

Connection with SSH: Windows session

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Plan of the talk

- Cluster presentation

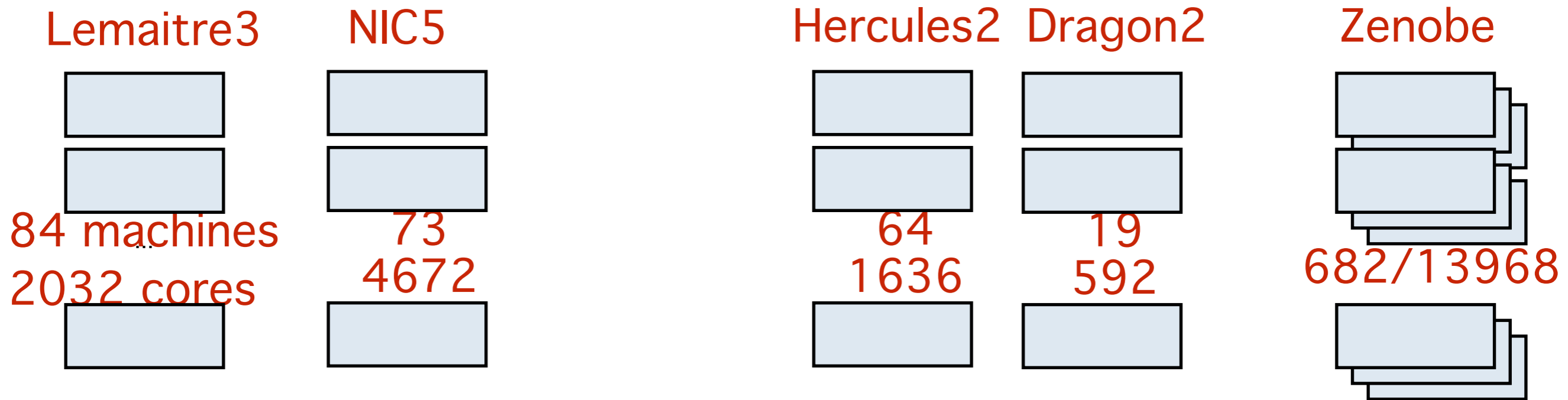
- ➔ how the cluster are organised
- ➔ On which machine you can connect and from where

- SSH theory

- ➔ What is a public/private key

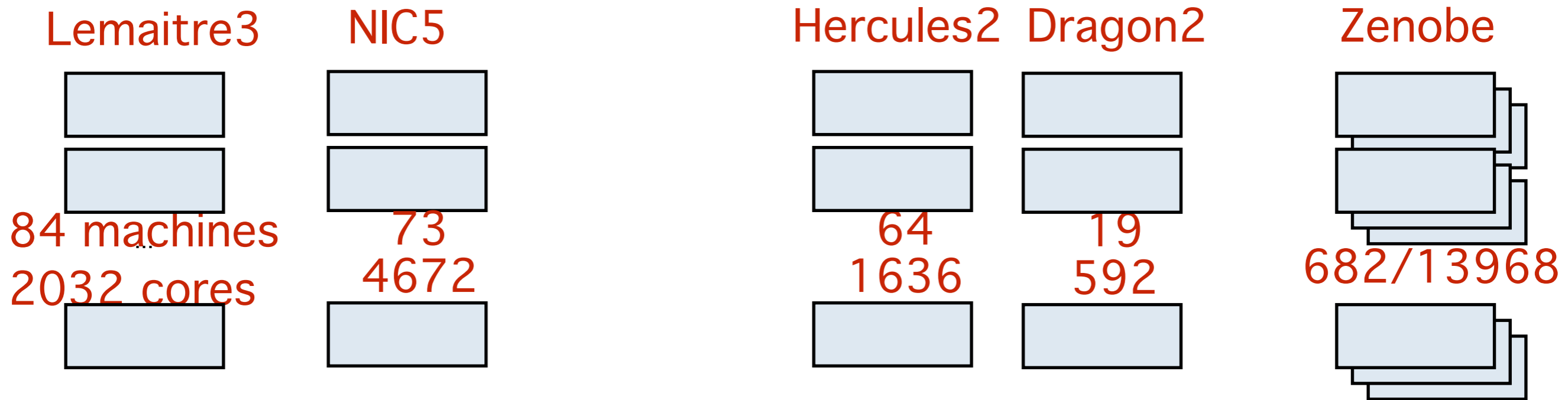
- SSH exercise

- ➔ How to get your keys
- ➔ Use of MobaXterm
- ➔ Use of Visual Studio Code

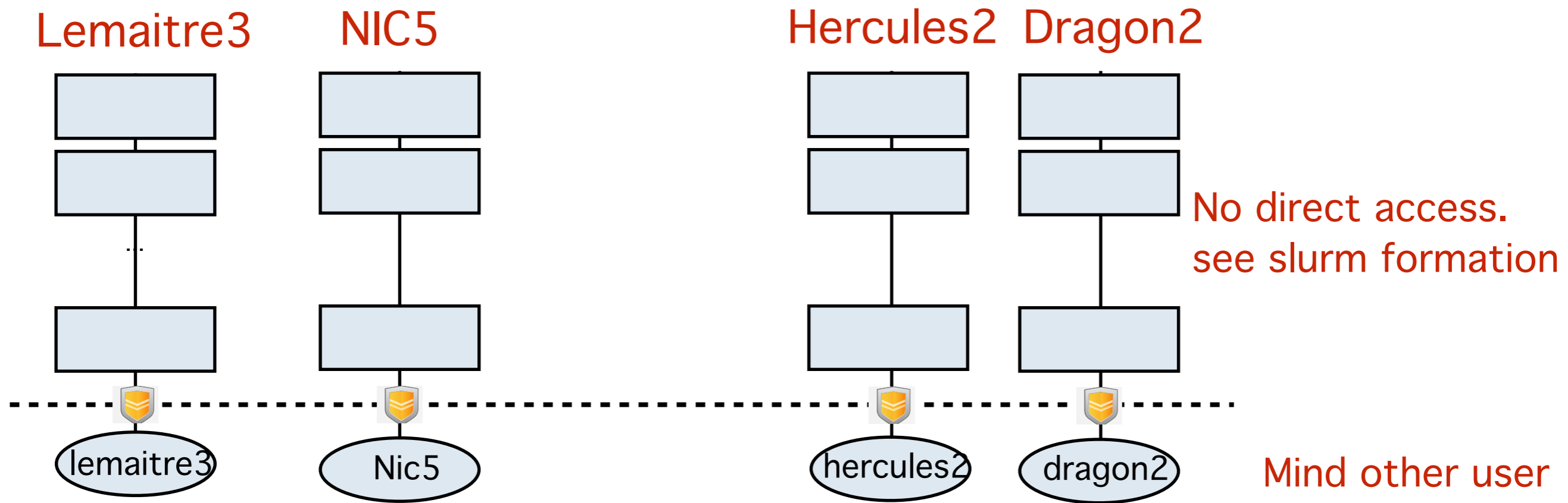


● Close to 10,000 cores available through your login

- ➔ 14k more with zenobe (require approval but same login)
- ➔ More available at European level (Prace program)
 - ◆ European competition to receive cpu time



- You do not need/want to physically connect to all those machines to run script
 - ➔ Difficult to control fair share of the machines
 - ➔ Using a job scheduler -> SLURM
 - ◆ Basic slurm tutorial at the end of the session
 - ◆ More on a dedicated session



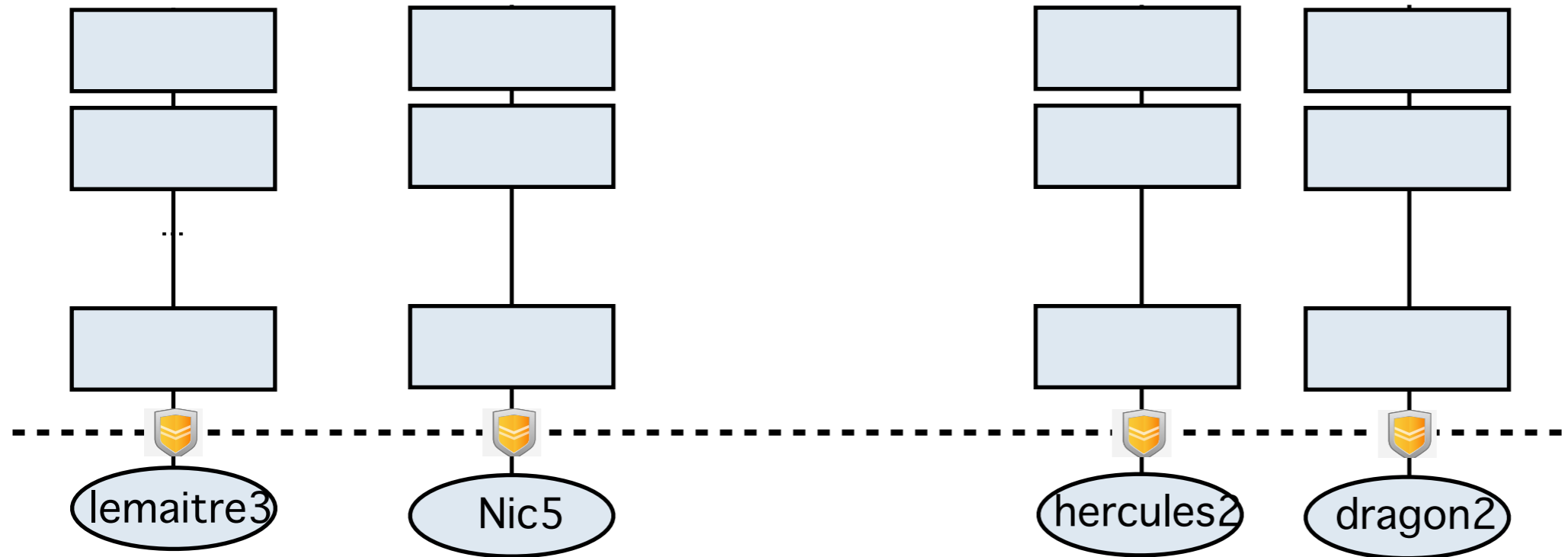
- To request machine, you connect to the **FRONTNODE** (also called user interface)
 - ◆ You can not connect to the other cpu!
 - ◆ You have to submit a job
 - ➔ **No heavy jobs** on that machine
 - ◆ You will impact everyone
 - ◆ rather use debug/fast partition

Lemaitre3

NIC5

Hercules2

Dragon2



- Cluster adress:

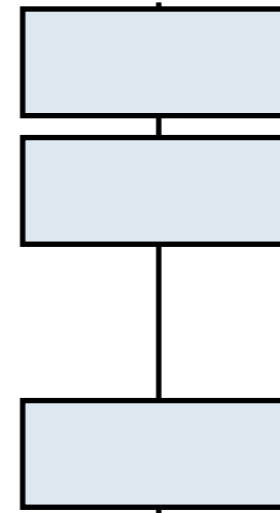
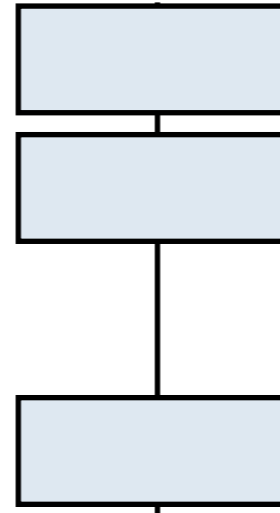
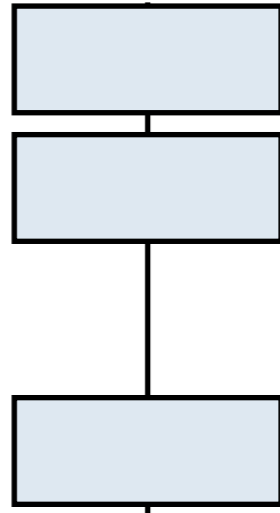
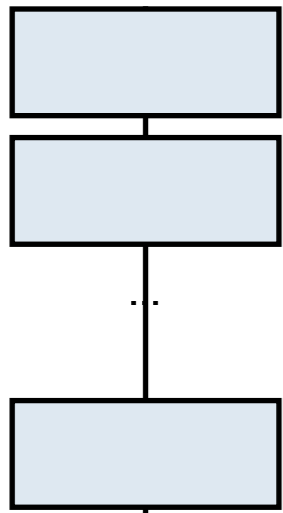
- ➔ lemaitre3.cism.ucl.ac.be
- ➔ nic5.uliege.be
- ➔ hercules.ptci.unamur.be
- ➔ dragon2.umons.ac.be

