



Introduction to GACRC Teaching Cluster

PHYS4601/6601

Georgia Advanced Computing Resource Center (GACRC)

Enterprise Information Technology Services(EITS)

The University of Georgia

Outline

- GACRC
- Overview
- Working Environment
 - Two Nodes and Three Folders
 - Computational Partitions
 - Software
- Submit a Computational Batch Job
- GACRC Wiki and Support

GACRC

- A high-performance-computing (HPC) center at the UGA
- Provide to the UGA research and education community an advanced computing environment:
 - HPC computing and networking infrastructure located at the Boyd Data Center
 - Comprehensive collection of scientific, engineering and business applications
 - Consulting and training services

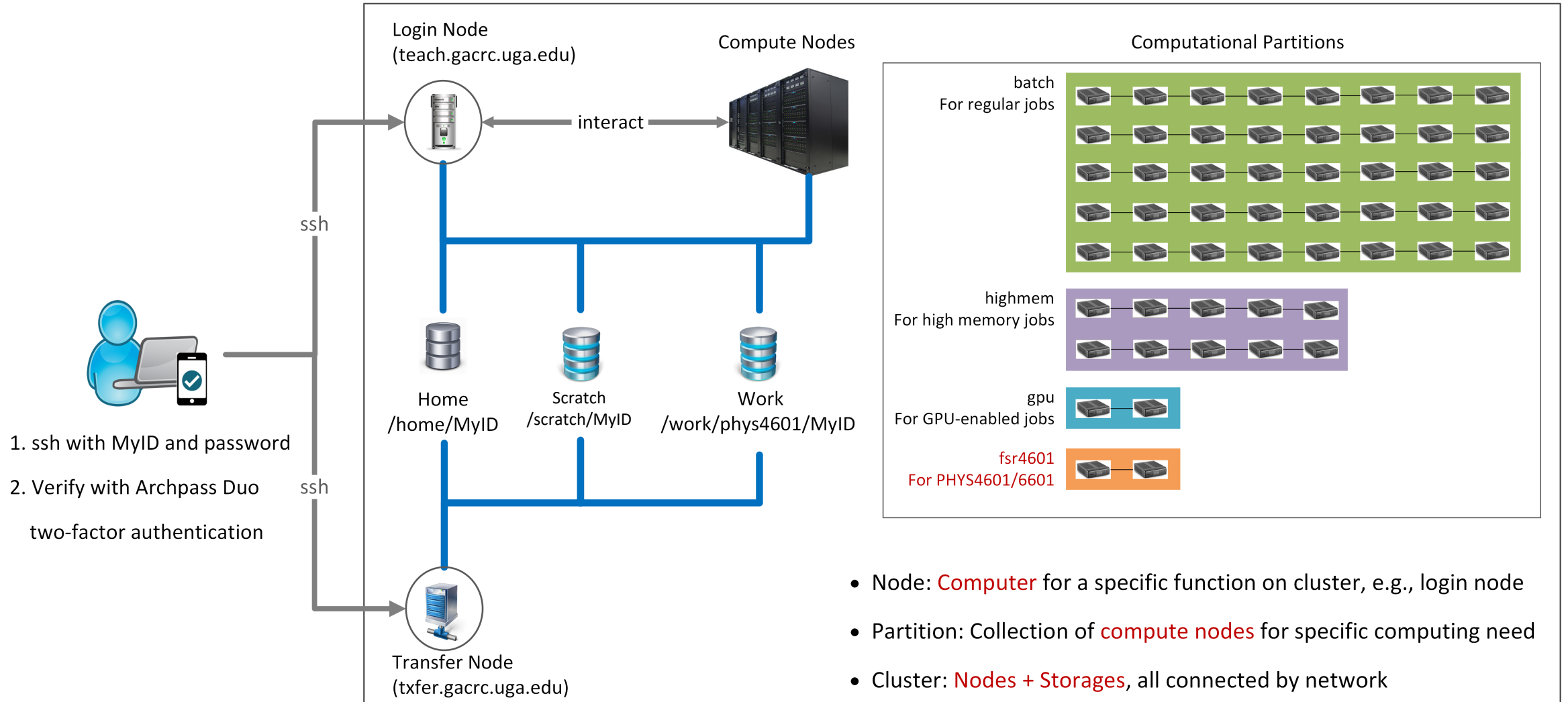
Wiki: <http://wiki.gacrc.uga.edu>

Support: https://wiki.gacrc.uga.edu/wiki/Getting_Help

Web Site: <http://gacrc.uga.edu>

Kaltura Channel: <https://kaltura.uga.edu/channel/GACRC/176125031>

Teaching Cluster



- Node: **Computer** for a specific function on cluster, e.g., login node
- Partition: Collection of **compute nodes** for specific computing need
- Cluster: **Nodes + Storages**, all connected by network

Note: You need to connect to the **UGA VPN** at first when accessing from outside of the UGA main campus.

