Connection with SSH:

Windows session

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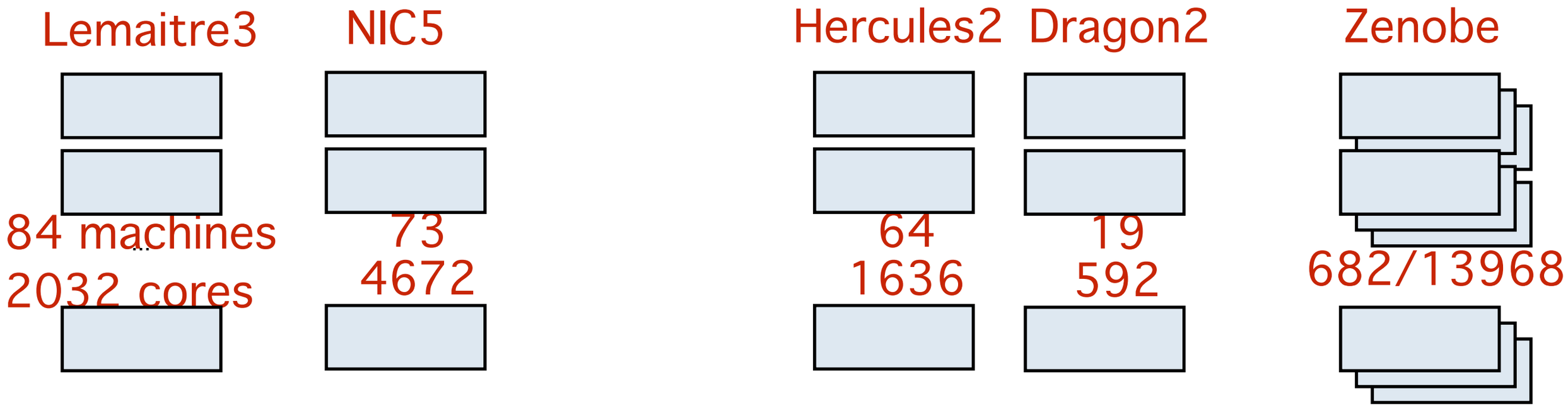
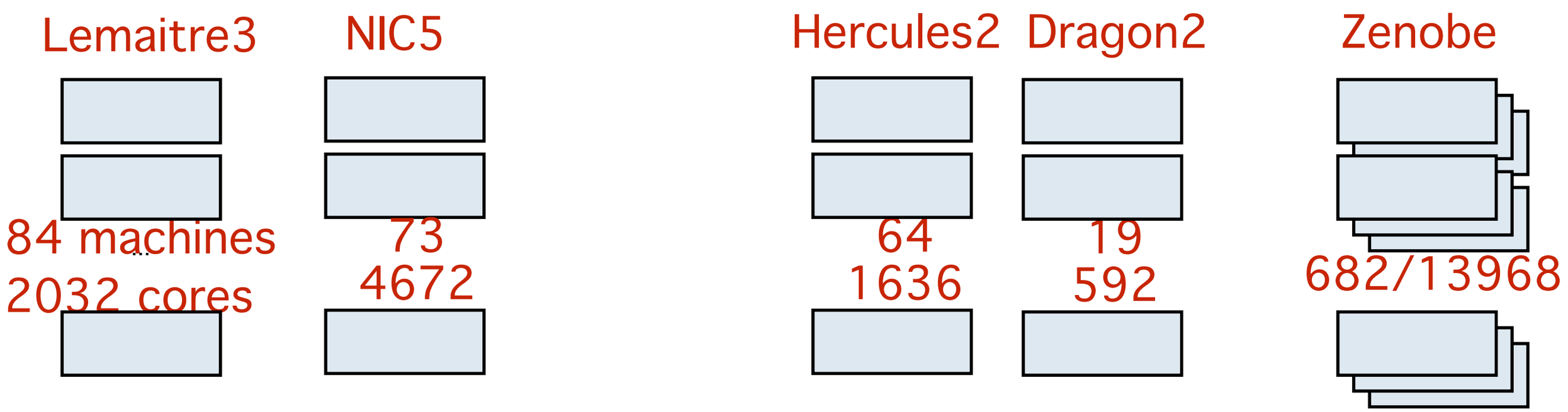
Plan of the talk

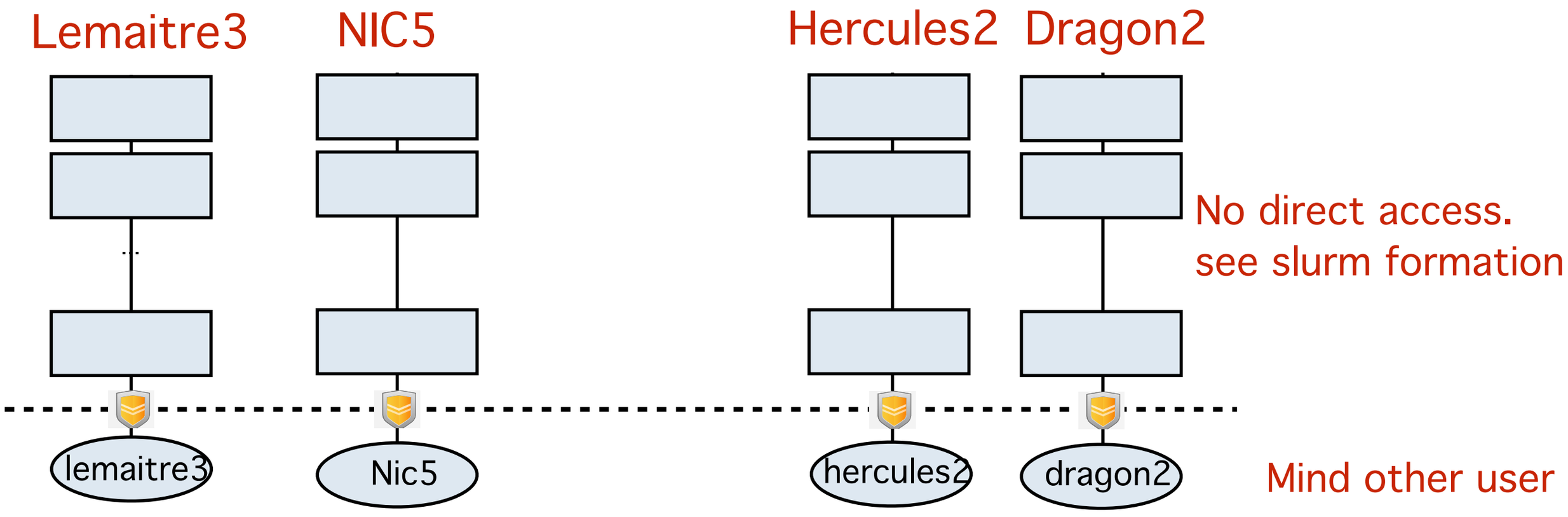
- Cluster presentation
  - ➡ how the cluster are organised
  - ➡ On which machine you can connect and from where
- SSH theory
  - ➡ What is a public/private key
- SSH exercise
  - ➡ How to get your keys
  - ➡ Use of MobaXterm
  - ➡ Use of Visual Studio Code



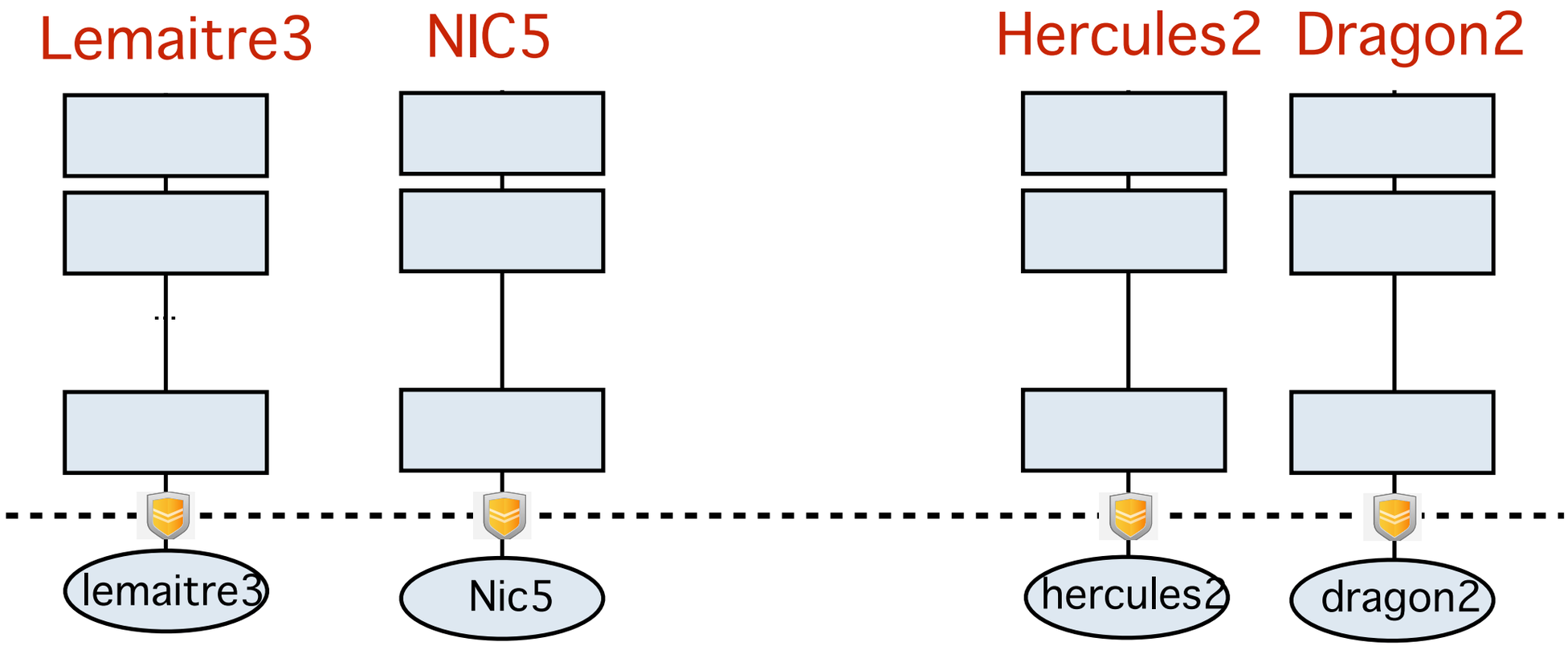
- Close to 10,000 cores available trough your login
  - ➡ 14k more with zenobe (require approval but same login)
  - ➡ More available at European level (Prace program)
    - ✦ European competition to receive cpu time



