EURO BELGIUM

Connecting with SSH from Windows

CÉCI HPC Training
olivier.mattelaer@uclouvain.be

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

I want to...

create an account

renew my account

join an existing project

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.

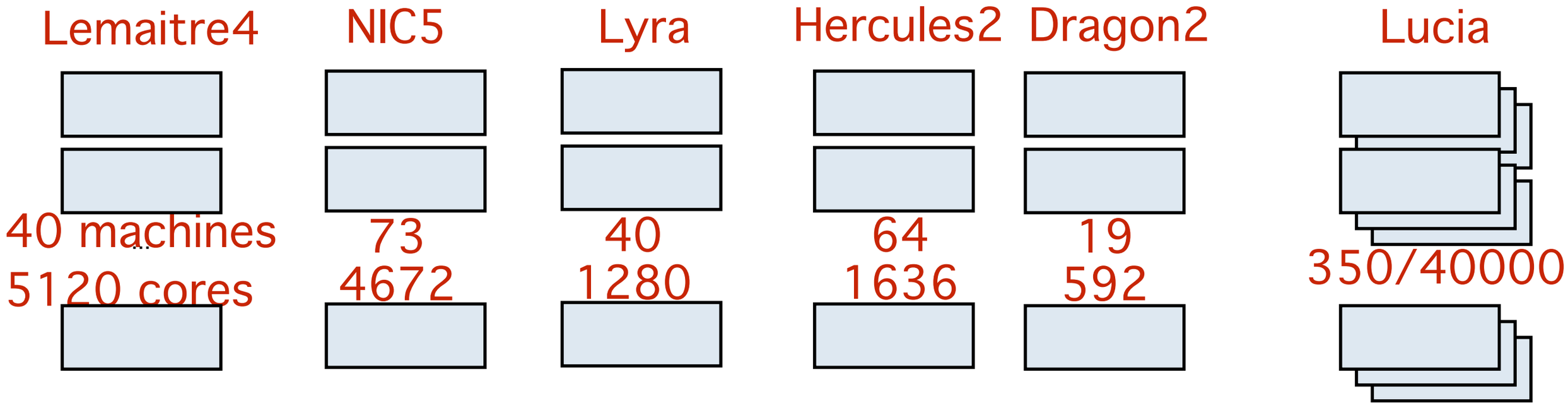
My email address:

@uclouvain.be

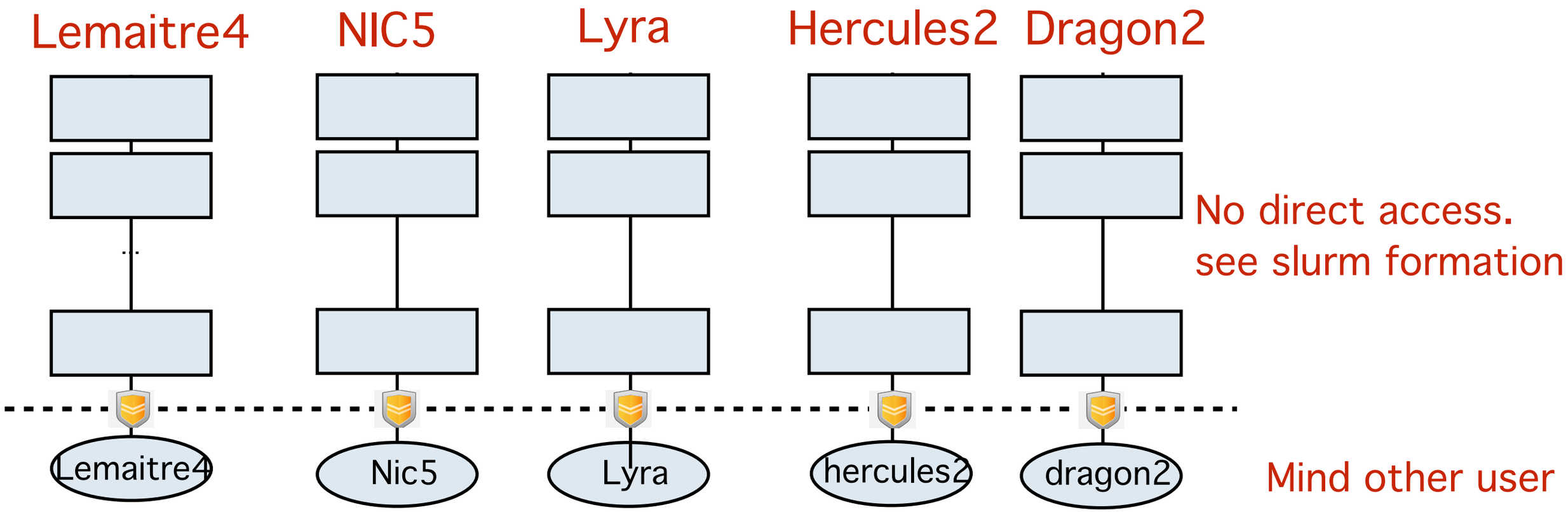
Send

Plan of the talk

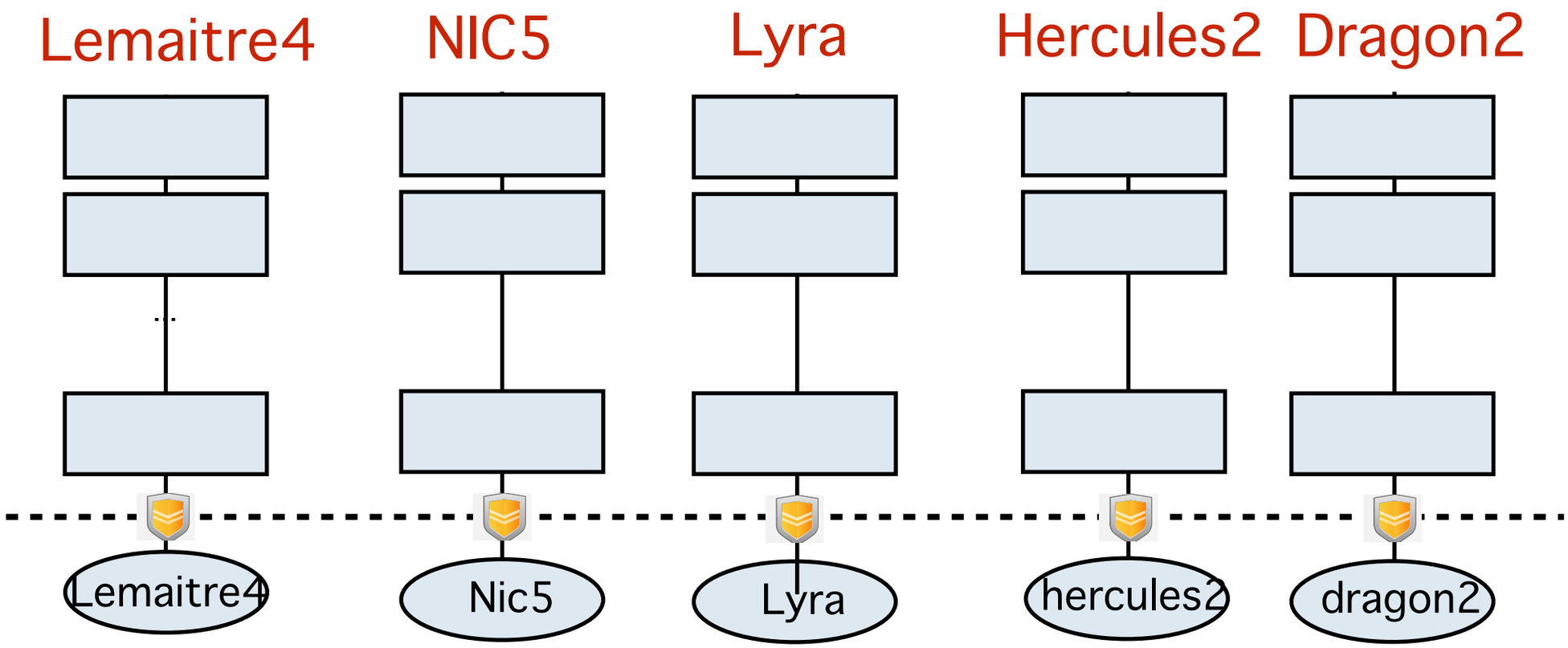
- Cluster presentation
  - ➡ On which machine you can connect and from where
- SSH theory
  - ➡ What is a public/private key
- SSH Tools
  - ➡ To connect
  - ➡ To edit file
  - ➡ To transfer file from/to the cluster



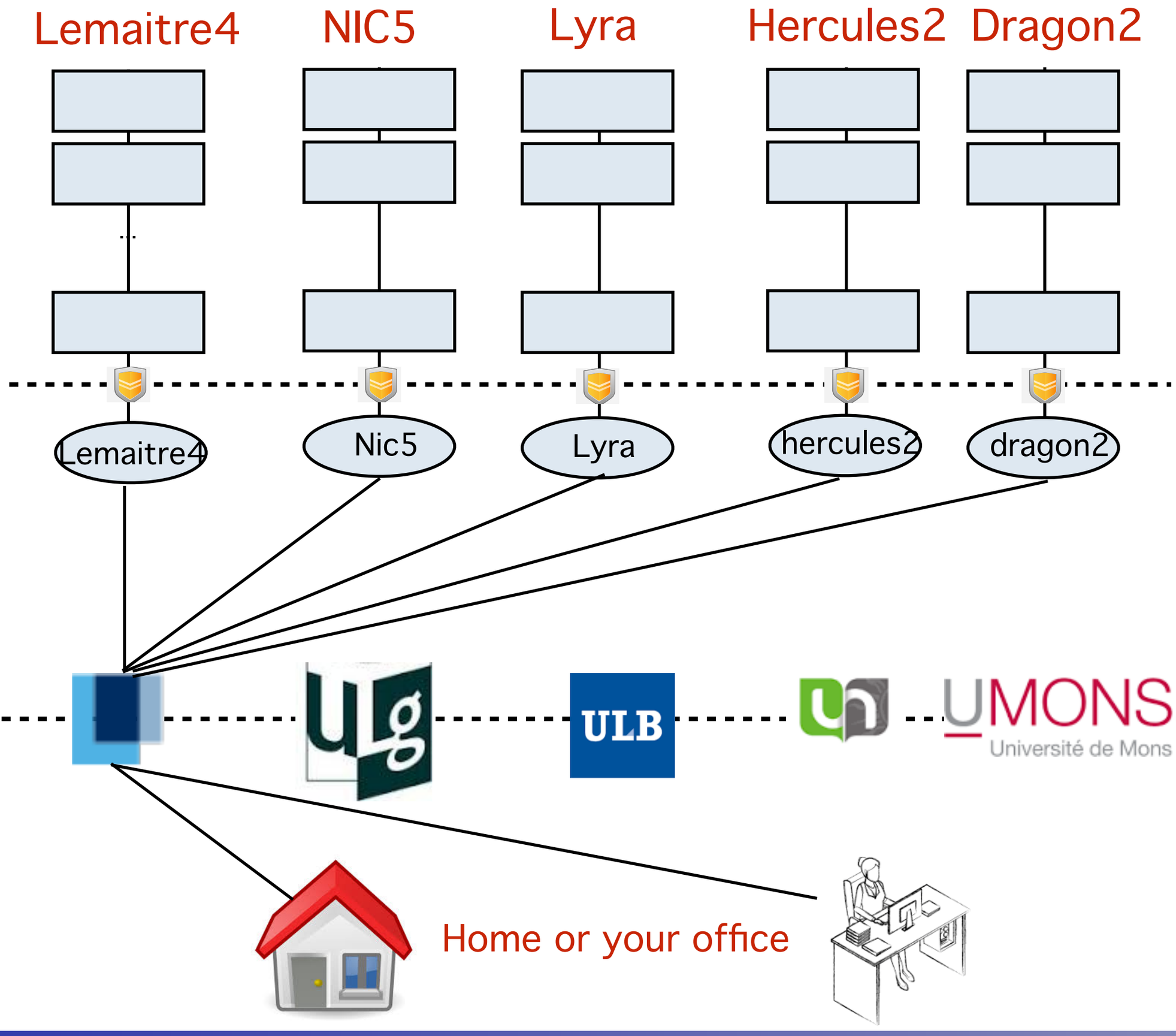
- You do not need/want to physically connect to all those machines to run script
  - ➡ Difficult to control fair share of the machines
  - ➡ Using a job scheduler -> SLURM
    - ✦ Session on SLURM on October 16

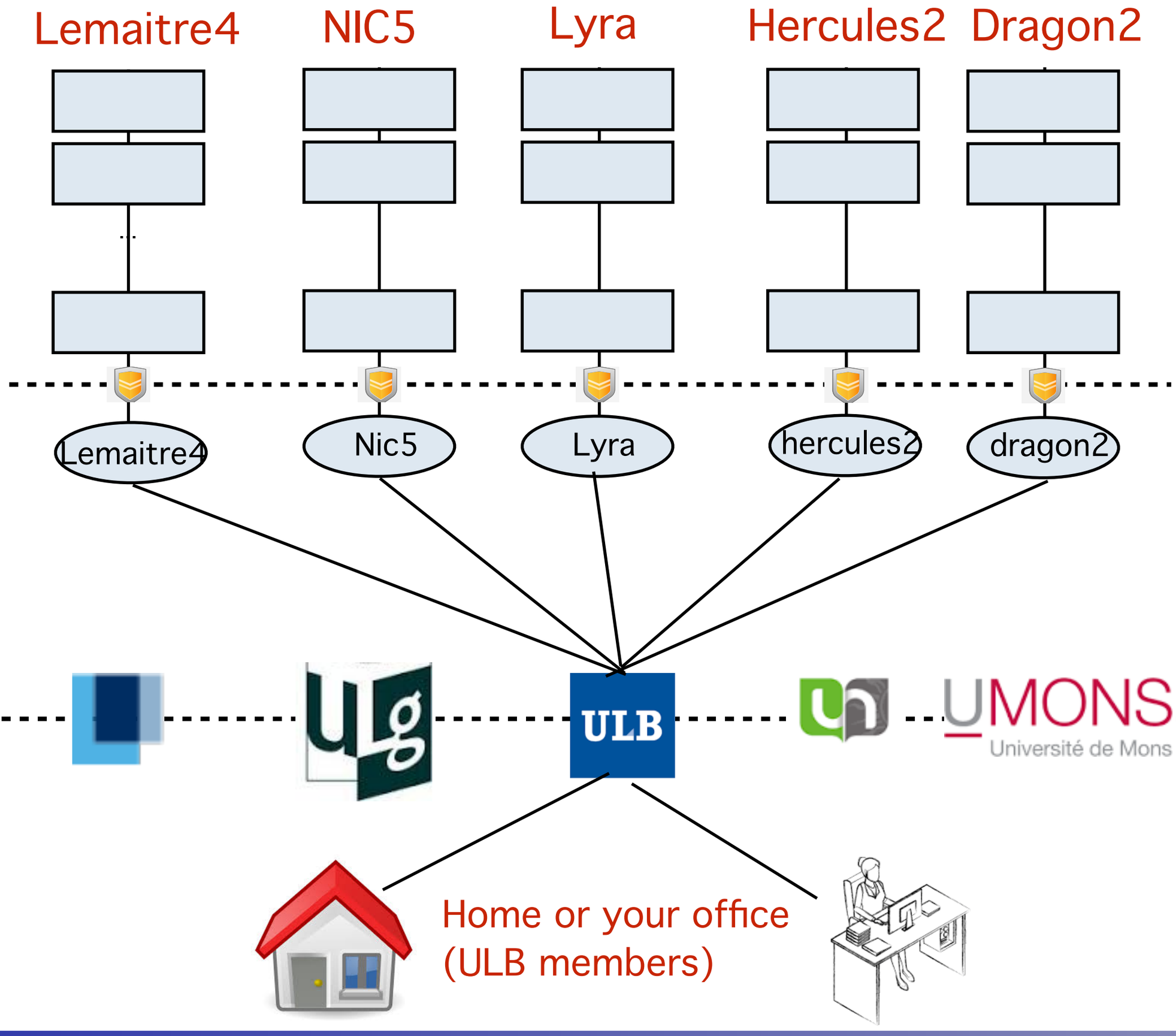


- To request machine, you connect to the FRONTNODE (also called user interface)
  - ✦ You can not connect to the other cpu!
  - ✦ You have to submit a job
  - ➡ No heavy jobs on that machine
  - ✦ You will impact everyone
  - ✦ rather use debug/fast partition



- Cluster adress:
  - ➡ lemaitre4.cism.ucl.ac.be
  - ➡ nic5.uliege.be
  - ➡ hercules.ptci.unamur.be
  - ➡ dragon2.umons.ac.be
  - ➡ lyra.ulb.be


Lemaitre4
NIC5
Lyra
Hercules2
Dragon2
Lemaitre4
Nic5
Lyra
hercules2
dragon2
Private network
ULB
UMONS
Université de Mons
Gateway
Home or your office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NIC5
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Hercules2
Dragon2
Lemaitre4
Nic5
Lyra
hercules2
dragon2
Private network
ULB
UMONS
Université de Mons
Gateway
Home or your office
(ULB members)

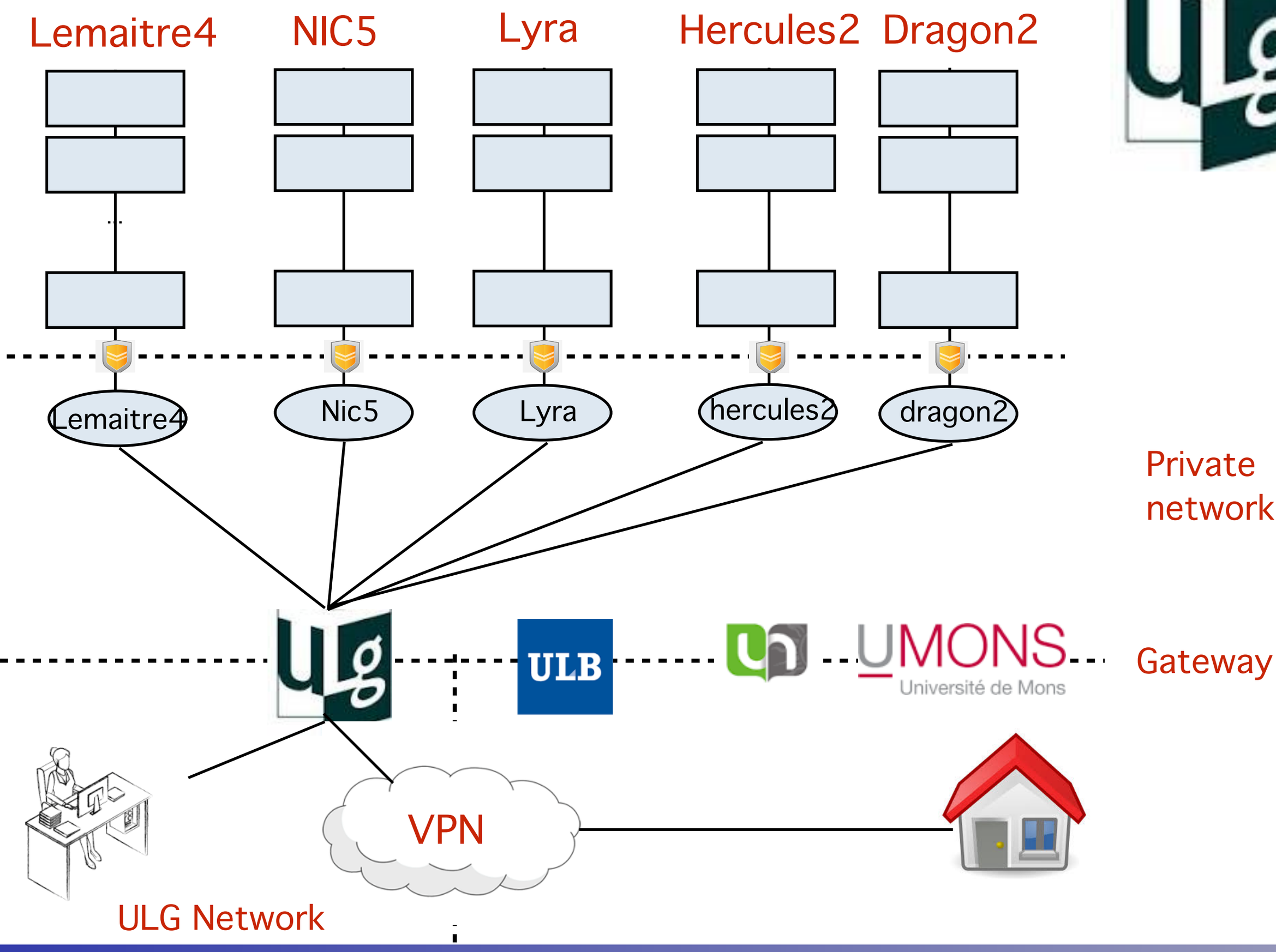
Lemaitre4 NIC5 Lyra Hercules2 Dragon2

Lemaitre4 Nic5 Lyra hercules2 dragon2

Private network

Gateway

Home or your office
Gateway login is via university login


Lemaitre4
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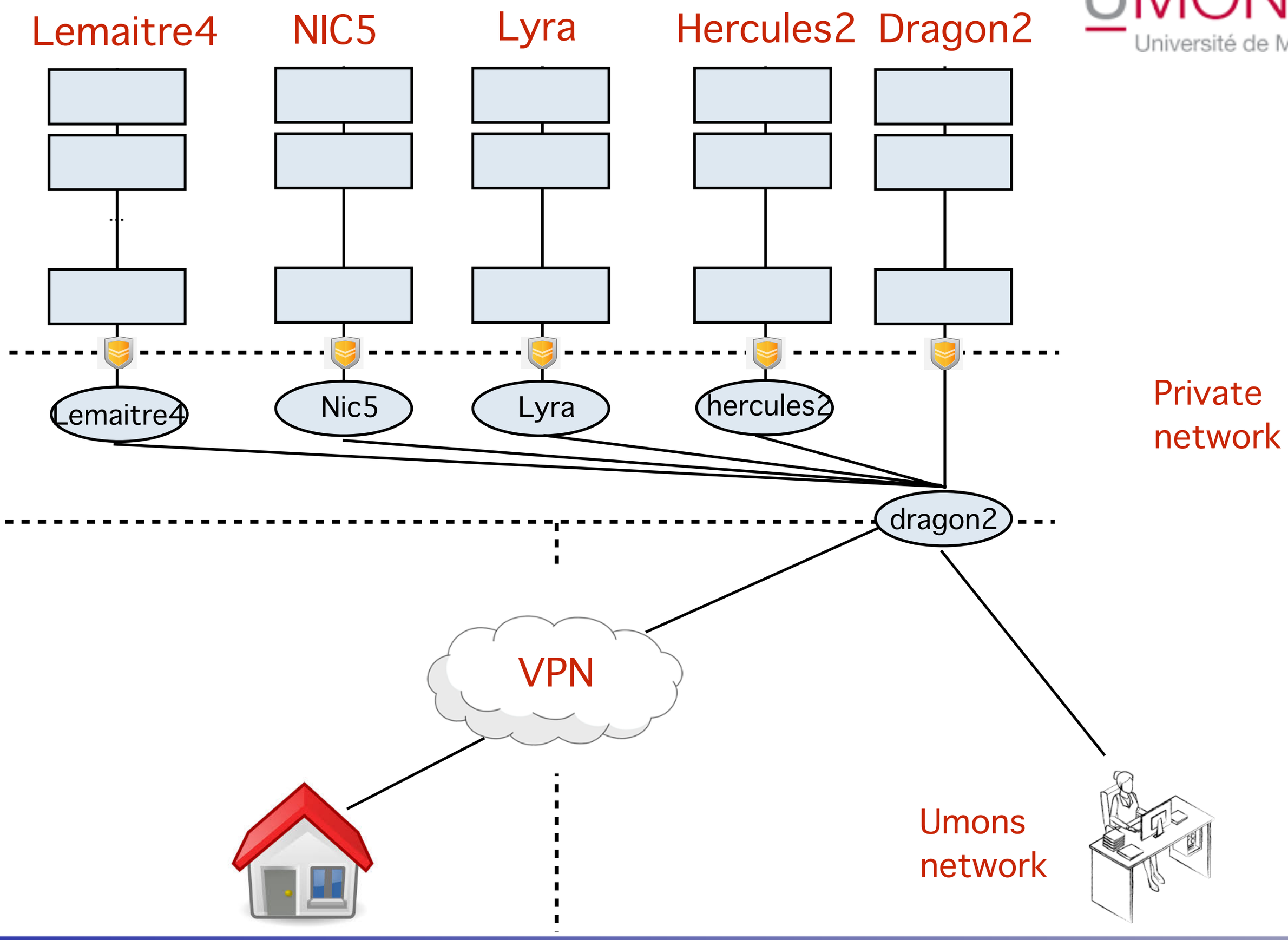
dragon2
Private network
ULB
UMONS
Université de Mons
Gateway
VPN
ULG Network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NIC5
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Hercules2
Dragon2
Lemaitre4
Nic5
Lyra
hercules2
Private network
dragon2
VPN
Umons network

- 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
=
Pass-phrase

- 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 !!