Working Environment

https://wiki.gacrc.uga.edu/wiki/Systems#Teaching_cluster

- Two nodes, your "username" is your MyID for both of them:
 1. For batch job workflow, the host to log into is **teach.gacrc.uga.edu**
 2. For file transfers, the host to log into is **txfer.gacrc.uga.edu**

- Three folders:
 1. /home/MyID : working space for running computational jobs
 2. /work/phys4601/MyID : data storing space for individual user in a class
 3. /work/phys4601/instructor_data : data shared with class by the instructors

- Partitions for PHYS4601/6601 class: **fsr4601**

Working Environment (cont.)

➤ Software

1. Software names are long and have a Easybuild toolchain name associated to it
2. Complete module name: **Name/Version**-toolchain, e.g., **Python/3.10.4**-GCCcore-11.3.0
3. Software names are case-sensitive!
 - `module spider pattern` : Search modules using a name pattern (case-insensitive)
 - `module load/unload moduleName` : Load/remove a module
 - `module avail` : List all available modules on the cluster
 - `module list` : List modules currently loaded
 - `module purge` : Remove all modules from working environment

Submit a Computational Batch Job

1. Log on to Login node using MyID and password, and two-factor authentication with Archpass Duo:
`ssh MyID@teach.gacrc.uga.edu`
2. Change directory to your scratch space: `cd /scratch/MyID`
3. Create a working subdirectory for a job : `mkdir workDir`
4. Change directory to workDir : `cd workDir`
5. Transfer data from local computer to workDir : use `scp` or `WinSCP` to connect Transfer node
Transfer data on cluster to workDir : log on to Transfer node and then use `cp` or `mv`
6. Compile Fortran code *mult.f* into a binary code
7. Make a job submission script in workDir : `nano sub.sh`
8. Submit a job from workDir : `sbatch sub.sh`
9. Check job status : `squeue --me` or Cancel a job : `scancel JobID`

Step1: Log on to Login node

https://wiki.gacrc.uga.edu/wiki/Connecting#Connecting_to_the_teaching_cluster

1. Teaching cluster access requires verification using two-factor authentication with **Archpass Duo**. If you are not enrolled in Archpass Duo, please refer to https://eits.uga.edu/access_and_security/infosec/tools/archpass_duo/ on how to enroll
2. If you are connecting from **off-campus**, please first connect to the **UGA VPN** and then connect to teach.gacrc.uga.edu. Information on how to use the VPN is available at https://eits.uga.edu/access_and_security/infosec/tools/vpn/



Step1: Log on to Login node - Mac/Linux using ssh

1. Open **Terminal** utility
2. Type command line: `ssh MyID@teach.gacrc.uga.edu`
3. You will be prompted for your **UGA MyID password**
4. You will verify your login using **Archpass Duo** authentication

ssh zhuofei@teach.gacrc.uga.edu ← 1. use ssh to open connection

UGA DUO authentication is required for SSH/SCP access to GACRC systems. For additional help with UGA DUO authentication or to report an issue please visit: https://eits.uga.edu/access_and_security...

Password: ← 2. Enter your MyID password
When you enter password, no stars or dots will show as you are typing. Please type password carefully!

Duo two-factor login for zhuofei

Enter a passcode or select one of the following options:

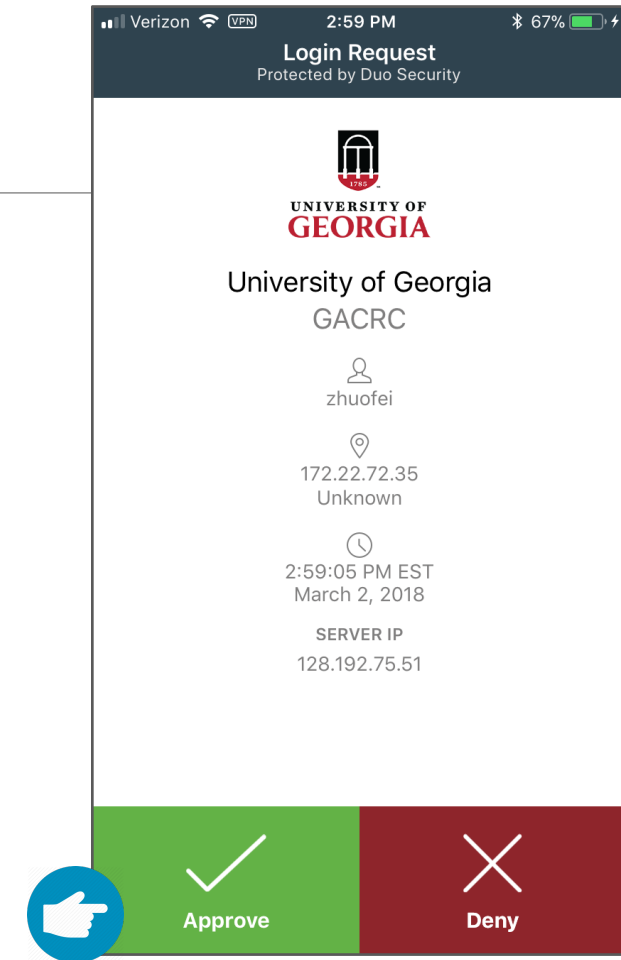
1. Duo Push to XXX-XXX-5758
2. Phone call to XXX-XXX-5758
3. Phone call to XXX-XXX-1925
- 4 5. SMS passcodes to XXX-XXX-5758 (next code starts with: 1)

Passcode or option (1-5): 1 ← 3. Select Duo option

Success. Logging you in...