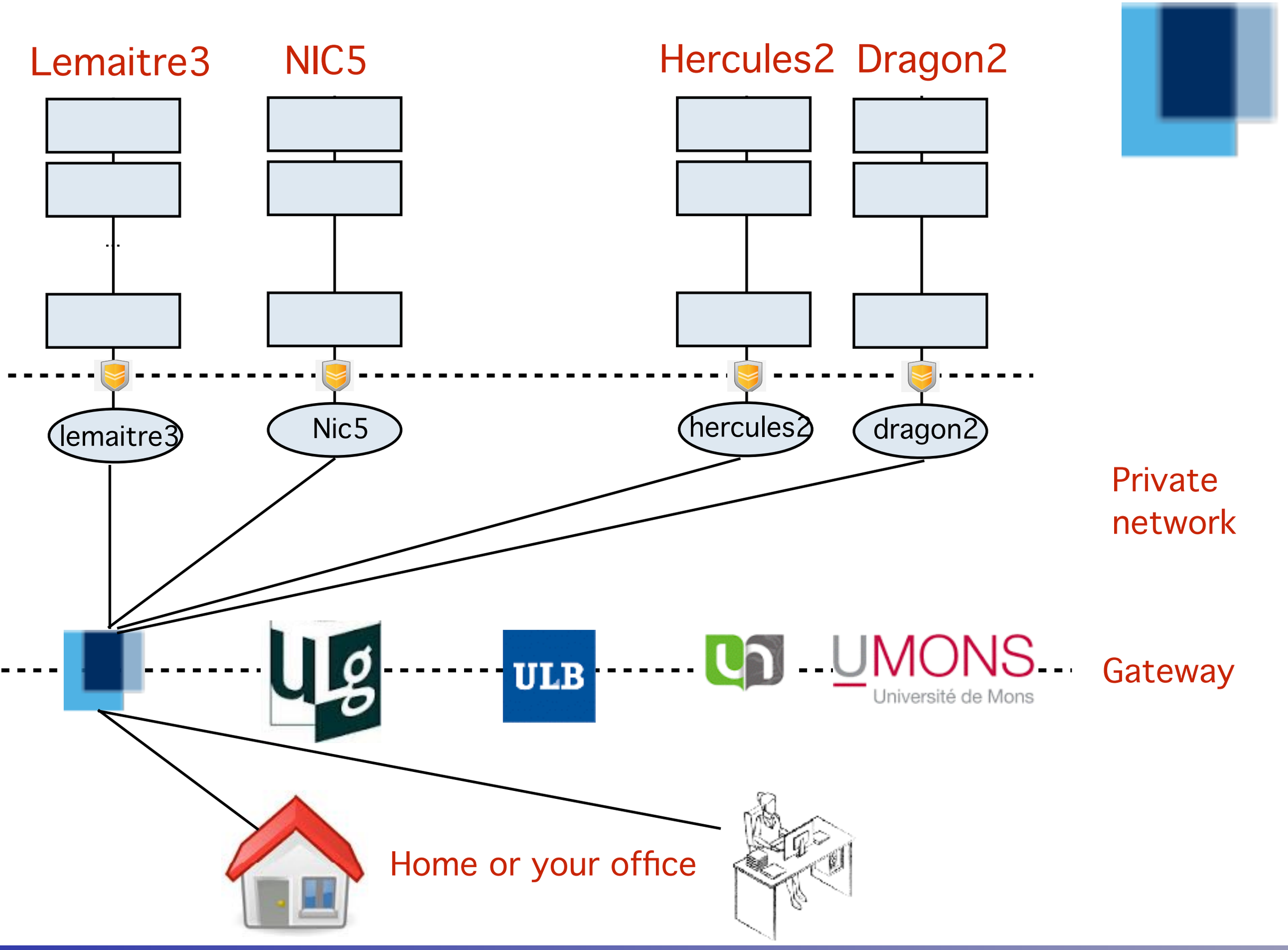
- You do not need/want to physically connect to all those machines to run script
  - ➡ Difficult to control fair share of the machines
  - ➡ Using a job scheduler -> SLURM
    - ✦ Basic slurm tutorial at the end of the session
    - ✦ More on a dedicated session

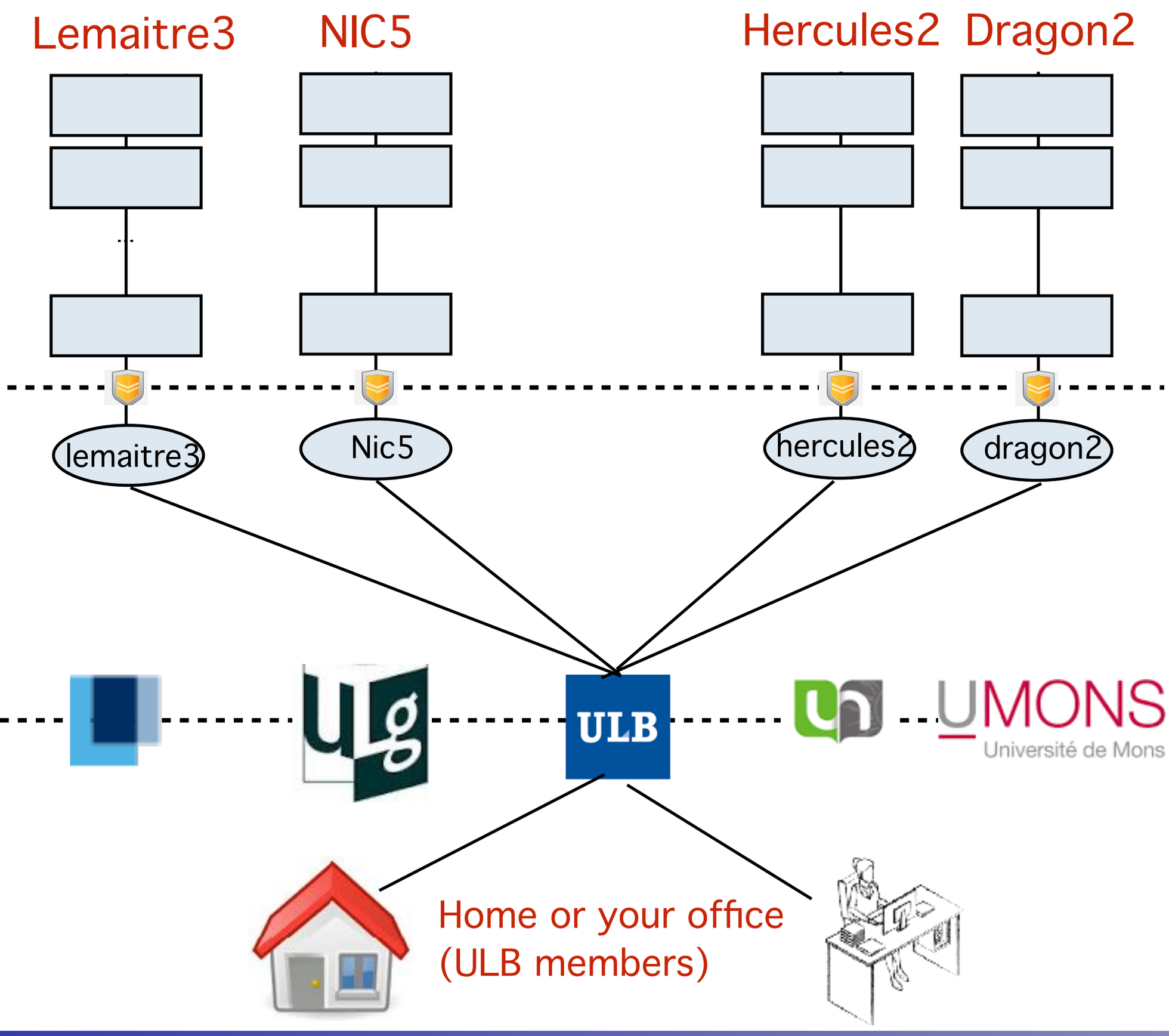


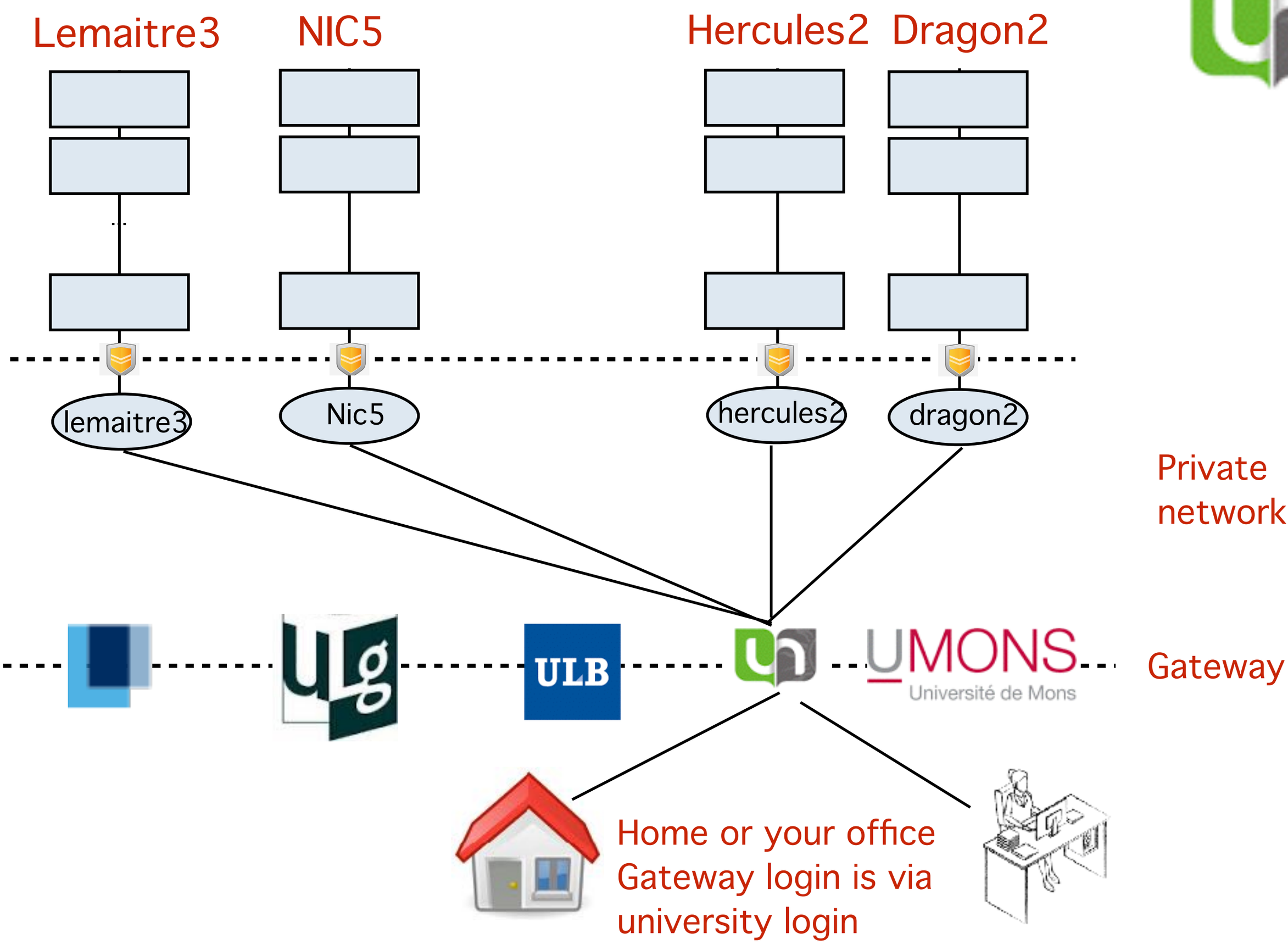
- To request machine, you connect to the FRONTNODE (also called user interface)
  - ✦ You can not connect to the other cpu!
  - ✦ You have to submit a job
  - ➡ No heavy jobs on that machine
  - ✦ You will impact everyone
  - ✦ rather use debug/fast partition



- 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
ULB
UMONS
Université de Mons
Gateway
Home or your office


Lemaitre3
NIC5
Hercules2
Dragon2
lemaitre3
Nic5
hercules2
dragon2
Private network
ULB
UMONS
Université de Mons
Gateway
Home or your office
(ULB members)


Lemaitre3
NIC5
Hercules2
Dragon2
lemaitre3
Nic5
hercules2
dragon2
Private network
ULB
UMONS
Université de Mons
Gateway
Home or your office
Gateway login is via university login

Lemaitre3

NIC5

Hercules2

Dragon2

lemaitre3

Nic5

hercules2

dragon2

Private network

Gateway

ULB

UMONS
Université de Mons

VPN

ULG Network

Lemaitre3 NIC5 Hercules2 Dragon2

UMONS Université de Mons

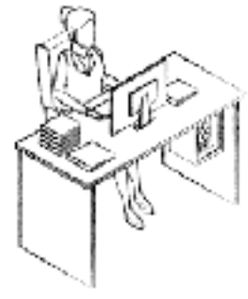
lemaitre3 Nic5 hercules2

Private network

dragon2

VPN

Umons 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

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 !!