Lemaitre3

NIC5

Hercules2

Dragon2



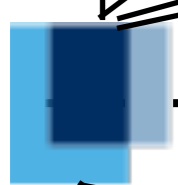
lemaitre3

Nic5

hercules2

dragon2

Private network



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Gateway



Home or your office



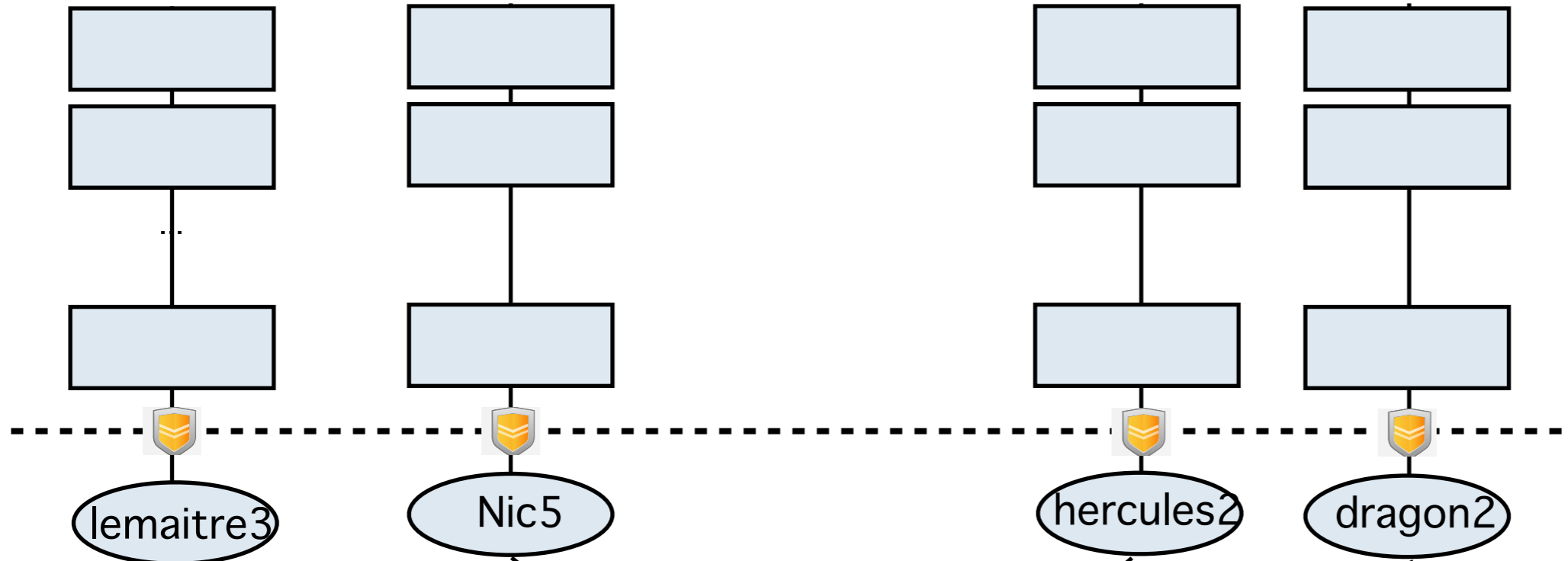


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Dragon2



Private network

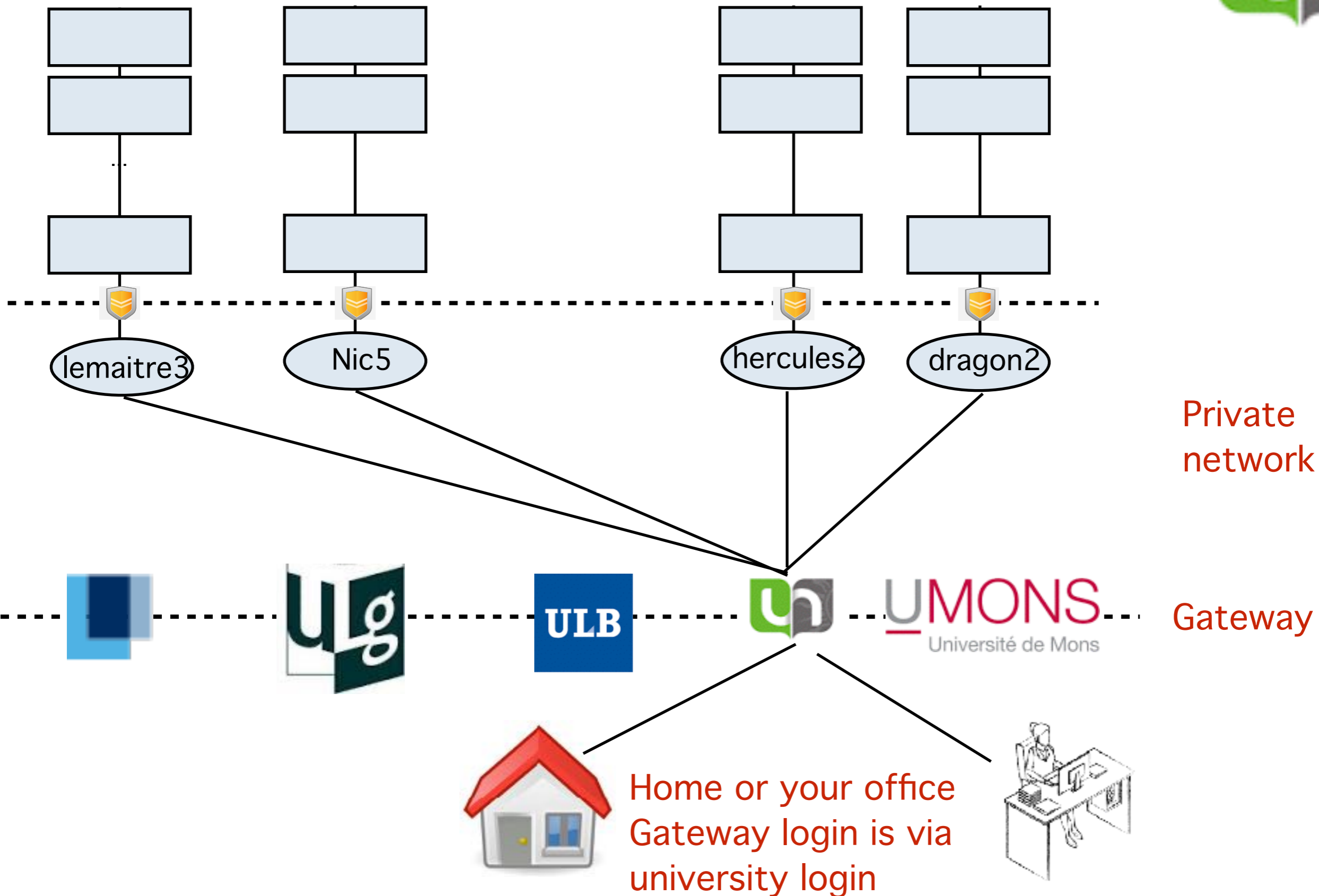
Gateway



Lemaitre3

NIC5

Hercules2 Dragon2



Private network

Gateway

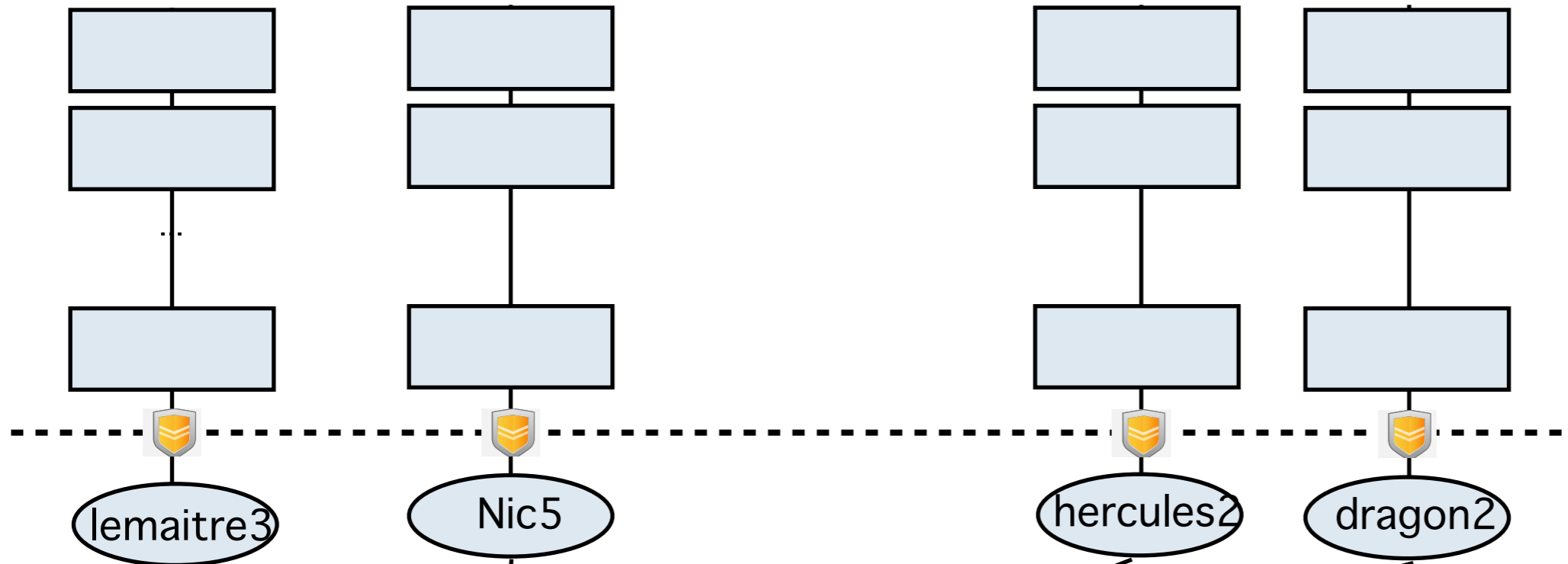
Home or your office
Gateway login is via
university login