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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.

Connecting cluster for Windows

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

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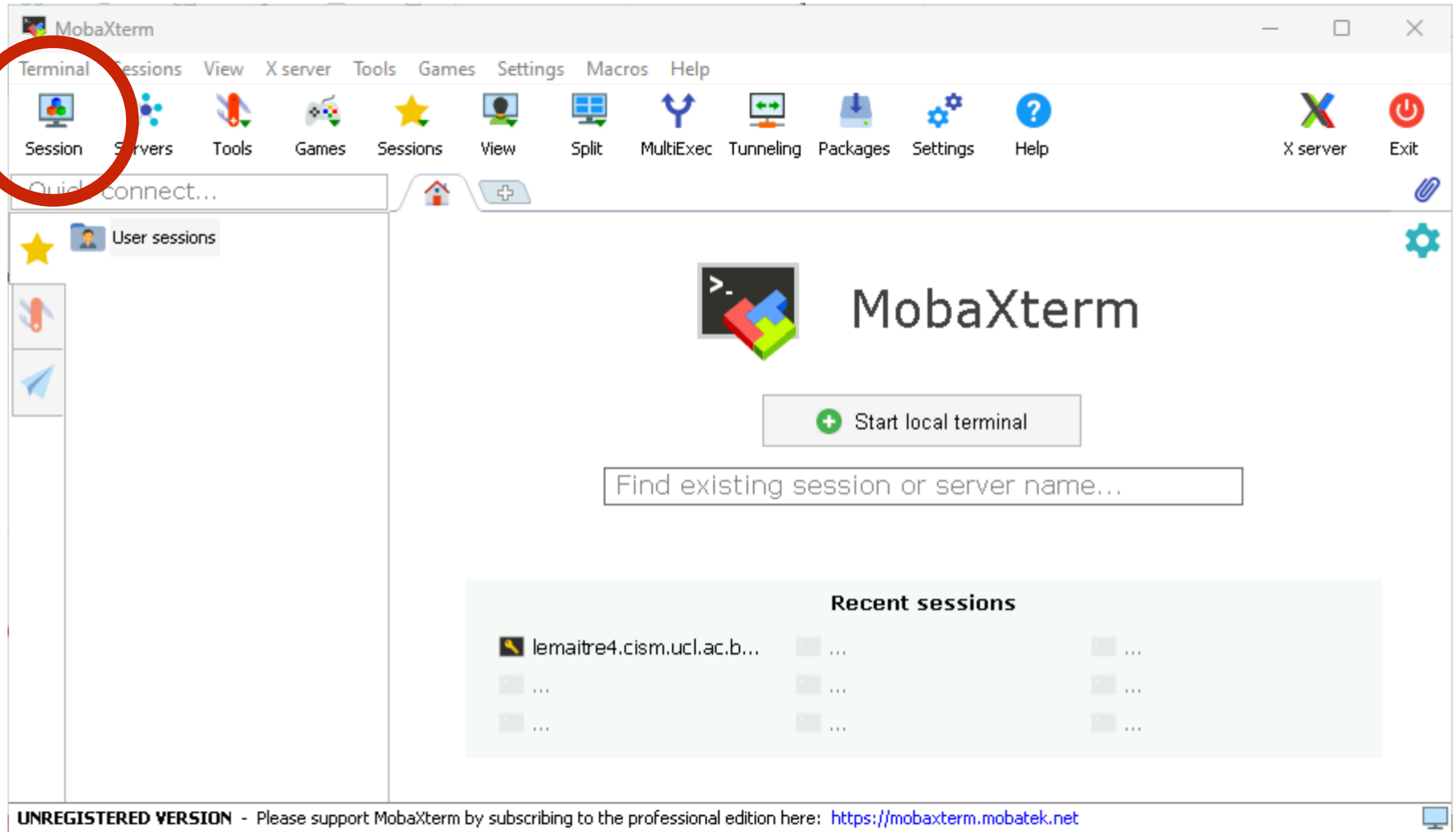
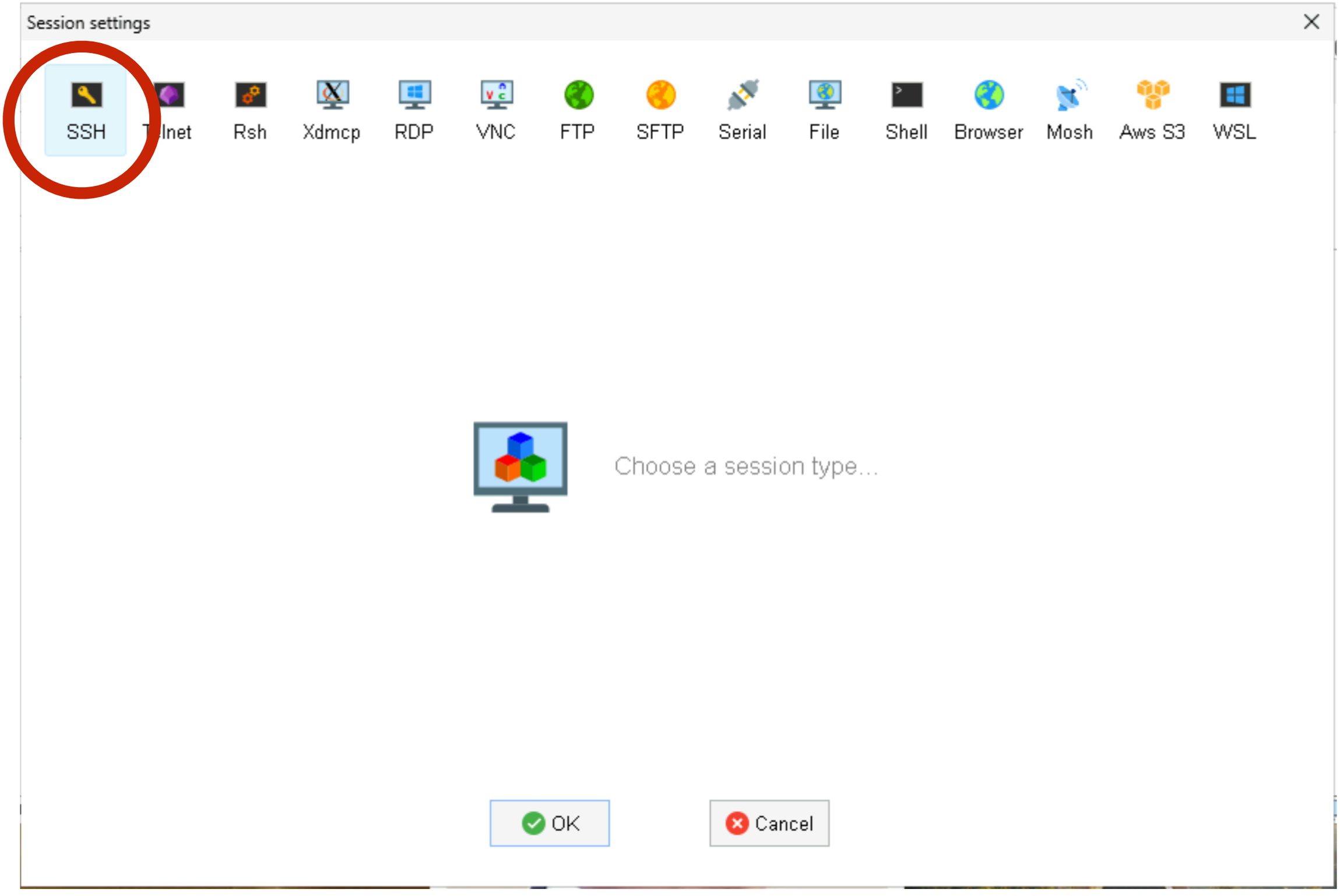
MobaXterm

- Live demo
- Demo also available on YouTube:
  - ➡ https://youtu.be/o41r0mFaURU
- Screen-shot available here

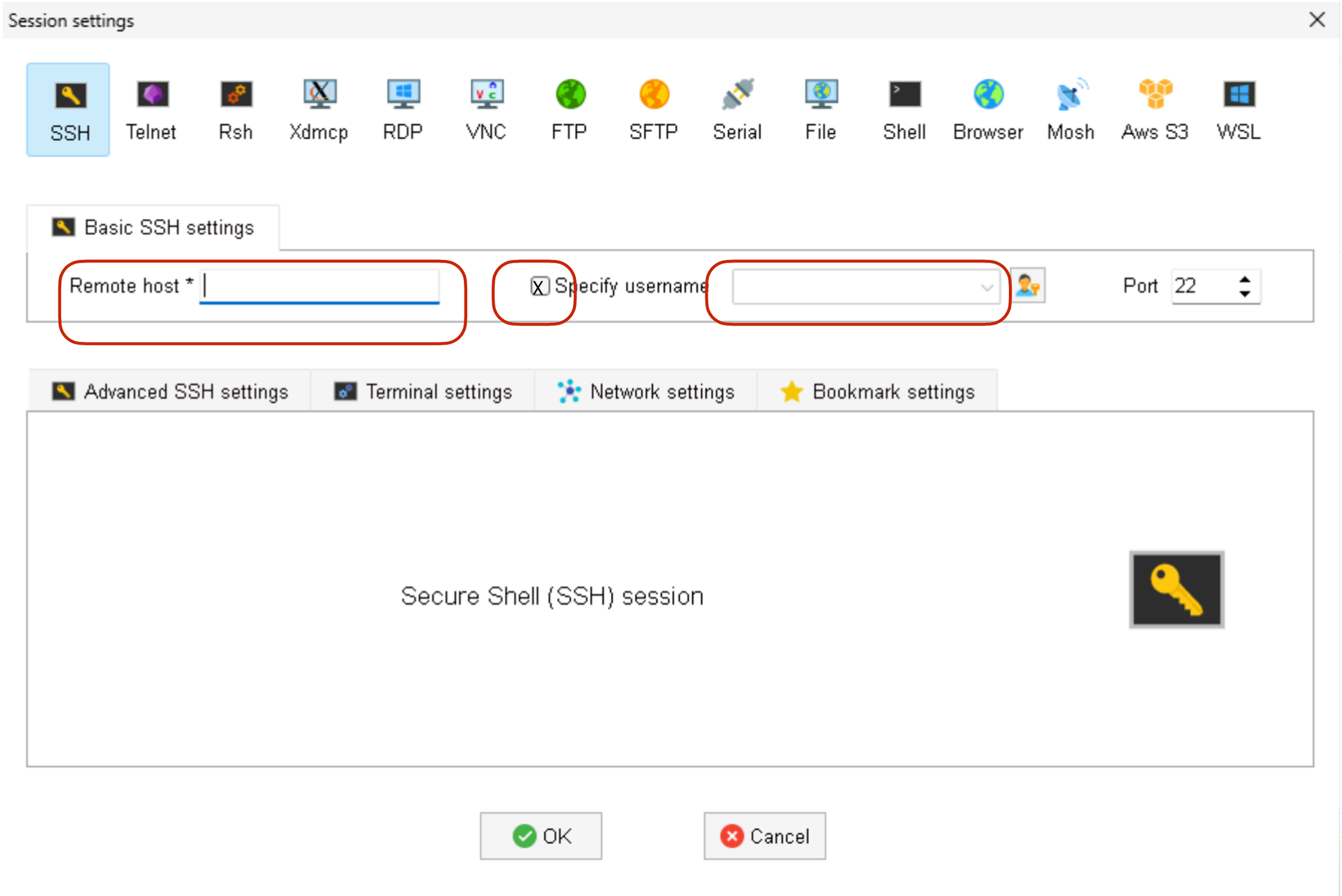
Click Here


MobaXterm
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...
User sessions
MobaXterm
Start local terminal
Find existing session or server name...
Recent sessions
lemaitre4.cism.ucl.ac.b...
UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: https://mobaxterm.mobatek.net

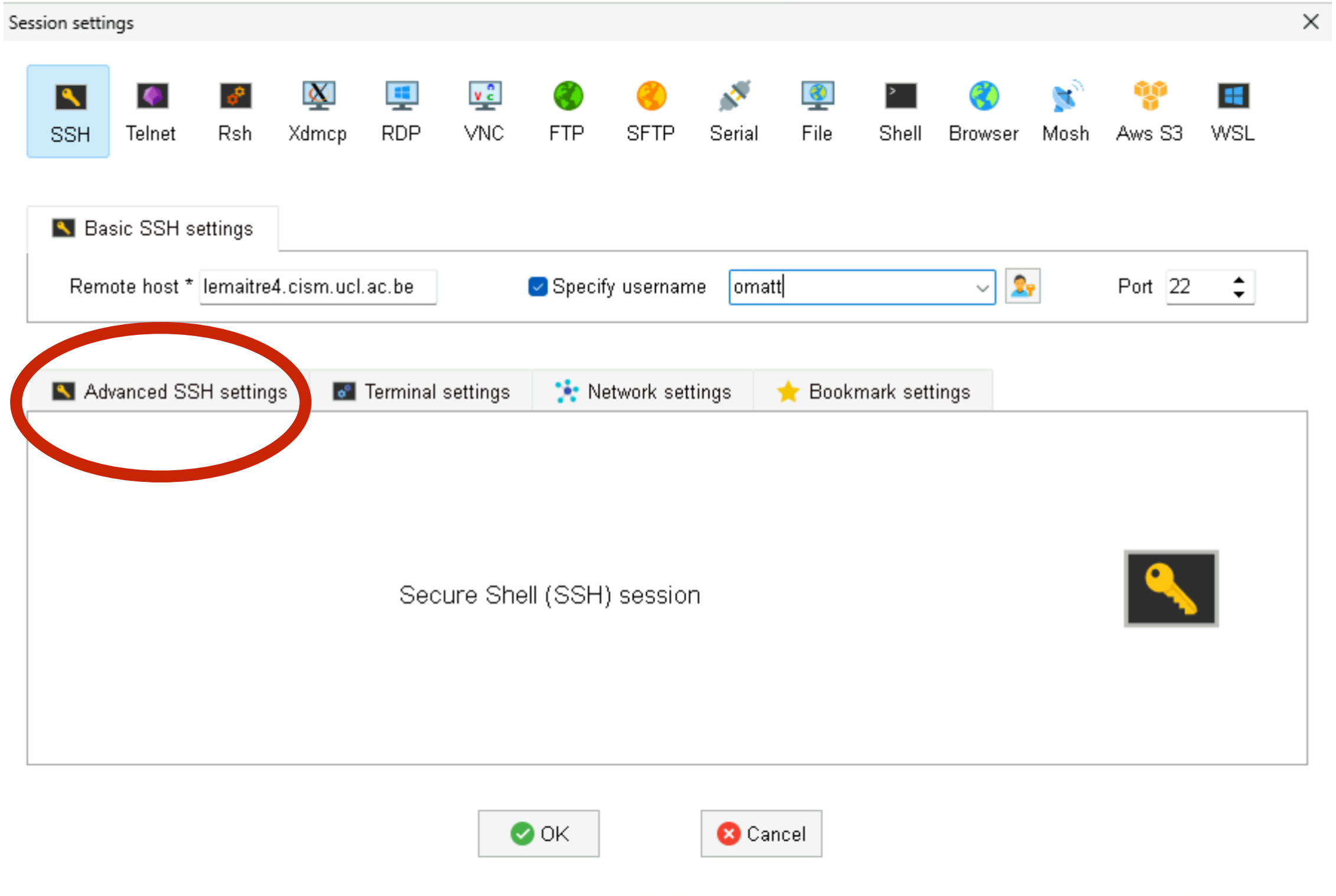
Click Here


Session settings
SSH
Telnet
Rsh
Xdmcp
RDP
VNC
FTP
SFTP
Serial
File
Shell
Browser
Mosh
Aws S3
WSL
Choose a session type...
OK
Cancel

Fill the cluster name and the user name



Click Here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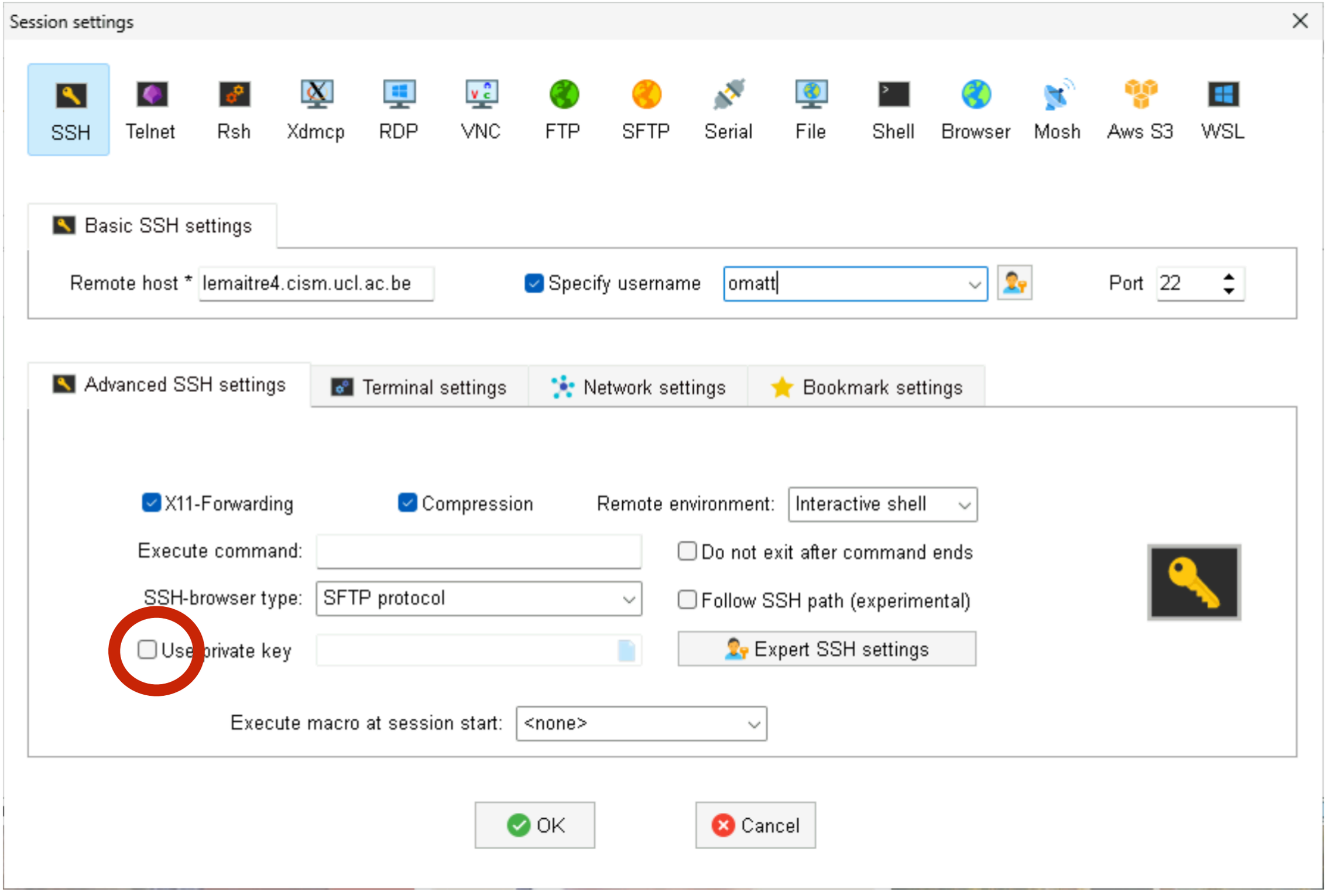
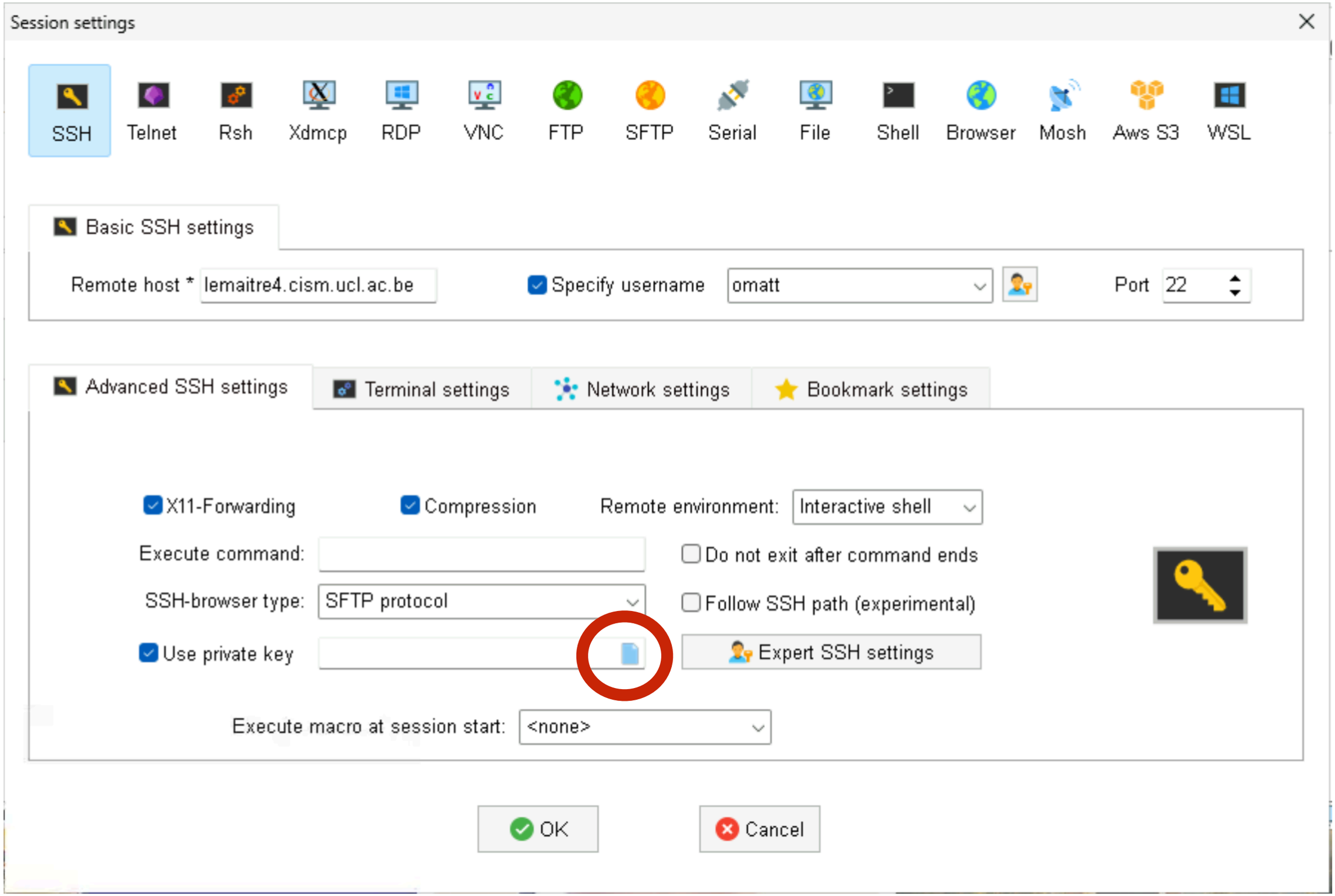
Rsh
Xdmcp
RDP
VNC
FTP
SFTP
Serial
File
Shell
Browser
Mosh
Aws S3
WSL
Basic SSH settings
Remote host * lemaitre4.cism.ucl.ac.be
Specify username
omatt
Port 22
Advanced SSH settings
Terminal settings
Network settings
Bookmark settings
Secure Shell (SSH) session
OK
Cancel