CÉCI Clusters News Training FAQ Documentation Support Contact Create/Manage Account

C.E.C.I

Consortium des Équipements de Calcul Intensif

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

CÉCI Login Management FAQ

I want to...

create an account

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 recieve 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:

@uclouvain.be

Send

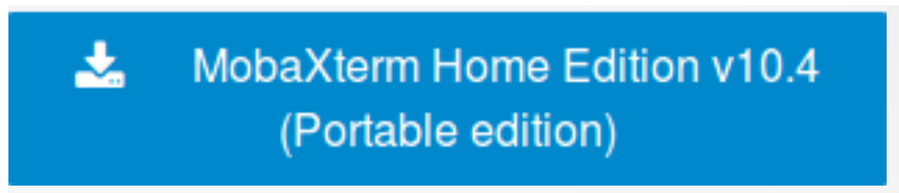
Getting your private key (I)

- 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

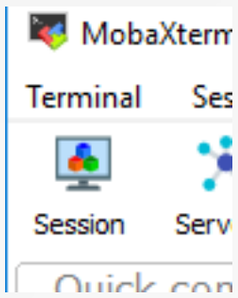
Install MobaXterm

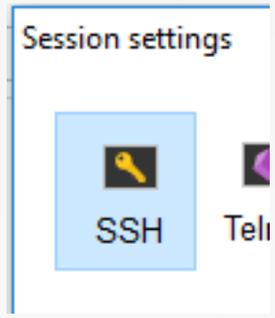


- search on your favorite web browser
- Download the free Portable edition
- Uncompress on folder ‘Documents\MobaXterm'
- Execute MobaXterm_Personal_X (where X is version number)
- If needed allow firewall access for Private and Domain networks

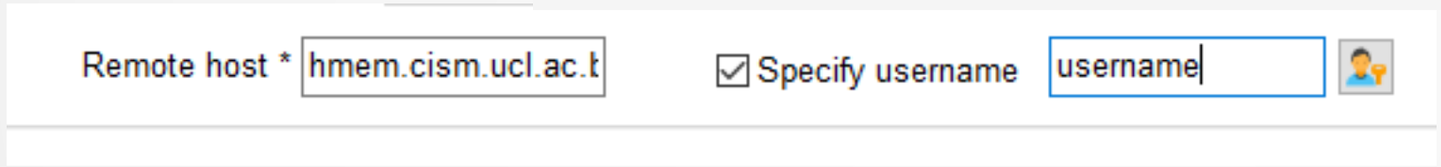
Configure mobaxterm

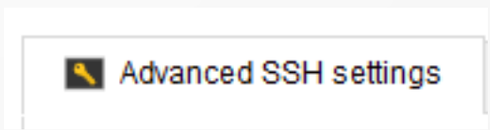
1) Save your id_rsa.ceci key file from your e-mail in a safe location

2) Click on Session 

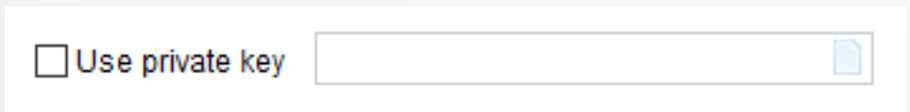
and SSH 

3) Add the Remote host



4) Select Advanced SSH Setting tab 

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

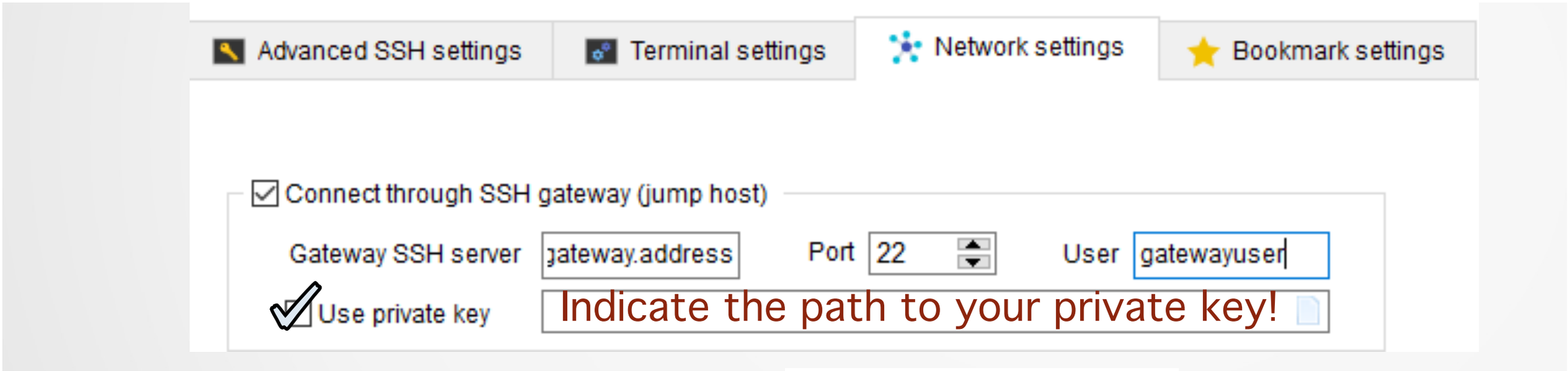


Depending of your version of mobaxterm/configuration it might ask you the passphrase already now

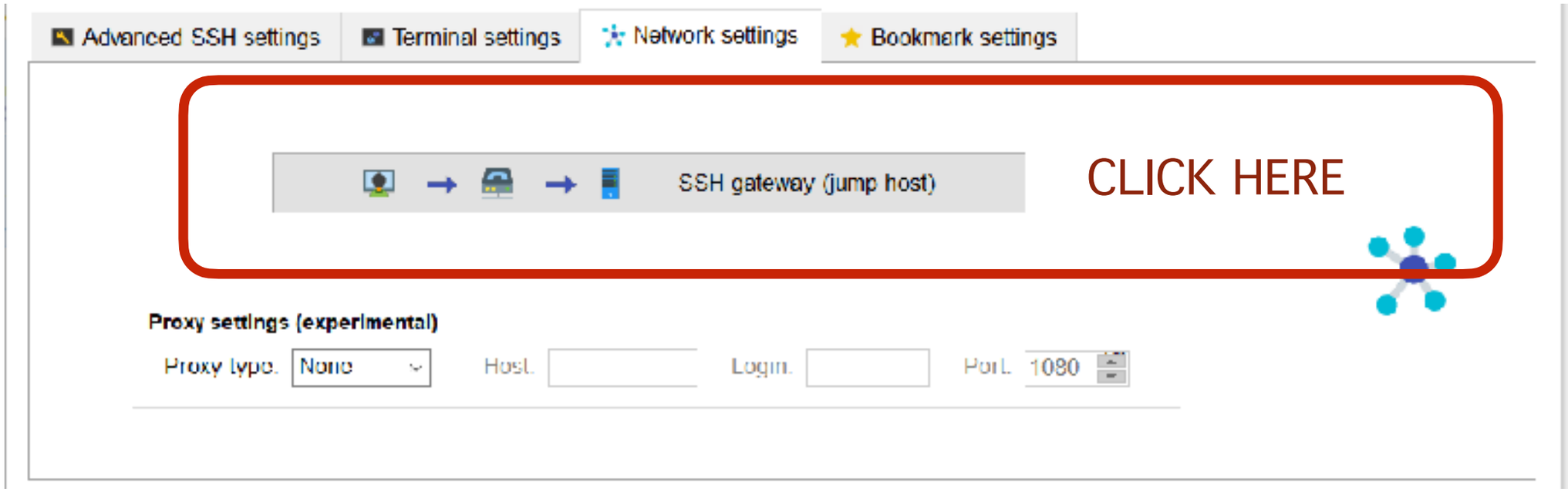
- Remote host options:
  - lemaitre3.cism.ucl.ac.be nic5.uliege.be hercules.ptci.unamur.be dragon2.umons.ac.be vega.ulb.ac.be

Gateway configuration

- Need to go trough a gateway!
  - ➡ Network settings

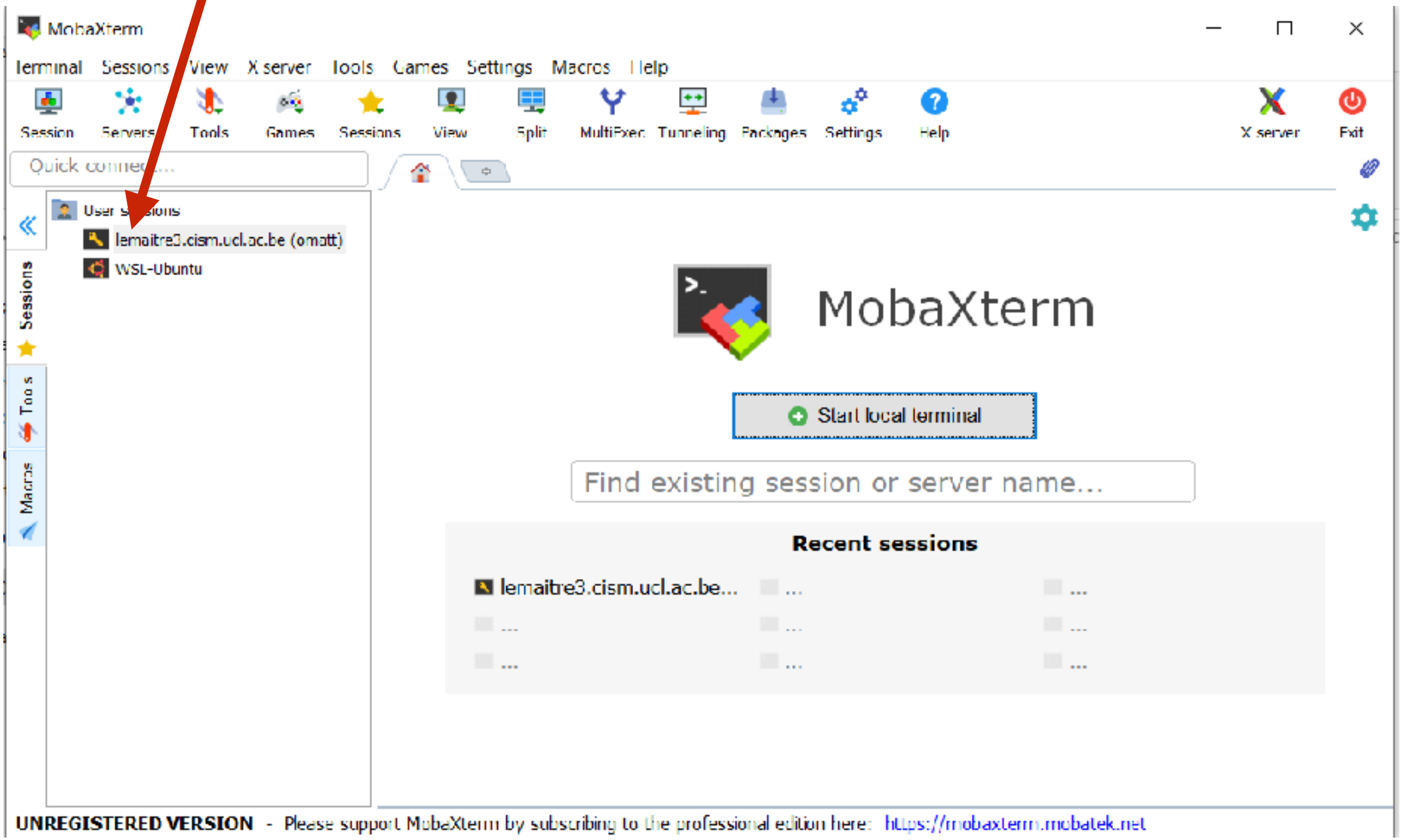


- Newer version looks like this:

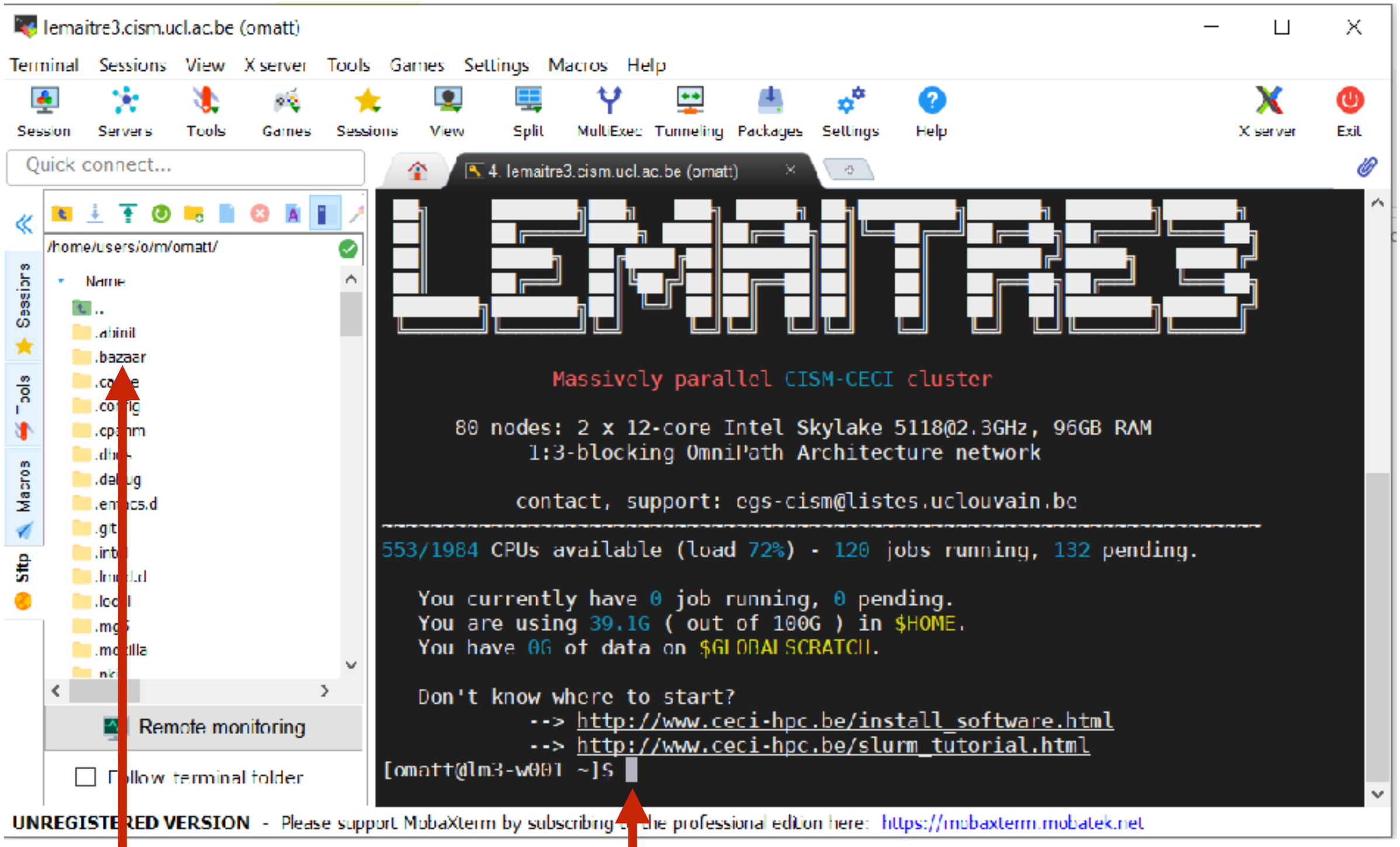


You can now connect to the cluster

CLICK HERE



You are now connected



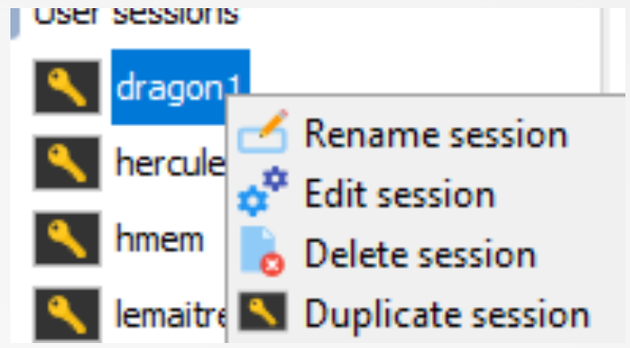
FILE ON DISK

TERMINAL

Exercise

- run xeyes to check that you can forward graphics trough 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.

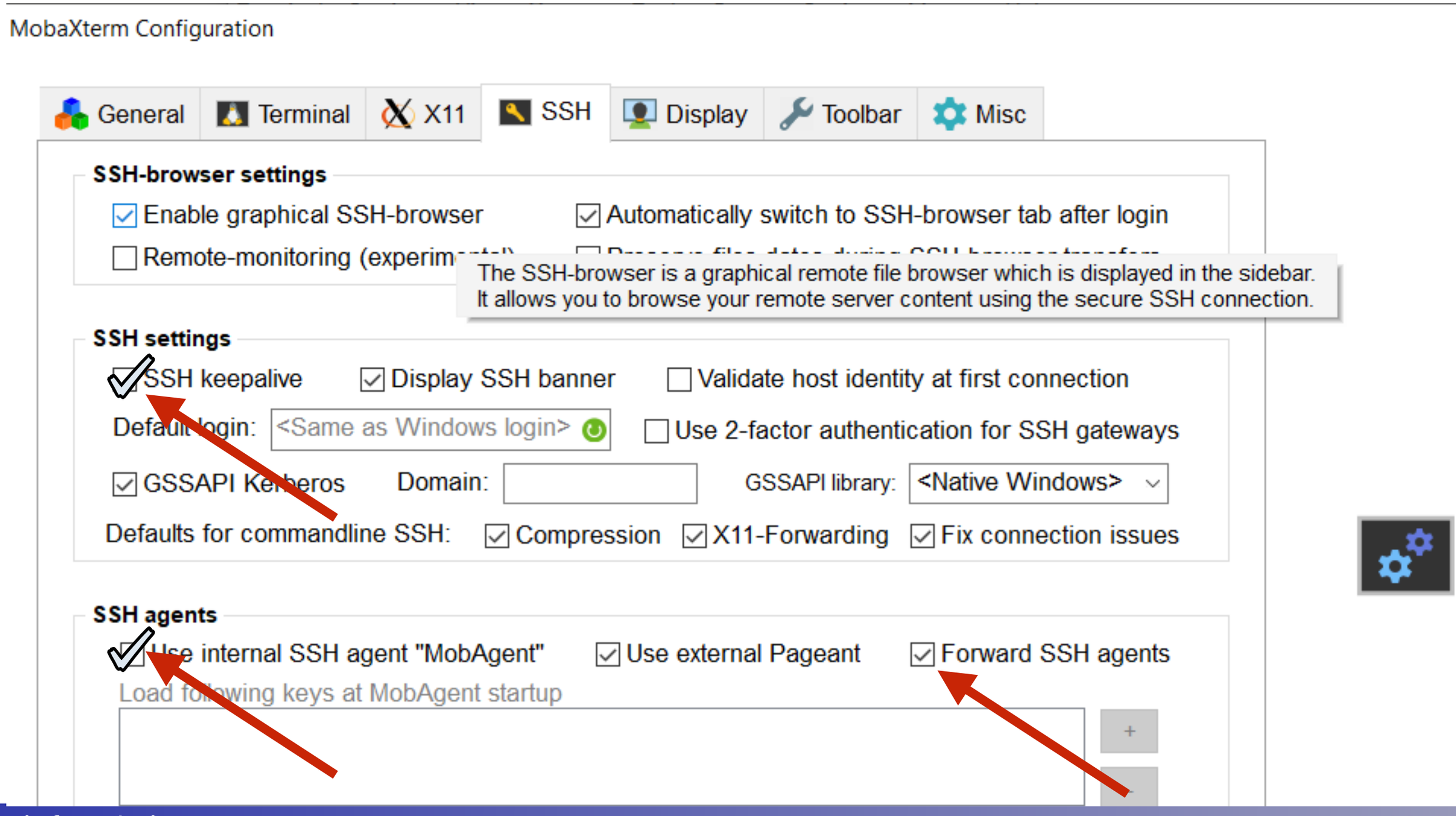
If, after running ssh, you are being asked for a passphrase, then a password,

```
$ 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.)

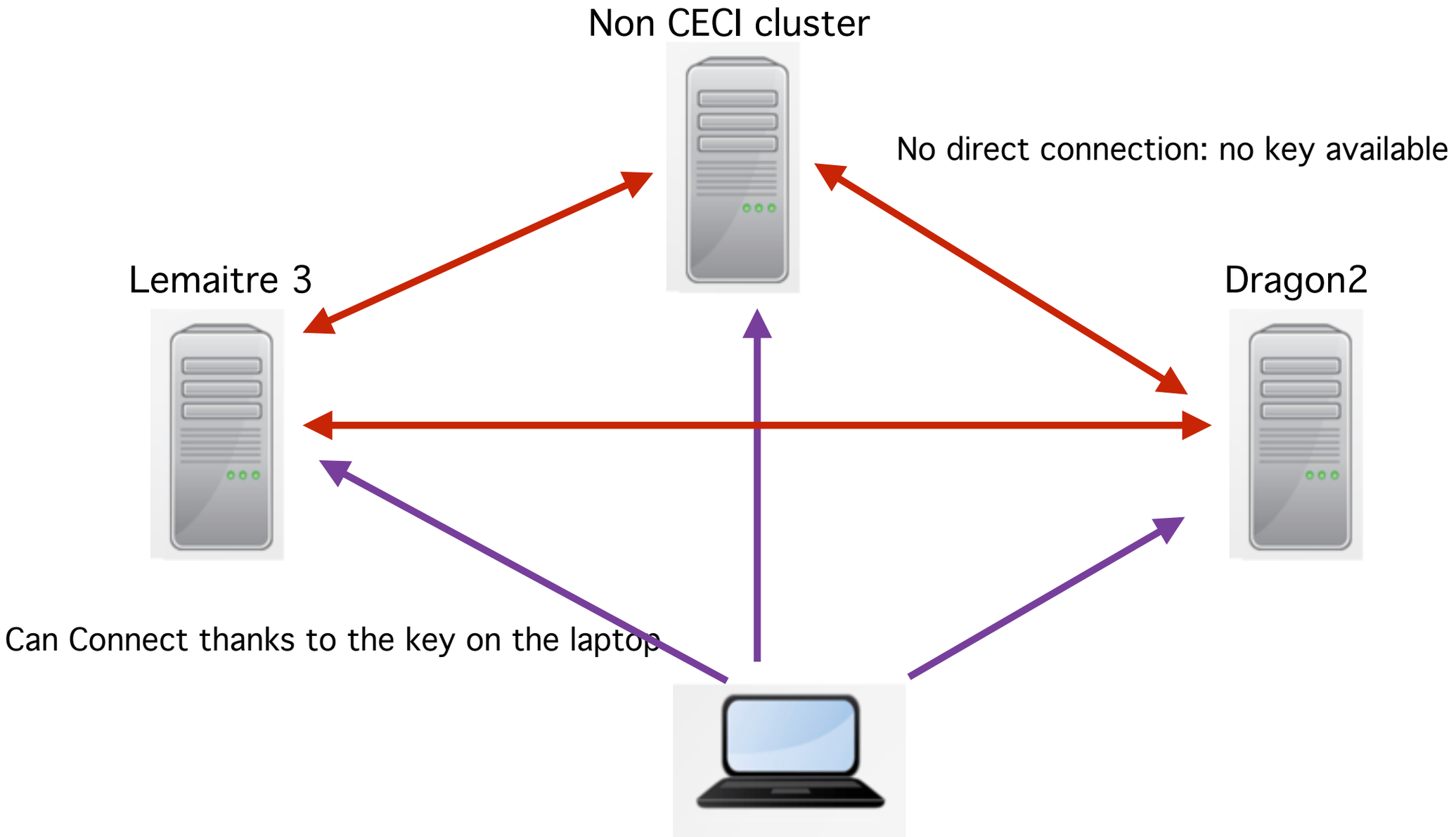
SSH AGENT

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



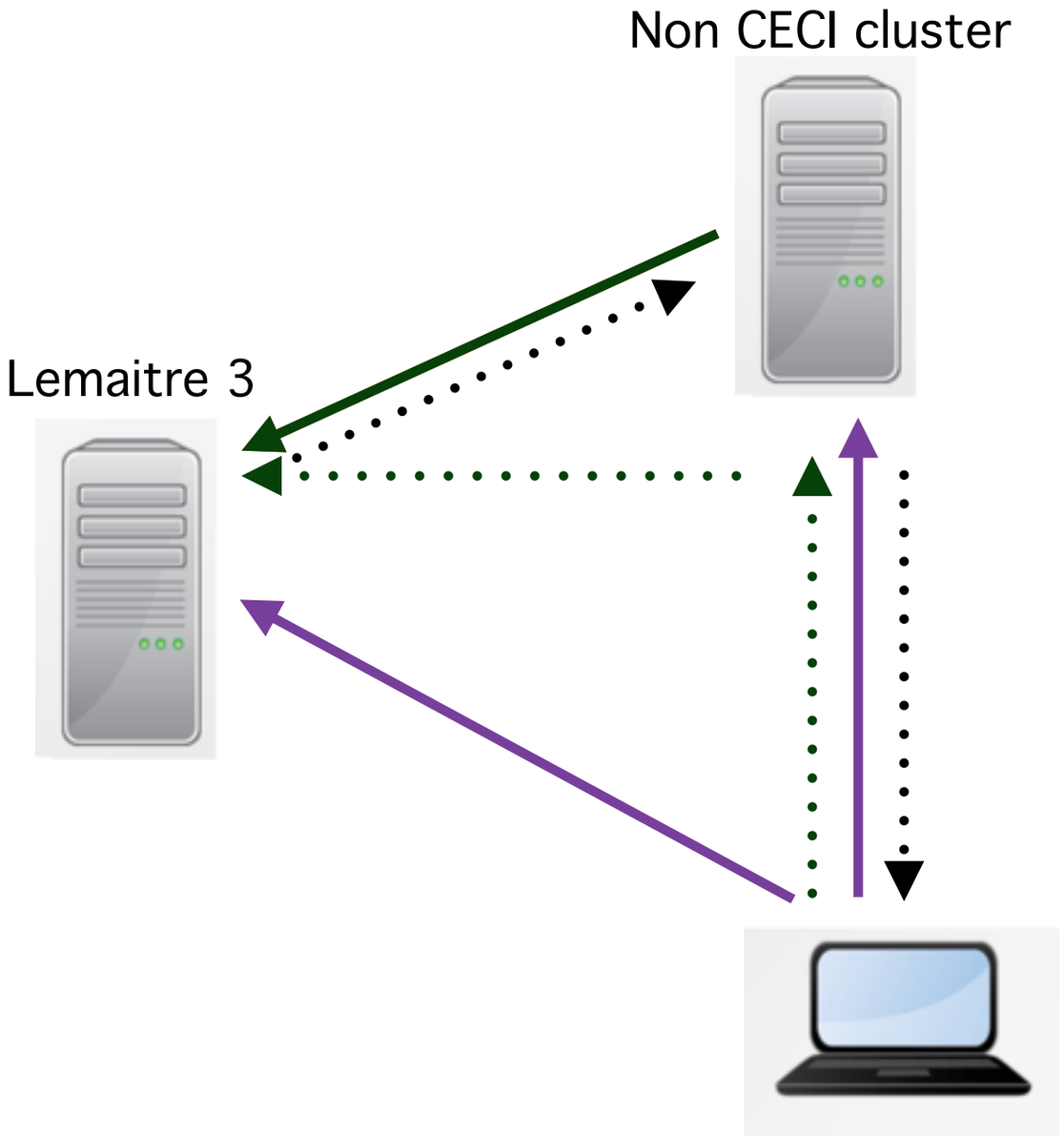
Avoid to propagate your private keys

- 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

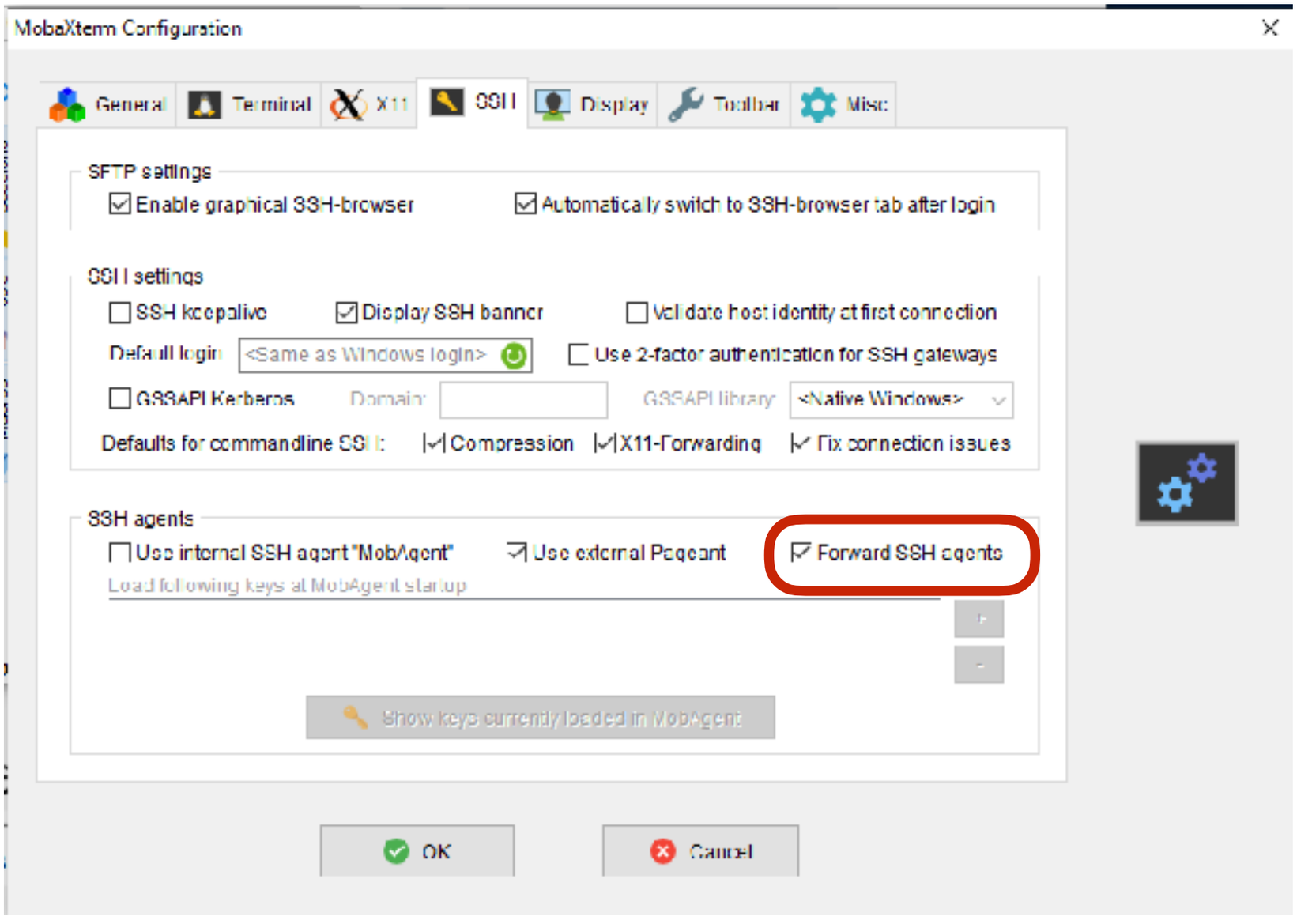
Message forward to laptop

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
```