Lemaitre3

NIC5

Hercules2 Dragon2

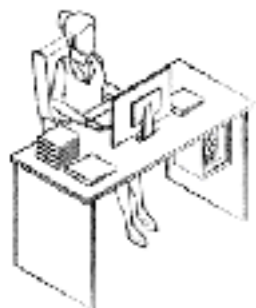


Private network

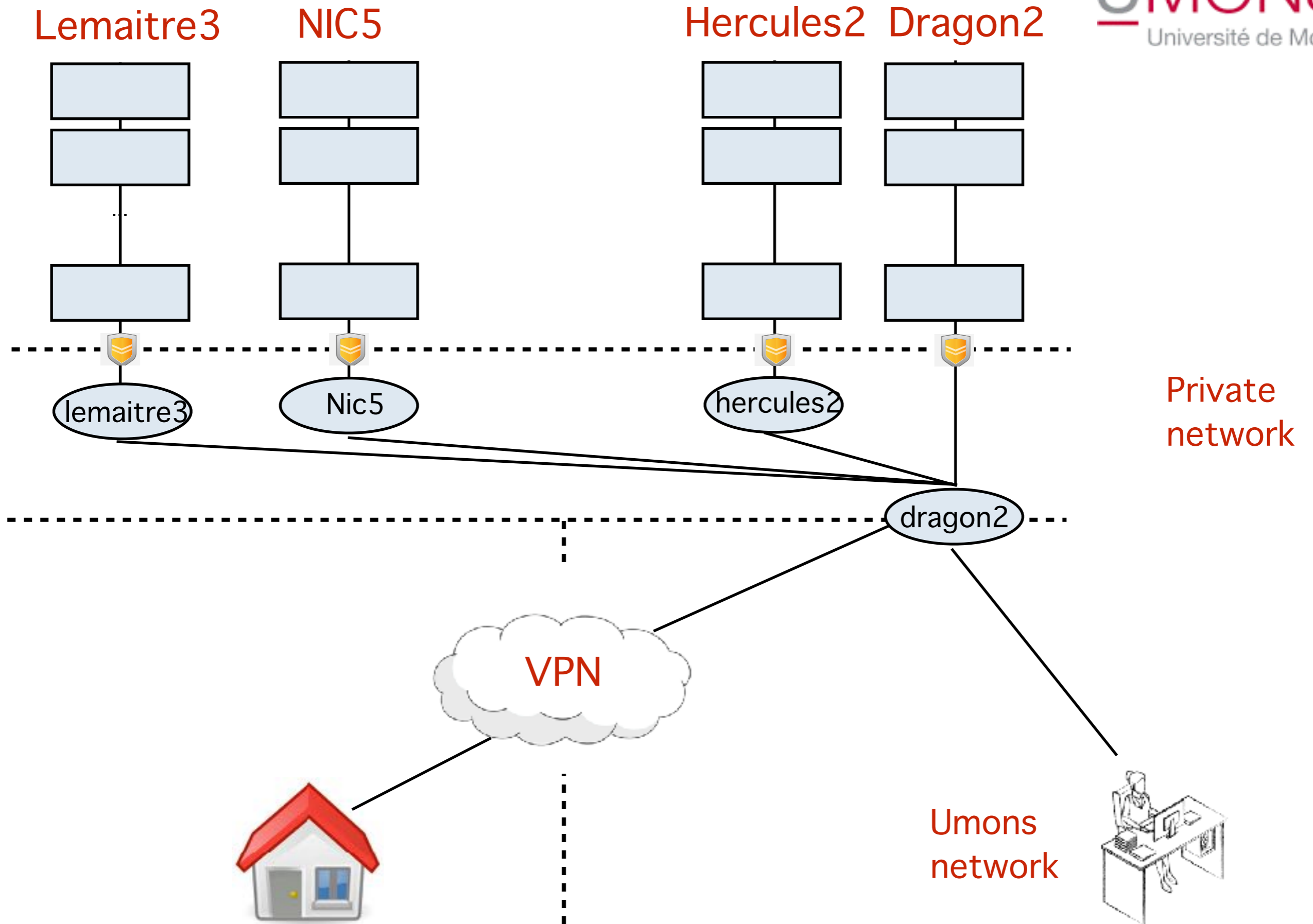


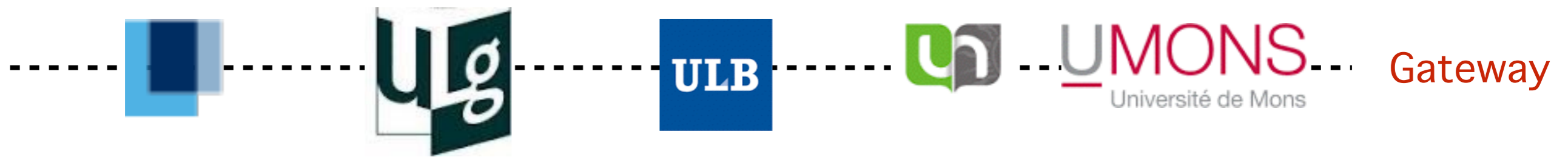
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Gateway



ULG Network





- Machine where you can not do anything
 - ➔ But gives you access to the frontend
 - ➔ Some of those gateway you are not even allowed to open a terminal (ulb, ucl, ulg)

- Gateway address

- ➔ gwceci.cism.ucl.ac.be

- ➔ gwceci.ulb.ac.be

- ➔ gwceci.uliege.be

- ➔ gwceci.unamur.be (unamur id)

- ➔ dragon2.umons.ac.be

SSH concept



Each user can enter the computer via a dedicated door protected via a key hole

Key hole
=
Public key



The user has the associate key

Physical key
=
Private key



To protect the key it is store in a safe with digicode

Digi-code
=
Pass-phrase

SSH concept



Key hole
=
Public key



Physical key
=
Private key



Digi-code
=
Passphrase

- When you create/renew your CECI account
 - ➔ We generate the public key (key hole)
 - ◆ Set it up on all cluster
 - ➔ We generate the private key (crypted by your passphrase)
 - ➔ Send it to YOU by email (we do not have any copy)



● Public key

- Used to encrypt data
- Use to verify digital signature



● Private key

- Used to decrypt data
- Create digital signature

steps of a ssh connection

1. Establishing communication and Negotiate algorithm of encryption

2. Host Identification

- ➔ Host send his public key + message sign with Host private key

Example

```
$ ssh -i ~/.ssh/id_rsa.ceci jcabrera@hmem.cism.ucl.ac.be
The authenticity of host 'hmem.cism.ucl.ac.be (130.104.1.220)' can't be established.
RSA key fingerprint is 06:54:39:a0:5c:b5:56:b3:29:9e:96:67:a0:4a:c1:ff.
Are you sure you want to continue connecting (yes/no)?
```

FIRST TIME you connect to a frontend host from a client,
you will be asked to accept the Public Key
Check the key fingerprint from CÉCI web site
<http://www.ceci-hpc.be/clusters.html#hmem>

SUPPORT: egs-cism@listes.uclouvain.be

Server SSH key fingerprint: (What's this?)

MD5: 06:54:39:a0:5c:b5:56:b3:29:9e:96:67:a0:4a:c1:ff

SHA256:

Xi4r0aNViNgg9KjnENiUFkEWPwnJGAjbnlX+m7Clm0

steps of a ssh connection

1. Establishing communication and Negotiate algorithm of encryption
2. Host Identification
 - ➔ Host send his public key + message sign with Host private key
3. Generation of symmetric key based on a common integer
 - ➔ from now all data are crypted with that method
4. User identification

Enough of “theory”
Let’s get practical and connect to
the machines !!



Consortium des Équipements de Calcul Intensif

6 clusters, 10k cores, 1 login, 1 home directory

I want to...

[create an account](#)

You are about to request an account on the CÉCI clusters.

The first step is to enter your email address. You will receive an email with a link to an online form which you will have to fill and submit.

Once your request has been approved, you will receive proper information on how to access the CÉCI clusters.

[renew my account](#)

[join an existing project](#)

create an account

My email address:

Send

Getting your private key (I)

- Users with email account access can ask for an account at: <https://login.ceci-hpc.be/init/>
 - ➔ Click 'Create Account'
 - ➔ Type in your email address
 - ➔ Click on the link sent to you by email.
 - ➔ Fill-in the form and hit the “Submit” button.
 - ➔ Wait ... (A sysadmin is reviewing your information). receive your private key by email.

SSH tools for windows

● Putty

- Only ssh connection
- No file transfer, **bad support of key**

● MobaXterm

- Very easy
- Both connection and file transfer

● VSCode

- Based on openssh, connection, file transfer and text edition, **no graphical server**

● OpenSSH on Windows (since 2018)

- Linux like experience
- Configure for free if using VSCode

Install MobaXterm



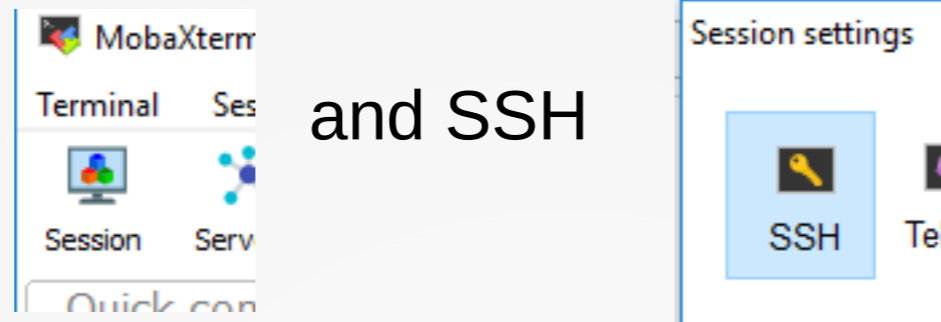
MobaXterm Home Edition v10.4
(Portable edition)

- search on your favorite web browser
- Download the free Portable edition
- Uncompress on folder
‘Documents\MobaXterm’
- Execute MobaXterm_Personal_X (where X
is version number)
- If needed allow firewall access for Private
and Domain networks

Configure mobaxterm

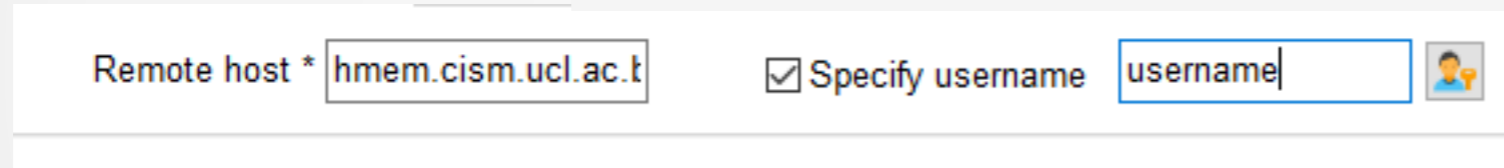
1) Save your id_rsa.ceci key file from your e-mail in a safe location

2) Click on Session

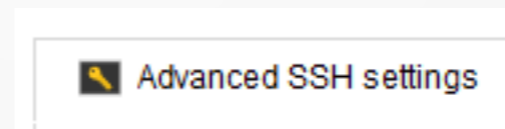


and SSH

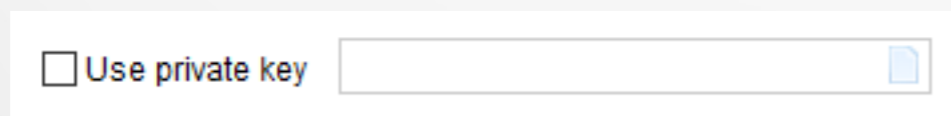
3) Add the Remote host



4) Select Advanced SSH Setting tab



5) Select use private key and browse for your id_rsa.ceci file



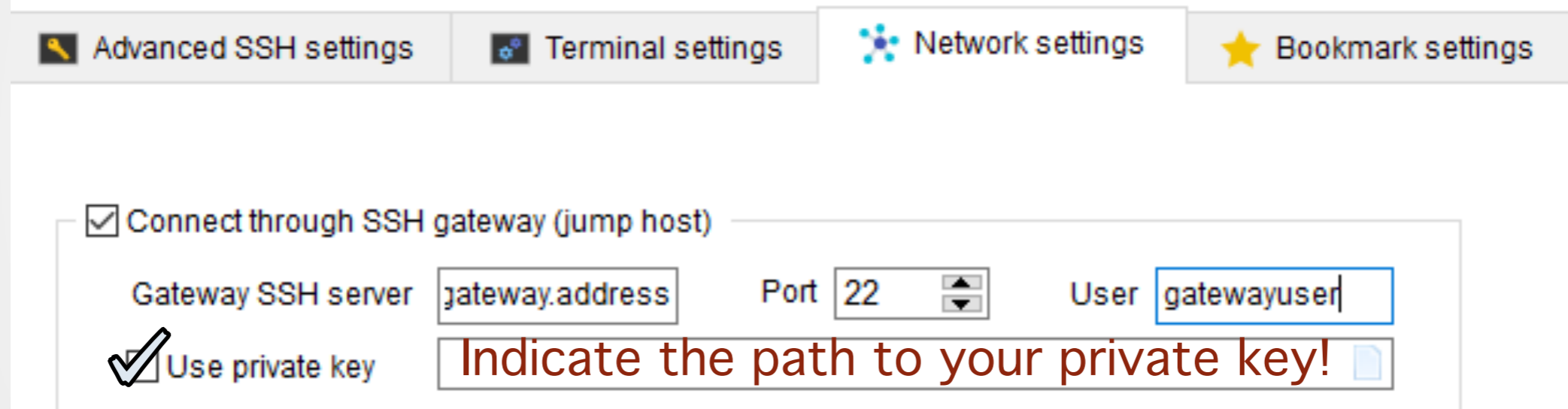
Depending of your version of mobaxterm/configuration it might ask you the passphrase already now

➔ Remote host options:

➔ lemaitre3.cism.ucl.ac.be nic5.uliege.be hercules.ptci.unamur.be
dragon2.umons.ac.be vega.ulb.ac.be

