

INF9380

Cloud computing intro

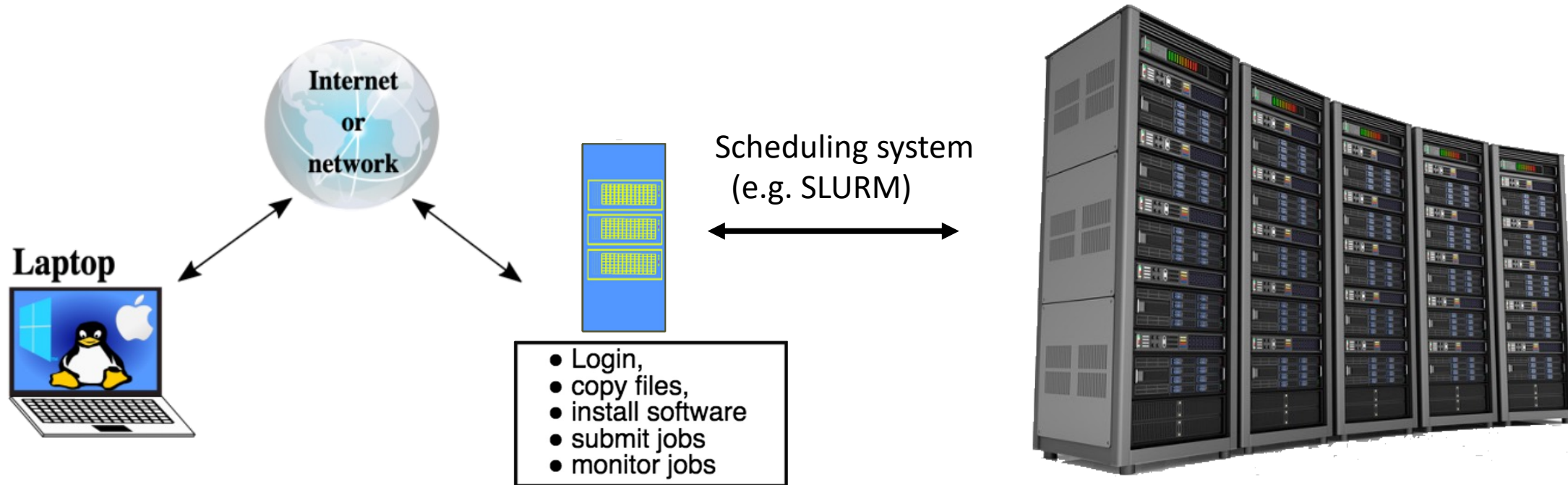
Outline of cloud session

1. Cloud, HPC differences and similarities
2. Create a cluster in the cloud using Terraform and Ansible
 - Intro to Terraform
 - Intro to Ansible
 - Hands-on: Set up and run an openmpi job in your own cluster

Part 1.

Cloud and HPC and HPC in the cloud differences and similarities

HPC recap – the general picture



“Traditional” computing cluster resource

Good, but non-flexible

- All machines have the same CPU chip architecture, let's say Intel or AMD processors
- High performance processors, not the regular standard processors (usually)
- All machines have the same OS, e.g. Red Hat 8
- Some speciality nodes: big-mem, GPU's
- Fast interconnect between nodes
- Access to common shared file system
- Queue system, some times with a long waiting time

Queueing system (SLURM):

“Please wait in line.