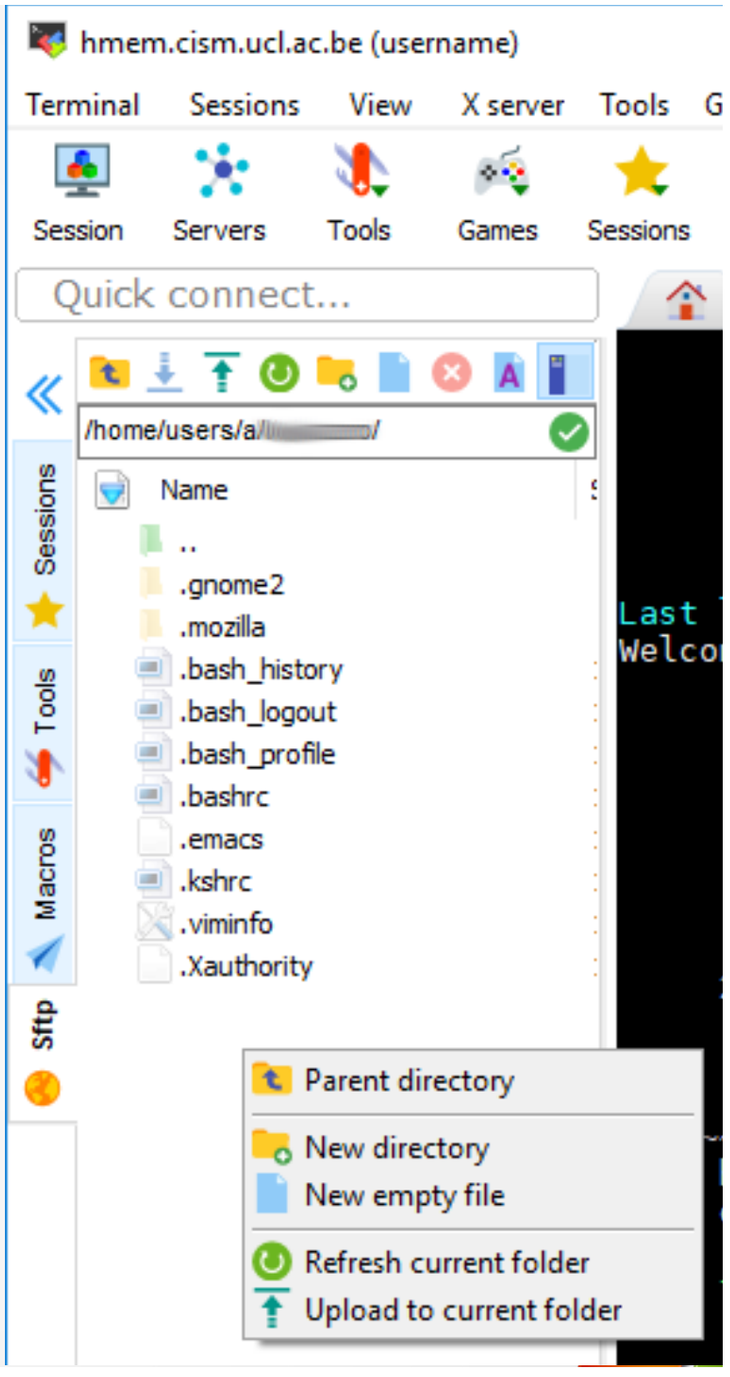
  - ➡ Plenty of options to customise your resource allocation (max-time, how many core, how many memory,....)
  - ➡ http://www.ceci-hpc.be/scriptgen.html
  - ➡ Use the sbatch command for that
    - ➡ sbatch mycmd.sh

SCP/SFTP

1) Select Sftp tab on the left sidebar you get a file browser on the cluster you are connected to