Gateway configuration

- Need to go through a gateway!
 - ➔ Network settings



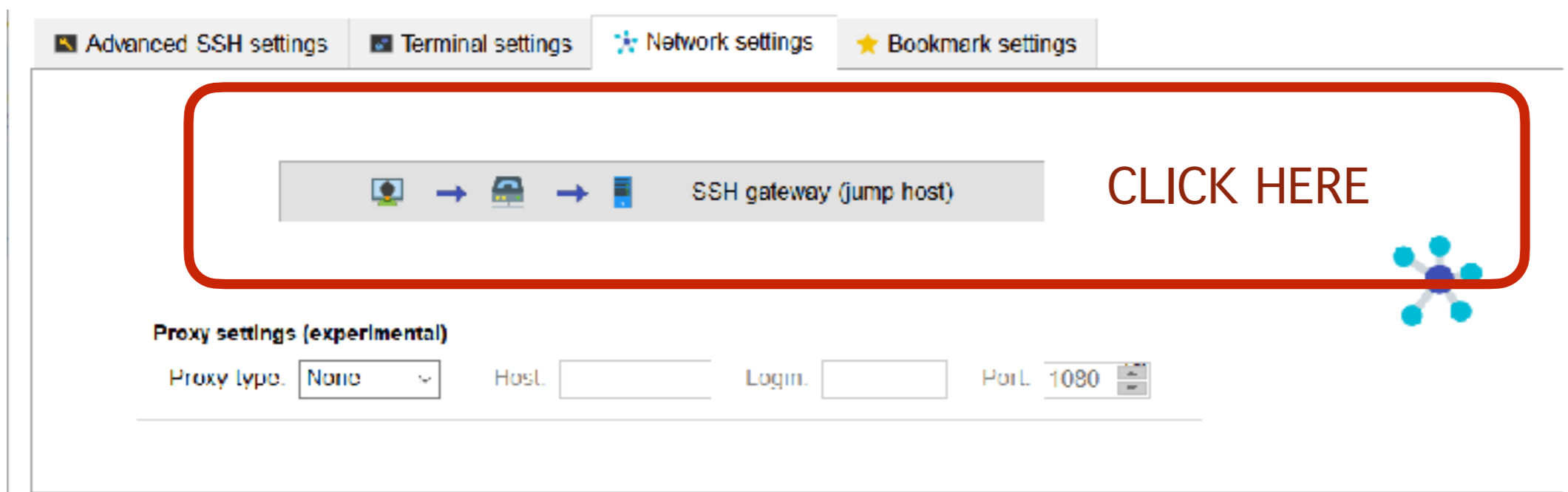
Advanced SSH settings | Terminal settings | **Network settings** | Bookmark settings

Connect through SSH gateway (jump host)

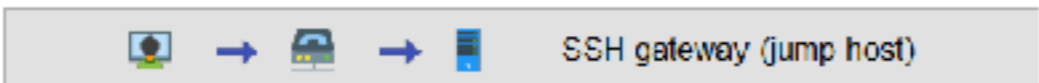
Gateway SSH server: Port: User:

Use private key

- Newer version looks like this:



Advanced SSH settings | Terminal settings | **Network settings** | Bookmark settings

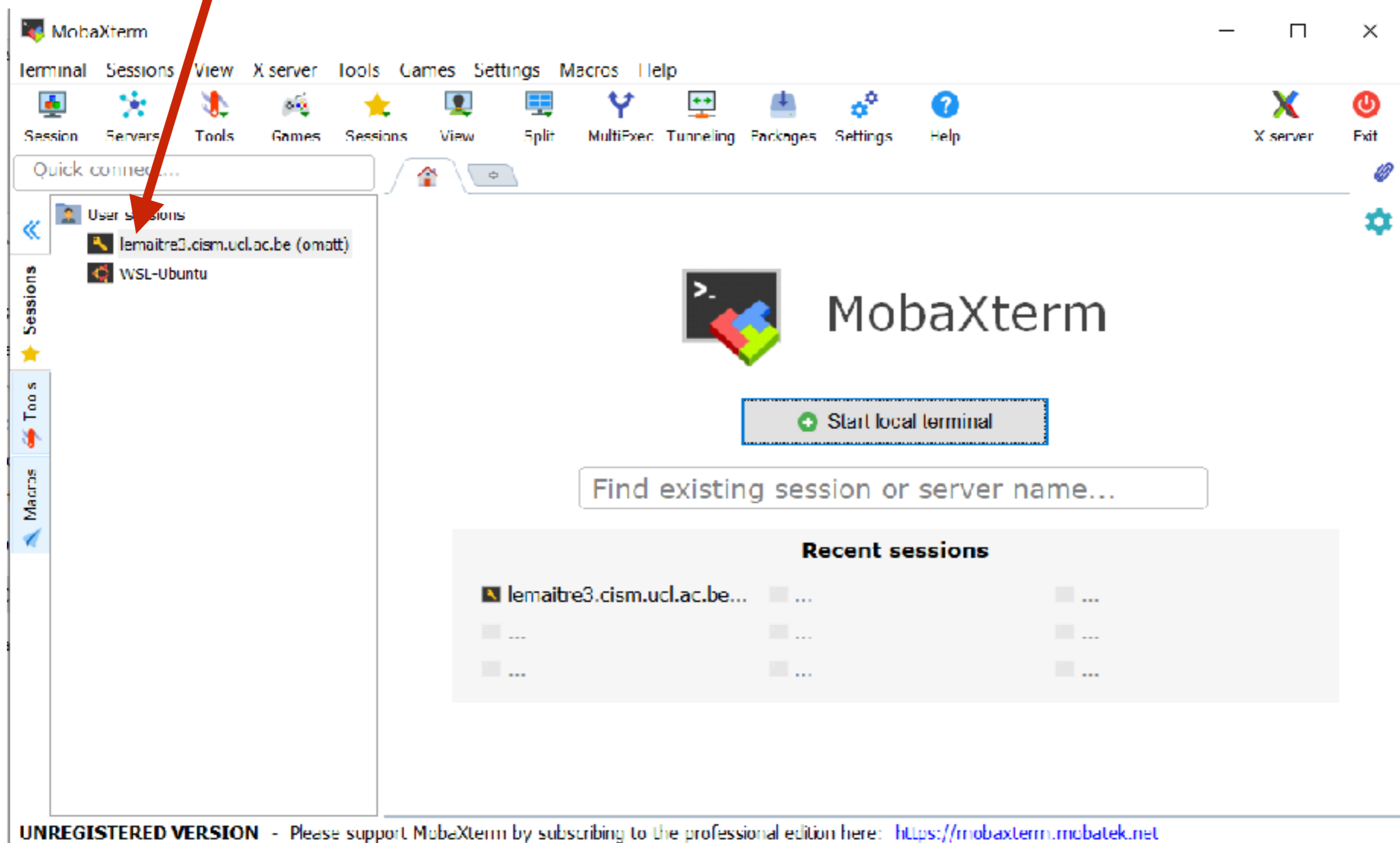
 SSH gateway (jump host) **CLICK HERE**

Proxy settings (experimental)

Proxy type: Host: Login: Port:

You can now connect to the cluster

CLICK HERE



You are now connected

Terminal Sessions View X server Tools Games Settings Macros Help

Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help X server Exit

Quick connect...

/home/users/o/m/omatt/

Remote monitoring

Follow terminal folder

UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>

```
Massively parallel CISM-CECI cluster
80 nodes: 2 x 12-core Intel Skylake 5118@2.3GHz, 96GB RAM
1:3-blocking OmniPath Architecture network
contact, support: cgs-cism@listes.uclouvain.be
-----
553/1984 CPUs available (load 72%) - 120 jobs running, 132 pending.
You currently have 0 job running, 0 pending.
You are using 39.1G ( out of 100G ) in $HOME.
You have 0G of data on $GLOBAL_SCRATCH.
Don't know where to start?
--> http://www.cec-hpc.be/install\_software.html
--> http://www.cec-hpc.be/slurm\_tutorial.html
[omatt@lm3-w001 ~]$
```

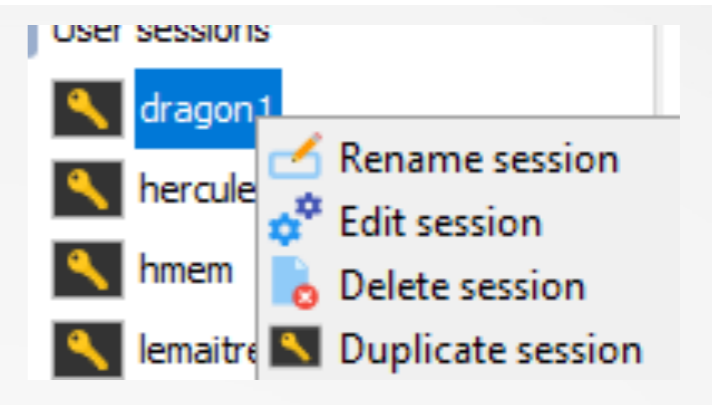
FILE ON DISK

TERMINAL

Exercise

- run `xeyes` to check that you can forward graphics through ssh
- Configure the other cluster that you need

Right click on a session to duplicate and rename it.



Frequent error

If, after running ssh, you are being asked for a password directly,

```
$ ssh hmem  
dfr@hmem.cism.ucl.ac.be's password:
```

it means that your SSH client did not try to use the SSH key.

If, after running ssh, you are being asked for a passphrase, then a password,

```
$ ssh hmem  
Enter passphrase for key '/home/dfr/.ssh/id_rsa.ceci':  
dfr@hmem.cism.ucl.ac.be's password:
```

it often means that the user name you are using is not the correct one. It could also mean that you are trying to connect with the new private key while it has not been synchronized to the cluster yet (clusters are not synchronized simultaneously.)

SSH AGENT

- Save your passphrase locally and let MobaXterm fill it for you! First, close your current ssh session

MobaXterm Configuration

The screenshot shows the MobaXterm Configuration window with the SSH tab selected. The window has a title bar with a close button (X) and a toolbar with icons for General, Terminal, X11, SSH, Display, Toolbar, and Misc. The SSH settings are organized into three sections:

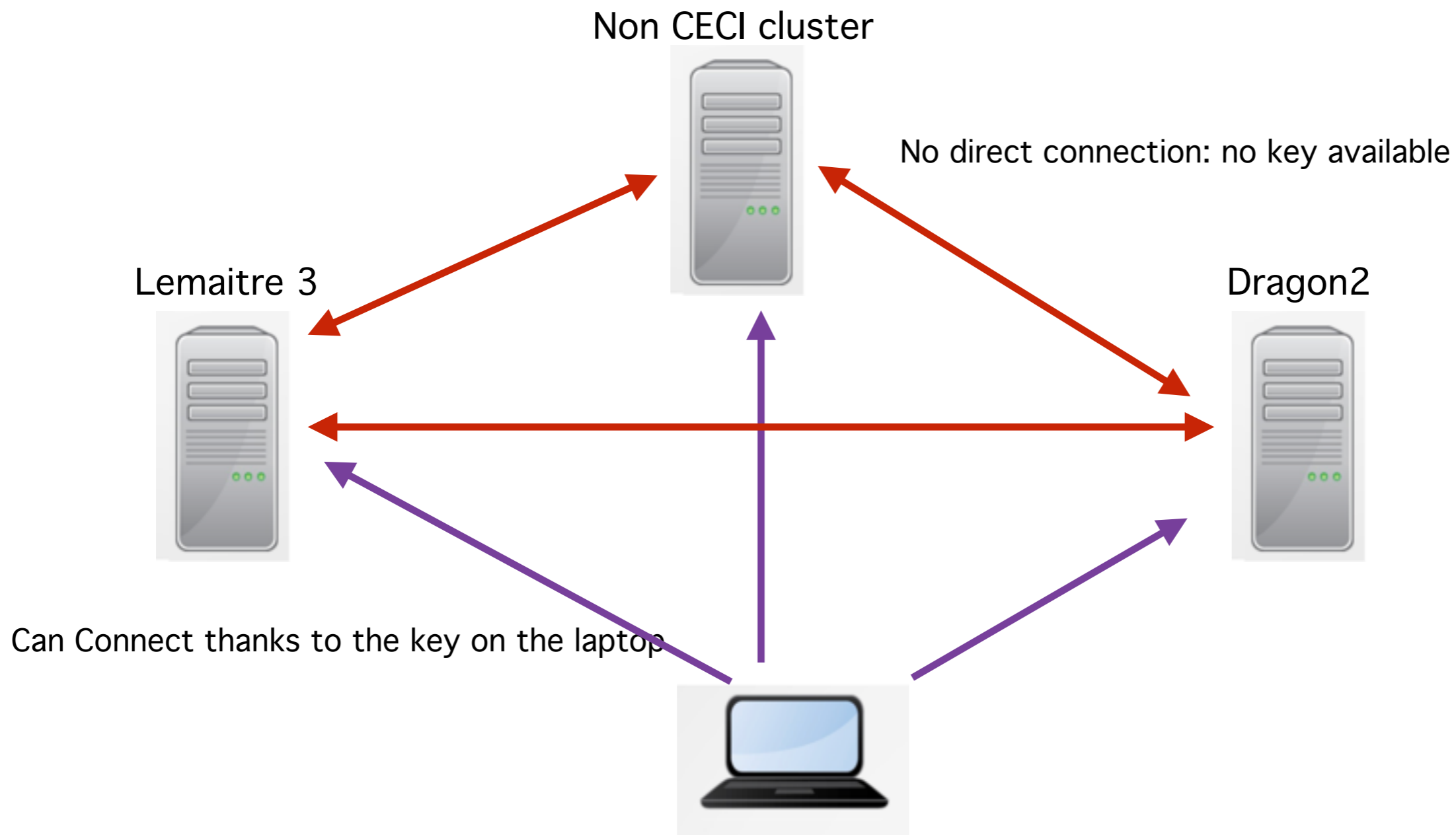
- SSH-browser settings:** Includes checkboxes for 'Enable graphical SSH-browser' (checked), 'Automatically switch to SSH-browser tab after login' (checked), 'Remote-monitoring (experimental)' (unchecked), and 'Disable file data during SSH browser transfer' (unchecked).
- SSH settings:** Includes checkboxes for 'SSH keepalive' (checked), 'Display SSH banner' (checked), and 'Validate host identity at first connection' (unchecked). It also features a 'Default login:' dropdown menu set to '<Same as Windows login>', a 'Use 2-factor authentication for SSH gateways' checkbox (unchecked), 'GSSAPI Kerberos' checkbox (checked) with a 'Domain:' text field and a 'GSSAPI library:' dropdown menu set to '<Native Windows>', and 'Defaults for commandline SSH:' with checkboxes for 'Compression' (checked), 'X11-Forwarding' (checked), and 'Fix connection issues' (checked).
- SSH agents:** Includes checkboxes for 'Use internal SSH agent "MobAgent"' (checked), 'Use external Pageant' (checked), and 'Forward SSH agents' (checked). Below this is a text field 'Load following keys at MobAgent startup' and a list of keys with a '+' button to add more.