Last login: Mon Aug 3 11:11:58 2020 from 172.18.114.119

zhuofei@teach-sub1 ~\$ ← 4. Logged on!



5. Verify login using Duo

Step1 (Cont.) - Windows using PuTTY

1. Download and install PuTTY: <https://www.putty.org/>

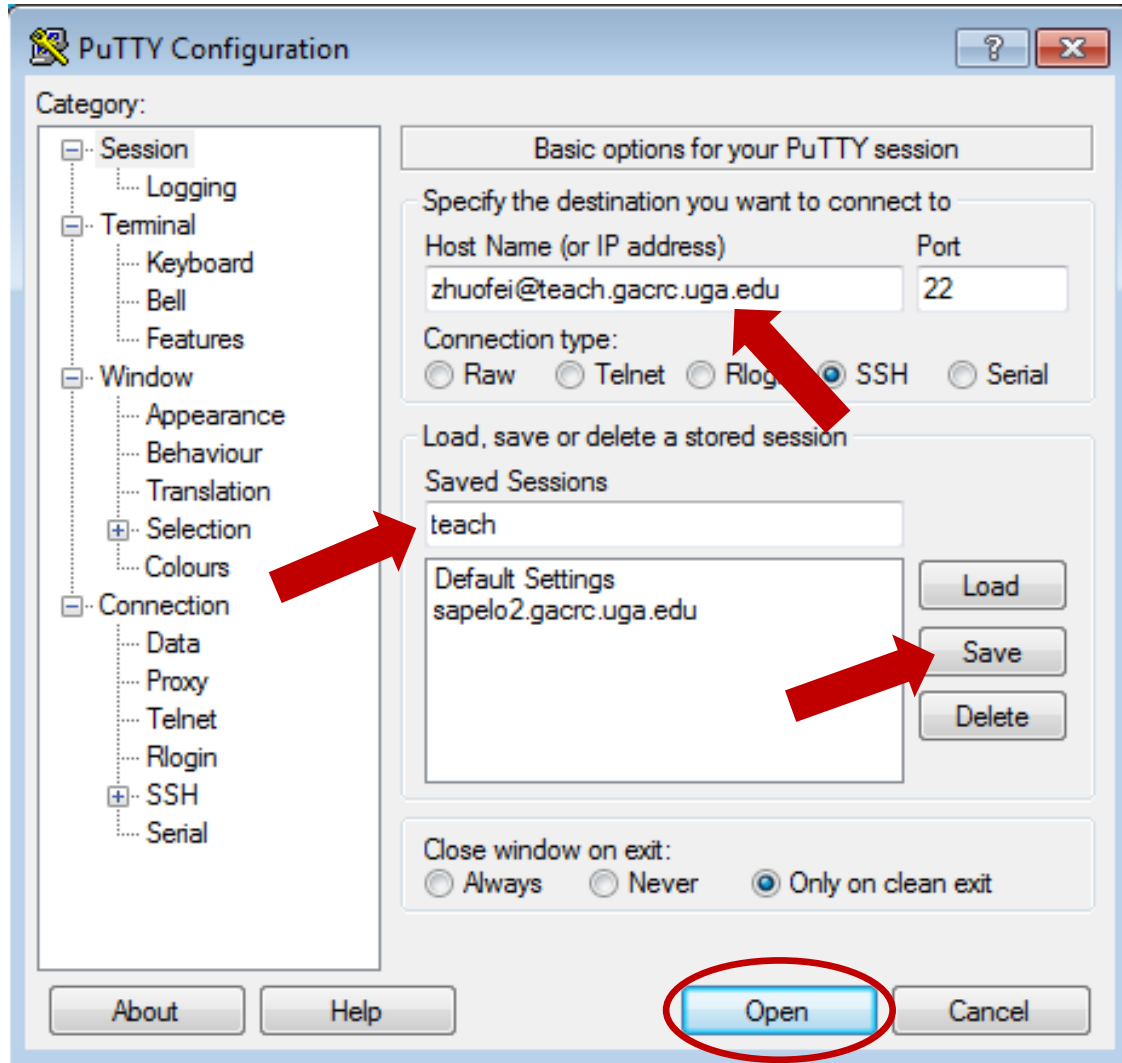
2. Detailed downloading and installation instructions:

https://wiki.gacrc.uga.edu/wiki/How_to_Install_and_Configure_PuTTY

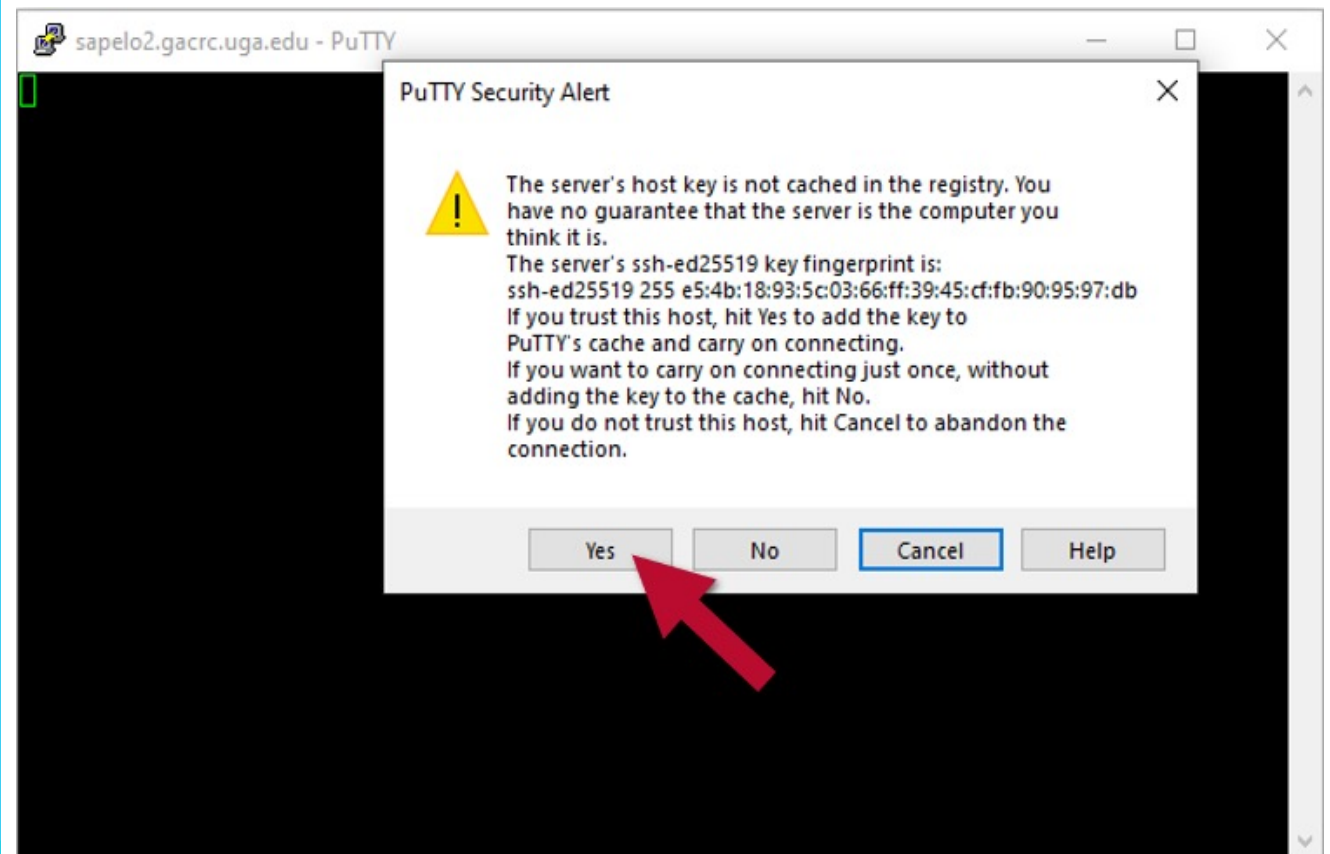
3. Detailed configuring and usage instructions:

https://wiki.gacrc.uga.edu/wiki/How_to_Install_and_Configure_PuTTY#Configuring_PuTTY

Step1 (Cont.) - Windows using PuTTY



The first time you connect to login node, PuTTY will give you this security alert window. Please click "Yes"



Step1 (Cont.) - Windows using PuTTY

Next you will enter your UGA MyID password and initiate DUO authentication procedure:

```
zhuofei@teach-sub1:~  
Using username "zhuofei".  
Keyboard-interactive authentication prompts from server:  
Password: ← UGA MyID password  
Duo two-factor login for zhuofei  
Enter a passcode or select one of the following options:  
1. Duo Push to XXX-XXX-5758  
2. Phone call to XXX-XXX-5758  
3. Phone call to XXX-XXX-1925  
4. Phone call to XXX-XXX-3535  
5. SMS passcodes to XXX-XXX-5758  
Passcode or option (1-5): 1 ← Select DUO option  
End of keyboard-interactive prompts from server  
Success. Logging you in..  
Last login: Thu Jan  7 10:20:01 2021 from 128.192.240.123  
zhuofei@teach-sub1 ~$ █ ← Logged on!
```

Step2 - 4: cd to /scratch dir, make and cd into workDir

```
zhuofei@teach-sub1 ~$ cd /scratch/zhuofei ← cd command to change directory
zhuofei@teach-sub1 zhuofei$ mkdir workDir ← mkdir command to create a subdirectory
zhuofei@teach-sub1 zhuofei$ cd workDir/ ← cd command to change directory
zhuofei@teach-sub1 workDir$ ls ← ls command to list contents of directory
zhuofei@teach-sub1 workDir$ ← it is empty in workDir!
```

Step5: Transfer data from local computer to workDir - Mac/Linux

https://wiki.gacrc.uga.edu/wiki/Transferring_Files#Using_scp_2

1. Connect to Transfer node (**txfer.gacrc.uga.edu**) in Terminal from your local computer
2. Use **scp** command: scp (-r) [Source] [Target]
3. Enter your MyID password, then select Duo option to verify connection