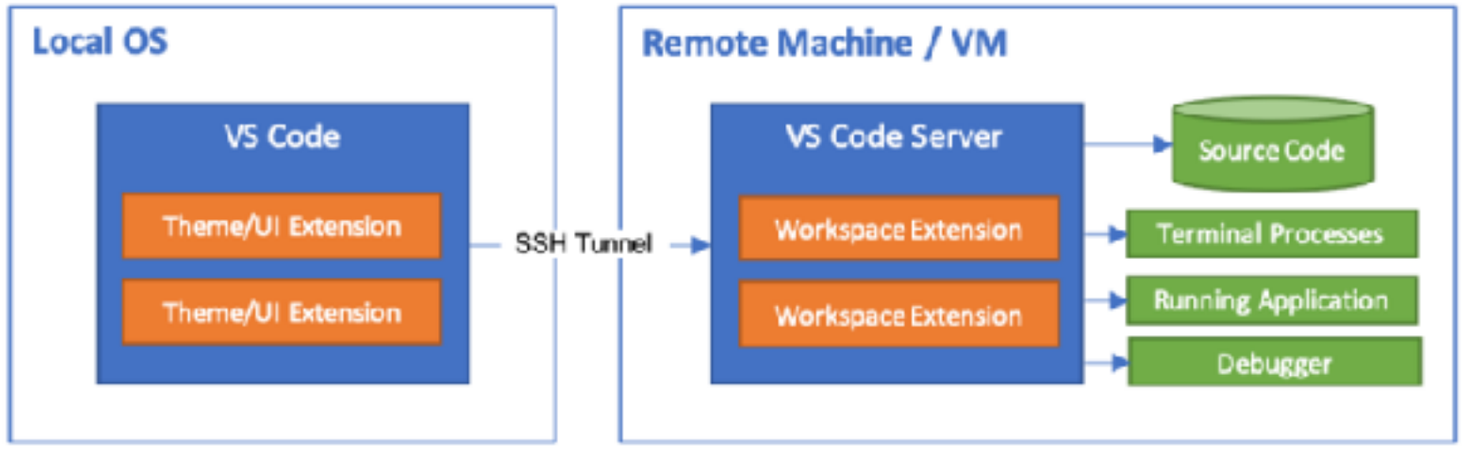
2) Drag and drop files from/to your computer to/from that panel and they will be copied to/from the cluster

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



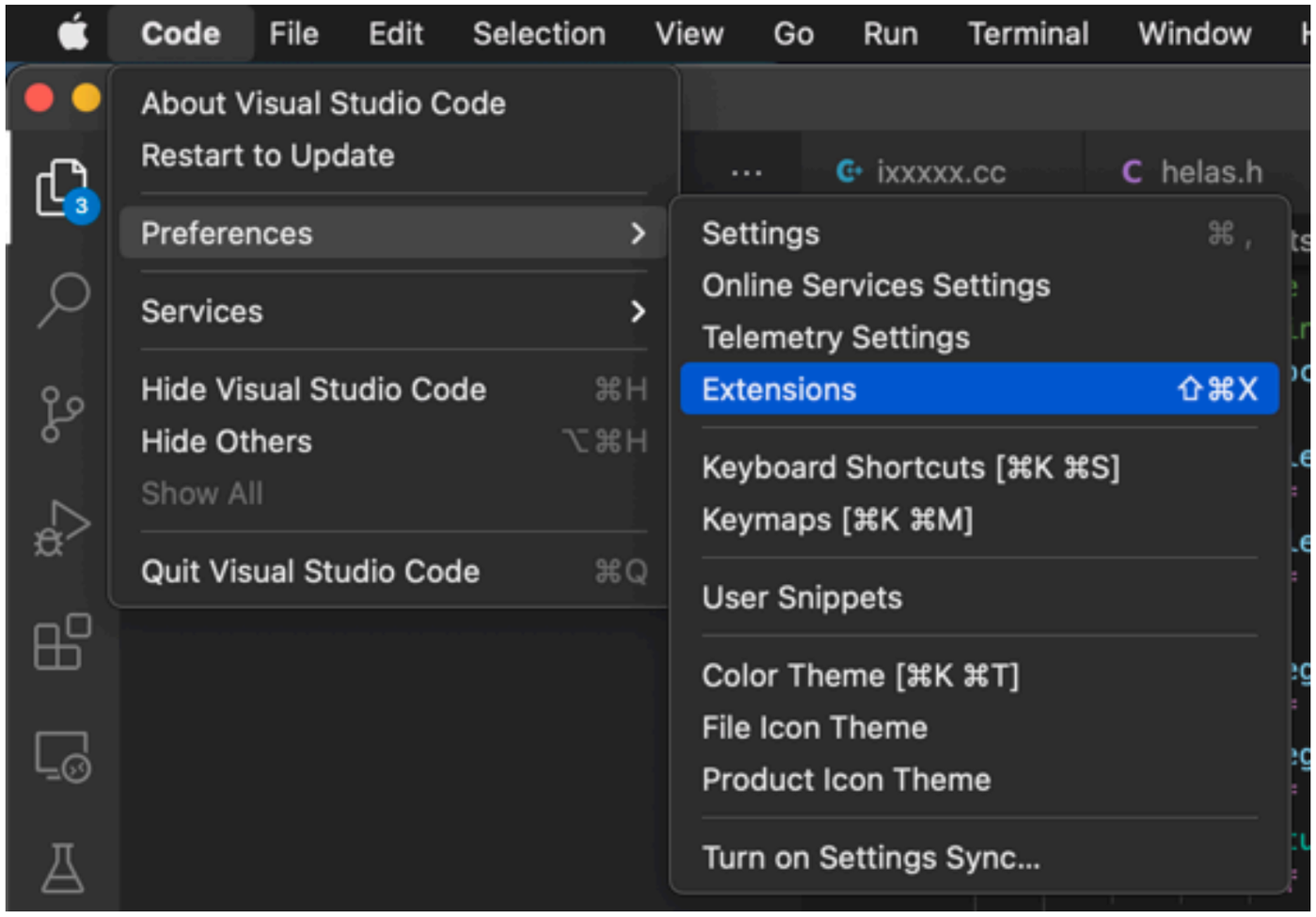
Edit file on cluster

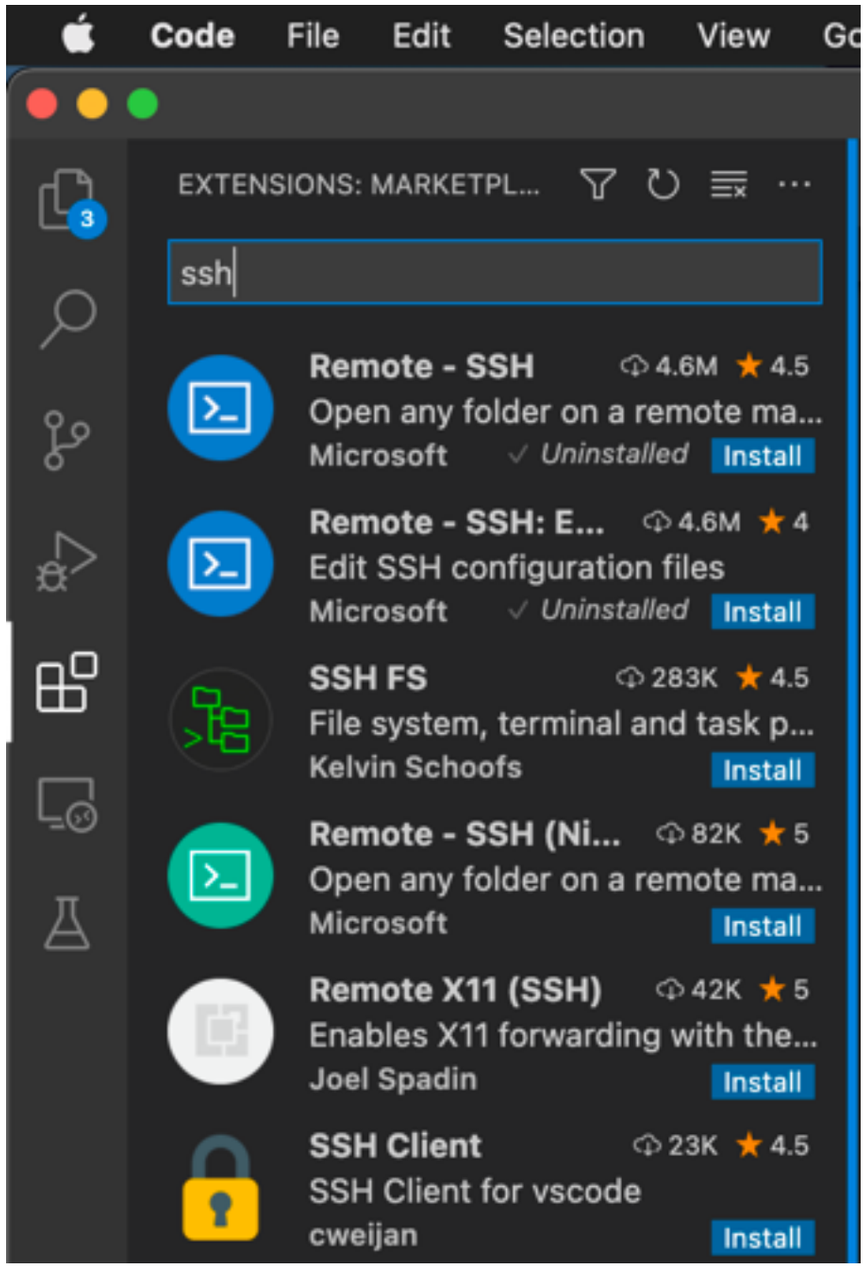
- Text editor are available on cluster
  - ➡ Non graphical editor (fast but hard to learn)
  - ➡ Graphical editor (bandwidth limitation, slow)
- My advised solution is to use Visual studio code:
  - ➡ https://code.visualstudio.com/download
  - ➡ And add ssh extension:
  - ➡ https://code.visualstudio.com/docs/remote/ssh



Install the ssh extension

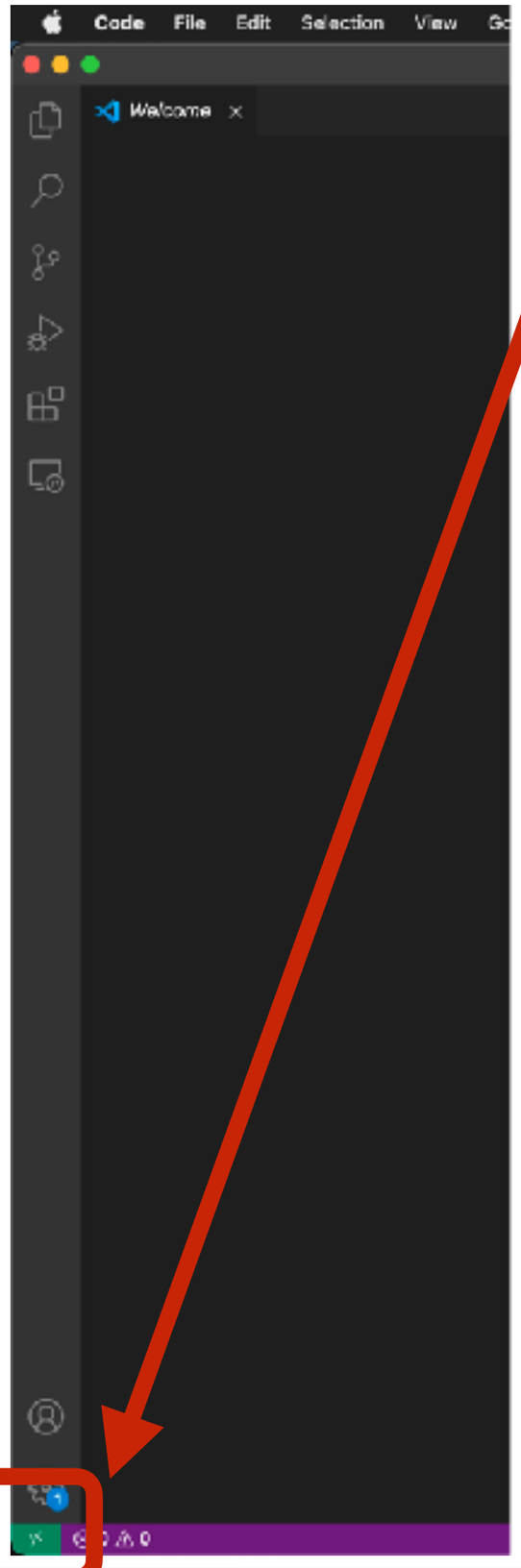
- Install Visual Studio Code
  - ➡ https://code.visualstudio.com/download
- Go to the preference menu/ extensions