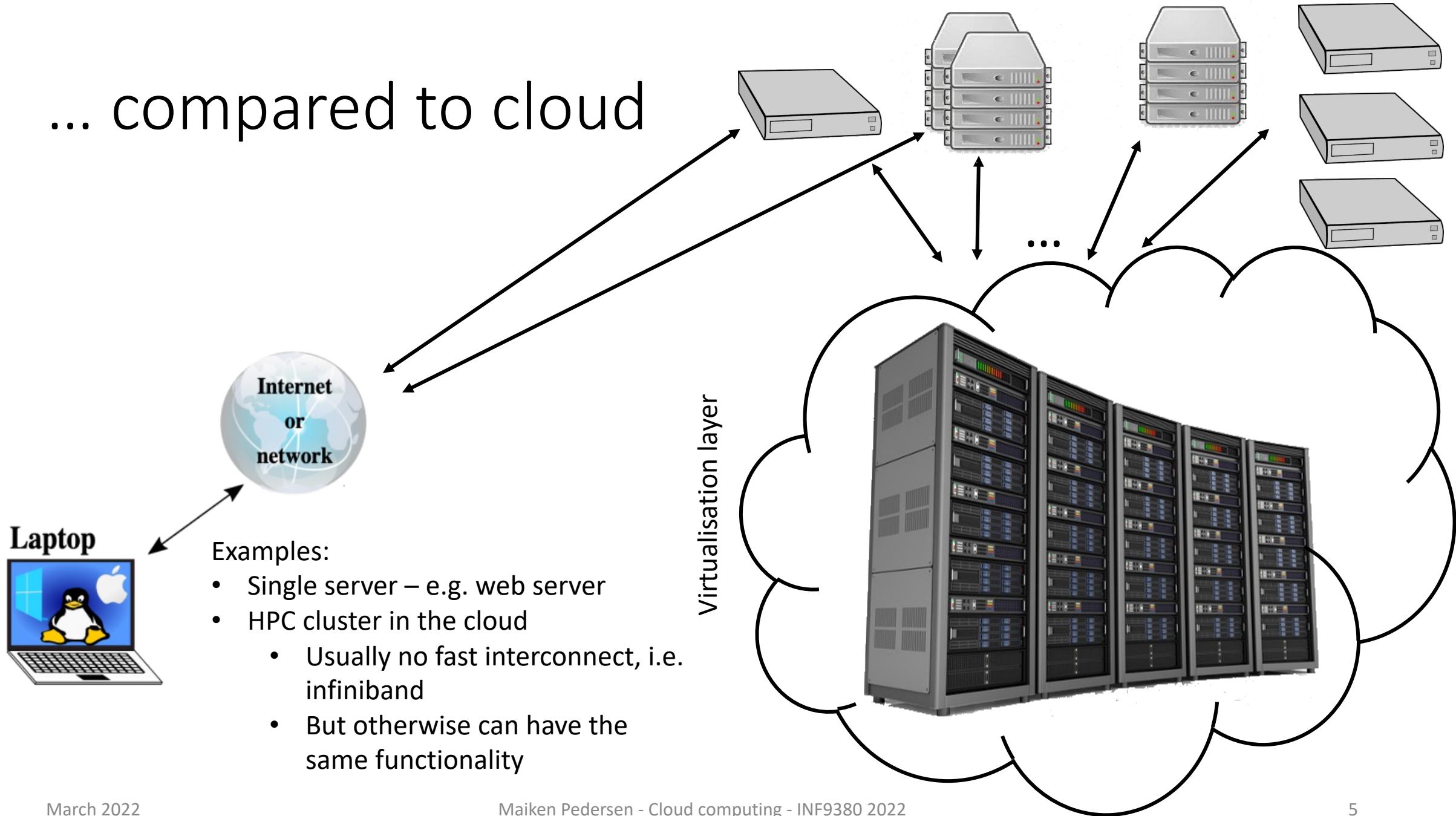
The big-mem nodes you are requesting are busy, and will be so for another 2 weeks. If you hold the line you will move forward in the queue. “

User:



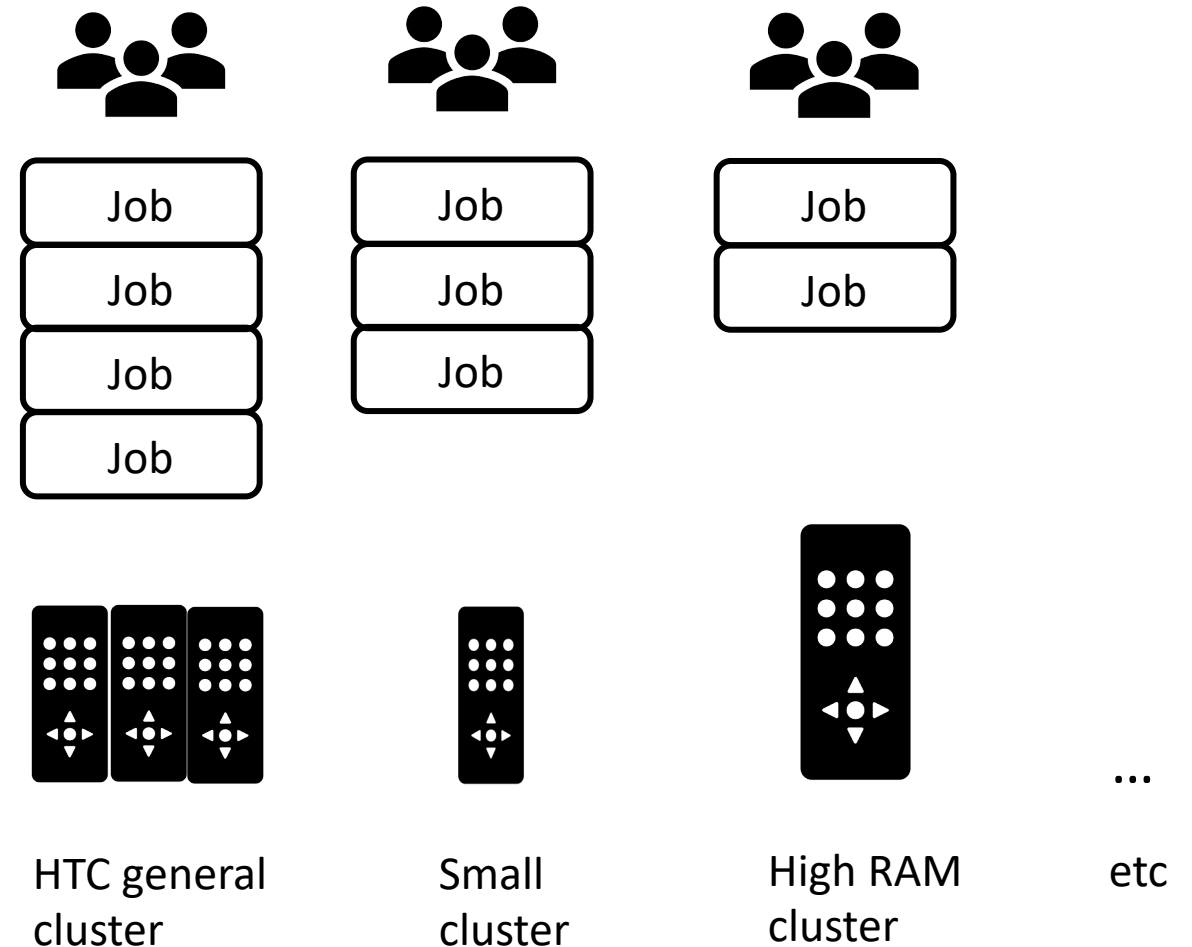
Fast and powerful system,
but waiting time can be long

