Going graphical: how to run GUI applications on Metacentrum

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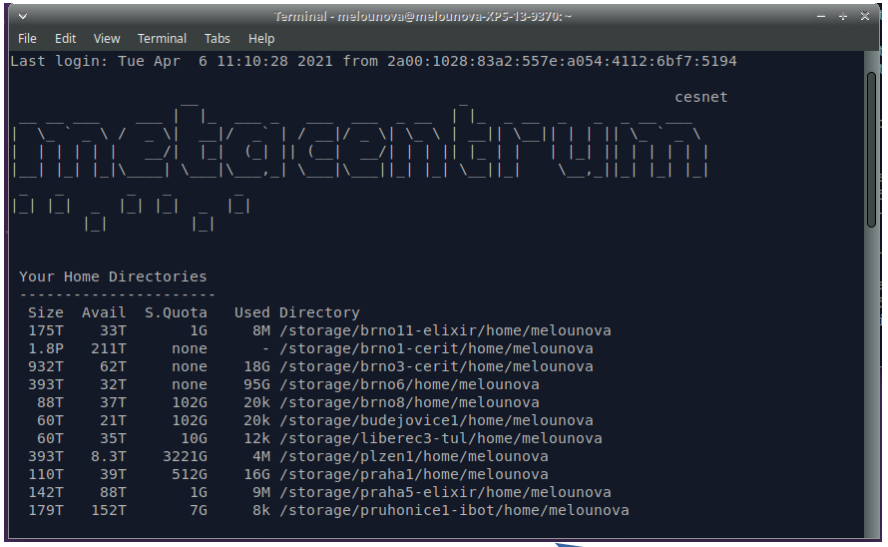
CLI vs GUI

Difference is rather obvious...



only ssh protocol

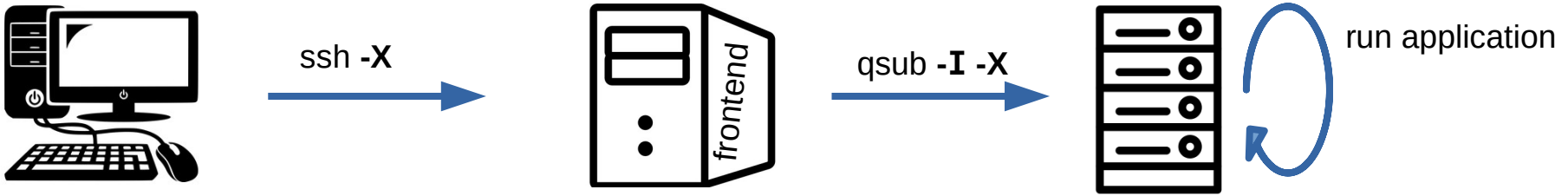
- X-Windows
- Remote desktop
- Open OnDemand
- (redirect **DISPLAY**)

- any approach may be useful, depending on situation and purpose
- we'll go through all of them
- start from the simplest and move up the level of sophistication

X-Windows

X-Window system, X11, X-protocol... windowing system for UNIX

How it works:




```
ssh -X melounova@skirit.ics.muni.cz
        qsub -X -I -l select=1:ncpus=2:mem=4gb -l walltime=1:00:00 -l matlab=1
                module add matlab; matlab
```

Pros:

- always available, uses system tools
- you need only what you already have to have in order to access Metacentrum
- fairly useful over LAN when you need only one application

Cons:

- higher latency, will use all bandwidth
- no possibility to reconnect
- can run only a single application

X-Windows (Windows users)

OS Windows users don't have X-server installed by default

step 1: Install X-server for Windows and run it

- Xming, Cygwin/X, X-Win32, Exceed
- ...
- (search for "X-server for Windows")