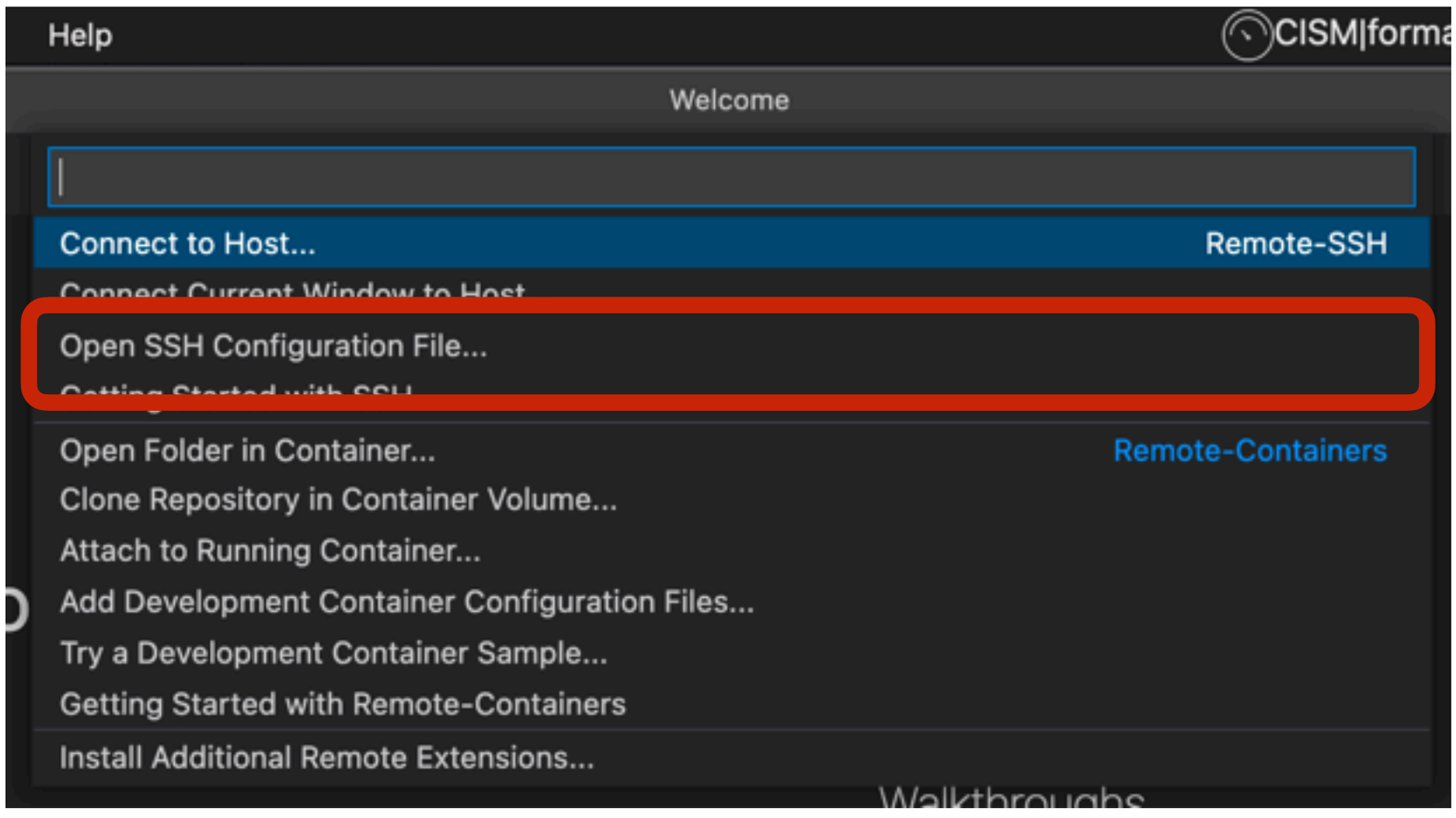


- Search for “ssh”
- Click on “install” of the Remote - SSH

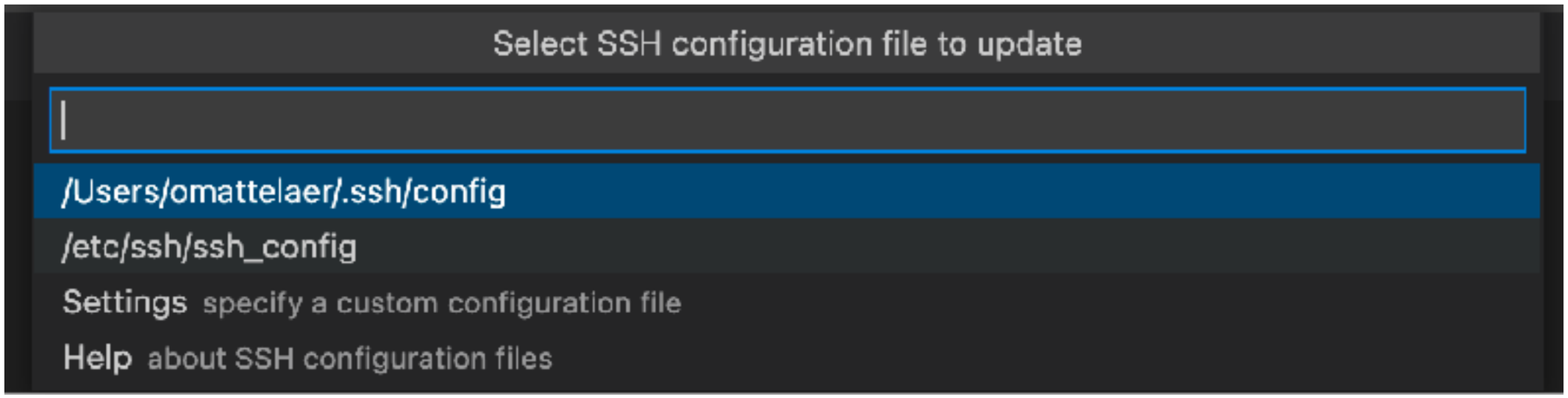
Setup connection



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

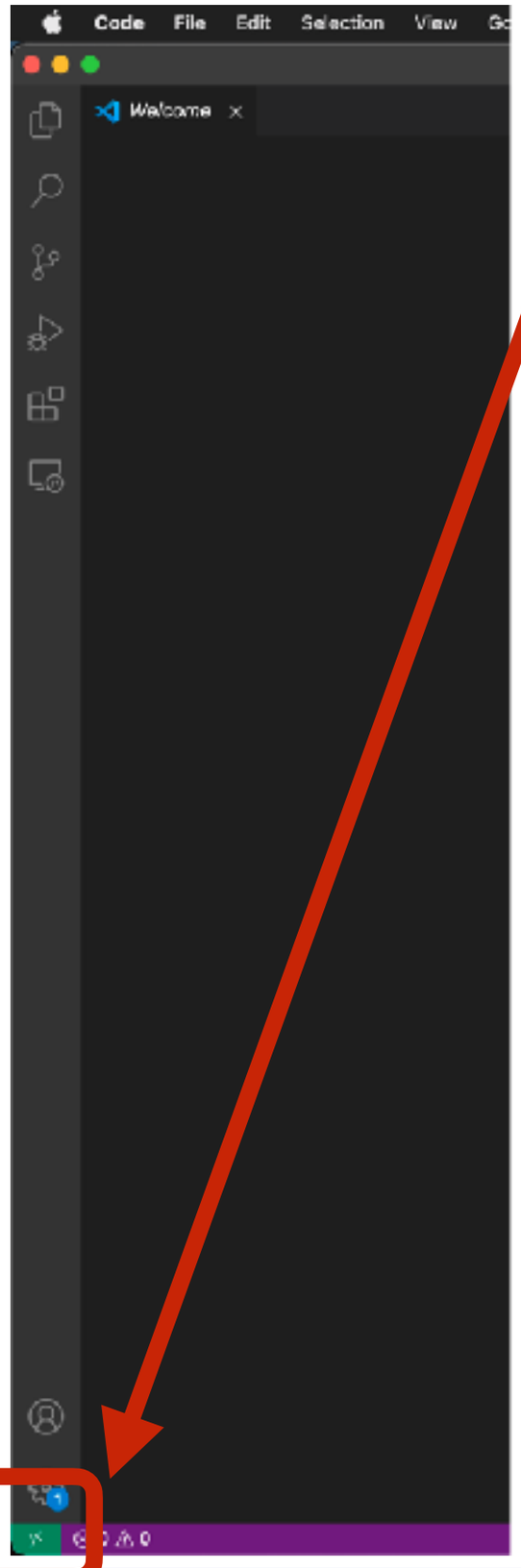


Setup connection

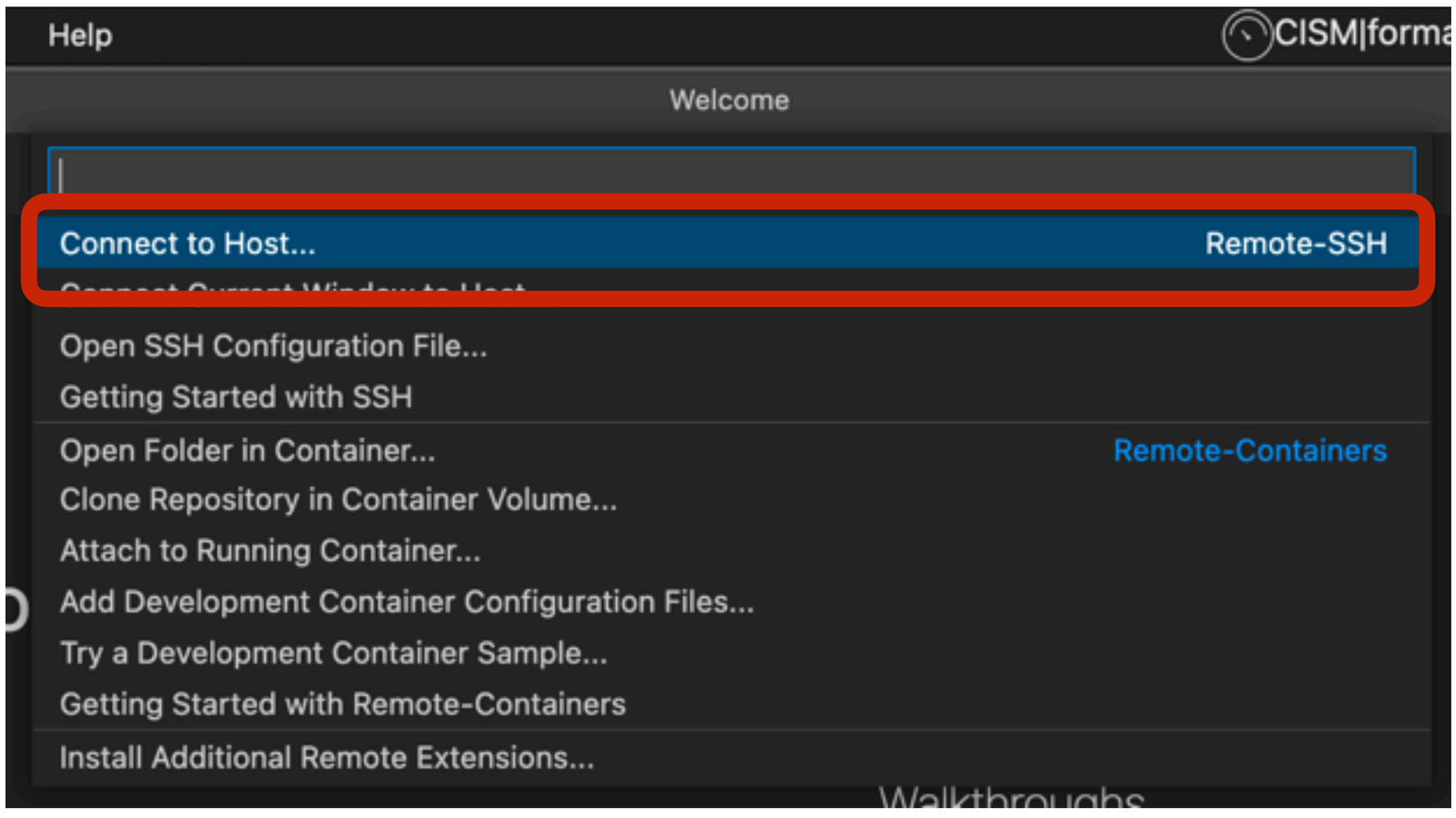


- First one is likely the best here (it is for me)
- Copy/paste in that file the content of
  - ➡ http://www.ceci-hpc.be/sshconfig.html
  - ➡ Edit the path to your private key
- Save the file and exit