E.g. 1: use scp on local computer, from Local → workDir on cluster

```
scp ./file zhuofei@txfer.gacrc.uga.edu:/home/zhuofei/workDir
```

```
scp -r ./folder/ zhuofei@txfer.gacrc.uga.edu:/home/zhuofei/workDir
```

E.g. 2: use scp on local computer, from workDir on cluster → Local

```
scp zhuofei@txfer.gacrc.uga.edu:/home/zhuofei/workDir/file .
```

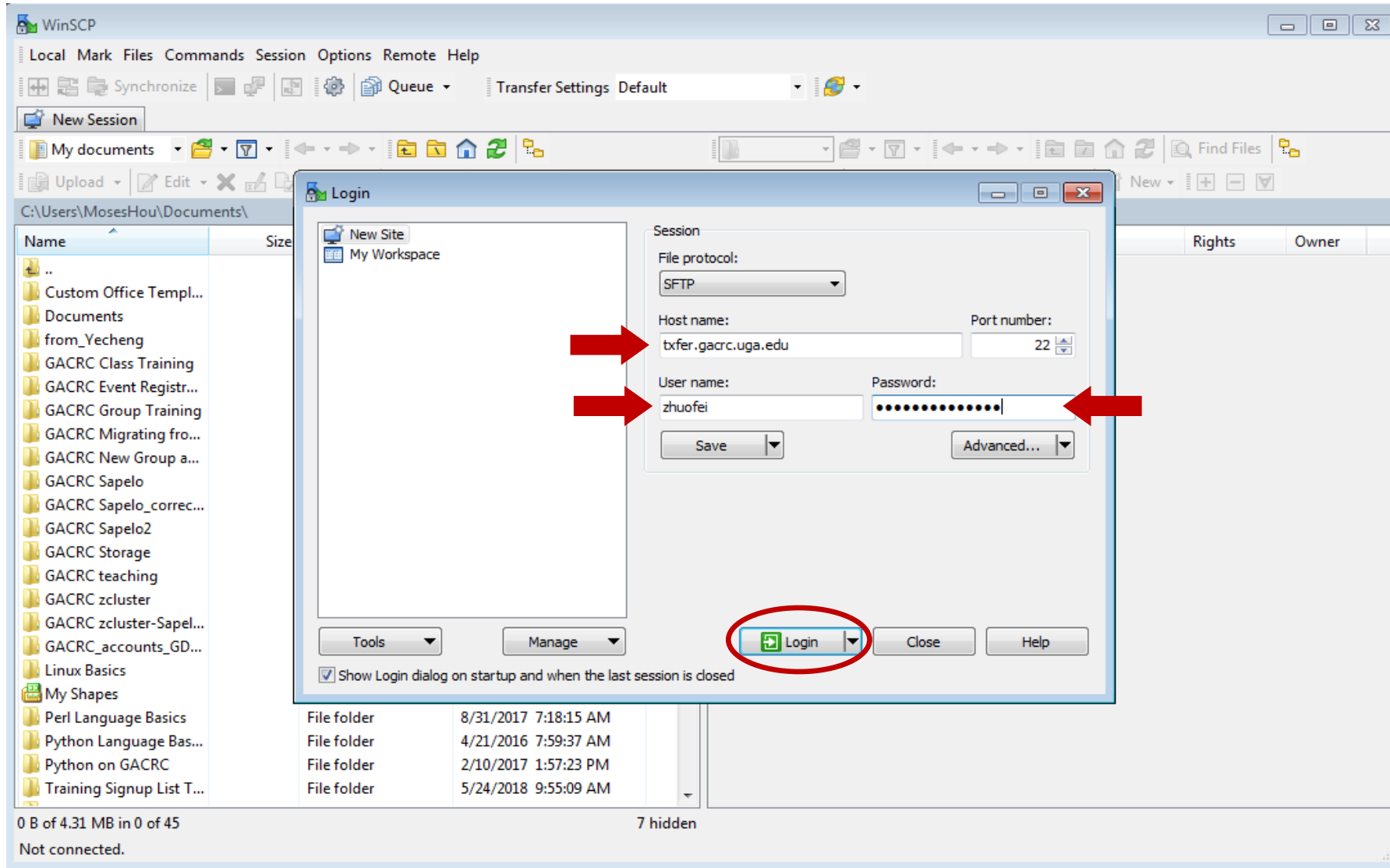
```
scp -r zhuofei@txfer.gacrc.uga.edu:/home/zhuofei/workDir/folder/ .
```

Step5 (Cont.) - Windows using WinSCP

https://wiki.gacrc.uga.edu/wiki/Transferring_Files#Using_WinSCP_2

1. You need to connect to cluster's Transfer node (txfer.gacrc.uga.edu)
2. Use **WinSCP** on local computer
 - WinSCP can be downloaded from <https://winscp.net/eng/index.php>
 - Default installation procedure is simple
3. Alternative FileZilla https://wiki.gacrc.uga.edu/wiki/Transferring_Files#Using_FileZilla_2