A tooltip is visible over the 'SSH-browser settings' section, stating: 'The SSH-browser is a graphical remote file browser which is displayed in the sidebar. It allows you to browse your remote server content using the secure SSH connection.'

Three red arrows point to the checked checkboxes: 'SSH keepalive', 'Use internal SSH agent "MobAgent"', and 'Forward SSH agents'.

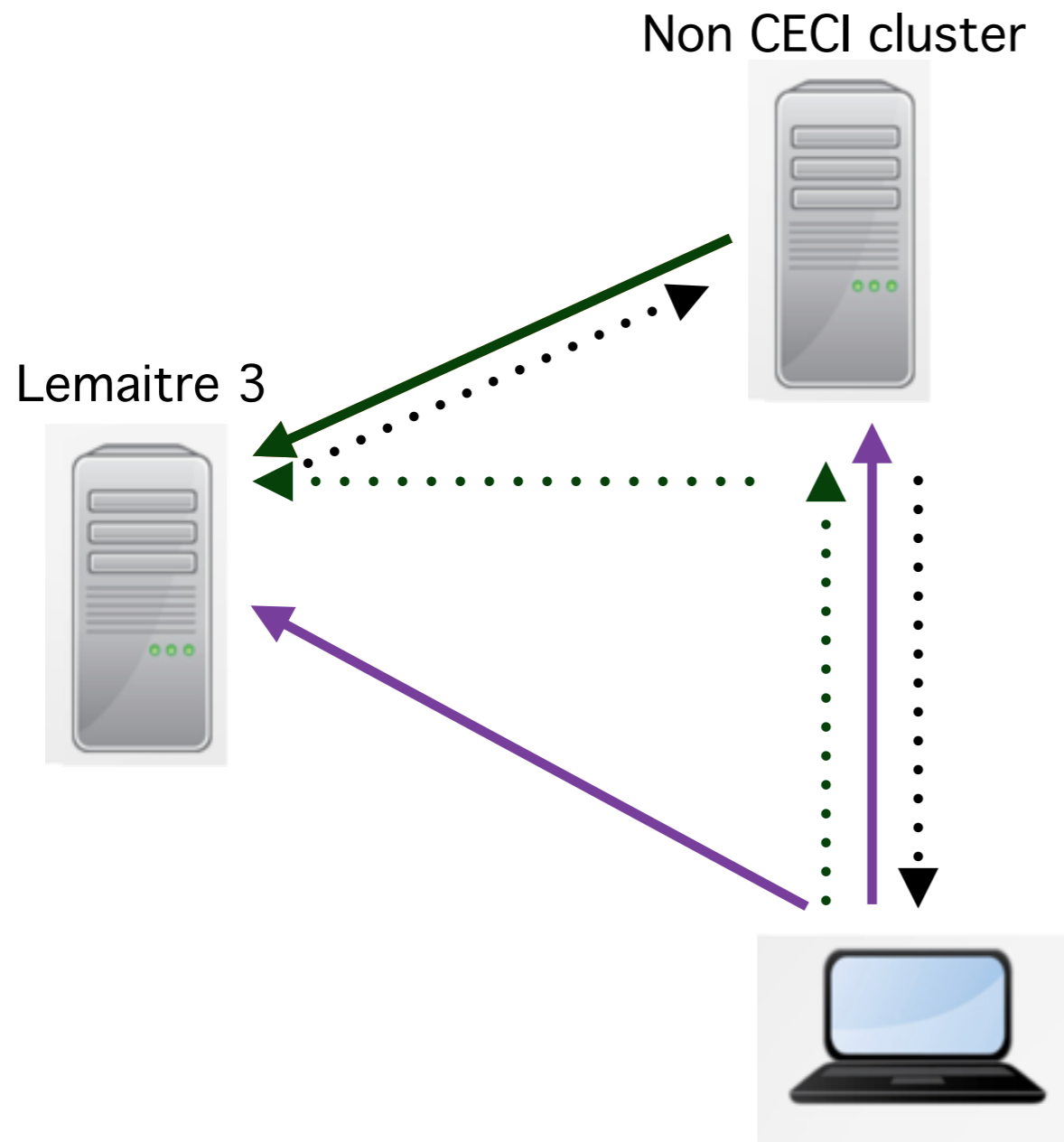
Avoid to propagate your private keys

- Less keys means more security



Avoid to propagate your private keys

- Forward agent send back the ssh request for a key to your laptop



Try to connect

Host ask for a key

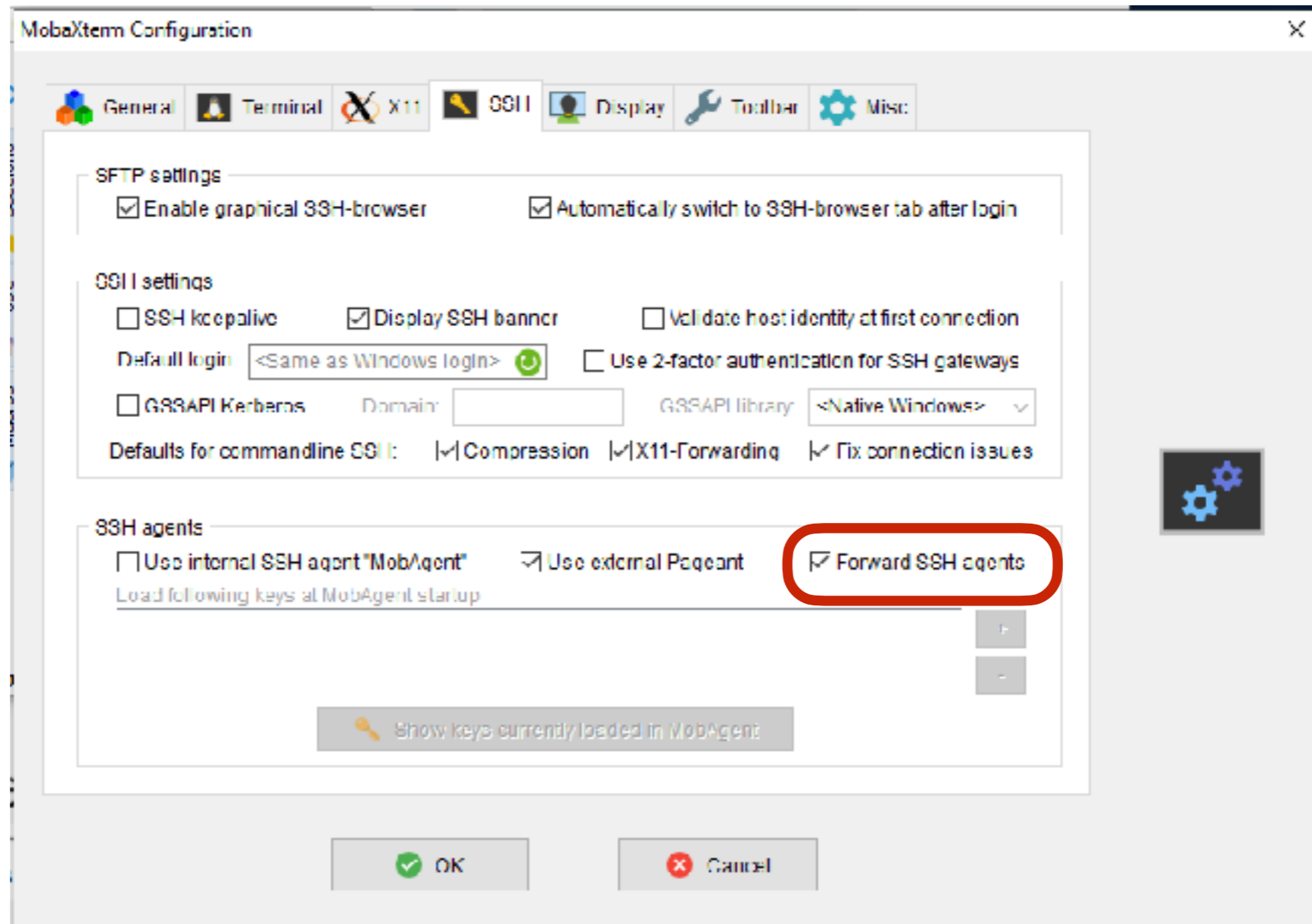
Message forward to laptop

Key provided

Connection granted

Forward Agent

- In order to connect from one machine to another (file transfer for example) Check that “forward ssh agents” is activated



- For large file use /CECI/trsf between CECI cluster

Basic Intro to SLURM

- What is available on the cluster

→ sinfo

```
[omattadm@lm3-w001 ~]$ sinfo
Partitions:
batch* (2days)  debug (6hours)
Nodes:
#Nodes  Partition  CPU                               Cores/Slots  Memory  GPUs
78      batch*     intel,skylake5000,5118           24           93G     (null)
4       debug     intel,haswell,e5-2690v4          28           63G     (null)
```

- ask to have access to one core for interactive session

→ srun --pty bash

```
[omatt@lm3-w001 ~]$ srun --pty bash
srun: job 70196378 queued and waiting for resources
srun: job 70196378 has been allocated resources
[omatt@lm3-w076 ~]$ █
```

Note that you are now in one node of the cluster, you can run heavy jobs here (note that you are restricted to one core but the above command can be updated to ask for more core)