connection to cluster

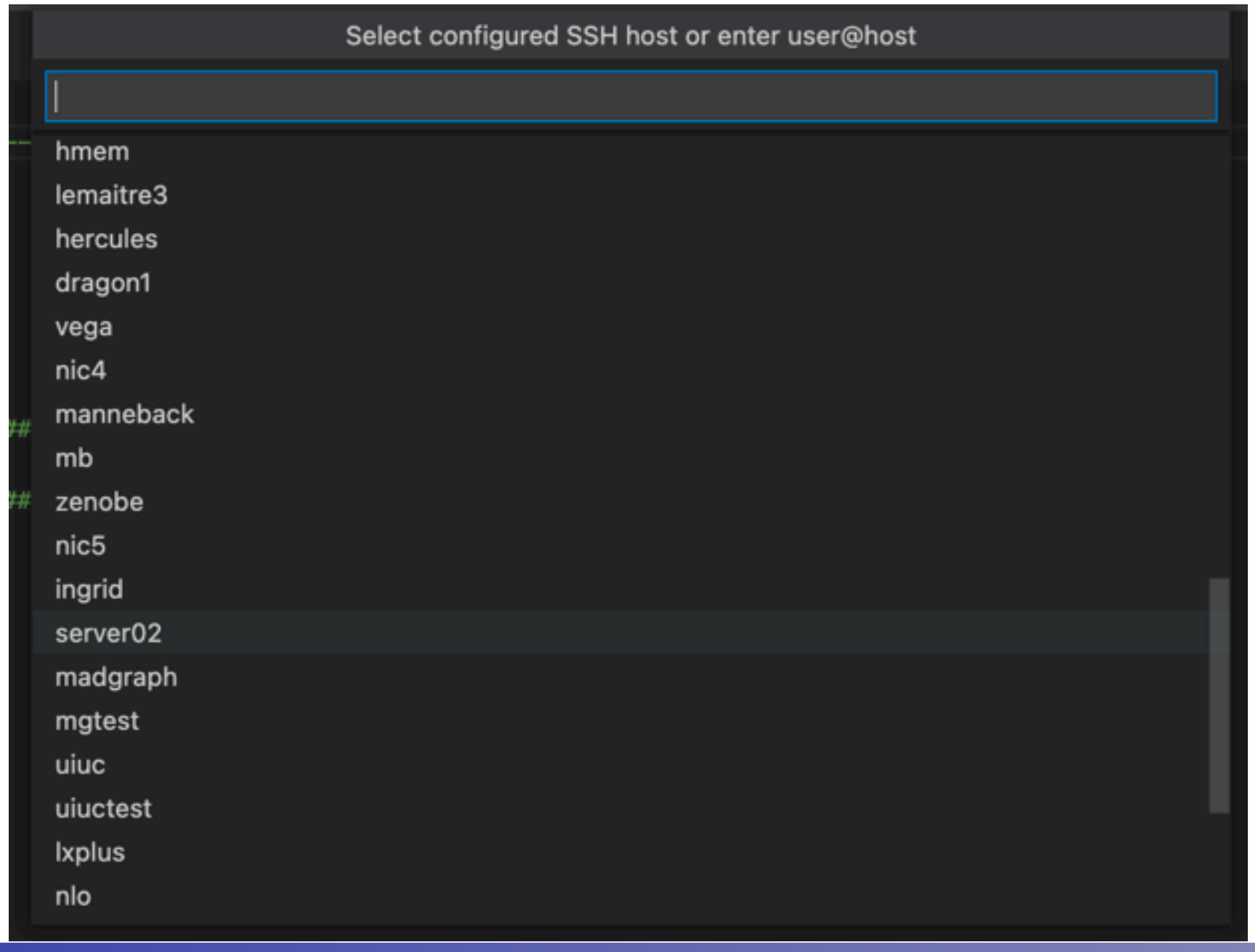


- Click on the green square
  - ➡ Bottom left
- Menu open (see below)
  - ➡ Select “connect to Host”

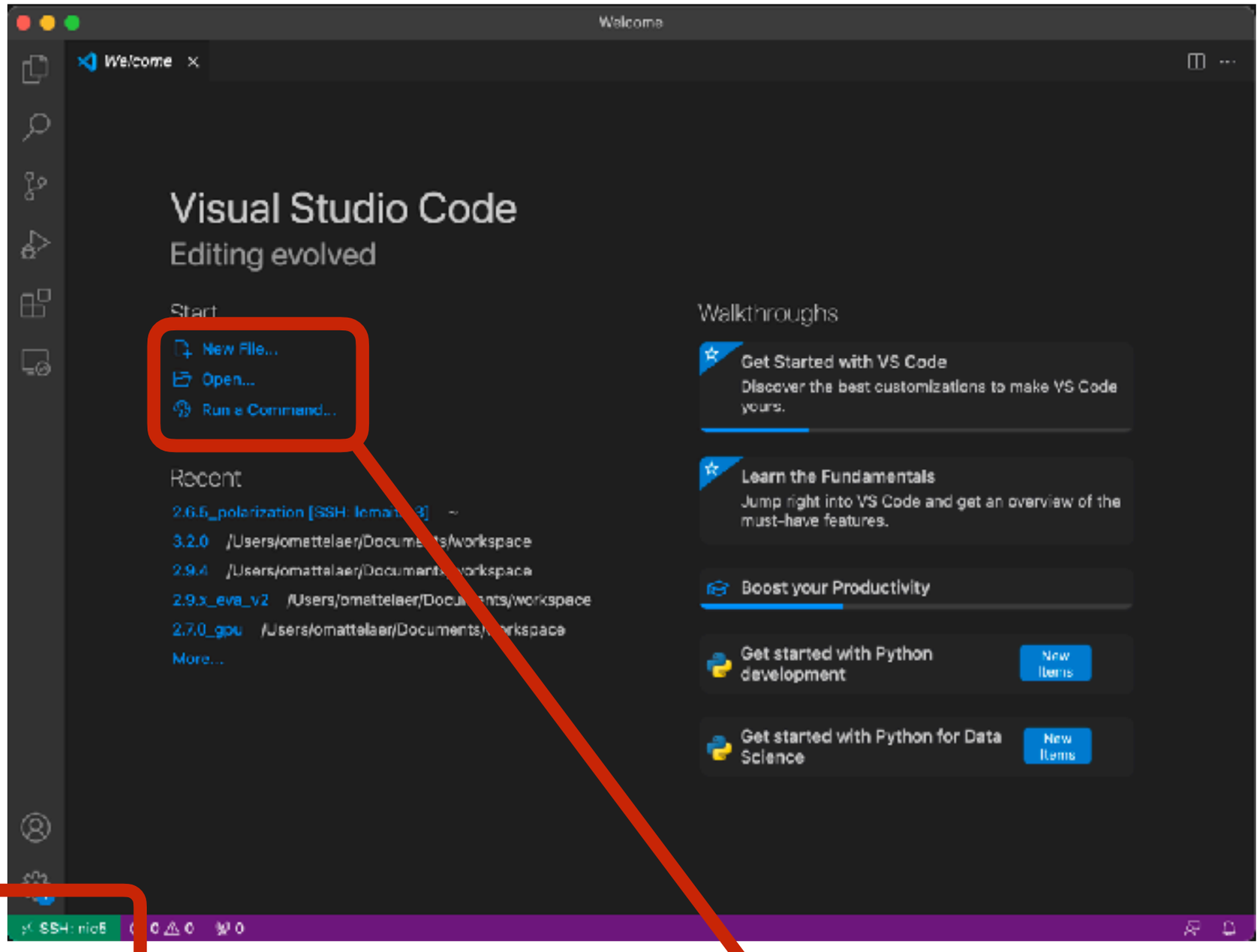


Ssh connection

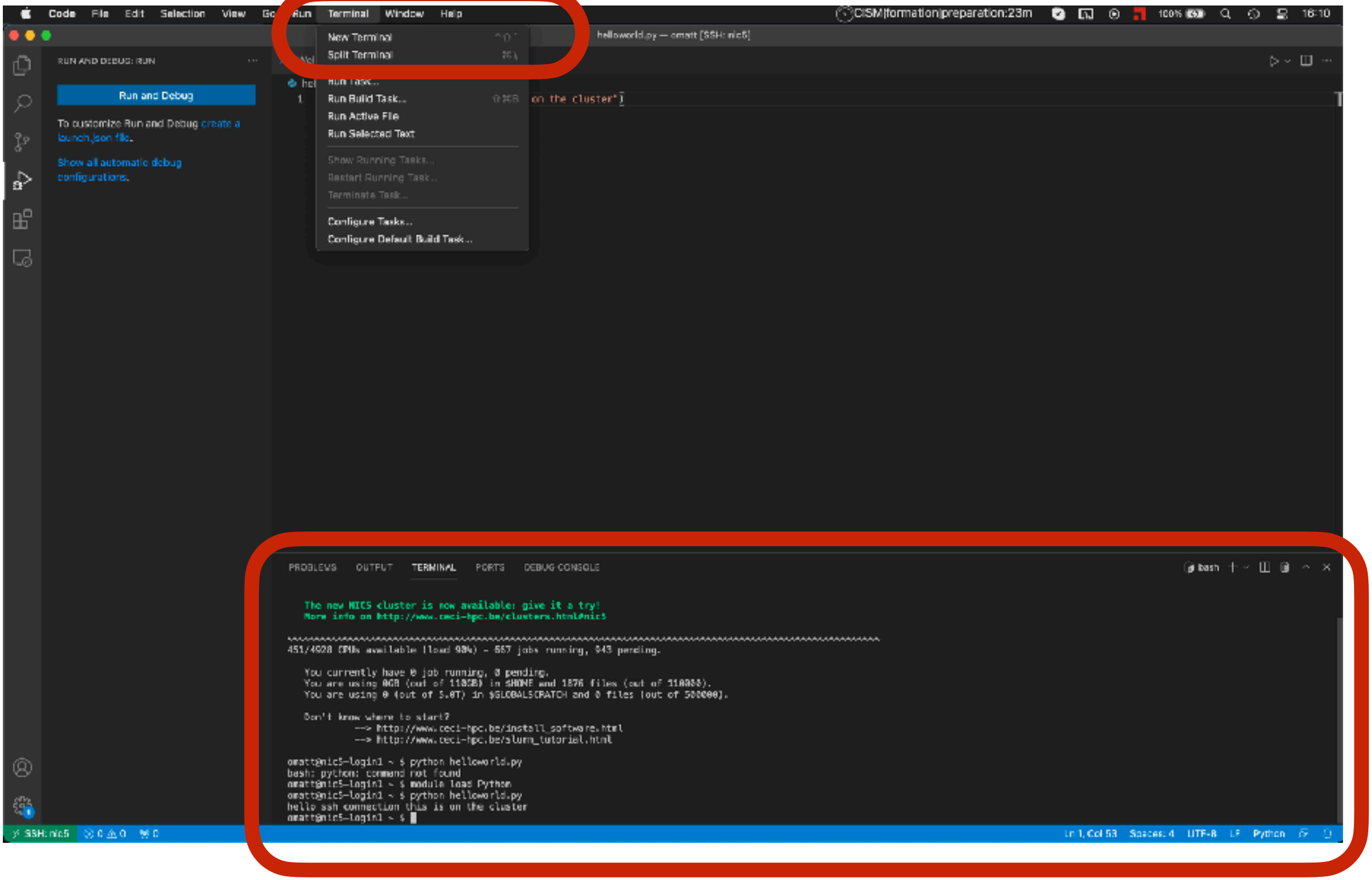
- Select the cluster that you want to connect/edit files



Start editing file



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/…