Step5 (Cont.) - Windows using WinSCP



Step5 (Cont.) - Windows using WinSCP

The screenshot shows the WinSCP application window titled "zhuofei@xfer.gacrc.uga.edu - WinSCP". The interface includes a menu bar (Local, Mark, Files, Commands, Session, Options, Remote, Help), a toolbar with icons for Synchronize, Queue, and Transfer Settings, and a file explorer view. The file explorer shows the local path "C:\Users\MosesHou\Documents\" with a list of folders including "Custom Office Templ...", "Documents", "from_Yecheng", "GACRC Class Training", "GACRC Event Registr...", "GACRC Group Training", "GACRC Migrating fro...", "GACRC New Group a...", "GACRC Sapelo", "GACRC Sapelo_correc...", "GACRC Sapelo2", "GACRC Storage", "GACRC teaching", "GACRC zcluster", "GACRC zcluster-Sapel...", "GACRC_accounts_GD...", "Linux Basics", "My Shapes", "Perl Language Basics", "Python Language Bas...", "Python on GACRC", and "Training Signup List T...".

A dialog box titled "Server prompt - zhuofei@xfer.gacrc.uga.edu" is overlaid on the file explorer. The dialog contains the following text:

UGA DUO authentication is required for SSH/SCP access to GACRC systems.

UGA DUO is a two-factor authentication service which requires a password (one factor) and a code, phone, or device (second factor) to successfully authenticate.

If you are not enrolled in the UGA DUO service please visit the UGA DUO service self-service portal to enroll and configure or manage your DUO enabled devices.

https://eits.uga.edu/access_and_security/infosec/tools/duo/portal/

For additional help with UGA DUO authentication or to report an issue please visit:

https://eits.uga.edu/access_and_security/infosec/tools/archpass/

Duo two-factor login for zhuofei

Enter a passcode or select one of the following options:

1. Duo Push to XXX-XXX-5758
2. Phone call to XXX-XXX-5758
3. Phone call to XXX-XXX-1925
4. Phone call to XXX-XXX-3535
5. SMS passcodes to XXX-XXX-5758

Passcode or option (1-5):

OK Cancel Help

A red arrow points to the text "Select DUO option" next to the input field.

Step5 (Cont.) - Windows using WinSCP

The screenshot shows the WinSCP interface with two panes. The left pane shows the local file system at `C:\Users\MosesHou\`, and the right pane shows the remote file system at `/home/zhuofei/`. Red circles highlight these paths, with arrows pointing to a text box that says "Change paths on your local computer and transfer node". A green double-headed arrow points between the two panes, with a text box above it that says "Drag to transfer files or folders".

Name	Size	Type	Changed	Name	Size	Changed	Rights	Owner
..		Parent directory	7/10/2020 6:29:42 AM	..		12/22/2020 2:35:28 PM	rw-r--r--	root
Contacts		File folder	6/24/2020 5:30:50 AM	class_test		9/5/2019 9:26:34 AM	rw-r--r--	zhuofei
Desktop		File	1/6/2021 9:32:41 AM	CytoscapeConfigurati...		8/11/2020 10:47:52 AM	rw-r--r--	zhuofei
Documents		File folder	11/18/2020 1:04:09 PM	ens		10/13/2020 8:39:53 AM	rw-r--r--	zhuofei
Downloads		File folder	1/5/2021 6:40:34 AM	intel		10/9/2020 10:03:39 AM	rw-r--r--	zhuofei
Favorites		File folder	6/24/2020 5:30:50 AM	notification		8/17/2018 5:43:27 AM	rw-r--r--	zhuofei
Links		File folder		scripts		8/8/2018 2:14:03 PM	rw-r--r--	zhuofei
Music		File folder		term-account		1/4/2021 1:01:58 PM	rw-r--r--	zhuofei
Pictures		File folder		templates		8/9/2018 8:18:34 AM	rw-r--r--	zhuofei
Saved Games		File folder		workDir		10/29/2020 9:00:13 AM	rw-r--r--	zhuofei
Searches		File folder	6/24/2020 5:30:50 AM	workDir_template		7/30/2020 12:17:24 PM	rw-r--r--	zhuofei
Tracing		File folder	7/7/2015 10:45:05 AM	gcc-4.4.sif	128,788 KB	10/9/2020 10:25:27 AM	rw-r--r--	zhuofei
Videos		File folder	6/24/2020 5:30:50 AM	ling6570_config.sh	1 KB	11/19/2019 6:19:22 AM	rw-r--r--	zhuofei
				ml-search-gacrc	3 KB	1/4/2021 1:03:39 PM	rw-r--r--	zhuofei
						9/25/2019 7:12:13 AM	rw-r--r--	zhuofei

Step5 (Cont.): Transfer data on cluster to workDir

- Log on to Transfer node (txfer.gacrc.uga.edu)
 - ✓ Mac/Linux: `ssh MyID@txfer.gacrc.uga.edu` (page 9-10)
 - ✓ Windows: use PuTTY to log in `MyID@txfer.gacrc.uga.edu` (page 11-13)
- Directories you can access on transfer node:
 1. `/home/MyID` (Landing home)
 2. `/work/phys4601/MyID`
 3. `/work/phys4601/instructor_data`
- Transfer data between two folders on cluster using `cp` or `mv`, e.g.:

```
mv /work/phys4601/MyID/datafile /home/MyID/workDir
```