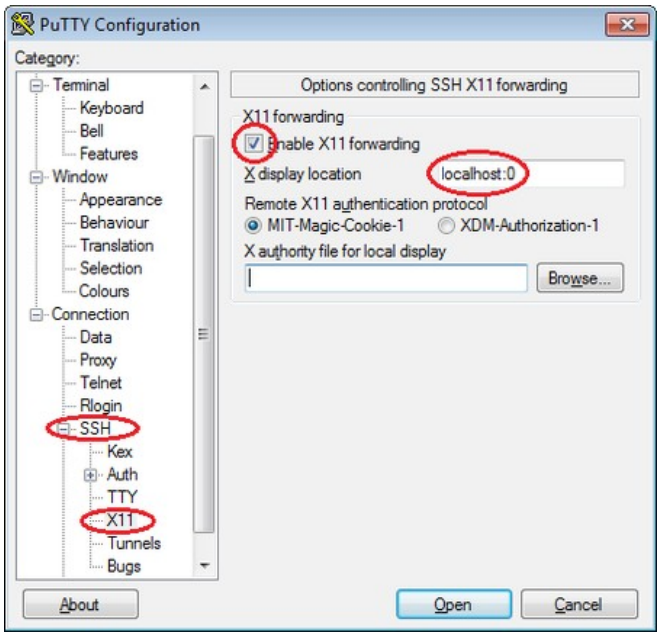
OpenText Exceed

Use X-Window (X11) applications on Microsoft

X-Win32

Cygwin/X

X Windows - on Windows!



step 2: set up Putty connection with -X option

- SSH authentication **`X11`**
- Enable **`X11 forwarding`**
- X display set to **`localhost:0`**

X-Windows

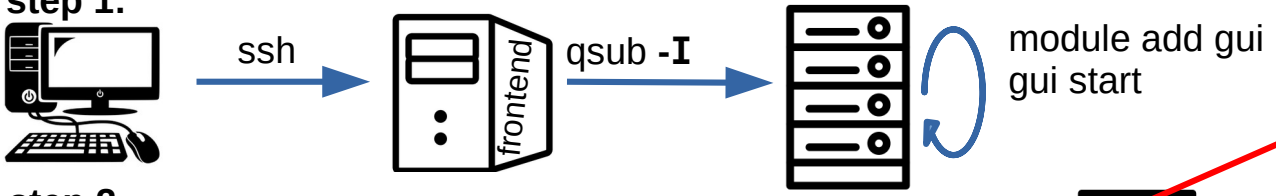
X-Windows_matlab.mp4

Remote desktop

VNC client = a piece of software running on your PC, e.g. xtightvncviewer

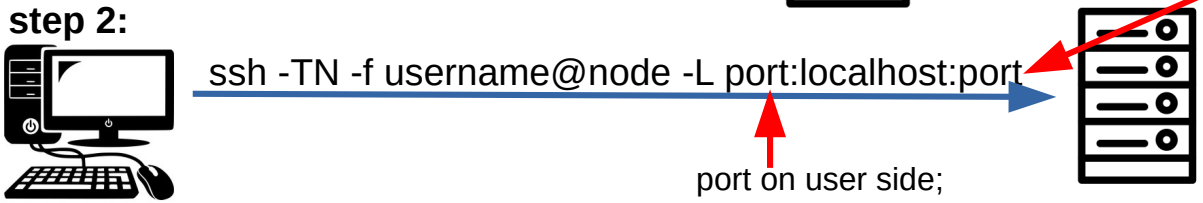
How it works:

step 1:




```
(BUSTER)melounova@elmo3-1:~$ gui start
****************************************
 Your VNC session has been started.
 The connection details are as follows:
   Remote Host : localhost
   Port        : 11834
   Use SSH tun : yes
   SSH Server  : elmo3-1.hw.elixir-czech.cz
   SSH User    : melounova
   VNC Password: asLuw397
   Display     : :53
****************************************
```

step 2:



port on user side;
does not have to be the same number as port on node side,
but for convenience we recommend that it is

e.g. **`ssh -TN -f melounova@elmo3-1.hw.elixir-czech.cz -L 11843:localhost:11843`**

```
****************************************
(BUSTER)melounova@elmo3-1:~$ gui info -p
****************************************
 Your running VNC sessions are:
   display tunnel machine:port (password)
   :53     SSH    elmo3-1.hw.elixir-czech.cz:11834  (asLuw397)
****************************************
```

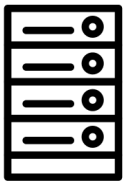
```
(BUSTER)melounova@skirit:~$ gui info -p
There're no VNC session(s) to show! Exiting...
(BUSTER)melounova@skirit:~$
```

Known issue: sometimes the VNC session
fails for the first time (`gui info -p` gives no output).
In that case, type `gui start` again.