Click on "use private key"



Click on the blue icon and then select the private key on your system



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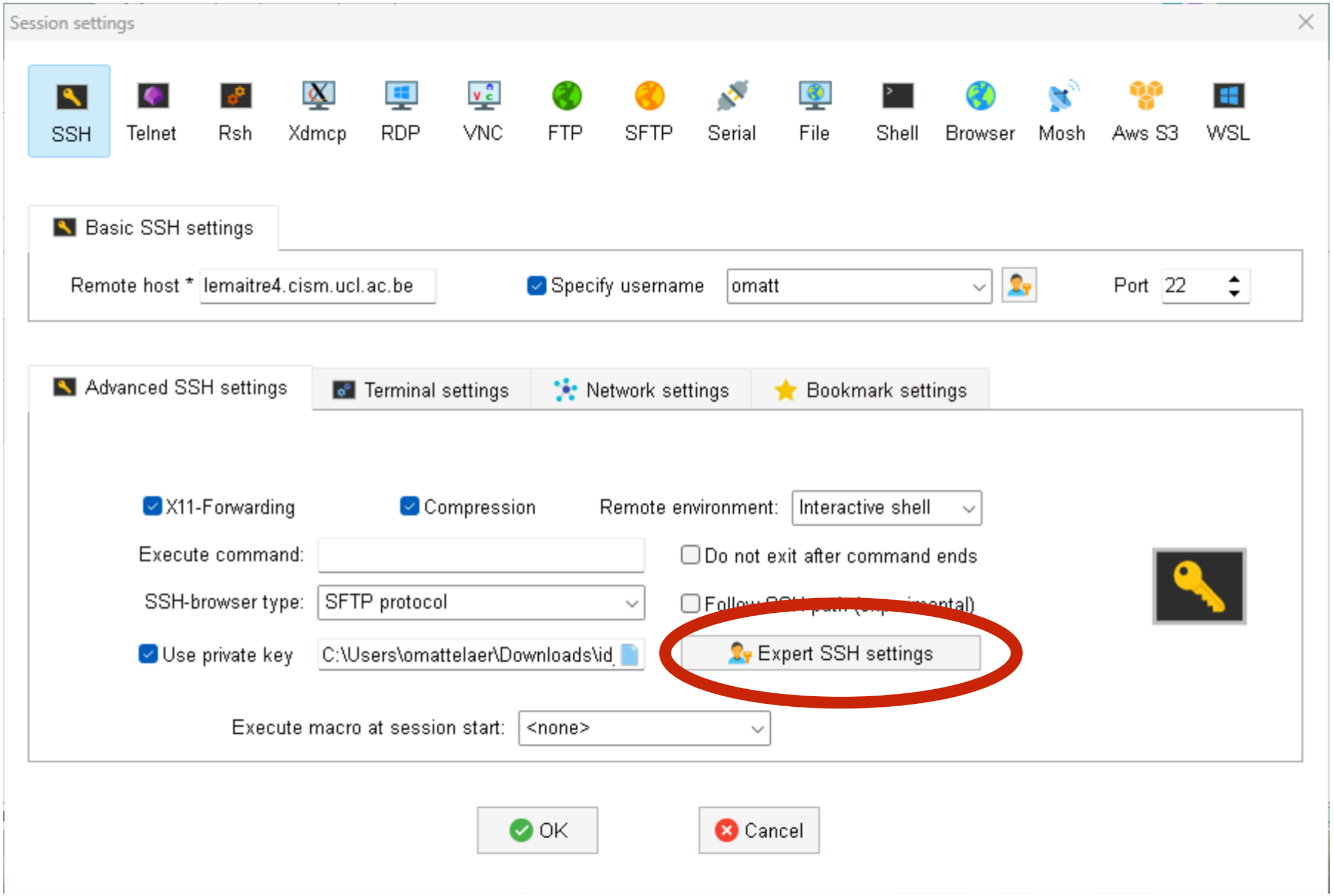
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Specify username
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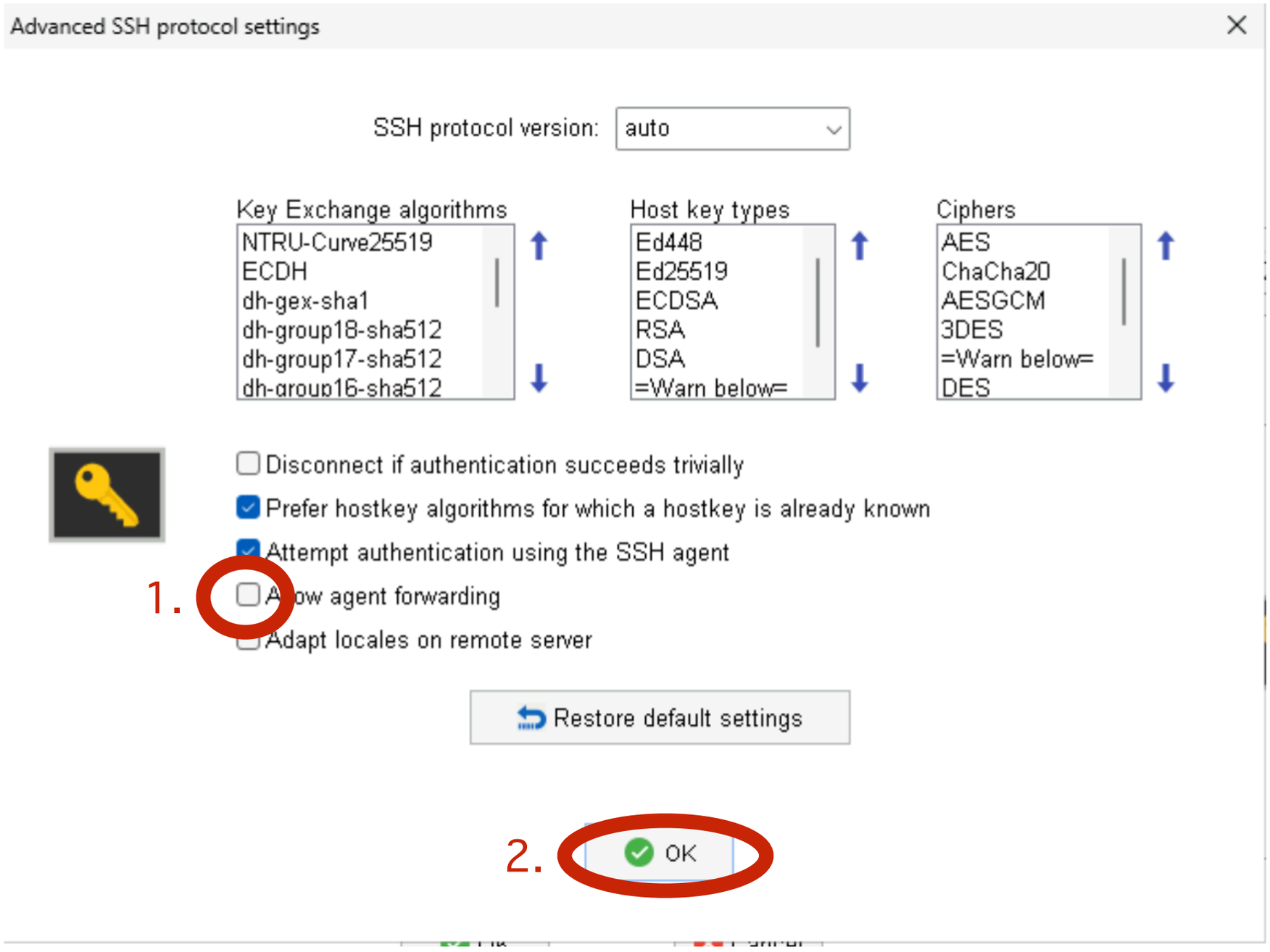
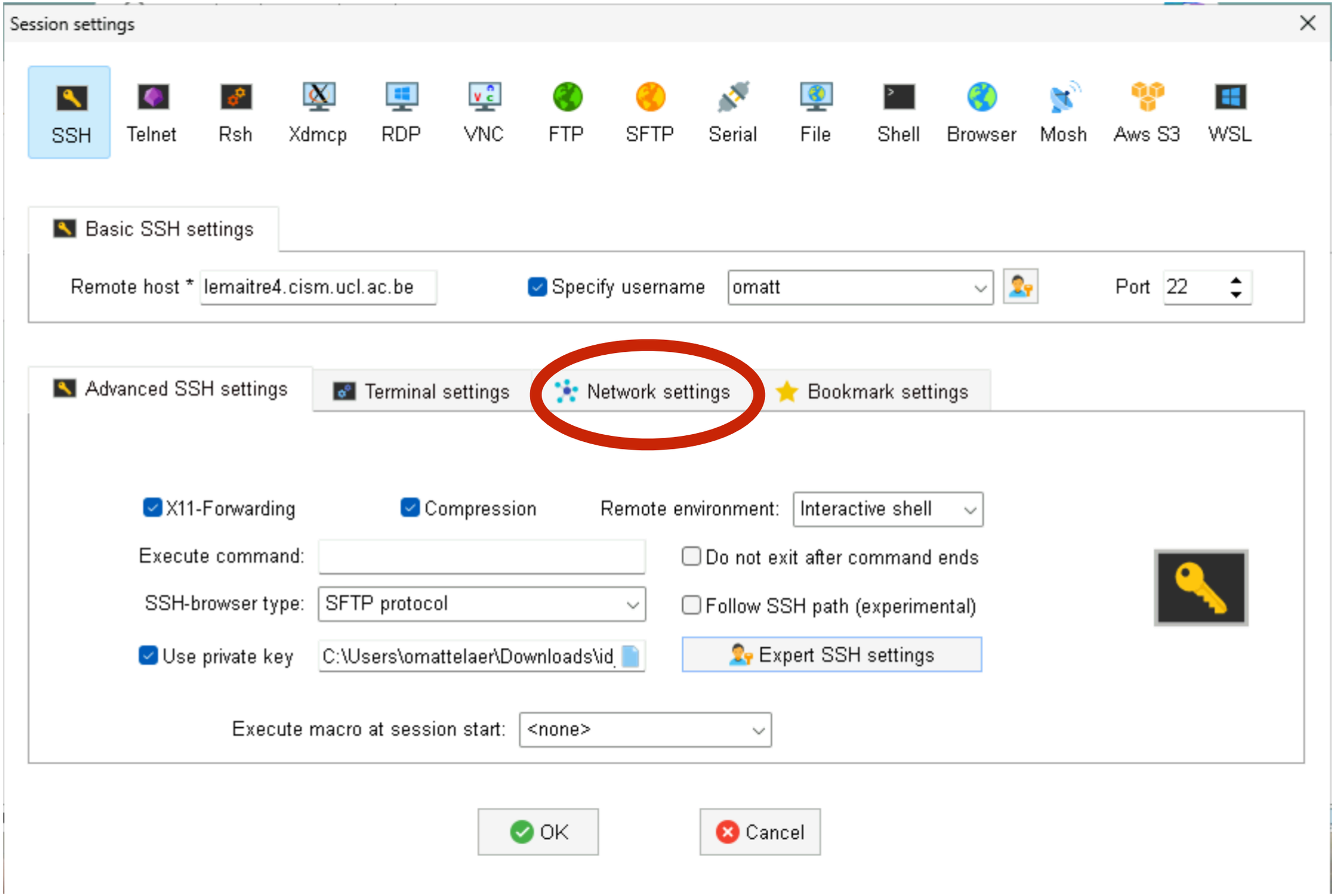
Port 22
Advanced SSH settings
Terminal settings
Network settings
Bookmark settings
X11-Forwarding
Compression
Remote environment: Interactive shell
Execute command:
Do not exit after command ends
SSH-browser type: SFTP protocol
Use private key
C:\Users\omattelaer\Downloads\id
Expert SSH settings
Execute macro at session start: <none>
OK
Cancel

Click Here then click OK



Click Here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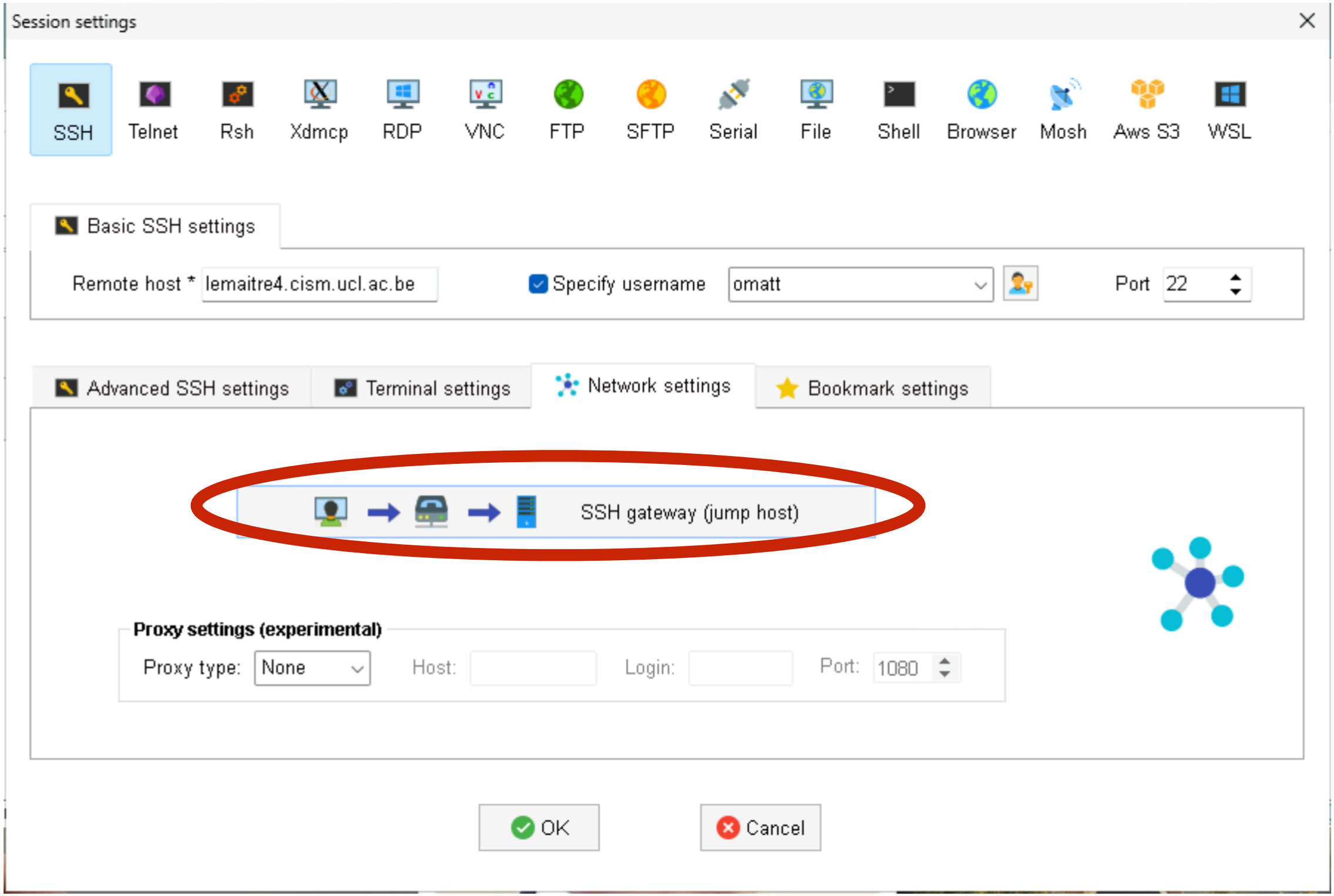
Telnet
Rsh
Xdmcp
RDP
VNC
FTP
SFTP
Serial
File
Shell
Browser
Mosh
Aws S3
WSL
Basic SSH settings
Remote host * lemaitre4.cism.ucl.ac.be
Specify username
omatt
Port 22
Advanced SSH settings
Terminal settings
Network settings
Bookmark settings
X11-Forwarding
Compression
Remote environment: Interactive shell
Execute command:
Do not exit after command ends
SSH-browser type: SFTP protocol
Follow SSH path (experimental)
Use private key
C:\Users\omattelaer\Downloads\id
Expert SSH settings
Execute macro at session start: <none>
OK
Cancel

Click Here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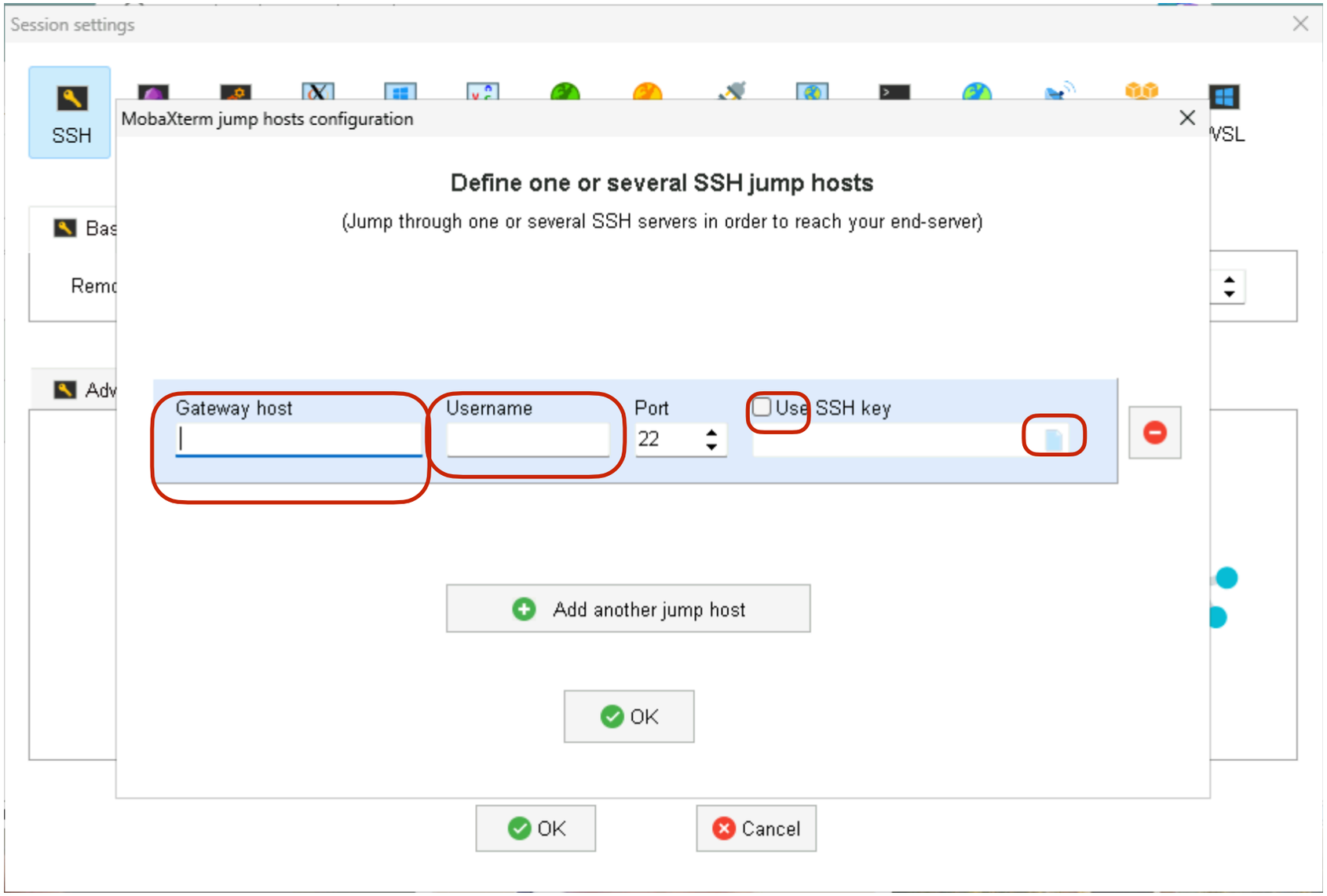
Specify username
omatt
Port 22
Advanced SSH settings
Terminal settings
Network settings
Bookmark settings
SSH gateway (jump host)
Proxy settings (experimental)
Proxy type: None
Host:
Login:
Port: 1080
OK
Cancel

Fill the information
Gateway address depend
Of YOUR university
(Same private key)

- gwceci.cism.ucl.ac.be
- gwceci.ulb.ac.be
- gwceci.uliege.be
- gwceci.unamur.be
  (unamur id)
- dragon2.umons.ac.be