Basic Intro to SLURM

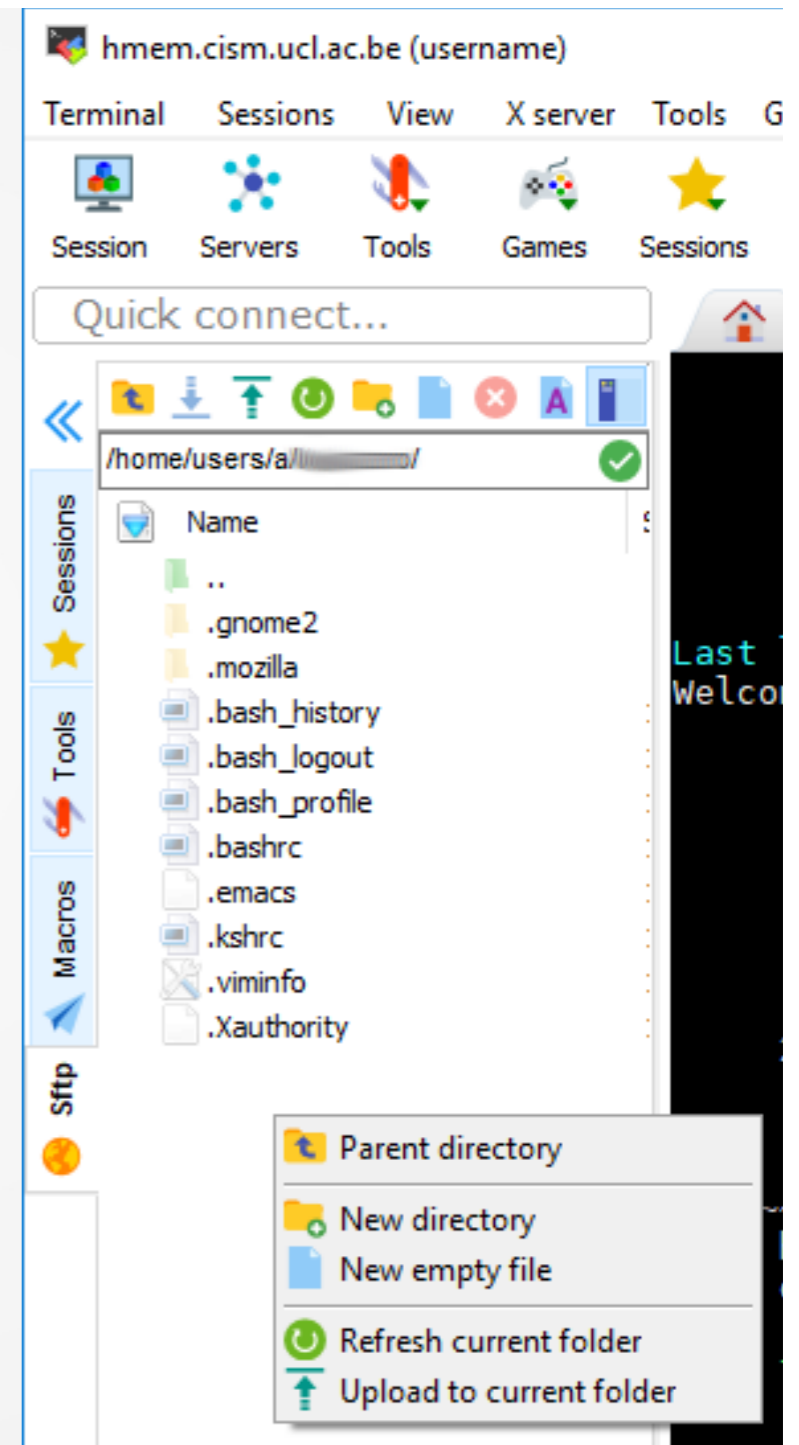
- Check what is your current usage of the clusters: `squeue`

```
[omatt@lm3-w076 ~]$ squeue --user=omatt
CLUSTER: lemaitre3
      JOBID PARTITION   NAME   USER  ST       TIME  NODES NODELIST(REASON)
      70196378    batch    bash   omatt  R        3:45     1  lm3-w076
```

- ➔ Plenty of options to customise your resource allocation (max-time, how many core, how many memory,.....)
- ➔ <http://www.cecil-hpc.be/scriptgen.html>
- ➔ Use the `sbatch` command for that
 - ➔ `sbatch mycmd.sh`

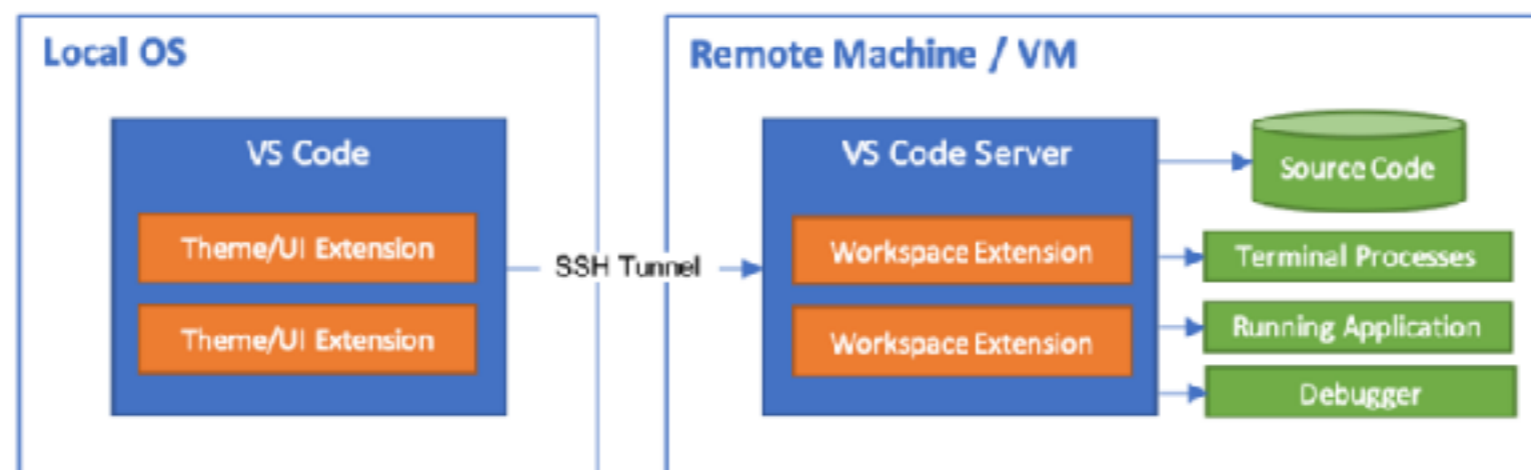
SCP/SFTP

- 1) Select Sftp tab on the left sidebar you get a file browser on the cluster you are connected to
- 2) Drag and drop files from/to your computer to/from that panel and they will be copied to/from the cluster
- 3) Right click on the panel and press the Refresh current folder button after you copied something or a new file or folder is created on the cluster



Edit file on cluster

- Text editor are available on cluster
 - ➔ Non graphical editor (fast but hard to learn)
 - ➔ Graphical editor (bandwidth limitation, slow)
- My advised solution is to use Visual studio code:
 - ➔ <https://code.visualstudio.com/download>
 - ➔ And add ssh extension:
 - ➔ <https://code.visualstudio.com/docs/remote/ssh>