Remote desktop

step 3:

ssh -TN -f username@node -L port:localhost:port
xtightvncviewer localhost:port



`xtightvncviewer localhost:11843`

tiny tiny terminal icon here...

click on the terminal icon
`module add matlab`
`matlab`

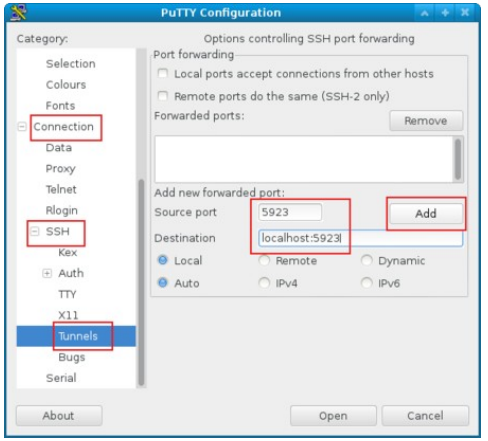
Pros:
- faster than X-windows (less latency), uses less bandwidth
- the session can be re-connected
- can run more applications at the same time

Cons:
- user must install VNC client
- consists of more steps on user side

Remote desktop (Windows users)

Windows users need both VNC client and change the setup in Putty connection

step 1: set up normal Putty connection
- run normal interactive job
- **`module add gui; gui start`**
- get **`PORT`**, password and **`node name`**



step 2: set up another Putty connection
- set SSH server address to **`node name`**
- SSH authentication **`Tunnels`**
- Enable **`port forwarding`**
- set source port to **`PORT`**, destination to **`localhost:PORT`**

step 3: run VNC client for Windows:
for example, TightVNC Java Viewer (multiplatform)
connect to **`localhost`** and port number **`PORT`**

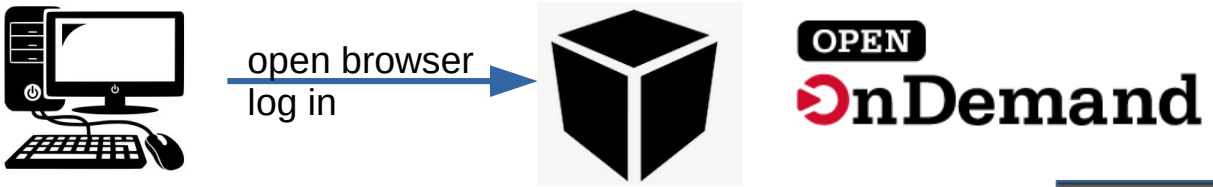
Remote desktop

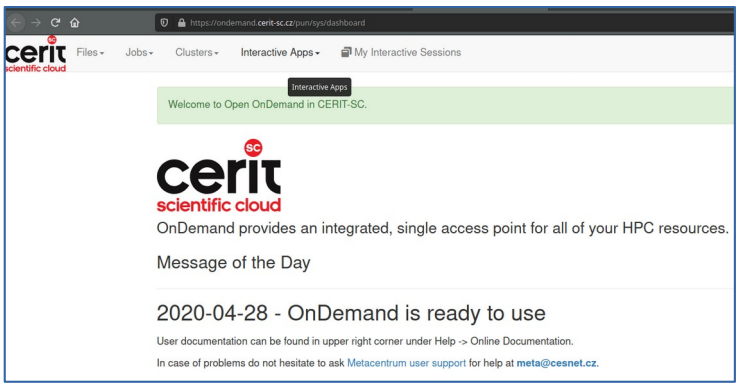
VNC_matlab.mp4

Open OnDemand

Open OnDemand - web-based client portal developed by a Ohio Supercomputer Center et al.