Step6: Compile Fortran code *mult.f* into a binary



```
zhuofei@teach-sub1 workDir$ interact
```

← Start an interactive session

```
zhuofei@tcn26 workDir$ cp /usr/local/gacrc/training/phys4601/mult.f .
```

← Copy source code to your working dir

```
zhuofei@tcn26 workDir$ cat mult.f
```

← Show contents of source code

```
Program mult
```

```
C Multiplies two integer numbers
```

```
implicit none
```

```
integer i,j,iproduct
```

```
i=3
```

```
j=4
```

```
open(1, file='output.txt')
```

```
iproduct=i*j
```

```
write(1,10)i,j,iproduct
```

```
10 format('The product of ', I2, ' and ', I2, ' is ', I3)
```

```
close(1)
```

```
end
```

```
zhuofei@tcn26 workDir$ module load GCC/11.3.0
```

← Load GCC compiler module

```
zhuofei@tcn26 workDir$ gfortran mult.f -o mult.x
```

← Compile source code into a binary

```
zhuofei@tcn26 workDir$ ls
```

```
mult.f mult.x
```

← Binary is generated in your working dir

```
zhuofei@tcn26 workDir$ exit
```

← Exit from interactive session

Step7: Make a job submission script *sub.sh* using *nano*



```
zhuofei@teach-sub1 workDir$ cp /usr/local/gacrc/training/phys4601/sub.sh .
zhuofei@teach-sub1 workDir$ cat sub.sh
#!/bin/bash
#SBATCH --job-name=test
#SBATCH --partition=fsr4601
#SBATCH --ntasks=1
#SBATCH --cpus-per-task=1
#SBATCH --mem=2gb
#SBATCH --time=00:01:00
#SBATCH --output=log.%j
#SBATCH --mail-user=MyID@uga.edu
#SBATCH --mail-type=ALL

cd $SLURM_SUBMIT_DIR
module load GCC/11.3.0
time ./mult.x
zhuofei@teach-sub1 workDir$ nano sub.sh
```

← Copy sub.sh to working dir

← Show contents of sub.sh

Job name

Submit job to fsr4601 partition

Single task job

Number of cores per task

Total memory for job

Time limit hrs:min:sec; fsr4601 TIMELIMIT 1 min

Standard output and error log

Where to send mail

Mail events (BEGIN, END, FAIL, ALL)

run the binary code you compiled in step 5 in this job

← Use nano modify sub.sh, e.g., email address

Step8: Submit a job from workDir using sbatch

https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster#How_to_submit_a_job_to_the_batch_queue

```
$ sbatch sub.sh  
Submitted batch job 12099
```

Tips: sub.sh is a job submission script for

1. specifying computing resources
2. loading compiler module using **module load**
3. running any Linux commands you want to run
4. running your binary code

Step9: Check job status using squeue

https://wiki.gacrc.uga.edu/wiki/Monitoring_Jobs_on_the_teaching_cluster

```
zhuofei@teach-sub1 workDir$ squeue --me
```

JOBID	PARTITION	NAME	USER	ST	TIME	NODES	NODELIST (REASON)
5230	fsr4601	test	zhuofei	R	0:01	1	rb1-3

```
zhuofei@teach-sub1 workDir$ squeue --me -l
```

```
Mon Jan 09 26:03:14 2024
```

JOBID	PARTITION	NAME	USER	STATE	TIME	TIME_LIMI	NODES	NODELIST (REASON)
5230	fsr4601	test	zhuofei	RUNNING	0:05	1:00	1	rb1-3

Job State: R for Running; PD for PenDing; F for Failed

TIME: the elapsed time used by the job, not remaining time, not CPU time



Step9 (Cont.): Cancel job using scancel

https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster#How_to_delete_a_running_or_pending_job

```
zhuofei@teach-sub1 workDir$ scancel 5230
```

```
zhuofei@teach-sub1 workDir$ squeue --me
```

```
JOBID PARTITION NAME USER ST TIME NODES NODELIST (REASON)
```

Step9 (Cont.): Check job details using sacct-gacrc -X and seff

https://wiki.gacrc.uga.edu/wiki/Monitoring_Jobs_on_the_teaching_cluster

```
$ sacct-gacrc -X
```

JobID	JobName	User	Partition	NNode	NCPUS	ReqMem	CPUTime	Elapsed	Timelimit	State	ExitCode	NodeList
5230	test	zhuofei	fsr4601	1	1	2G	00:00:01	00:00:01	00:01:00	COMPLETED	0:0	rb1-3

```
$ seff 5230 # Check computing resources used by a COMPLETED job
```

```
Cluster: gacrc-teach
```

```
User/Group: zhuofei/gacrc-instruction
```

```
State: COMPLETED (exit code 0)
```

```
Cores: 1
```

```
CPU Utilized: 00:00:00
```

```
CPU Efficiency: 0.00% of 00:00:01 core-walltime
```

```
Job Wall-clock time: 00:00:01
```

```
Memory Utilized: 0.00 MB (estimated maximum)
```

```
Memory Efficiency: 0.00% of 2.00 GB (2.00 GB/node)
```