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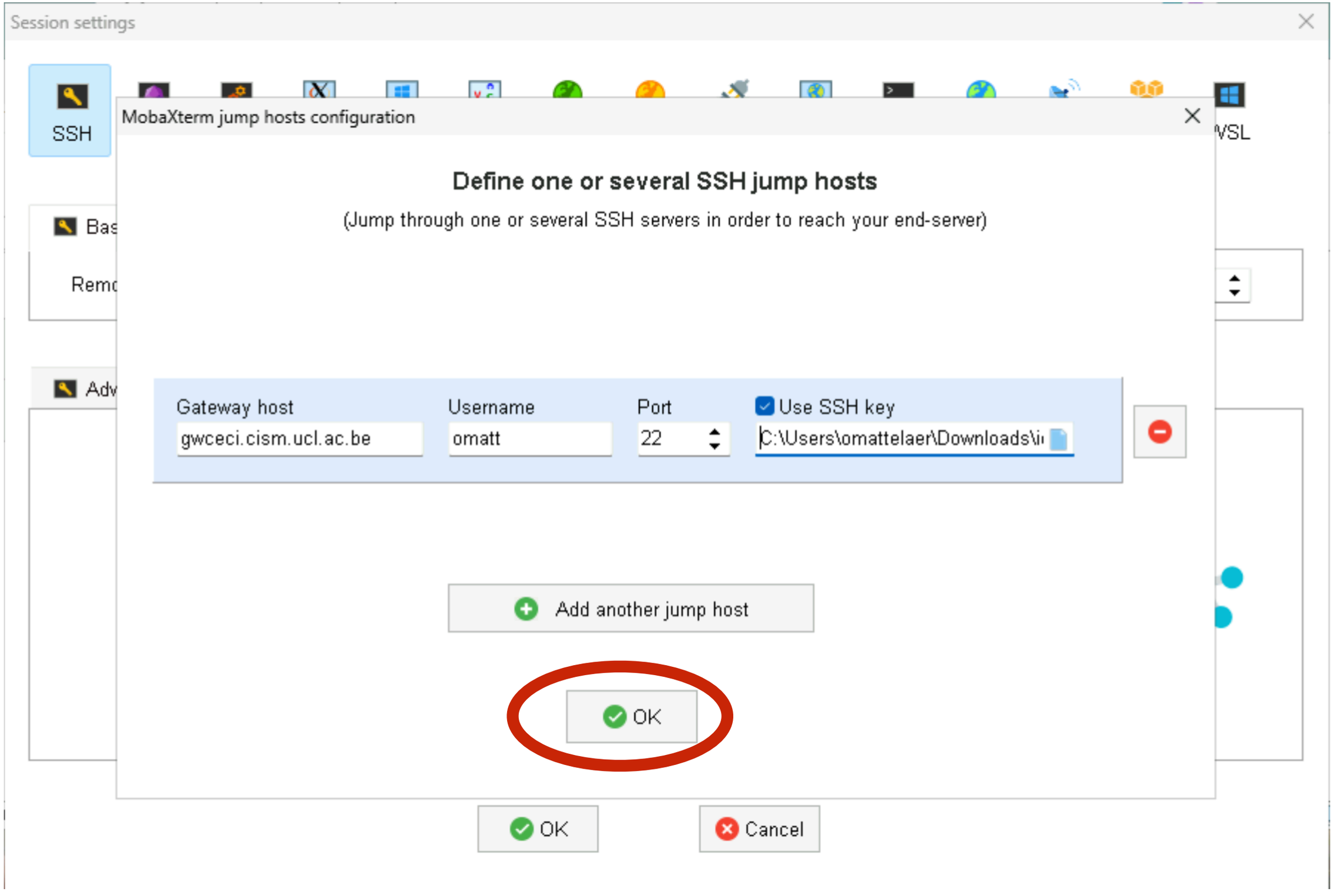
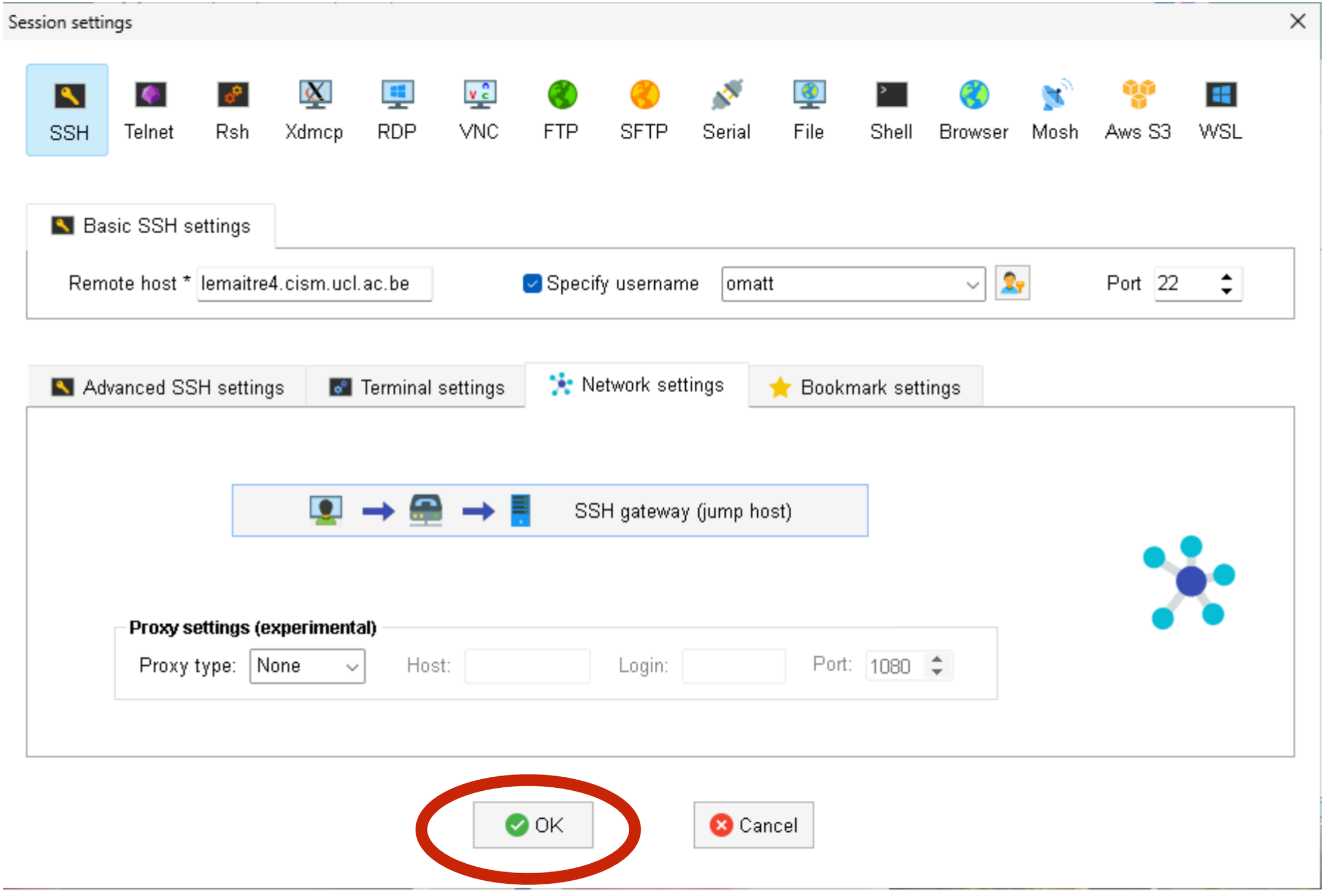

Session settings
SSH
MobaXterm jump hosts configuration
Define one or several SSH jump hosts
(Jump through one or several SSH servers in order to reach your end-server)
Gateway host
Username
Port
Use SSH key
gwceci.cism.ucl.ac.be
omatt
22
C:\Users\omattelaer\Downloads\i
Add another jump host
OK
OK
Cancel

Click Here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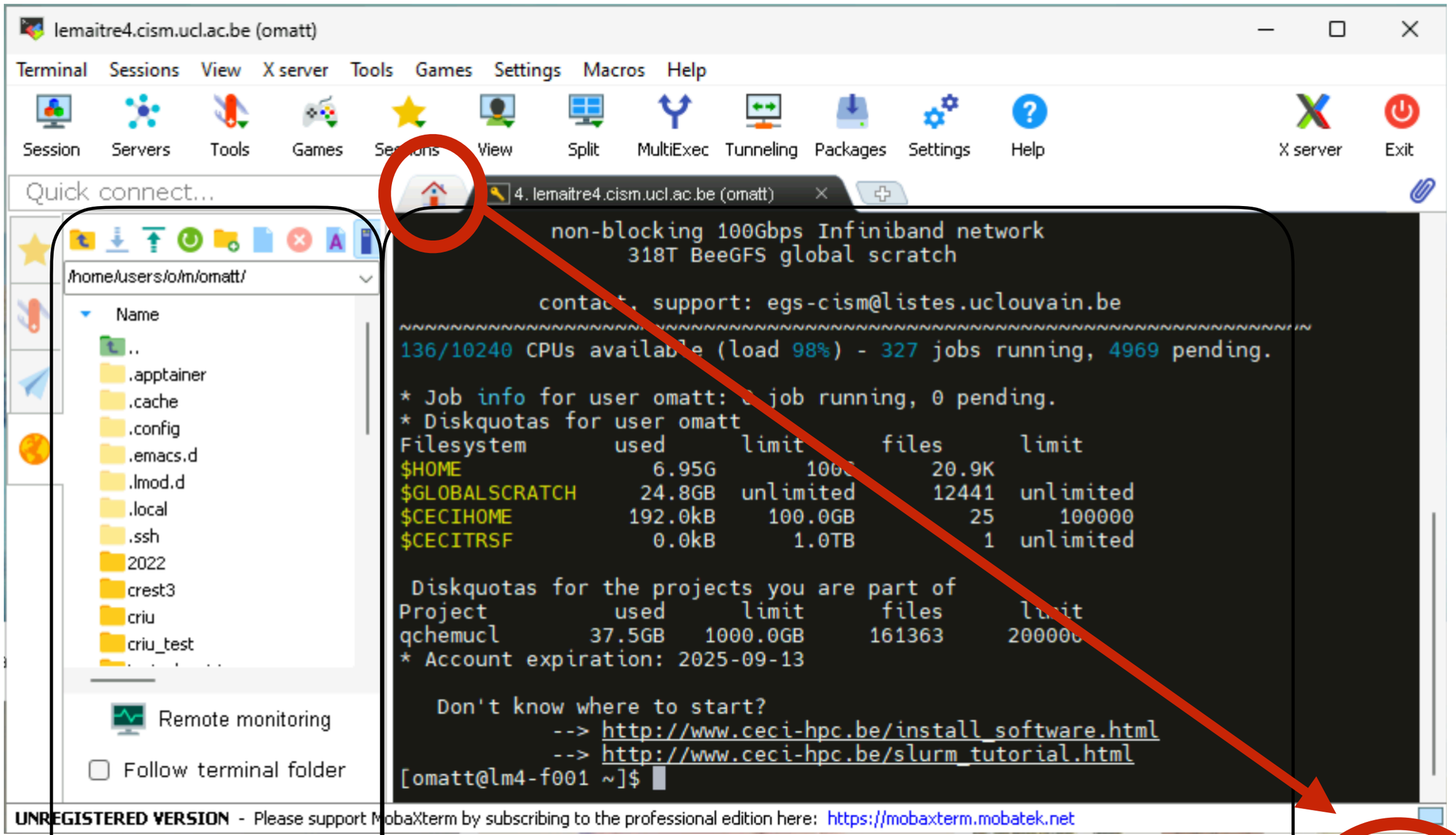
Remote host * lemaitre4.cism.ucl.ac.be
Specify username
omatt
Port 22
Advanced SSH settings
Terminal settings
Network settings
Bookmark settings
SSH gateway (jump host)
Proxy settings (experimental)
Proxy type: None
Host:
Login:
Port: 1080
OK
Cancel

You are connected !!!

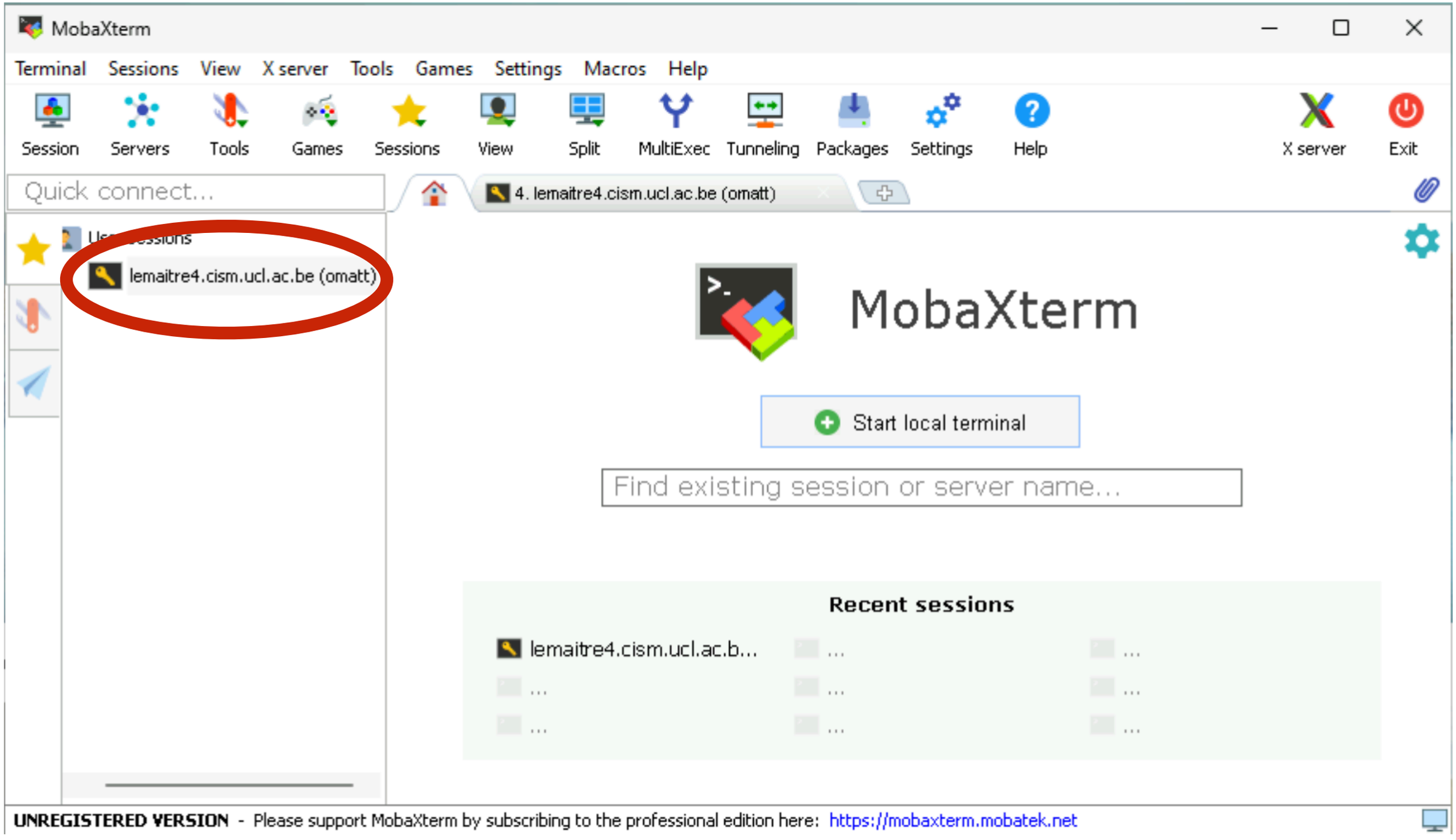


Drag and drop file from/to the cluster

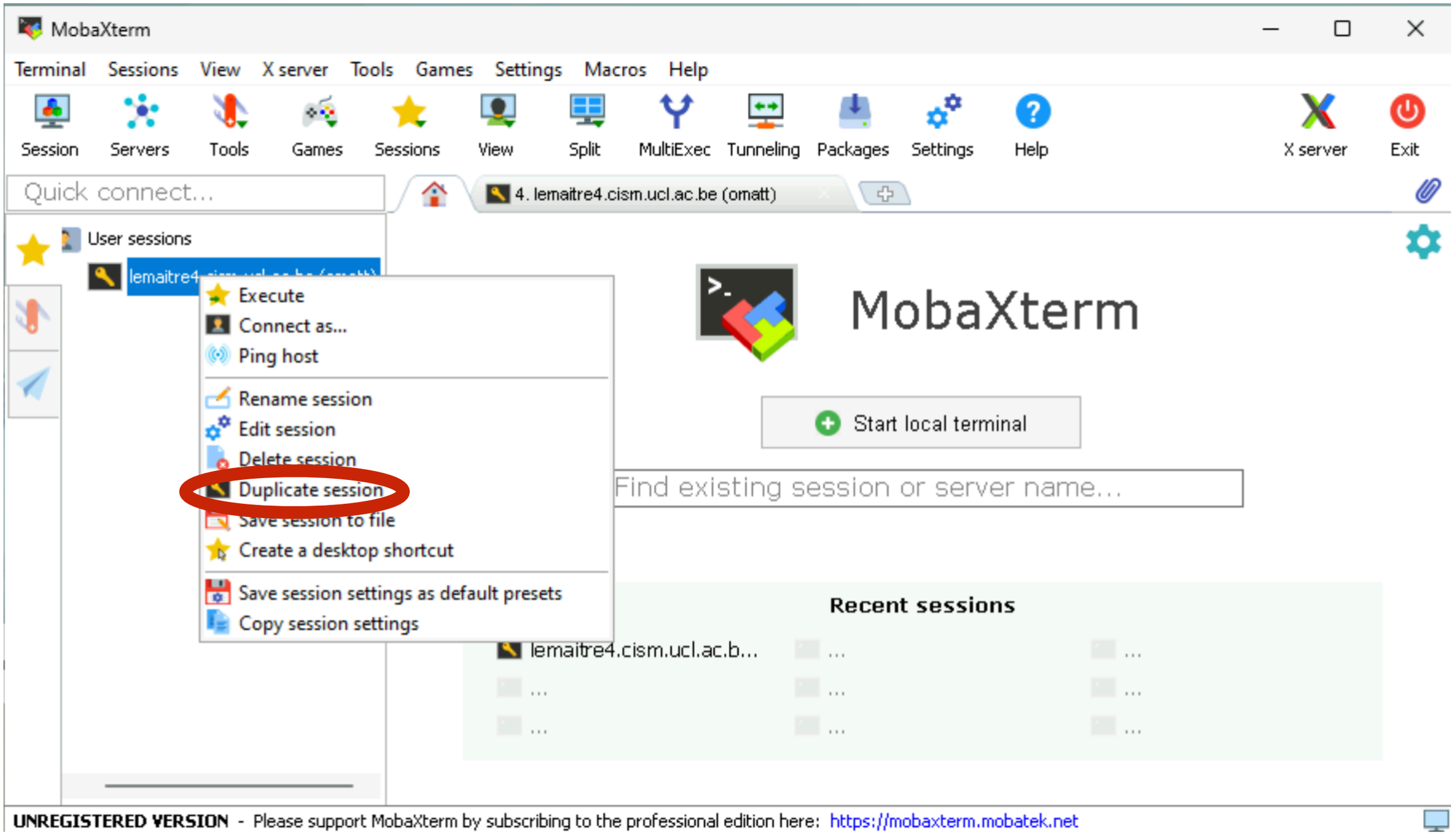
Unix terminal running on the cluster

New connection (See next slide)

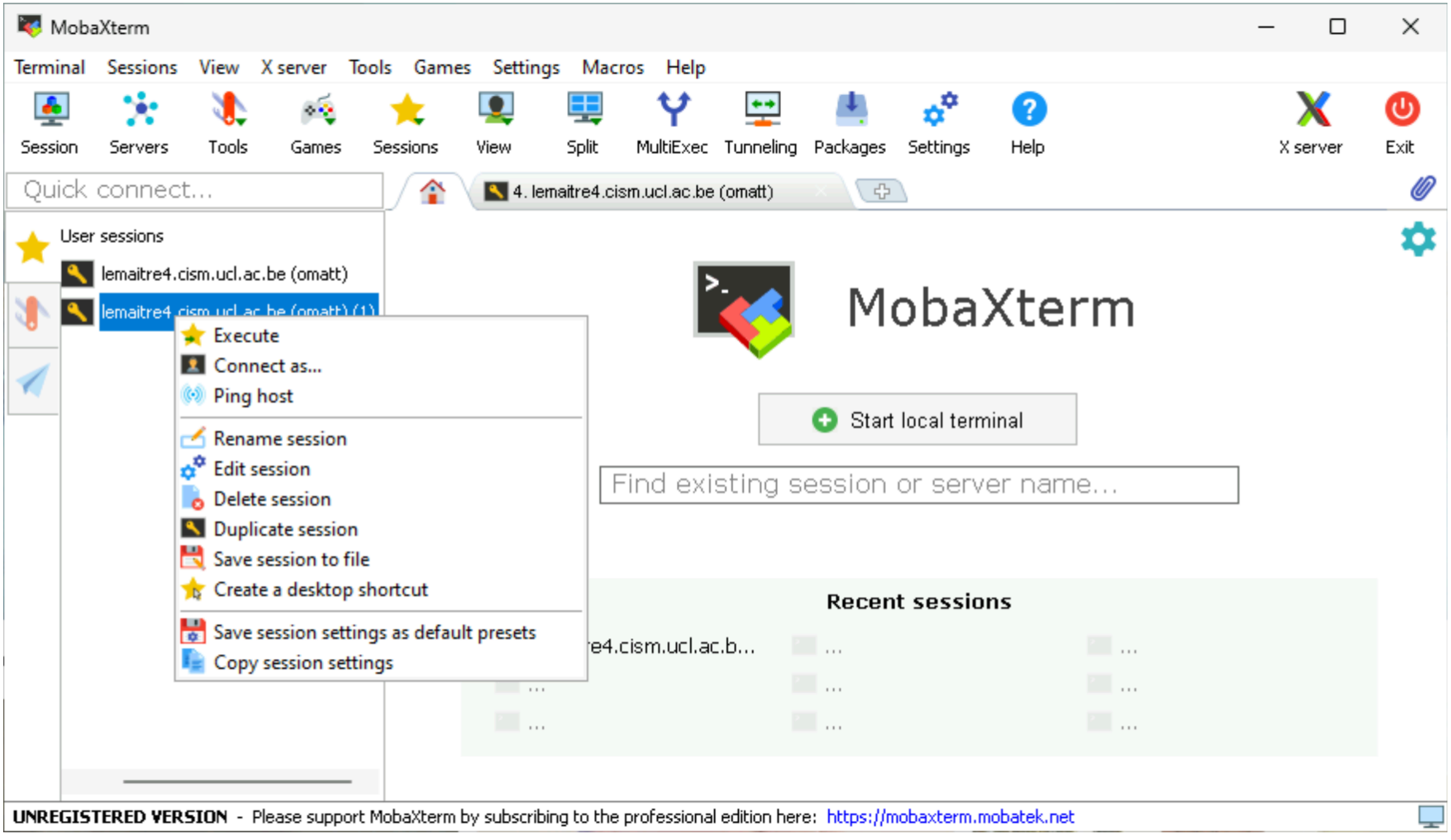
Click Here to start a second terminal on the same cluster