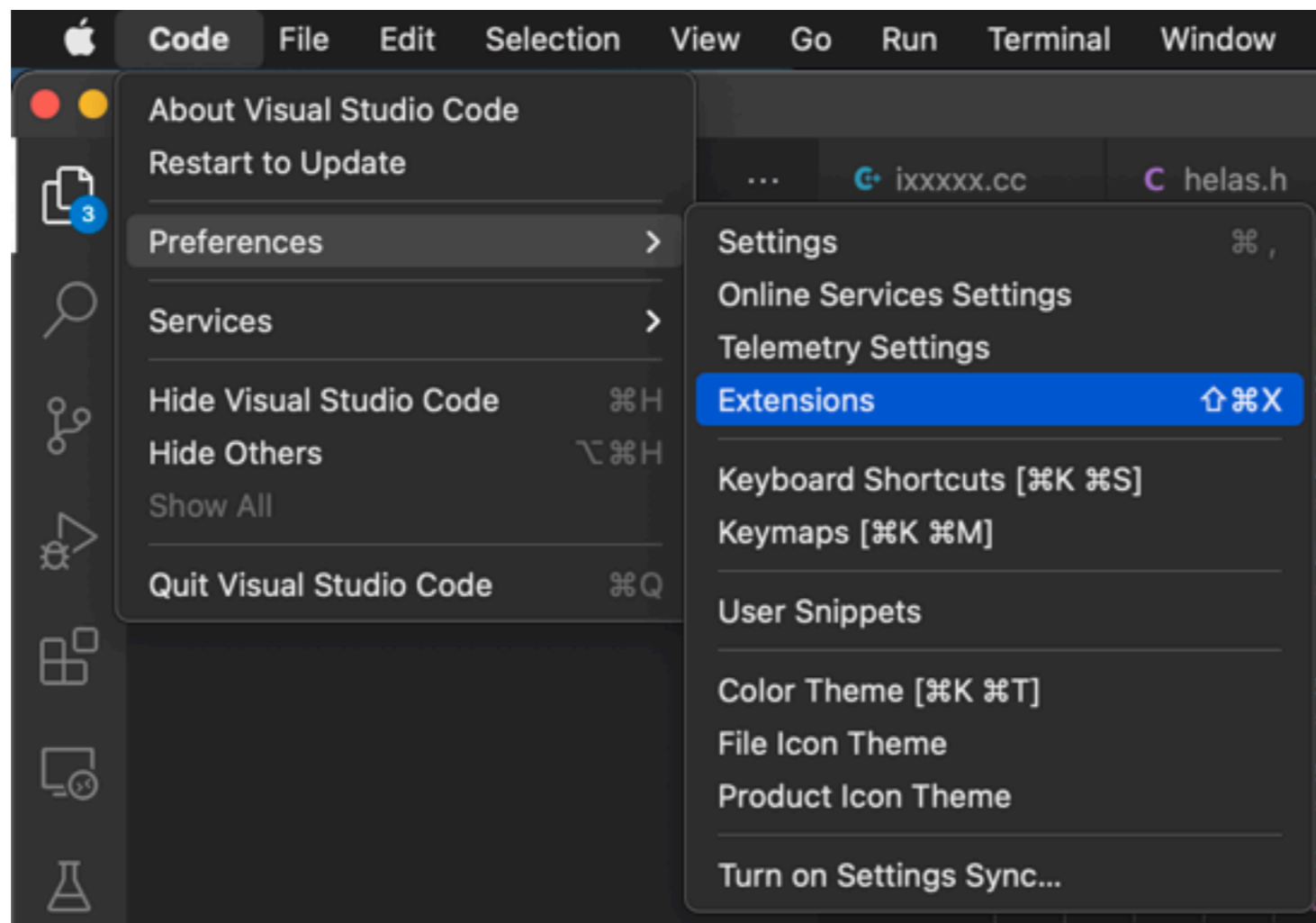


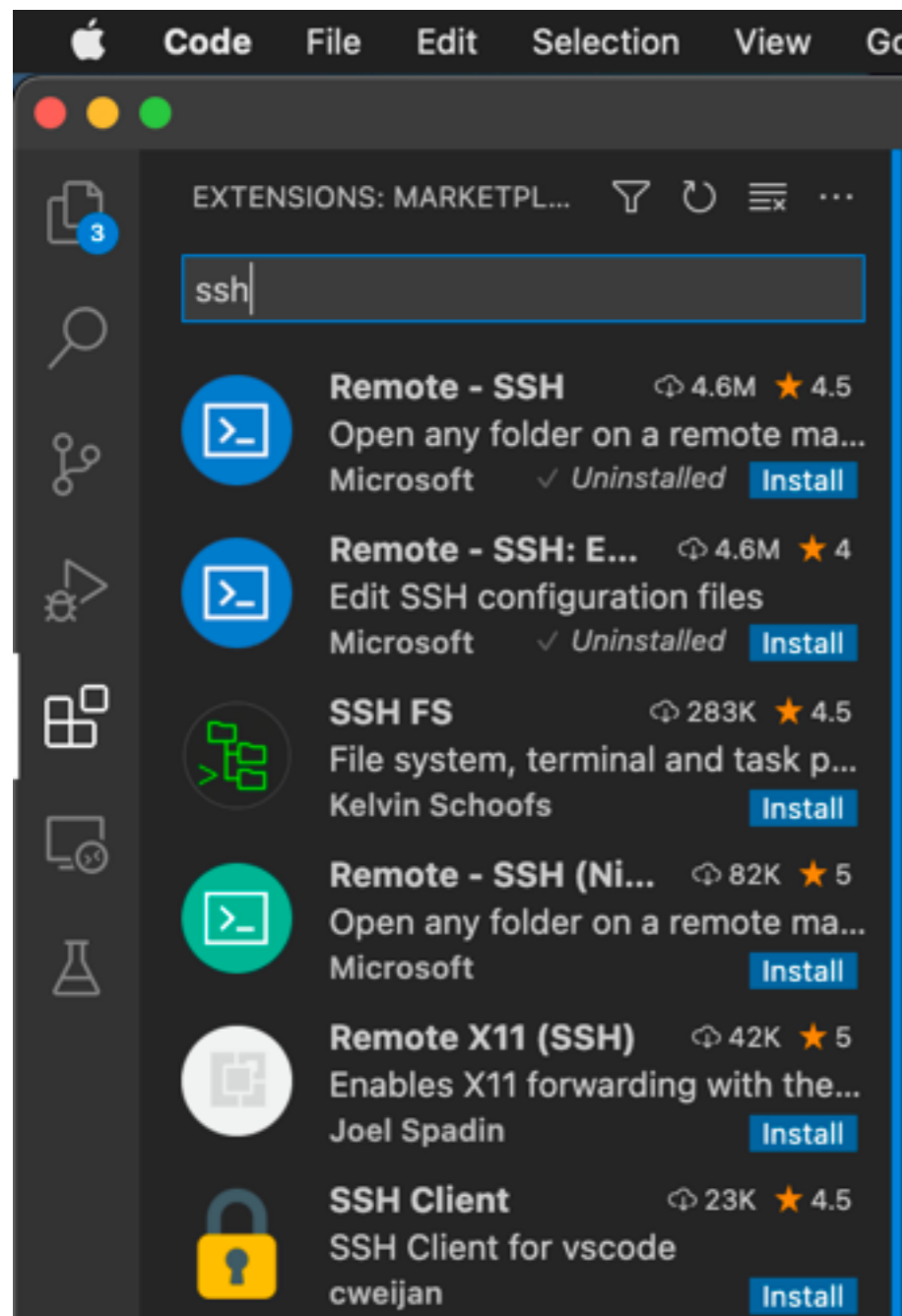
Install the ssh extension

- Install Visual Studio Code

 - ➔ <https://code.visualstudio.com/download>

- Go to the preference menu/ extensions

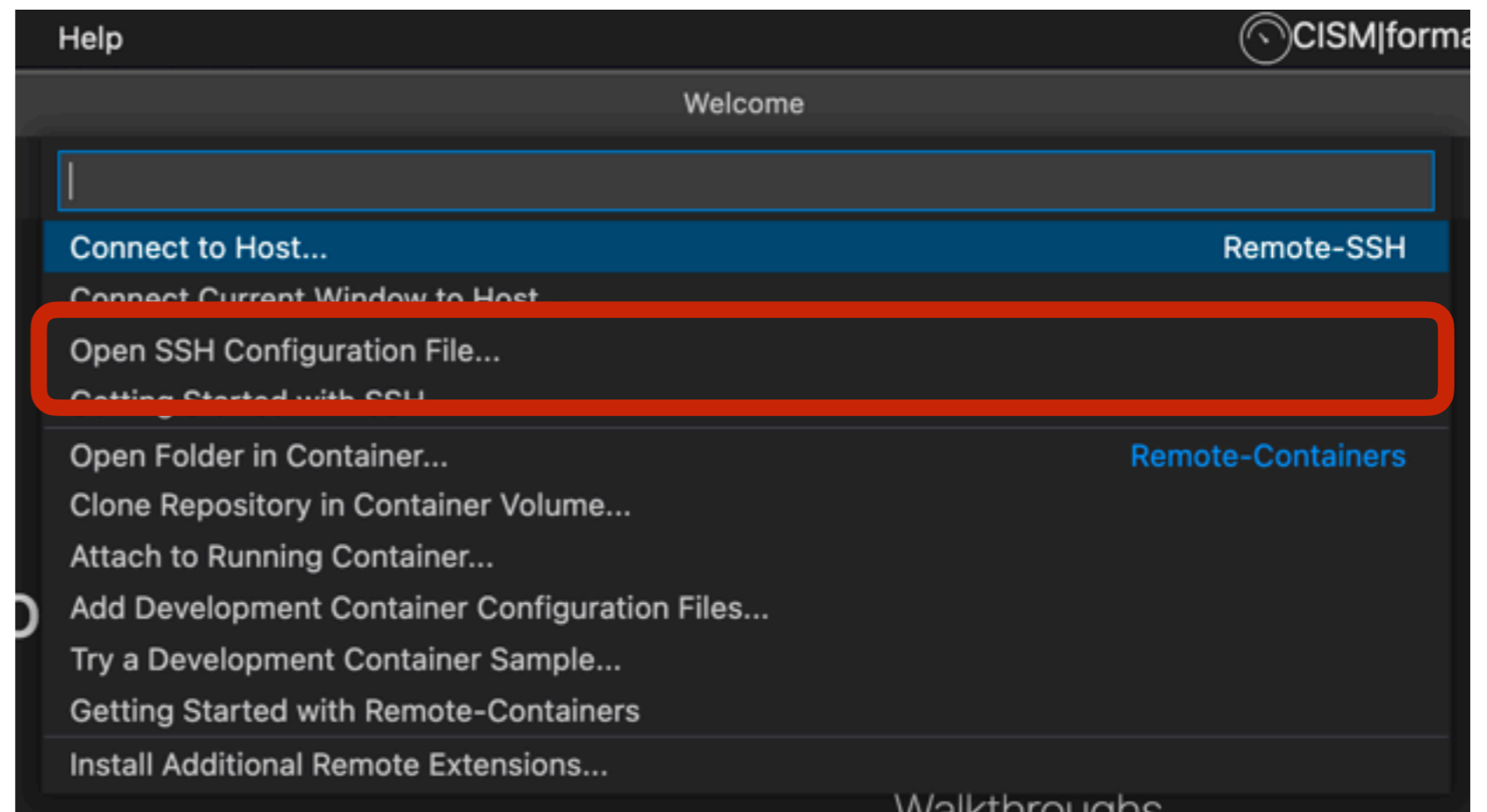




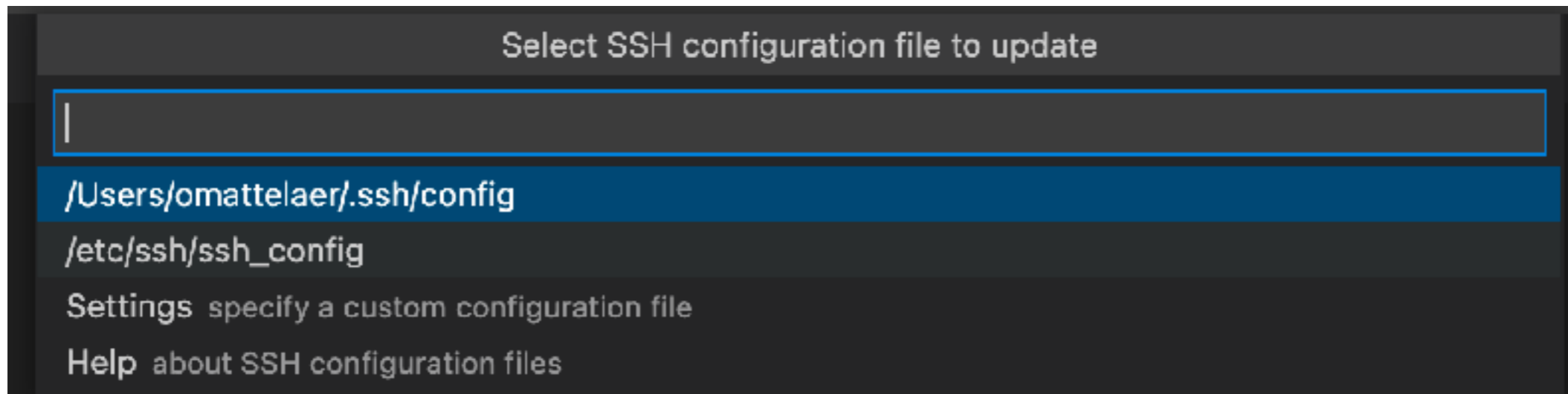
- Search for “ssh”
- Click on “install” of the Remote - SSH

Setup connection

- Click on the green square
 - ➔ Bottom left
- Menu open (see below)
 - ➔ Select “open ssh configuration file”



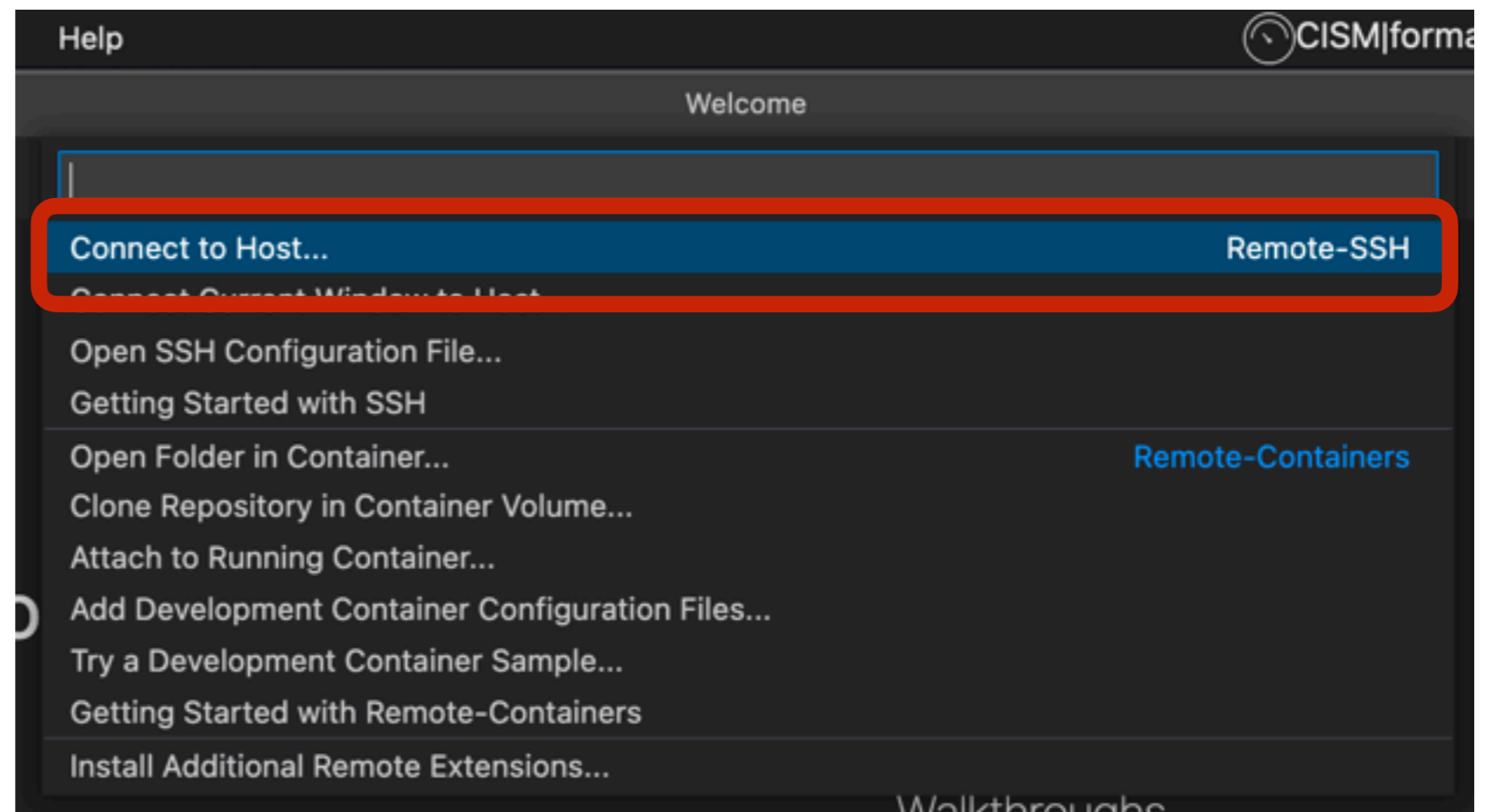
Setup connection



- First one is likely the best here (it is for me)
- Copy/paste in that file the content of
 - ➔ <http://www.cec-hpc.be/sshconfig.html>
 - ➔ Edit the path to your private key
- Save the file and exit