Step9 (Cont.): Check node info using sinfo

https://wiki.gacrc.uga.edu/wiki/Monitoring_Jobs_on_the_teaching_cluster

```
zhuofei@teach-sub1 workDir$ sinfo
```

PARTITION	AVAIL	TIMELIMIT	NODES	STATE	NODELIST
allnodes	up	infinite	1	mix	rb1-11
allnodes	up	infinite	12	idle	c4-23,rb1-[1-10,12]
batch	up	7-00:00:00	8	idle	rb1-[3-10]
gpu	up	7-00:00:00	1	idle	c4-23
highmem	up	7-00:00:00	2	idle	rb1-[1-2]
Interactive	up	7-00:00:00	1	mix	rb1-11
interactive	up	7-00:00:00	1	idle	rb1-12
fsr4601	up	1:00	8	idle	rb1-[3-10]
fsr8602	up	10:00	8	idle	rb1-[3-10]

idle = no cores in use; mix = some cores are still free; alloc = all cores are allocated

Obtain Job Details

https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster#How_to_check_resource_utilization_of_a_running_or_finished_job

Option 1: `seff` for details of computing resource usage of a finished job

Option 2: `sacct-gacrc` for details of computing resource usage of a running or finished job

Option 3: Email notification from finished jobs (completed, canceled, or crashed), if using:

```
#SBATCH --mail-user=username@uga.edu
```

```
#SBATCH --mail-type=ALL
```



GACRC Wiki <http://wiki.gacrc.uga.edu>

Kaltura Channel <https://kaltura.uga.edu/channel/GACRC/176125031>

Connecting: https://wiki.gacrc.uga.edu/wiki/Connecting#Connecting_to_the_teaching_cluster

Running Jobs: https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster

Monitoring Jobs: https://wiki.gacrc.uga.edu/wiki/Monitoring_Jobs_on_the_teaching_cluster

Transfer File:

[https://wiki.gacrc.uga.edu/wiki/Transferring_Files#The_File_Transfer_node_for_the_teaching_cluster_.](https://wiki.gacrc.uga.edu/wiki/Transferring_Files#The_File_Transfer_node_for_the_teaching_cluster_.28txfer.gacrc.uga.edu.29)

[28txfer.gacrc.uga.edu.29](https://wiki.gacrc.uga.edu/wiki/Transferring_Files#The_File_Transfer_node_for_the_teaching_cluster_.28txfer.gacrc.uga.edu.29)

Sample Job Scripts:

https://wiki.gacrc.uga.edu/wiki/Sample_batch_job_submission_scripts_on_the_teaching_cluster

Linux Command: https://wiki.gacrc.uga.edu/wiki/Command_List

GACRC Support

https://wiki.gacrc.uga.edu/wiki/Getting_Help

➤ **Job Troubleshooting:**

Please tell us details of your question or problem, including but not limited to:

- ✓ Your user name
- ✓ Your job ID
- ✓ Your working directory
- ✓ The partition name and command you used to submit the job

➤ **Software Installation:**

- ✓ Specific name and version of the software
- ✓ Download website
- ✓ Supporting package information if have

Please note to make sure the correctness of datasets being used by your jobs!



[Service Catalog](#) / [Academics, Learning & Research](#) / [GACRC Service Catalog](#)

GACRC Service Catalog

Georgia Advanced Computing Resource Center (GACRC) service catalog.

If you would like to reach out to GACRC and do not have a UGA MyID, please send an email to gacrc-help@uga.edu, and we will respond promptly.

Categories (3)



Services For Users

General user support, request software installation or update, request training.

Services for PIs

For PIs only: Lab registration, user account creation/modification, class account requests, storage quota modifications.

For GACRC Staff

For GACRC's internal use only.

My Recent Requests

[Class provision on the teaching cluster - phys8601 - dlandau](#)

[Class provision on the teaching cluster - bcmb8330 - rjwoods](#)

[Class provision on the teaching cluster - binf8211 - szhao, lm43161](#)

[MATLAB License Request](#)

[Create cider lab group](#)

[View All Recent Requests >](#)

Popular Services

Service - General Support - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Mail - zhuofei@uga.edu x Service - General Support x

https://uga.teamdynamix.com/TDClient/Requests/ServiceDet?ID=25844

90% ...

UNIVERSITY OF GEORGIA

Search the client portal

Zhuofei Hou

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[Service Catalog](#) / [Academics, Learning & Research](#) / [GACRC Service Catalog](#) / General Support

General Support


If you do not have a myid, please mail gacrc-help@uga.edu, and we will respond promptly.


The purpose of this form is to provide a method to report issues and to request help with GACRC systems.


Please use this form for all questions and support needs (e.g. to report issues, to troubleshoot jobs, to request resources or grant writing help, etc). Please do not use this form for software installation requests or lab/user account management, which all have separate forms.

Please refer to the GACRC documentation for information on GACRC resources, how to connect and transfer files, how to run jobs, installed software list, training schedule, and a FAQ.

The link to this documentation is <https://wiki.gacrc.uga.edu>

 Request Service

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 Click to request

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[Privacy](#) | [Accessibility](#) | [Website Feedback](#)

https://uga.teamdynamix.com/TDClient/Requests/ServiceCatalogSearch

Need Support? <http://help.gacrc.uga.edu>