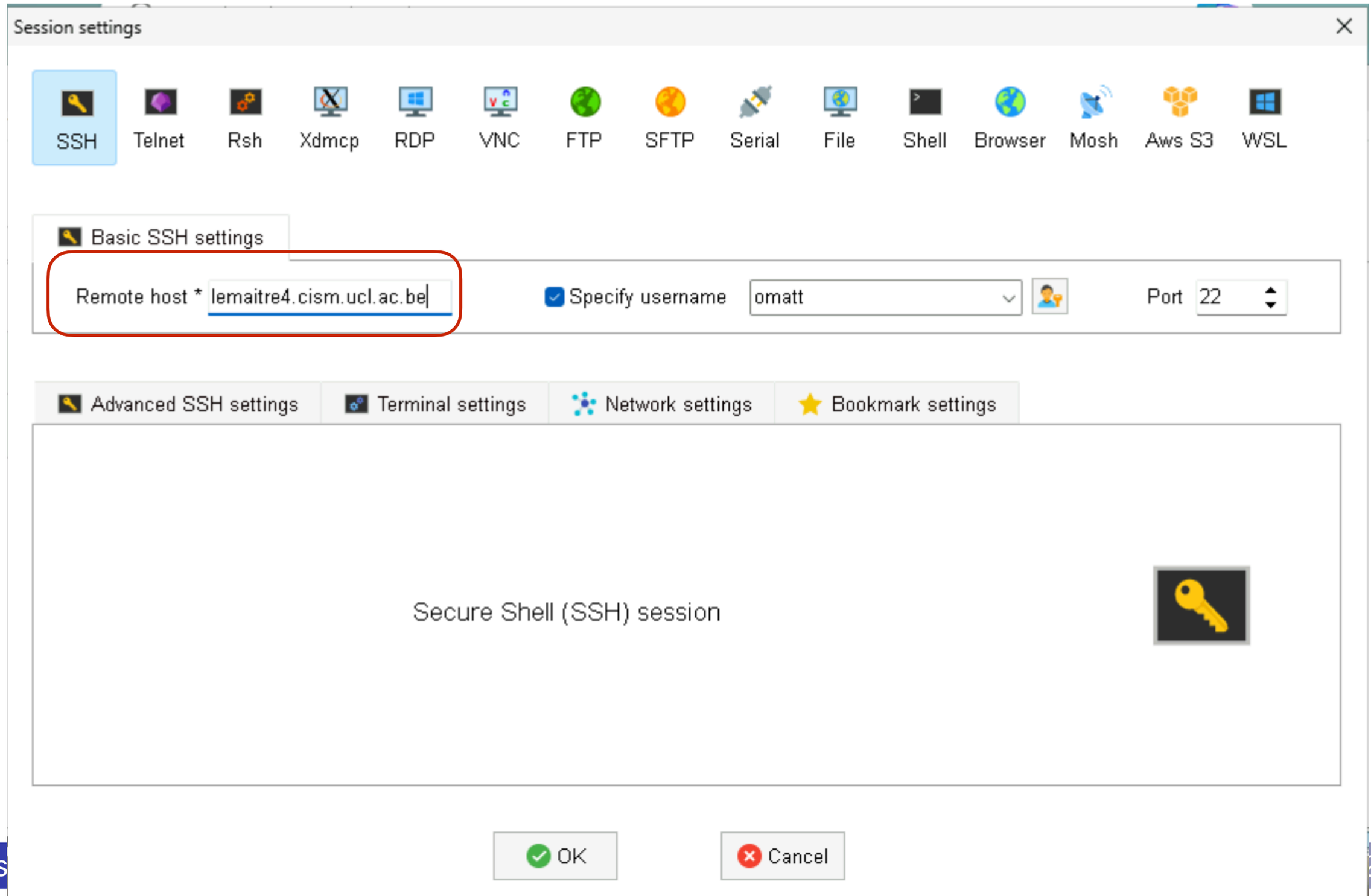
Or right click on it and duplicate it to copy the configuration for another cluster



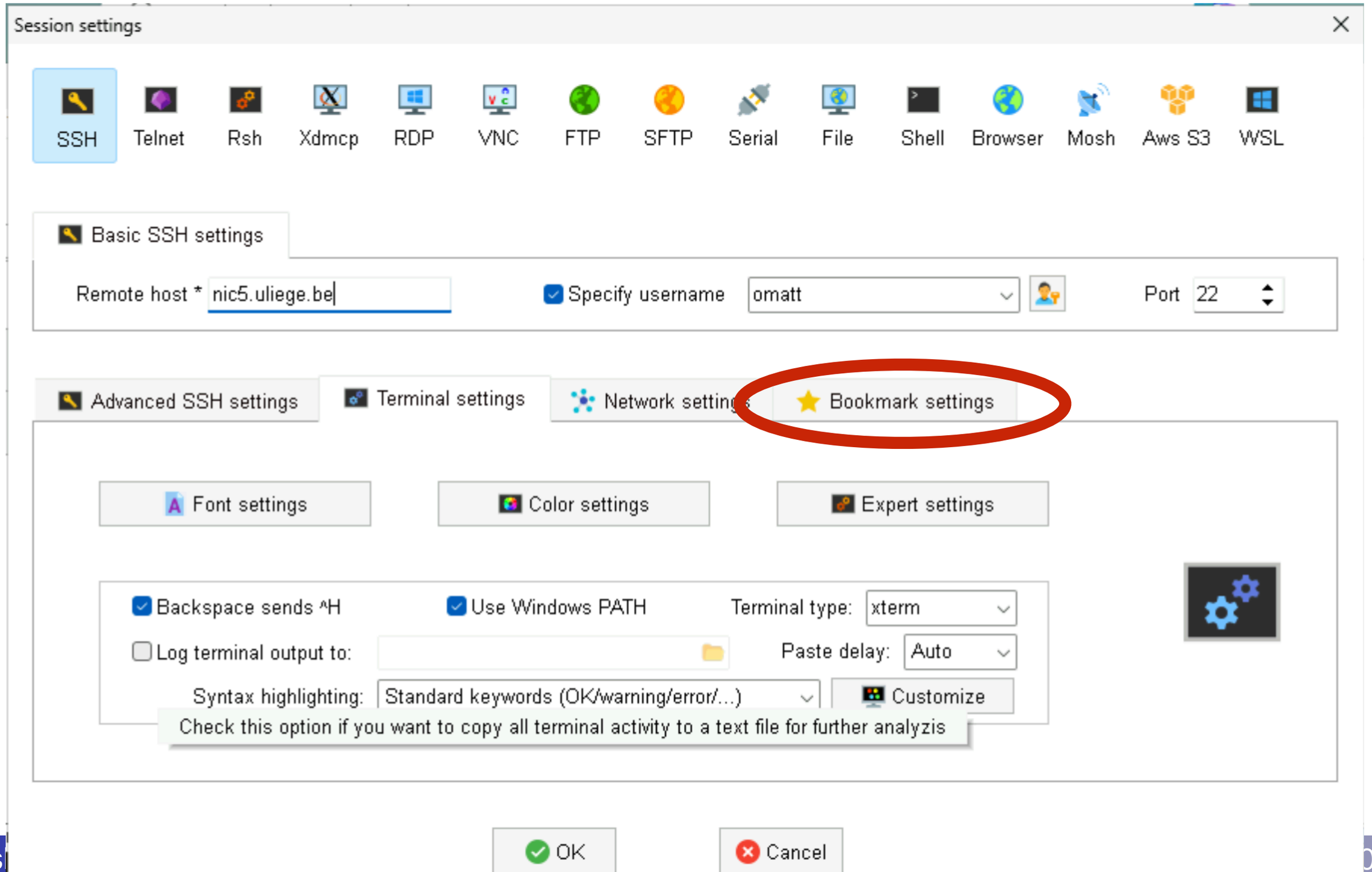
Right click on the duplicate and choose edit session:



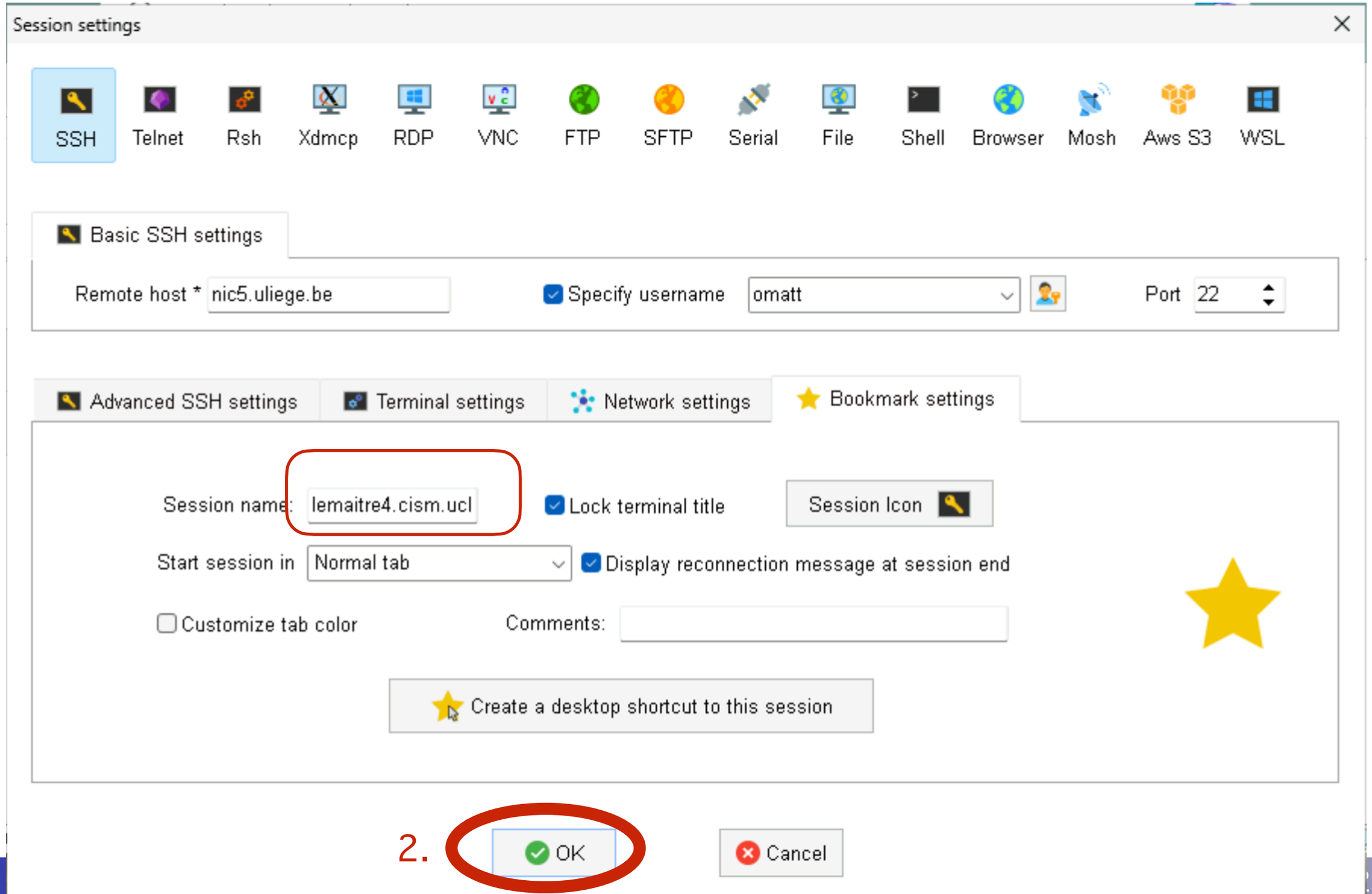
Change the address of the cluster



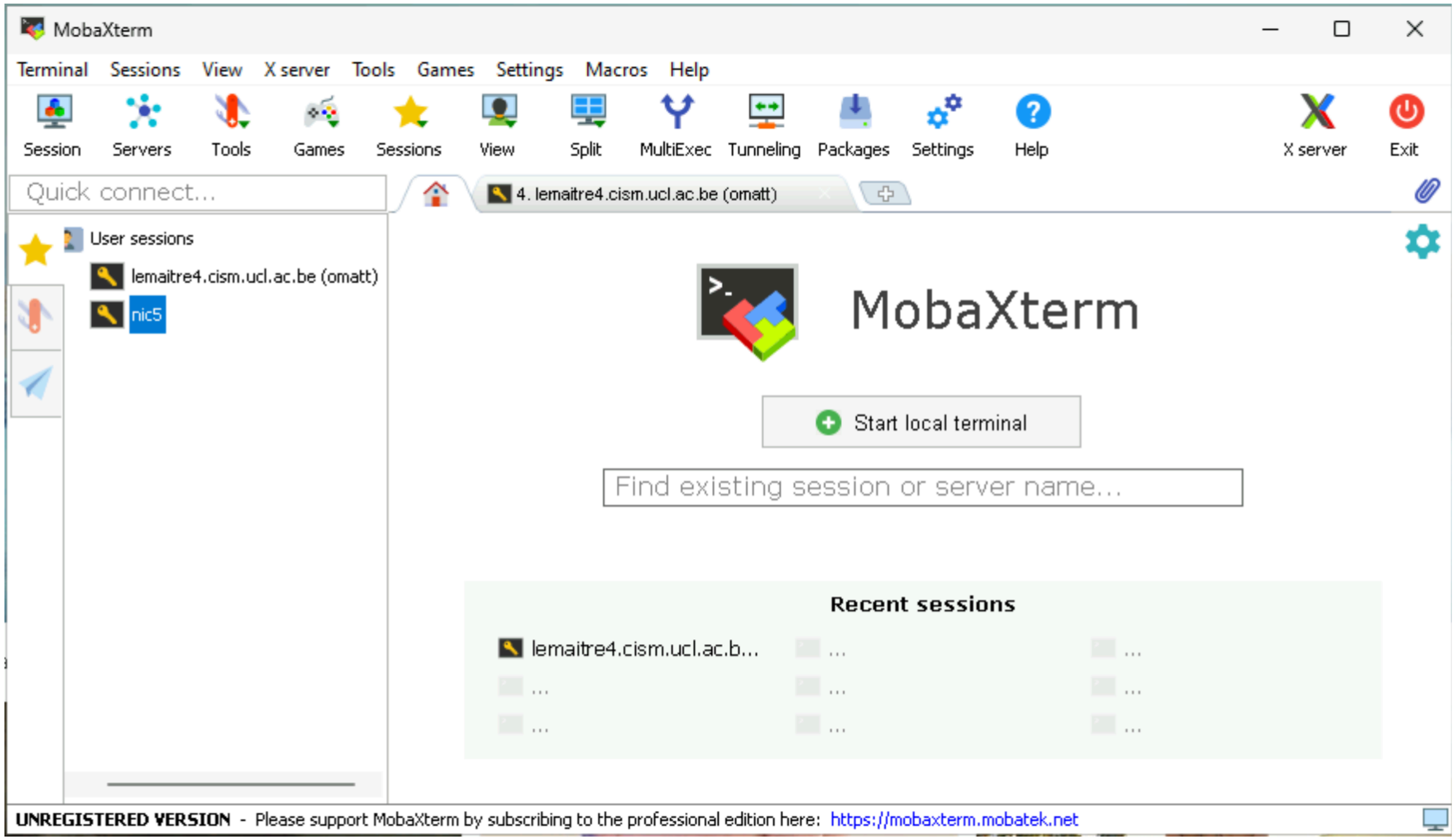
Click Here


Session settings
SSH
Telnet
Rsh
Xdmcp
RDP
VNC
FTP
SFTP
Serial
File
Shell
Browser
Mosh
Aws S3
WSL
Basic SSH settings
Remote host * nic5.uliege.be
Specify username
omatt
Port 22
Advanced SSH settings
Terminal settings
Network settings
Bookmark settings
Font settings
Color settings
Expert settings
Backspace sends ^H
Use Windows PATH
Terminal type: xterm
Log terminal output to:
Paste delay: Auto
Syntax highlighting: Standard keywords (OK/warning/error/...)
Customize
Check this option if you want to copy all terminal activity to a text file for further analyzis
OK
Cancel

Change the name of the cluster (this will be the name displayed on the left column)
Then click OK



Now you can start a session on the second cluster by double clicking on it!



Exercise: Connect to the cluster

- Cluster adress:
  - ➡ lemaitre3.cism.ucl.ac.be
  - ➡ nic5.uliege.be
  - ➡ hercules.ptci.unamur.be
  - ➡ dragon2.umons.ac.be
  - ➡ lyra.ulb.be

- Gateway address

➡ gwceci.cism.ucl.ac.be

➡ gwceci.ulb.ac.be

➡ gwceci.uliege.be

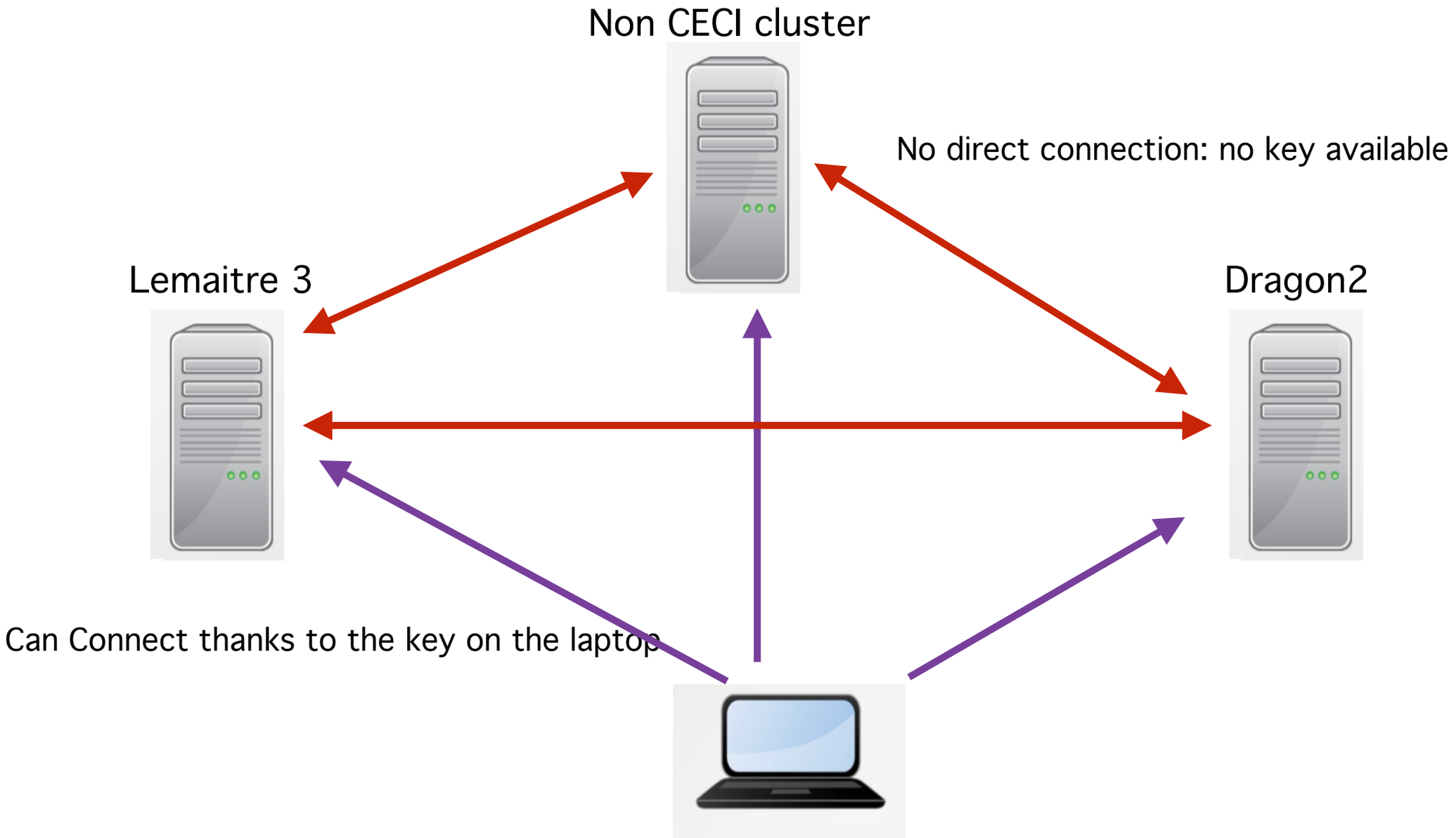
➡ gwceci.unamur.be (unamur id)

➡ dragon2.umons.ac.be

More features:

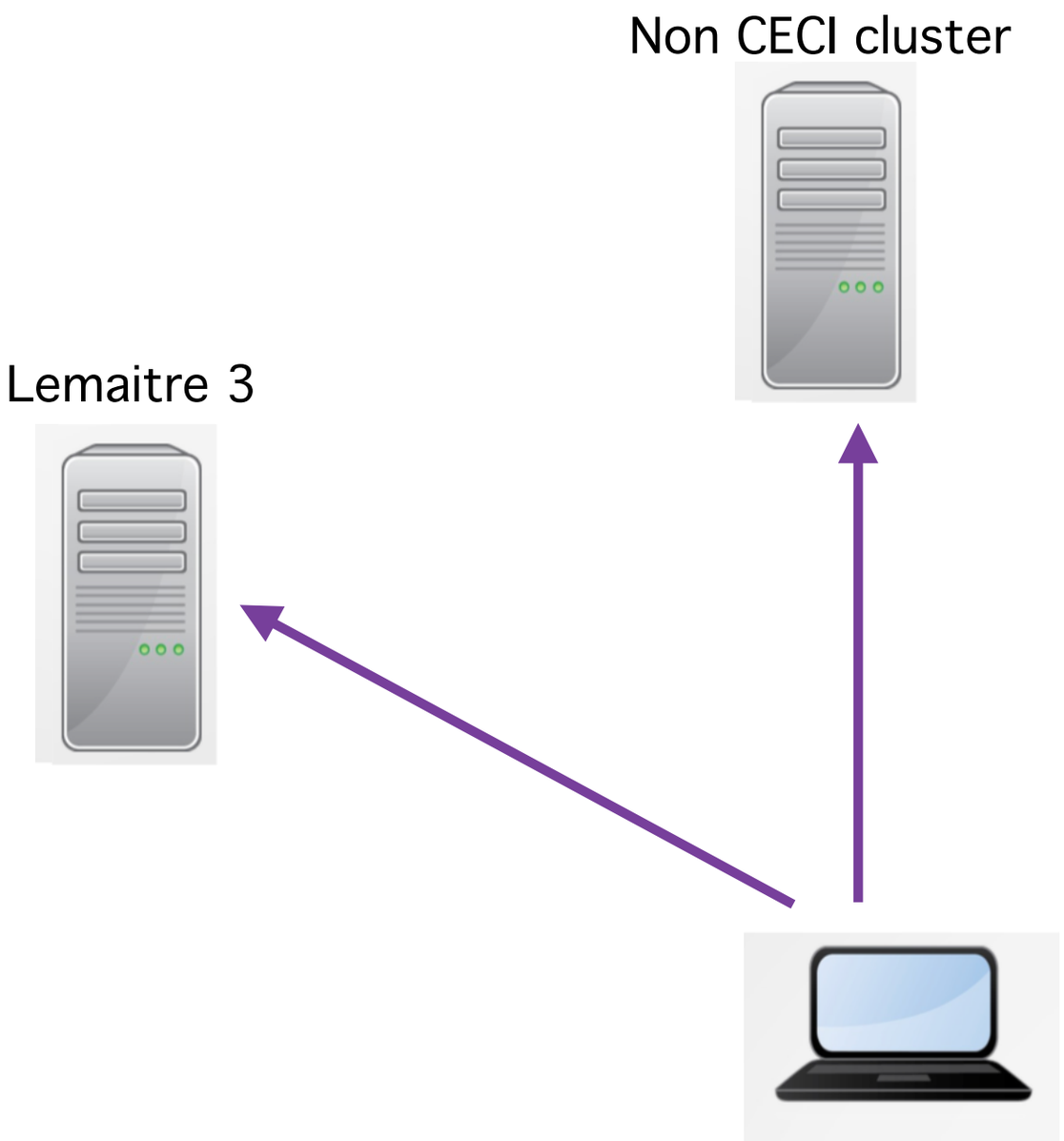
Avoid to propagate your private keys

- Less keys means more security



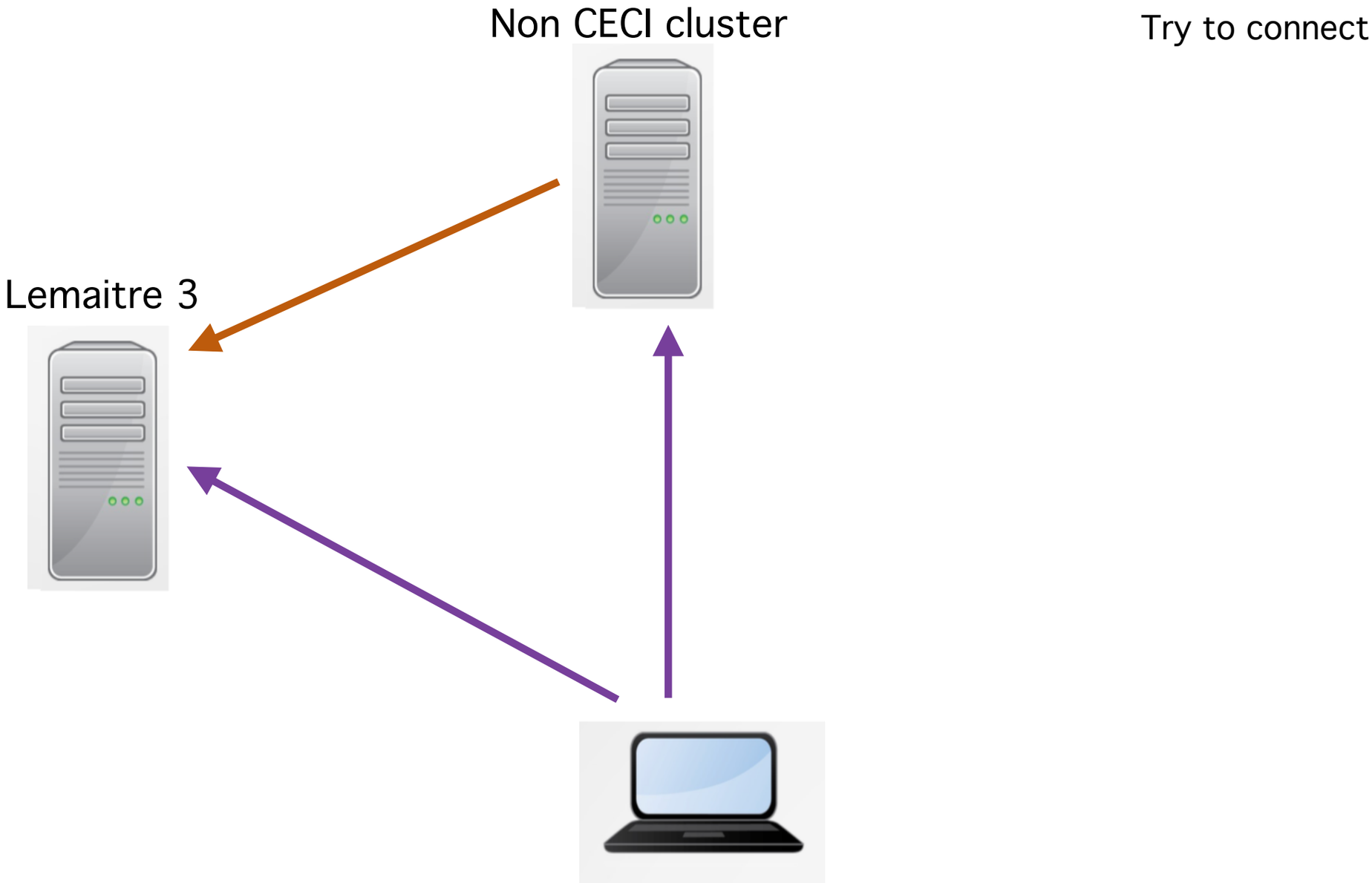
Avoid to propagate your private keys

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



Avoid to propagate your private keys

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



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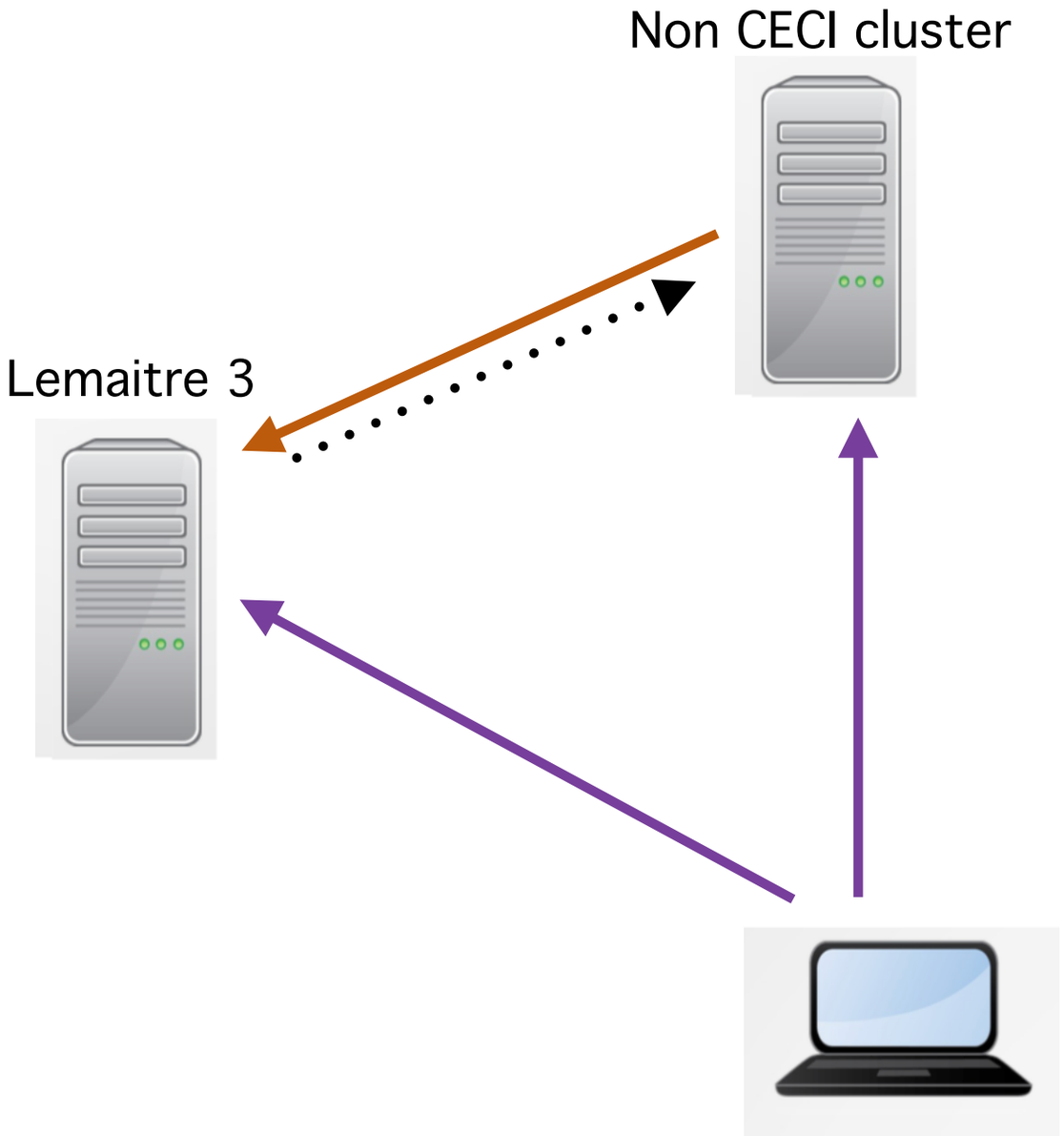

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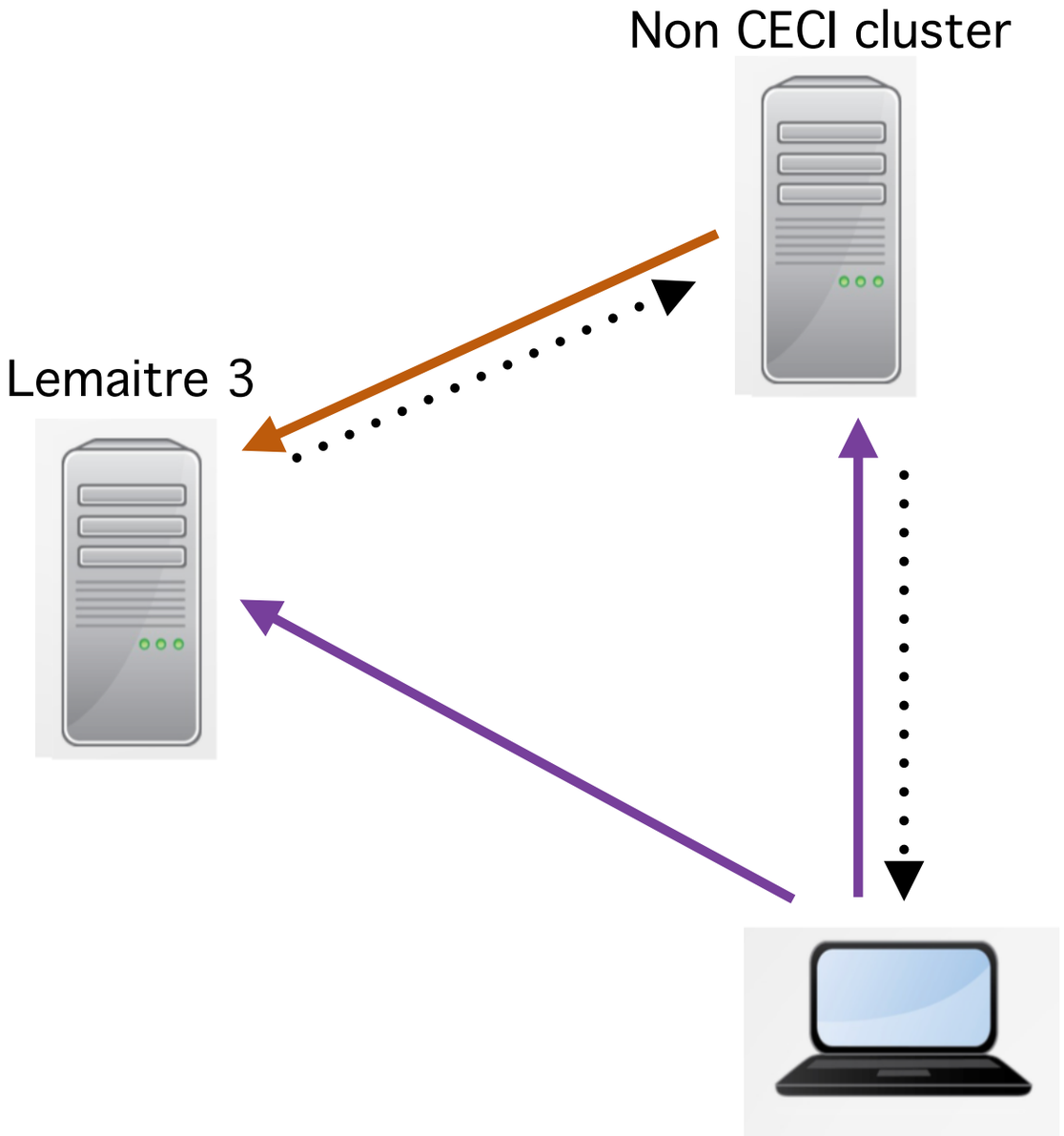

Try to connect

Host ask for a key

Message forward to laptop

Avoid to propagate your private keys

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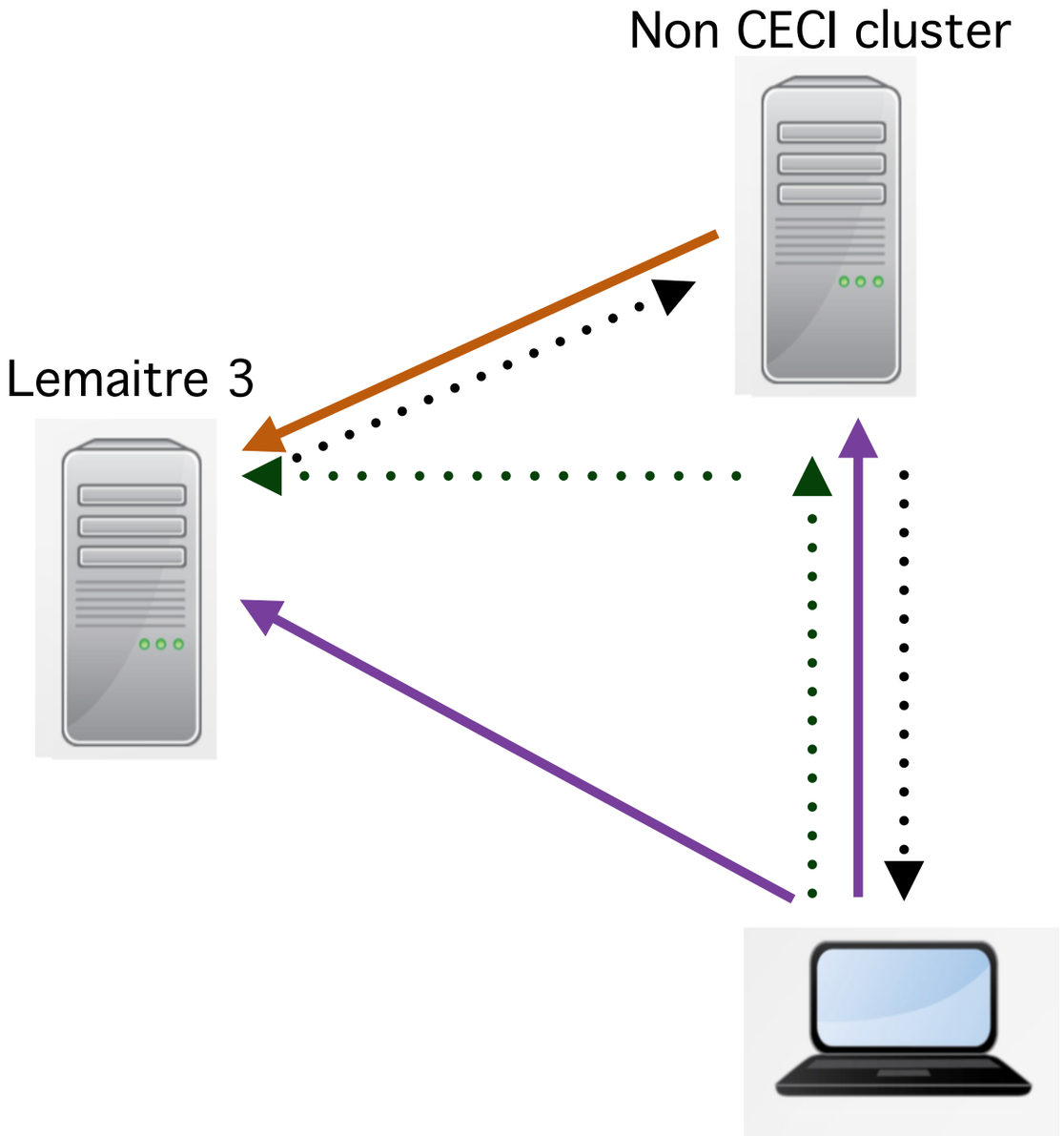
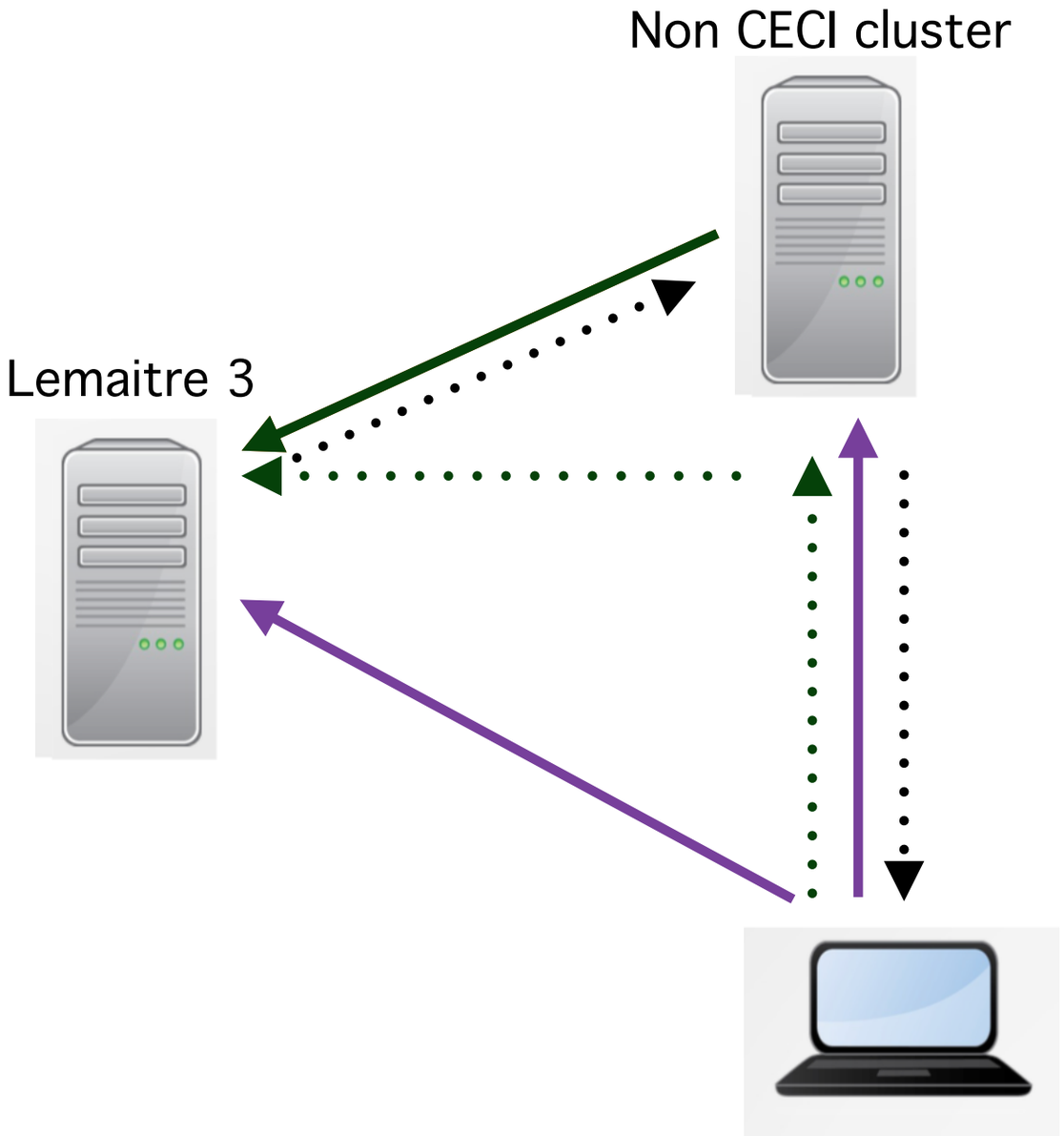