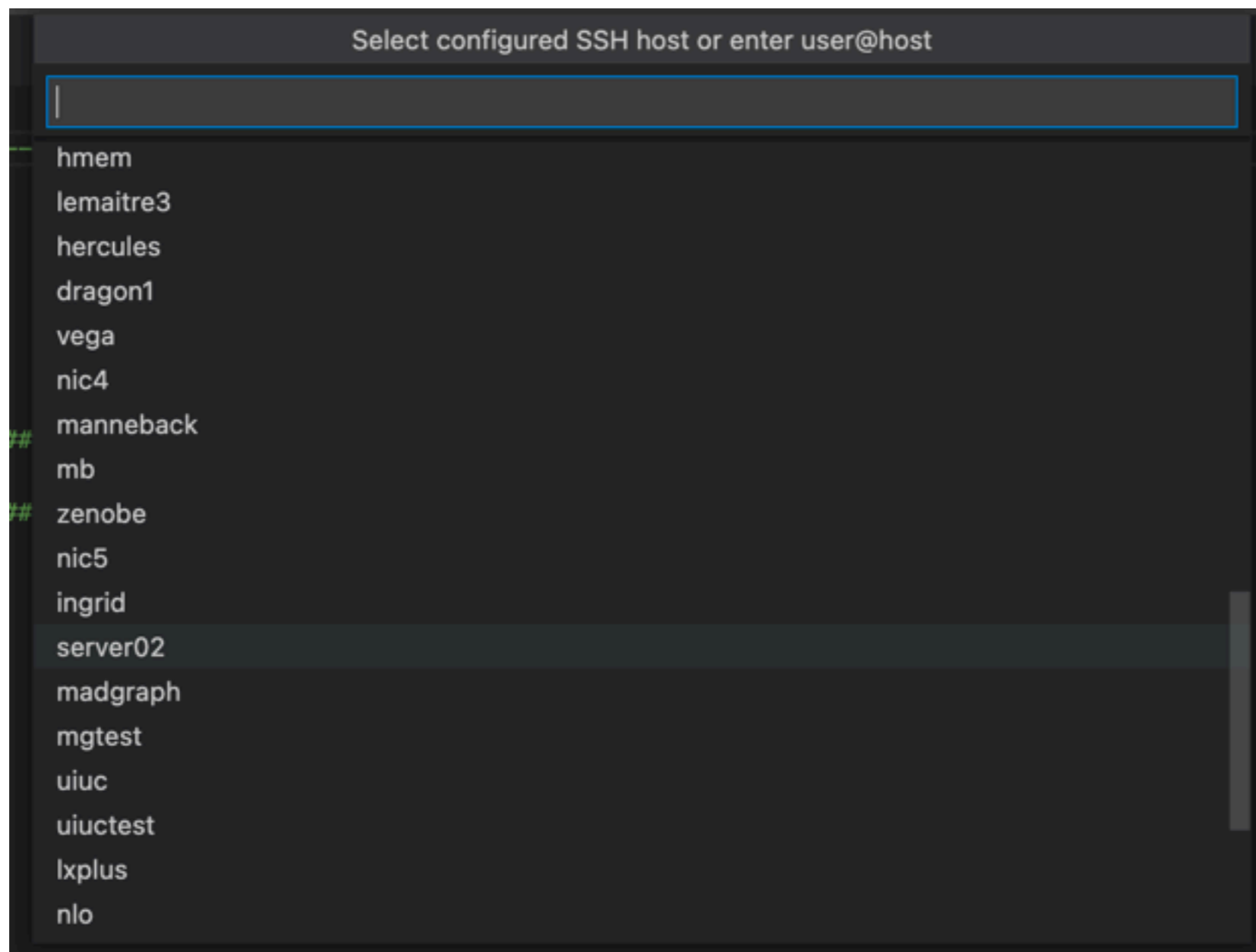
connection to cluster

- Click on the green square
 - ➔ Bottom left
- Menu open (see below)
 - ➔ Select “connect to Host”

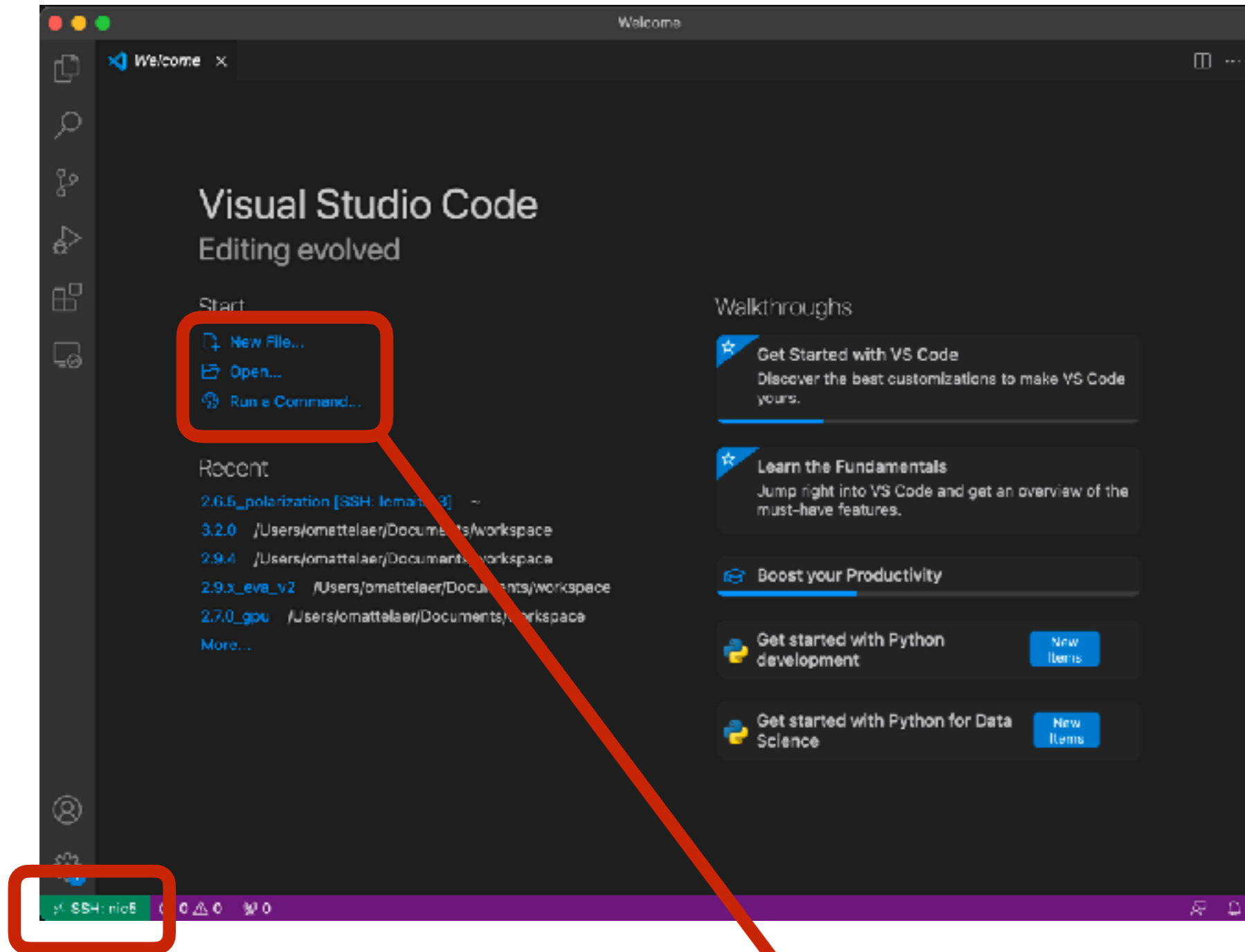


Ssh connection

- Select the cluster that you want to connect/edit files



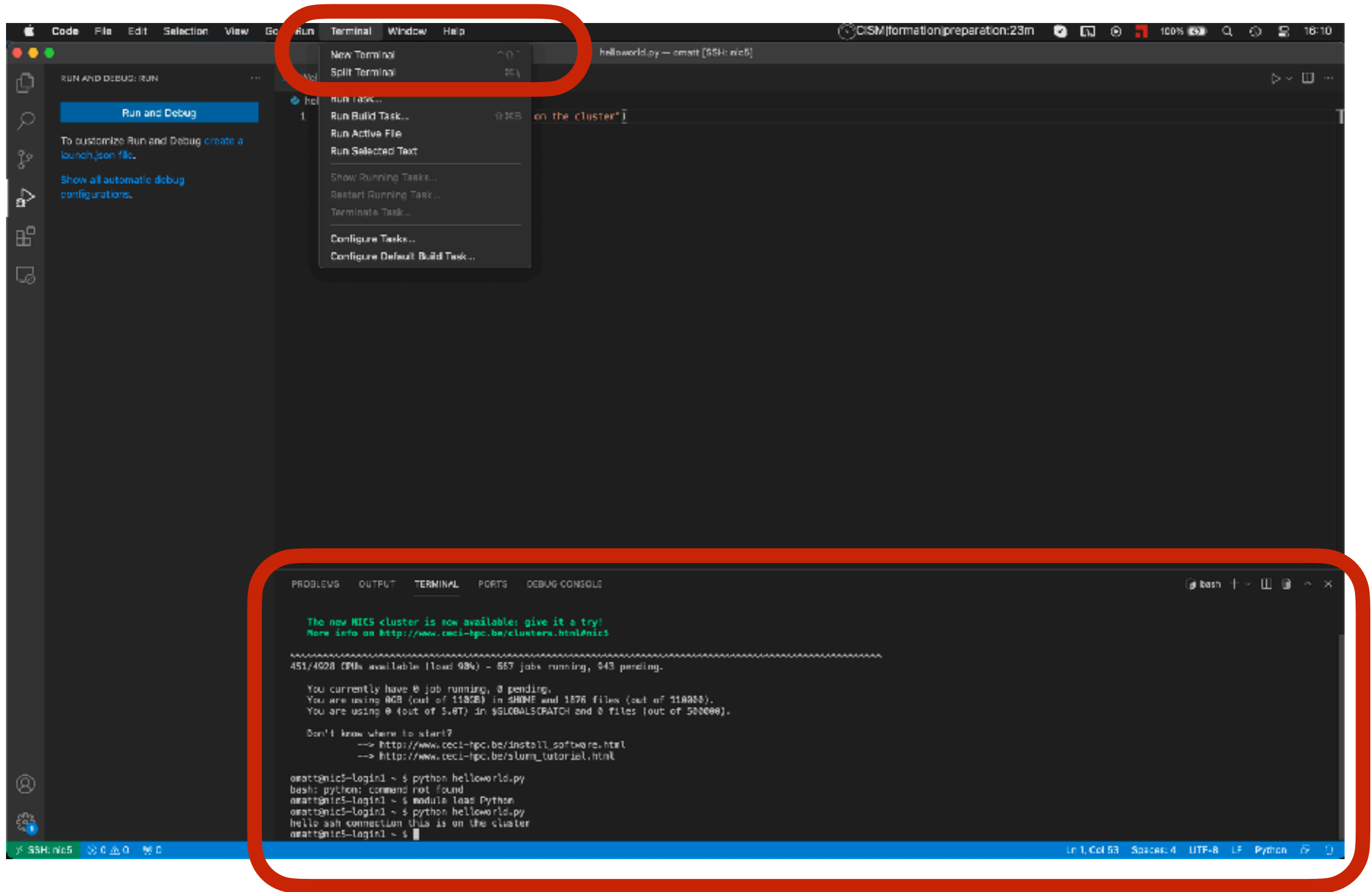
Start editing file



Connection status

Open file/directory (on the cluster)

Terminal from VScode



Note: You do have openssh configured now, you can do “ssh nic5” from your windows terminal

Ssh-agent

- Possible to remove the need to enter your password and have the agent but you need to be administrator

Windows:

To enable SSH Agent automatically on Windows, start a **local Administrator PowerShell** and run the following commands:

```
# Make sure you're running as an Administrator
Set-Service ssh-agent -StartupType Automatic
Start-Service ssh-agent
Get-Service ssh-agent
```

Now the agent will be started automatically on login.

Conclusion

- Now you should have access to our clusters
 - ➔ Mobaxterm / VSCode / openssh
 - ➔ Do not forget gateway
- A lot of core are available
 - ➔ Great power = great responsibility
 - ➔ Remember to not overload the front node
 - ◆ Use SLURM
- Security is important
 - ➔ Do not share your public key
 - ➔ Invalidate your key if your laptop is stolen/...