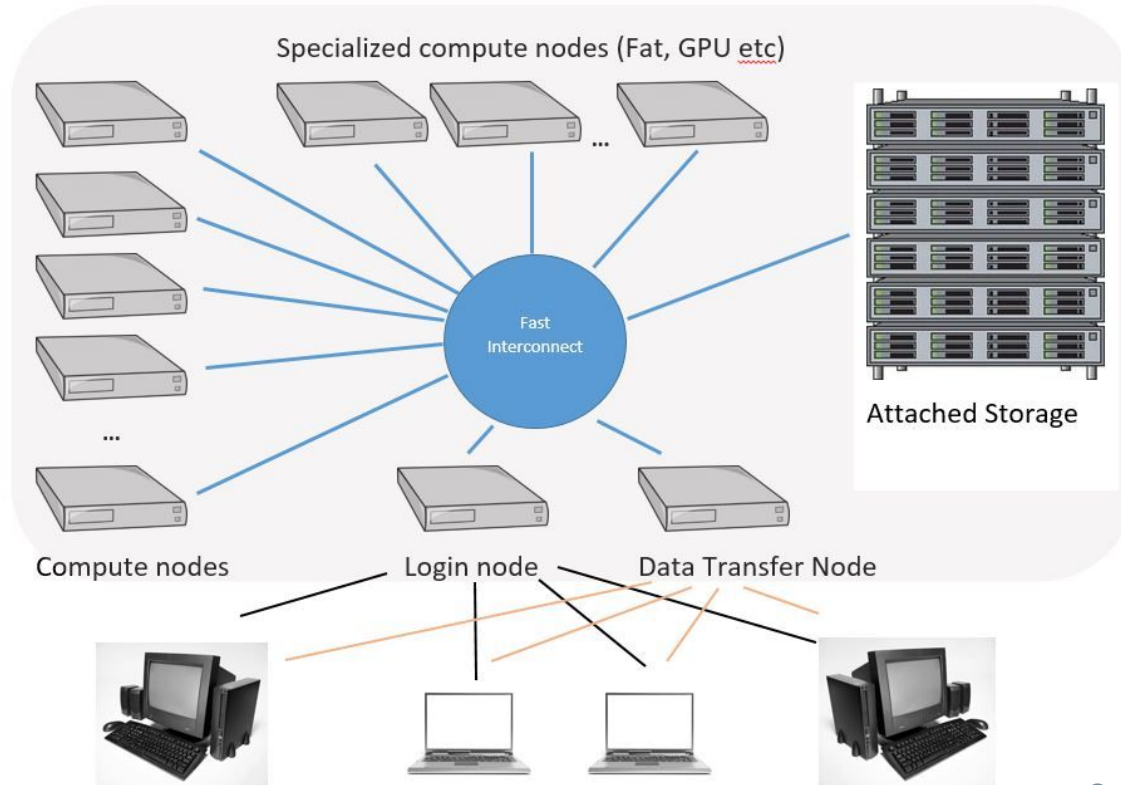
10 Aug 2021

Overview
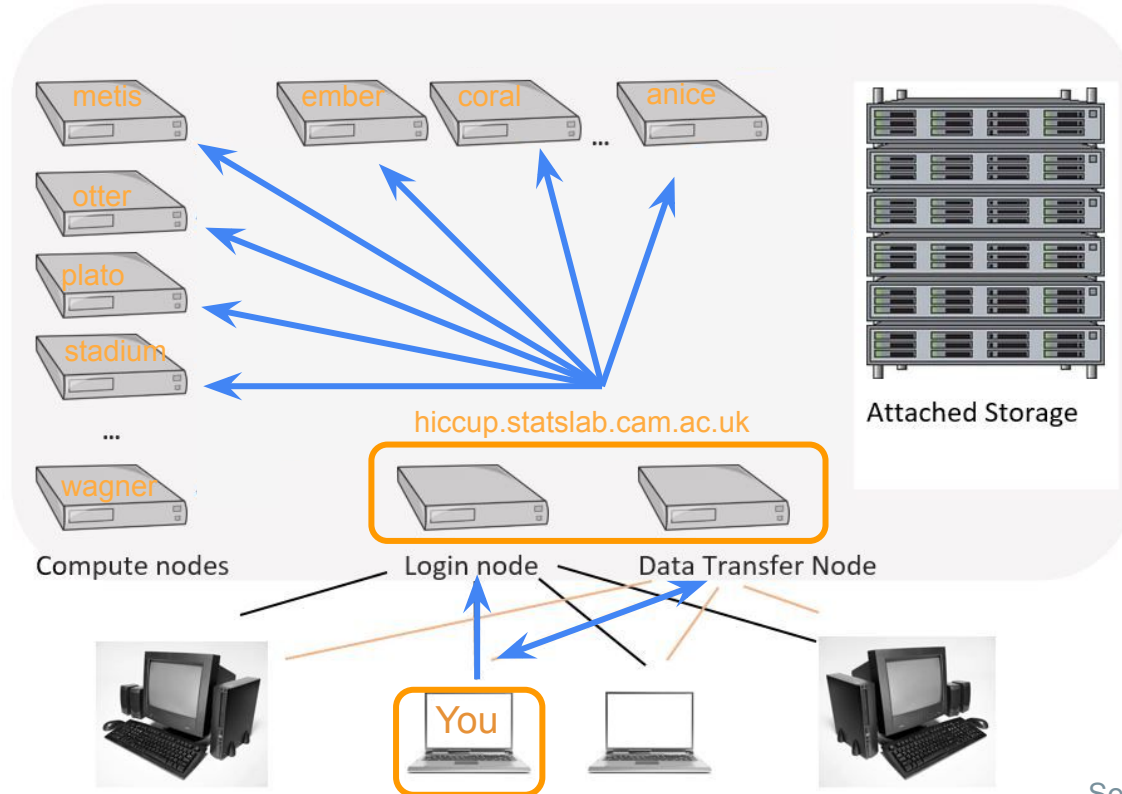
- Running simulations in parallel
- Analysing simulation results
- Generating pretty figures

Parallel computation cluster

Specialized compute nodes (Fat, GPU etc)

...

Fast Interconnect

Attached Storage

Compute nodes   Login node   Data Transfer Node

Numerical experiments are embarrassingly parallelisable

Source: Iowa State University

Writing simulation script

- It is easiest to let all computers do the same list of simulations
- Set seed base on machine name
- Output simulation parameters and simulation results into one text file per machine

```
Library:      putils  # devtools::install_github('wangtengyao/putils')
Example:      lambda_choice.R
```

Send script to run in the cluster

- Upload your simulation script to a Cambridge Maths computer (`scp` / `sftp`)
- Login to a Maths computer (`ssh crsid@buffoon.statslab.cam.ac.uk`)
- Dispatch the script to many Maths computers to run in parallel

```
for computer in $AVAILABLE; do
    (nohup ssh -f $computer "cd ~/path_to_my_simulation_folder/
&& nice -n 19 Rscript $Rfile && exit")
done
```

Code: `MultipleLogIns.sh`

Manage your simulations

- Errors will be reported in `nohup.out`
- Record your list of computers so that if there is a bug in the code, you can terminate all parallel simulations quickly. (`./CloseAll.sh`)
- Check status easily using `wc -l outfiles/*`
- Once all (or enough) simulation runs are finished, terminate remaining ones and combine output files (`cat outfiles/* > simulation.out`)
- Download output file (`scp` / `sftp`)

Code: `CloseAll.sh`

Analysing simulation results

- Parse text to obtain a dataframe of simulation results (`readLines`, `strsplit`)
- Aggregate rows with the same parameter settings (`aggregate`)
- Convert output to LaTeX table (`putils::write.latextable`)

Example: `fig2.R`

Generate pretty figures

- Use a nice palette (`putils::matplotlib_palette`)
- Reduce R's enormous margins and tick sizes
- Use colour and line types to represent different parameters
- [Optional] Use the `psfrag` package to get LaTeX fonts / typesetting

Example: `img.tex`
             `process.sh`

Thank you!

All codes available at:

https://github.com/wangtengyao/sharing/tree/main/SimTips