Avoid to propagate your private keys

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



Try to connect

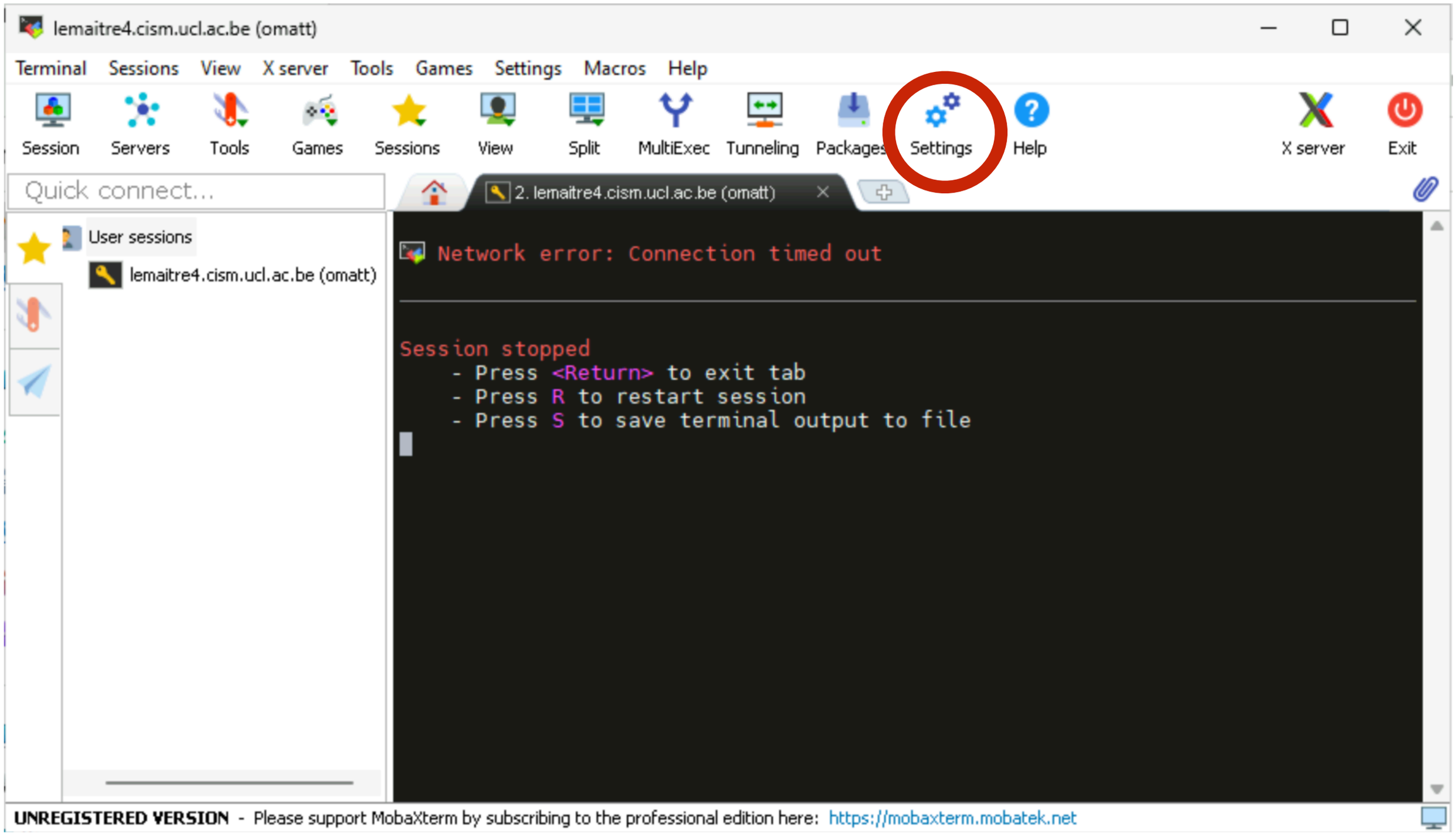
Host ask for a key

Message forward to laptop

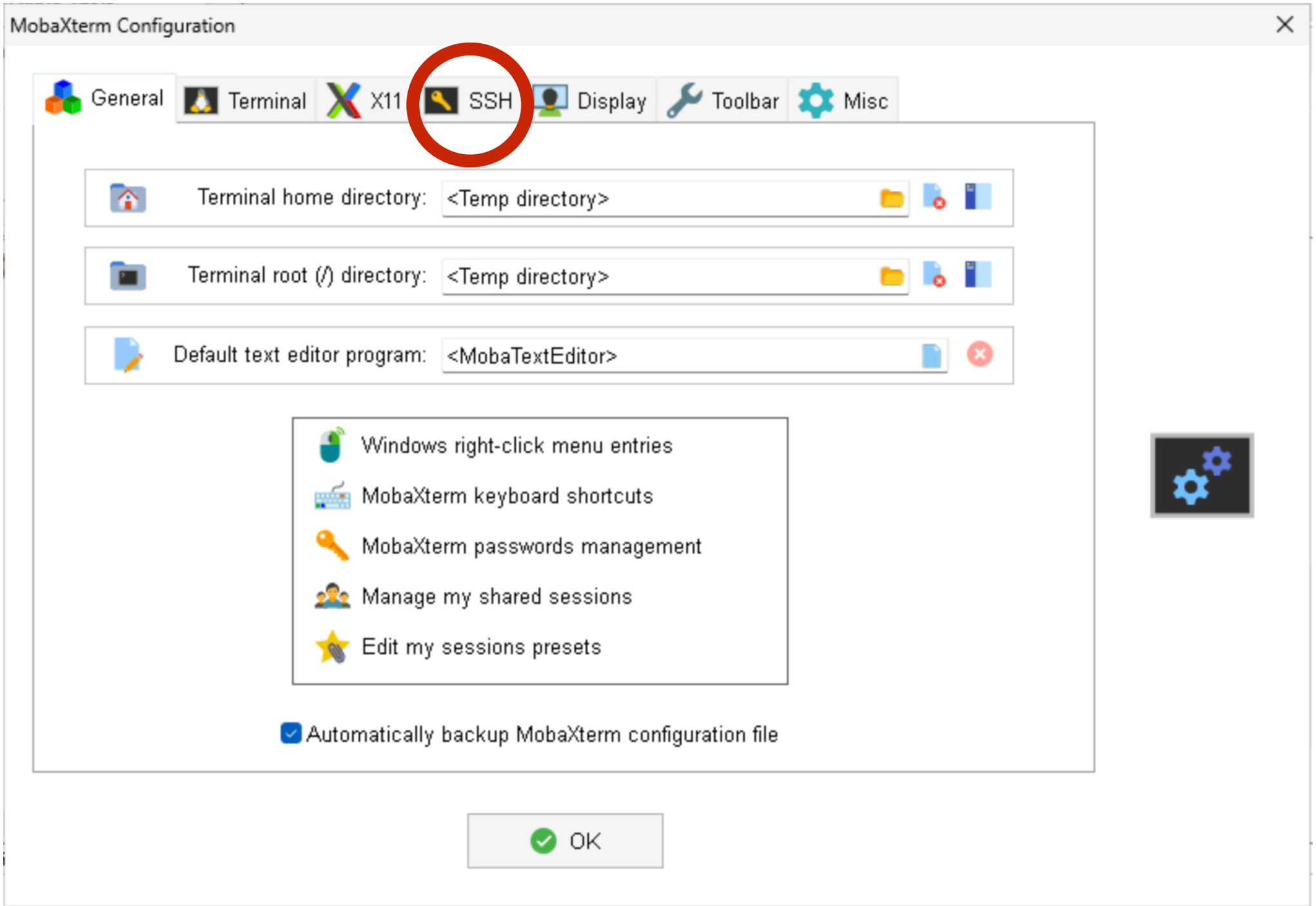
Key provided

Connection granted

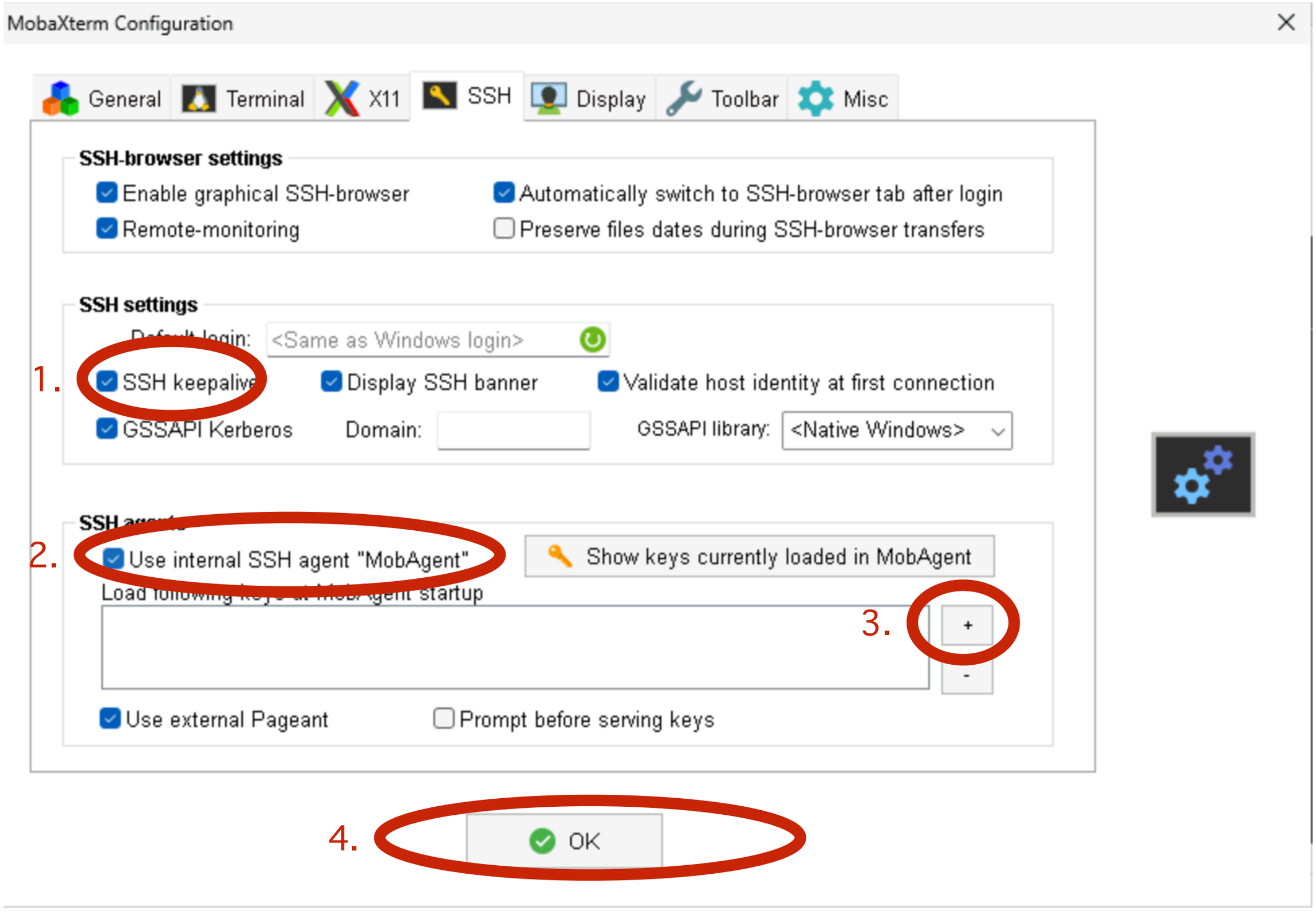
Additional Configuration



Additional Configuration



Additional Configuration



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

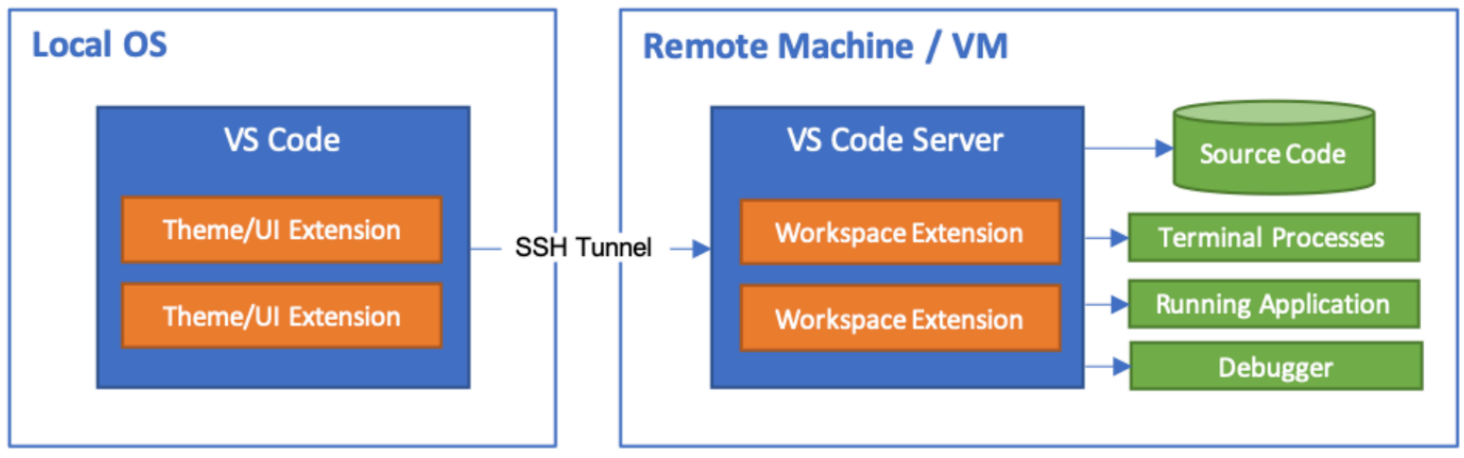
Text Editor

Text Editor Option

- Text editor on the cluster
  - ➡ Non graphical: Emacs, vi
    - ✦ Tutorial on vi, next week
    - ✦ Graphical one: gedit , ...
    - ✦ Nano (tommorow)
- Graphical interface running on your laptop
  - ➡ Visual Studio Code
  - ➡ Mount the file-system

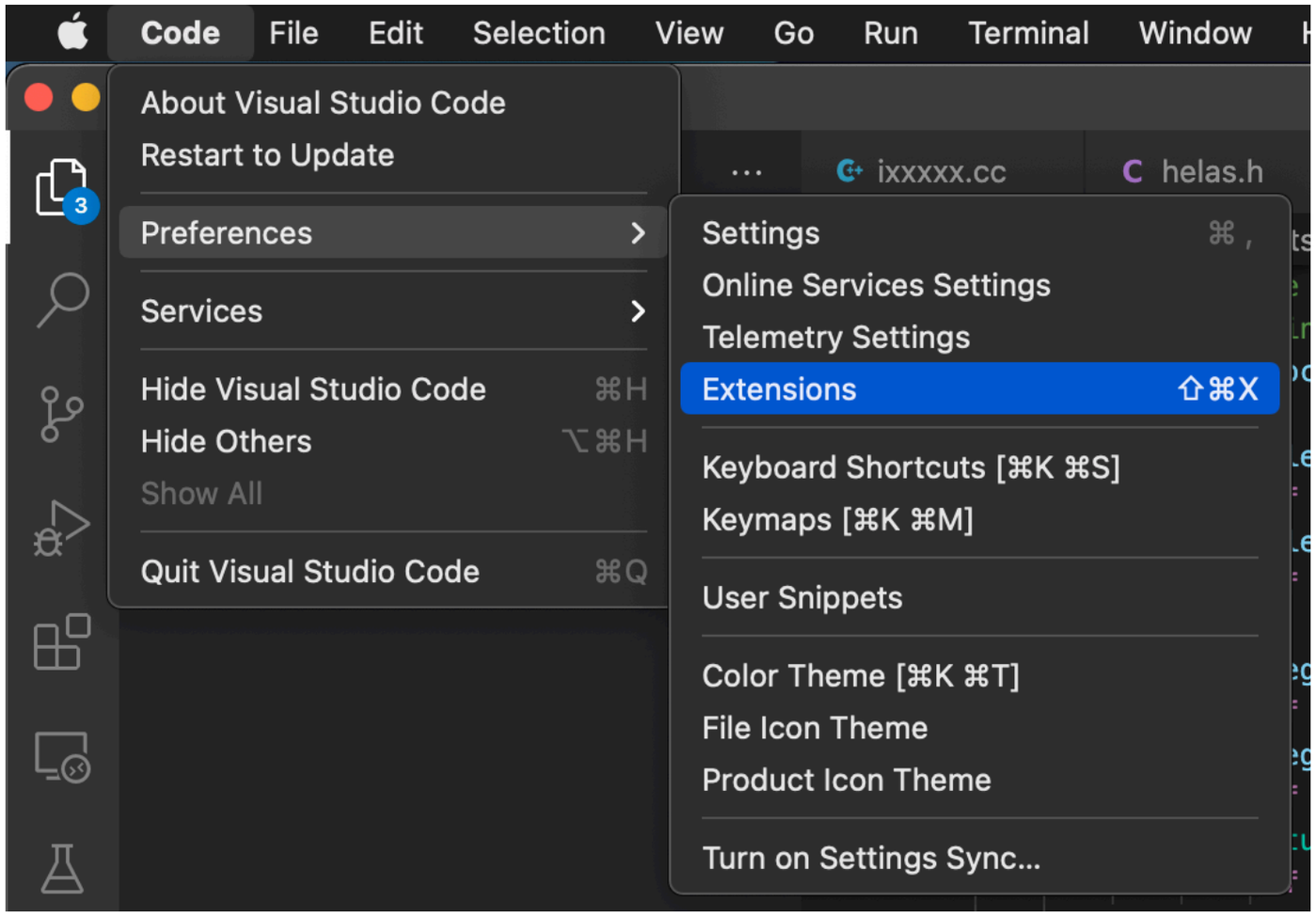
Visual Studio Code

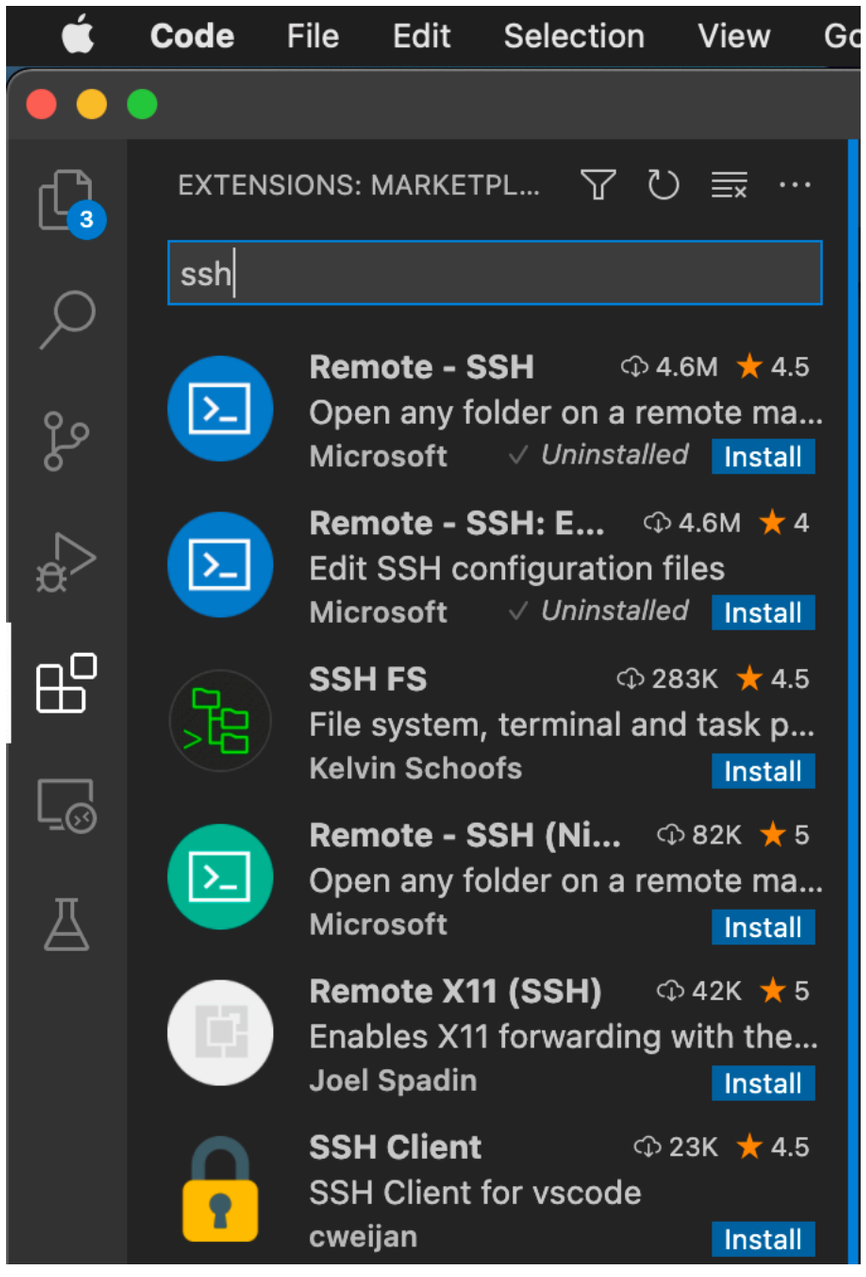
- Install VSC
  - ➡ https://code.visualstudio.com/download
- add ssh extension:
  - ➡ https://code.visualstudio.com/docs/remote/ssh
- See step by step pdf on indico page



Install the ssh extension

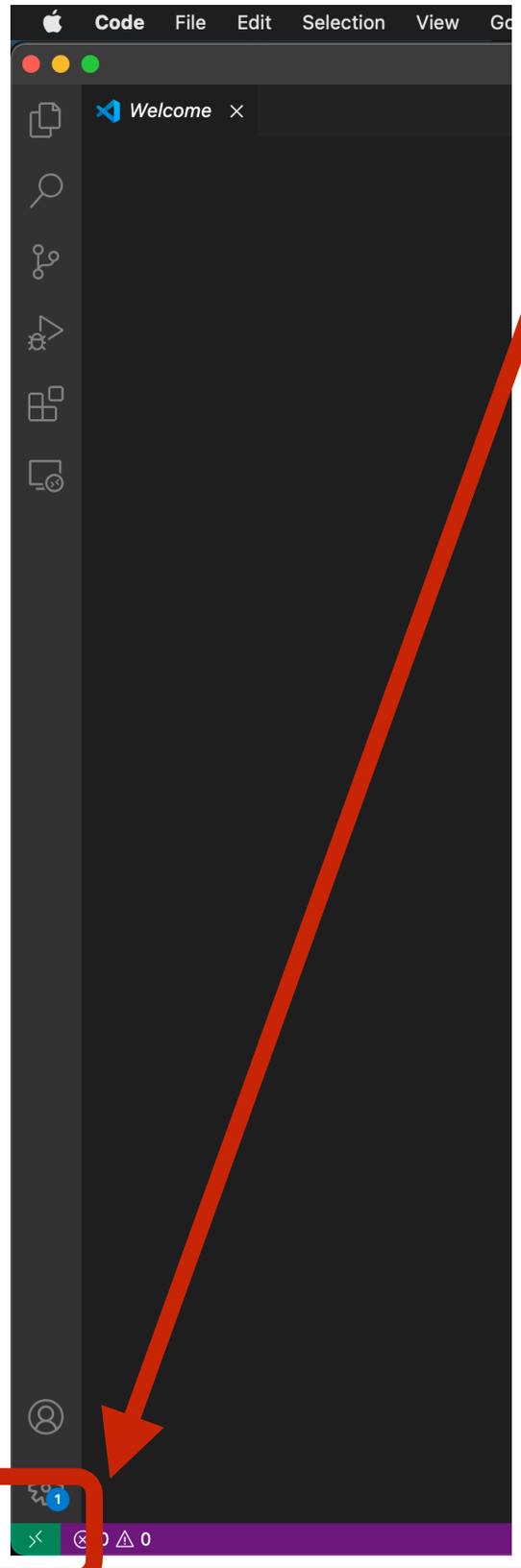
- Install Visual Studio Code
  - ➡ https://code.visualstudio.com/download
- Go to the preference menu/ extensions