... compared to cloud



Cloud

- Virtualisation is used to provision servers
- Dynamic set of servers – i.e. virtual servers are fired up as needed, and destroyed when not needed anymore
- You can pick and choose the type of (virtual) server you want: size (number of virtual cpu's, size of RAM, size of disk etc etc)
- Pick from a selection of offered OS-systems – CentOS, Ubuntu, Debian, Windows etc
- Can set up as many queues as you want or as many clusters as you want – you create the cluster that suits your needs
- You do not have to wait in line!
- Flexible!!
- Not necessarily high performance hardware – can be “off-the-shelf” processors
- Not necessarily very good interconnect between nodes (no infiniband)



But: you have to do everything yourself!
All software must be installed by you etc.

When would you use a cloud?

- Obvious/trivial reasons:
 - You have access to a cloud resource
 - You have some “free” cloud credits
 - You don’t have any other options
- Other reasons
 - You need to run some services that are not offered in your “local” HPC system
 - You have access to HPC and could use it, but
 - you do not want to use your quota there
 - or you don’t want to wait in line
 - you don’t really need all the super-duperness of the HPC, a simpler solution would work
 - you want to be able to do whatever you want with the system, i.e. become root and install and manage the system according to your needs
 - ...

Some cloud platforms/providers

- Google Cloud Platform
- Amazon Web Services (AWS)
- Microsoft Azure
- Oracle Cloud
- ... <https://www.c-sharpcorner.com/article/top-10-cloud-service-providers/>

Public - commercial



- Openstack - free open standard
 - NREC: *Norwegian* Research and Education Cloud
 - This is what we will be working in



Workflow - clouds



- Launch
 - Create the virtual machine with a base OS
 - RedHat/CentOS/Ubuntu/Debian/Windows



- Storage
 - If needed, add additional network storage
- Configure
 - Install necessary software like e.g. database software, web application software, scientific software etc etc



- Connect
 - Remotely connect to your instance via ssh

- Click-based web-interface
- CLI
- Automatisation tools (e.g. Terraform)
- Manually via ssh
- Automatisation tools (e.g. ansible)

Terminology and workflow - clouds



- **Region**

- When you create virtual machines you do that in a geographical region – e.g. North Europe, Oslo, Bergen etc
- Your virtual machines will then be created on host machines in a data center belonging to that region
- Can be performance issues and/or political reasons for choosing a certain region



- **Instance**

- A virtual machine



- **Network**

- ipv4 (dualStack) or ipv6



- **Images**

- What OS image to install on your instance



- **Flavor**

- The specifications of the virtual machine:
 - Number of virtual CPU's (vCPU)
 - Amount of RAM
 - Amount of disk
 - Processor type (AMD/Intel/ARM)



- **Key pairs**

- To connect to your instances you use an ssh private-public key pair



- **Network security group**

- Set of network rules (firewall)