How it works:





- login at https://ondemand.cerit-sc.cz
- selected applications - direct link (ANSYS, Matlab, VMD, Jupyter notebook, R-Studio server)
- others – via terminal on Interactive desktop

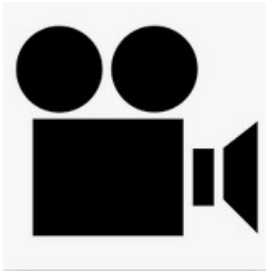
Pros:

- user-friendly face
- Windows and Linux users are equivalent
- you need your internet browser only (and Metacentrum credenials)
- offers link to share readonly output (for debugging and help)

Cons:

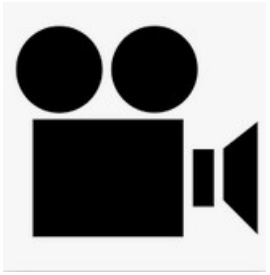
- currently limited span (only Cerit machines, zuphux frontend, only some queues)
- more layers = less transparency

Open OnDemand



OnDemand_direct_matlab.mp4

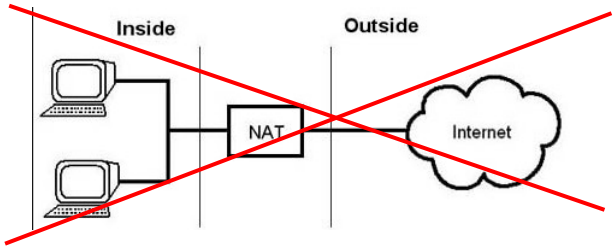
Open OnDemand



OnDemand_IntD_matlab.mp4

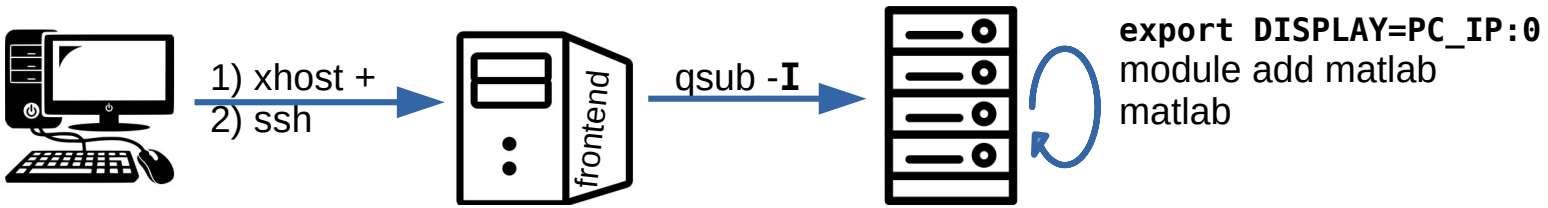
DISPLAY redirect (limited usage)

NAT = Network Address Translation



If you sit behind any wifi,
you are most probably NATted

How it works:




```
export DISPLAY=PC_IP:0
module add matlab
matlab
```

Who is it for?

- advanced user who know their network and need maximal speed

How do I find out if I am behind a NAT?

- find your public IP and private IP (IP of your network interface controller); if they differ, you are behind NAT
- public IP: at webpages devised for this purpose, e.g. www.whatismyip.com
- private IP: `hostname -I | awk '{print $1}'`
- if your local IP address looks like 192.168.x.y, the 10.x.y.z , or is 172.16.0.0-172.31.255.255, you are behind NAT

Concluding notes

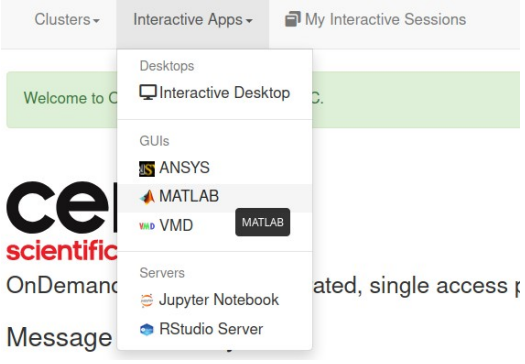
X-Windows
- fast to setup and run
- one application only
- session cannot be reconnected
- uses all bandwidth, can be slow

```
(BUSTER)melounova@skirit:~$ qsub -X -I -l select=1:ncpus=2:mem=4gb -l walltime=1:00:00 -l matlab=1
qsub: waiting for job 7309729.meta-pbs.metacentrum.cz to start
```

```
melounova@melounova-XPS-13-9370:~$ ssh -X melounova@skirit.ics.muni.cz
melounova@skirit.ics.muni.cz's password:
```

VNC client
- VNC client needed, more steps to setup
- session can be reconnected, exported etc.
- uses less bandwidth, faster

Open OnDemand
- needs browser only
- Linux and Windows users equivalent
- user-friendly and modern interface
- currently limited to Cerit PBS scheduler



Questions?