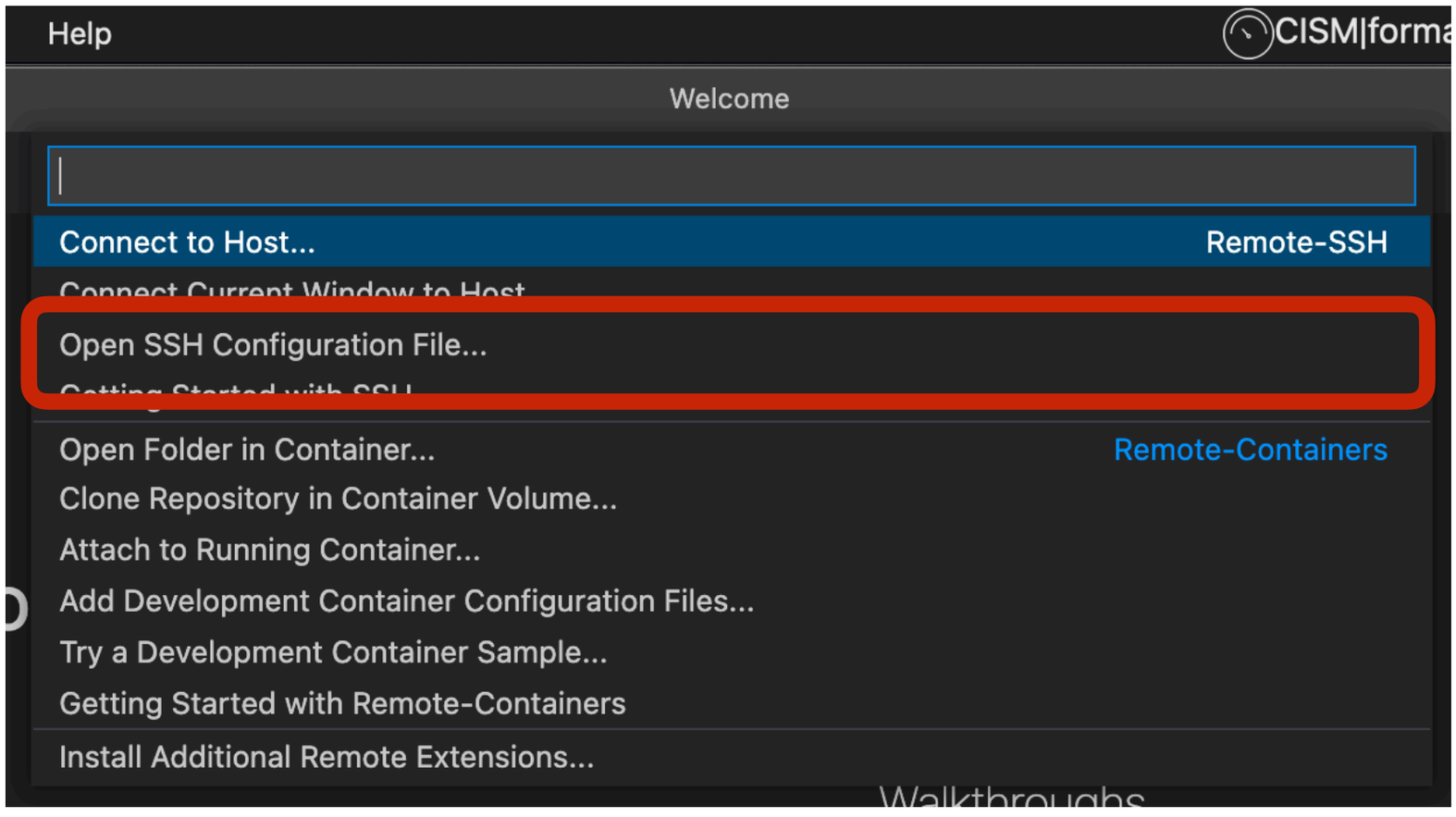


- Search for “ssh”
- Click on “install” of the Remote - SSH

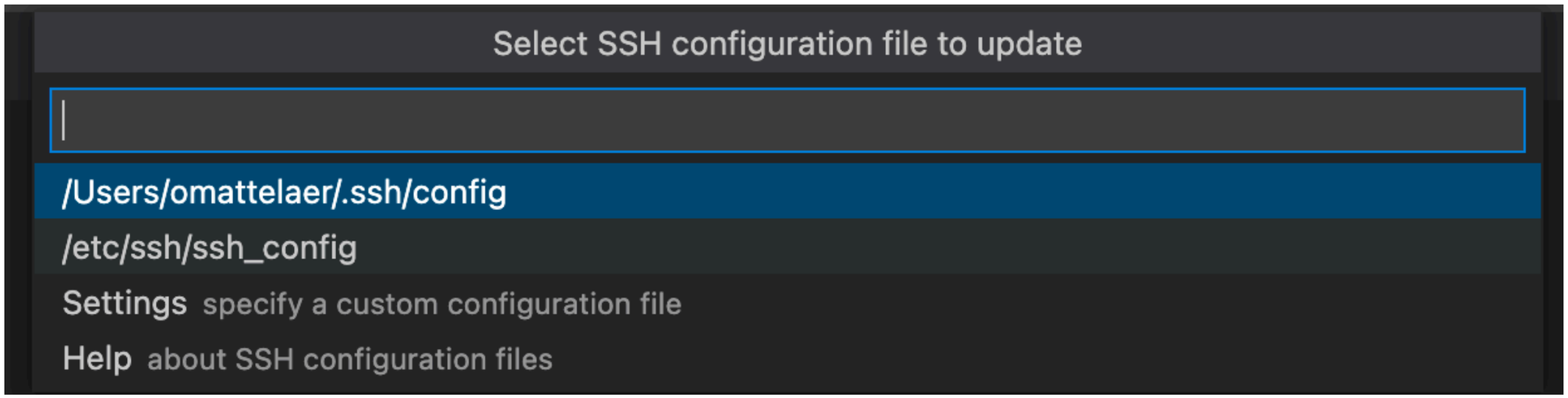
Setup connection



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

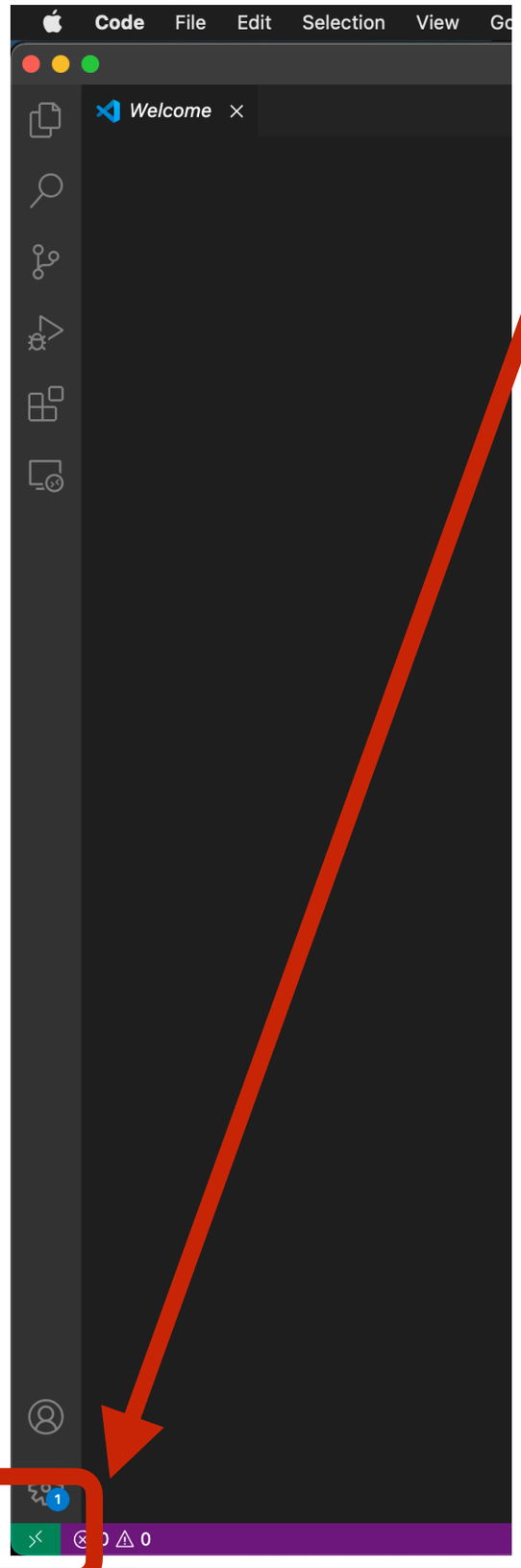


Setup connection

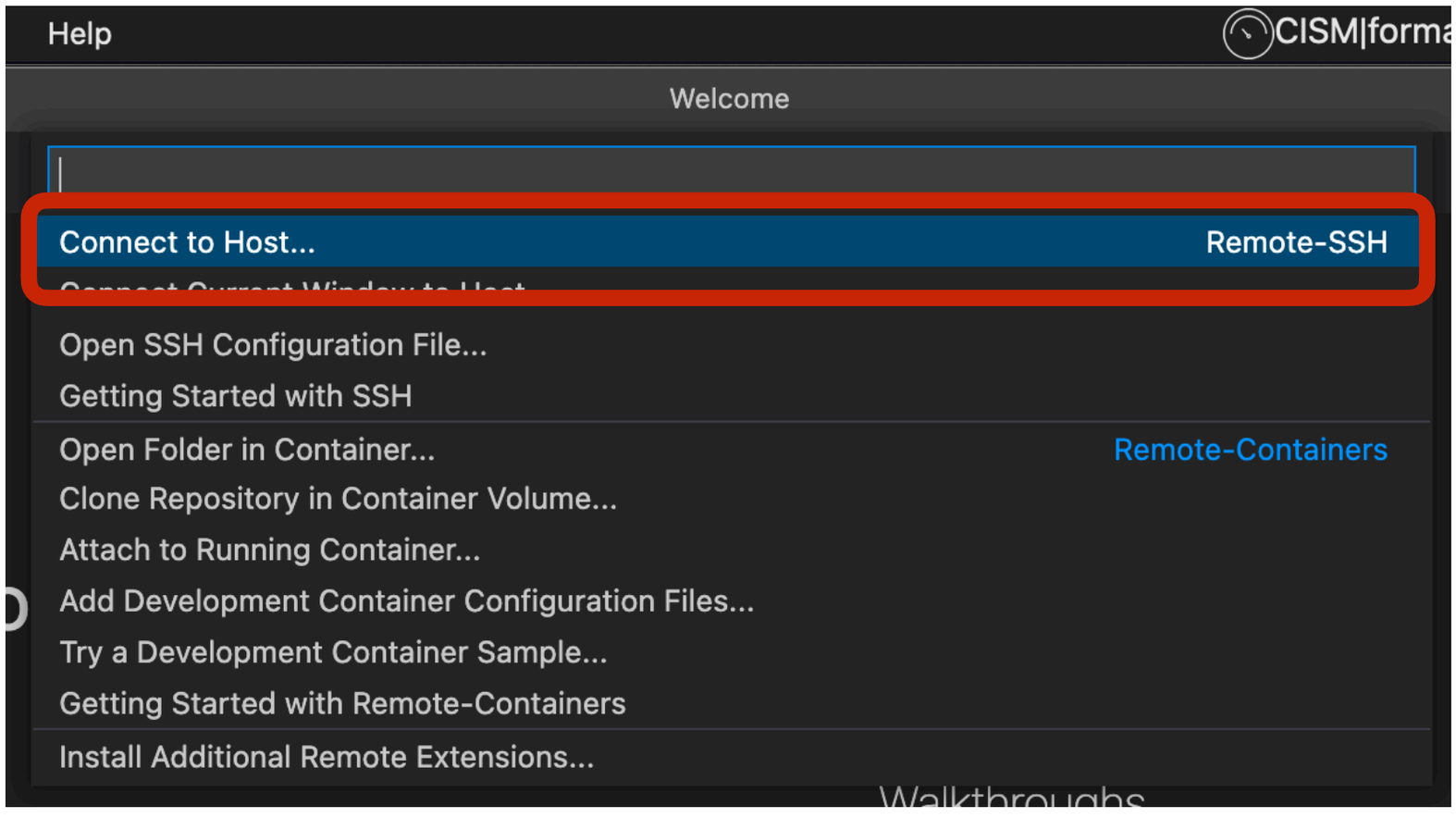


- First one is likely the best here (it is for me)
- Copy/paste in that file the content of
  - ➡ http://www.ceci-hpc.be/sshconfig.html
  - ➡ Edit the path to your private key
- Save the file and exit

connection to cluster

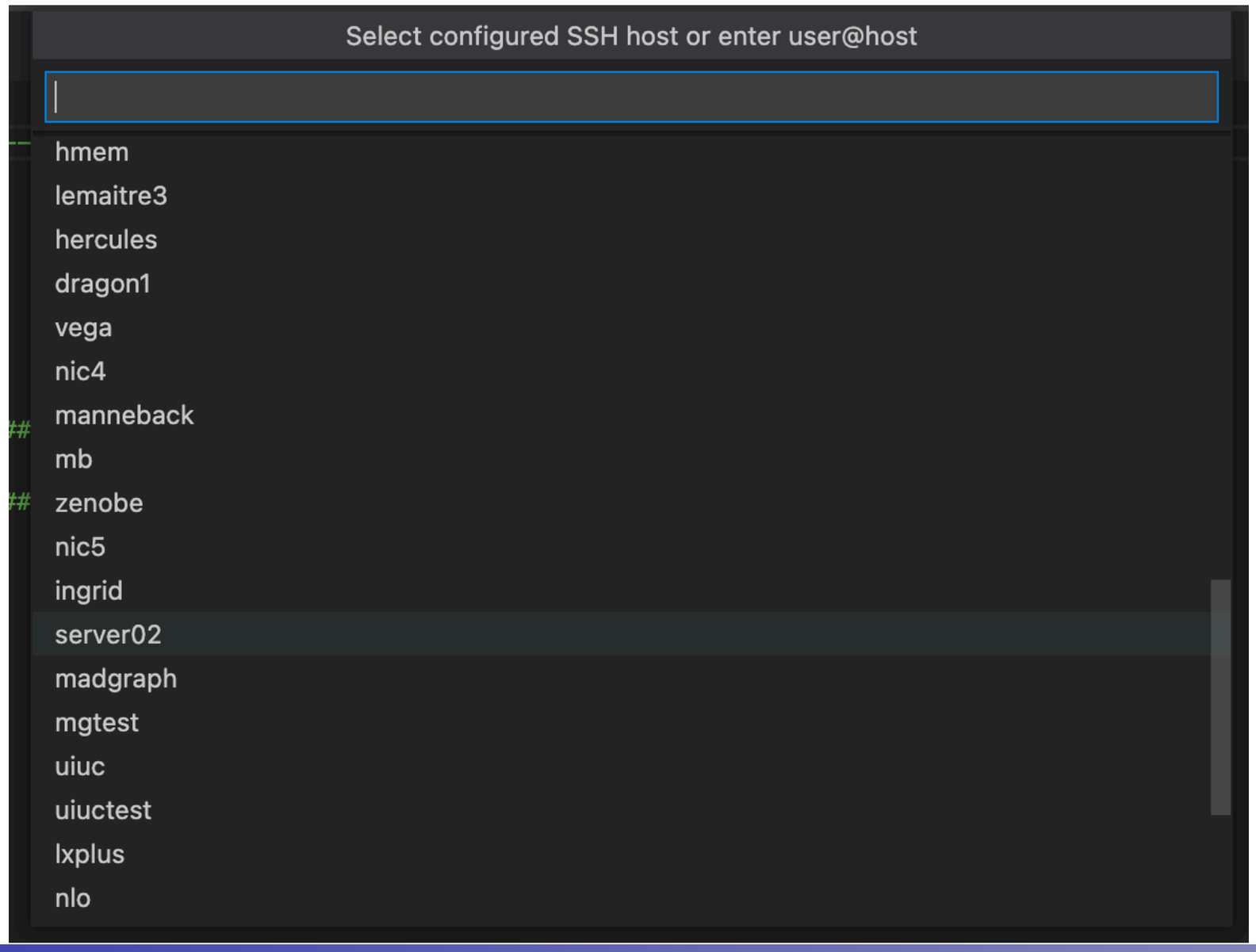


- Click on the green square
  - ➡ Bottom left
- Menu open (see below)
  - ➡ Select “connect to Host”

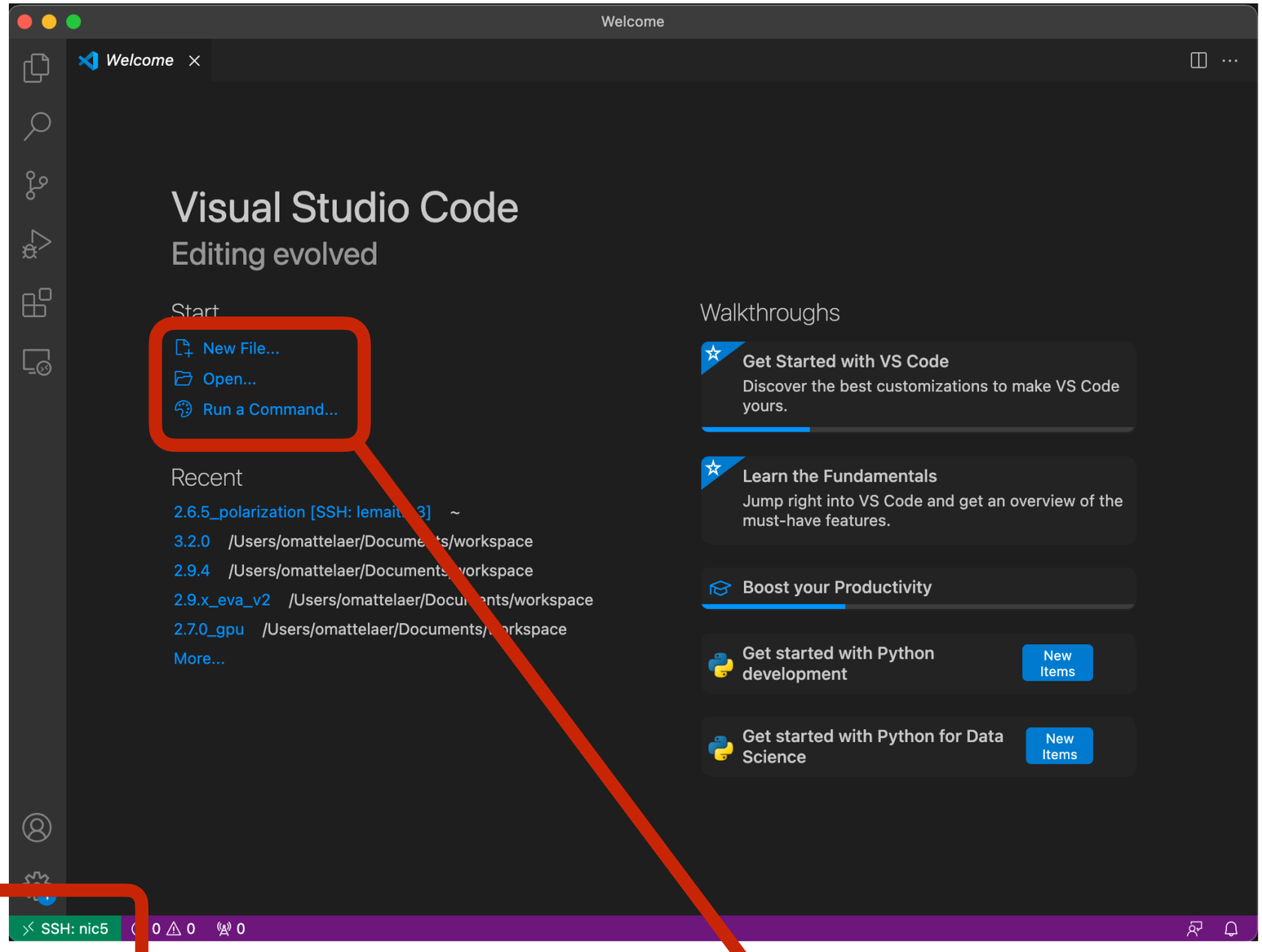


Ssh connection

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



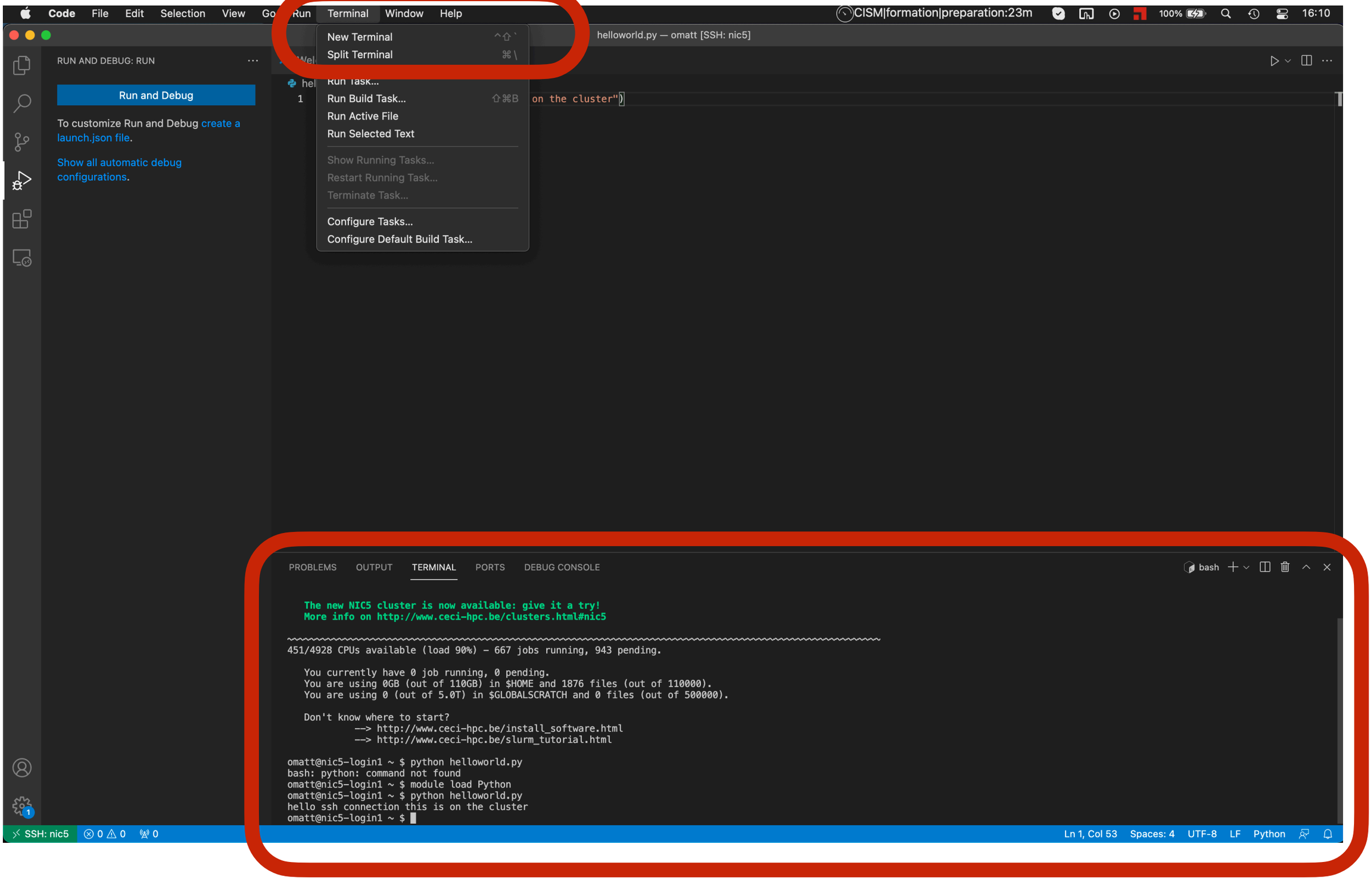
Start editing file



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

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 (-> Next Week)
- Security is important
  - ➡ Do not share your private key
  - ➡ Invalidate your key if your laptop is stolen/…