

Introduction to GACRC Teaching Cluster

PHYS8602

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

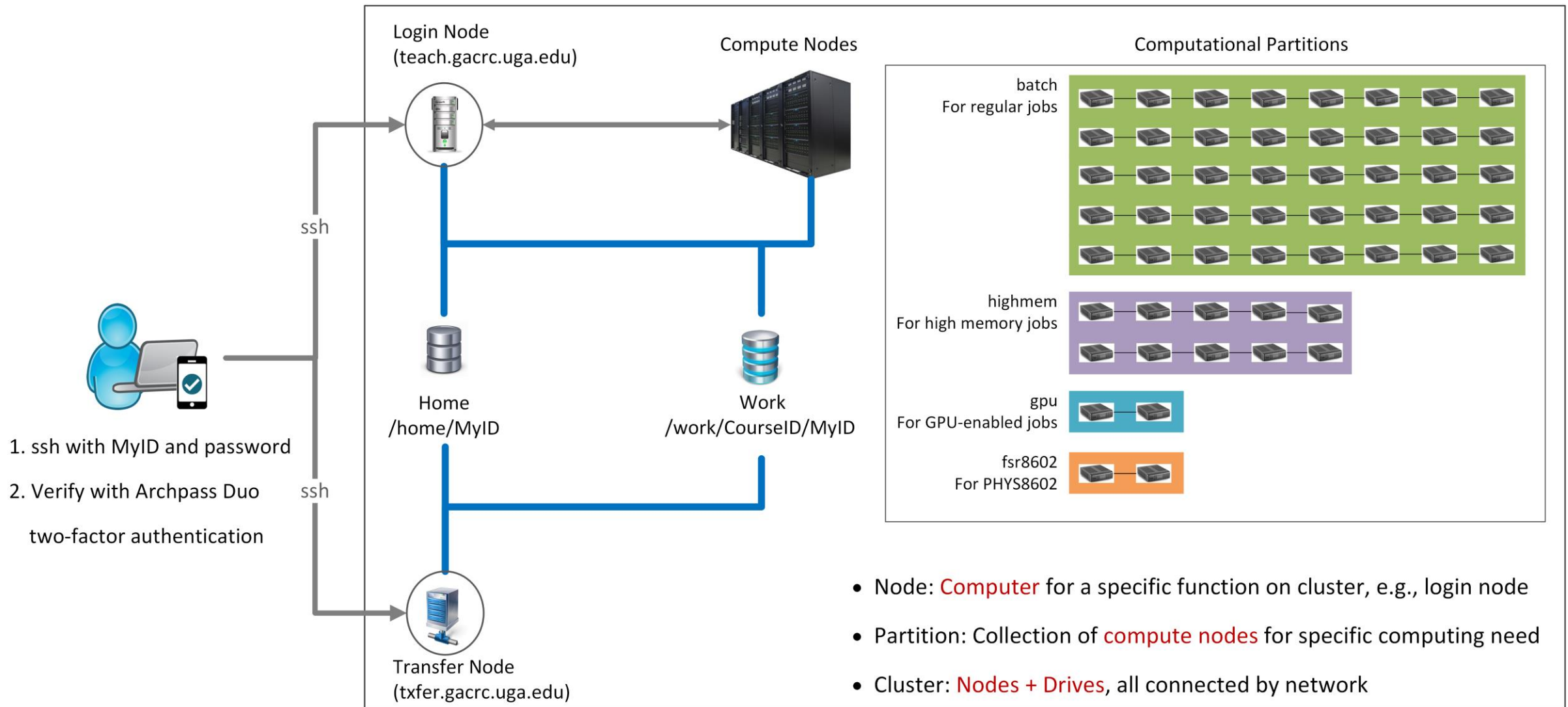
Wiki: <http://wiki.gacrc.uga.edu>

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



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/phys8602/MyID : data storing space for individual user in a class
 3. /work/phys8602/instructor_data : data shared with class by the instructors
- Partitions for your class: **fsr8602**

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**/**3.8.2**-GCCcore-8.3.0
3. Software names are case-sensitive!
 - `module spider pattern` : Search module names matching a pattern (case-insensitive)
 - `module load moduleName` : Load a module into your working environment
 - `module avail` : List all available software modules installed on cluster
 - `module list` : List modules currently loaded
 - `module unload moduleName` : Remove a module 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. Create a working subdirectory for a job : `mkdir ./workDir`
3. Change directory to workDir : `cd ./workDir`
4. 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`
5. Compile C code *mult.c* into a binary code
6. Make a job submission script in workDir : `nano ./sub.sh`
7. Submit a job from workDir : `sbatch ./sub.sh`
8. Check job status : `squeue --me (-l)` or Cancel a job : `scancel JobID`

Step1: Log on to Login node

[https://wiki.gacrc.uga.edu/wiki/Connecting#Connecting to the teaching cluster](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:

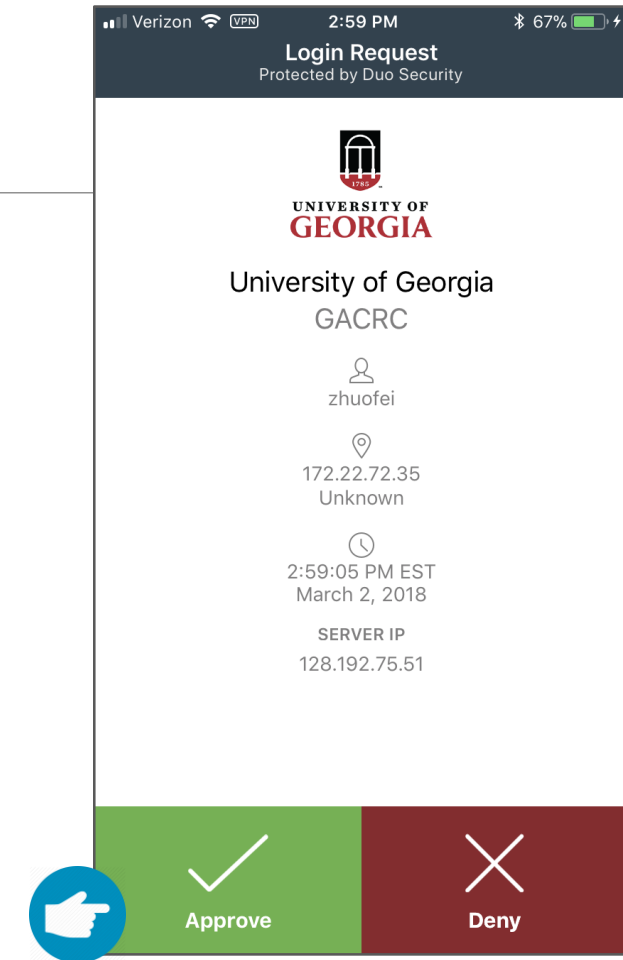
1. Duo Push to XXX-XXX-5758
2. Phone call to XXX-XXX-5758
3. Phone call to XXX-XXX-1925
- 4 5. SMS passcodes to XXX-XXX-5758 (next code starts with: 1)

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/>

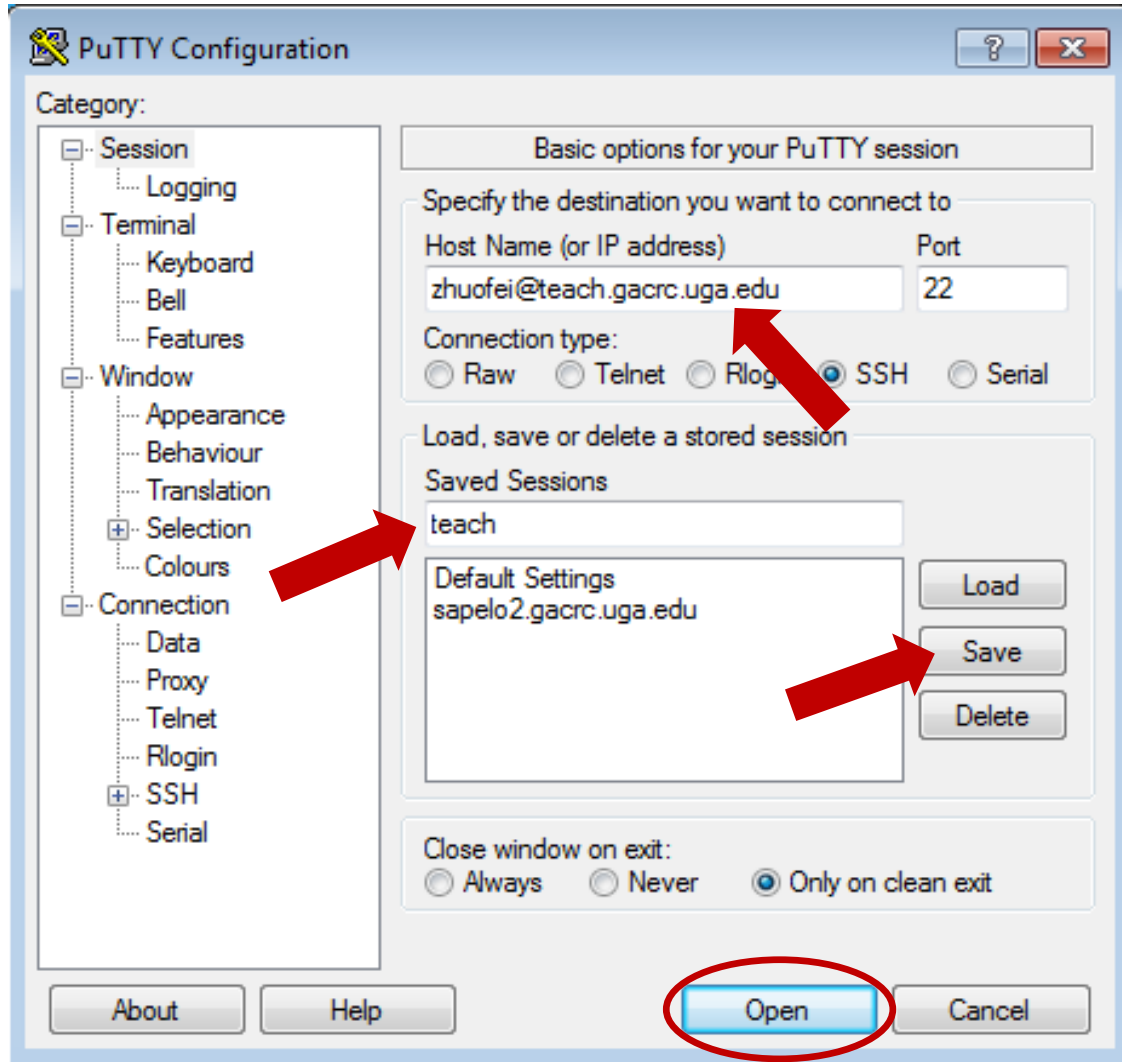
2. Detailed downloading and installation instructions:

[https://wiki.gacrc.uga.edu/wiki/How to Install and Configure PuTTY](https://wiki.gacrc.uga.edu/wiki/How_to_Install_and_Configure_PuTTY)

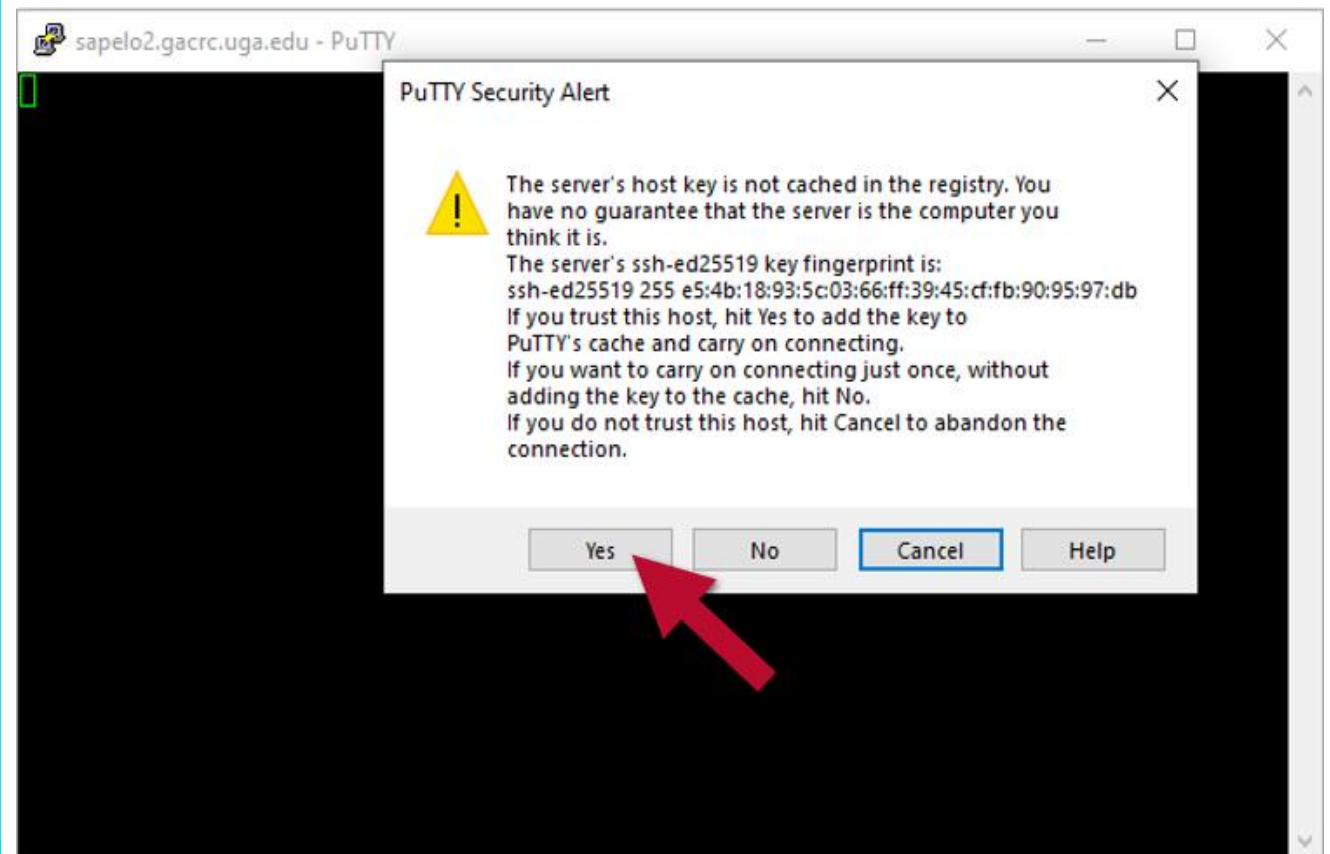
3. Detailed configuring and usage instructions:

[https://wiki.gacrc.uga.edu/wiki/How to Install and Configure PuTTY#Configuring PuTTY](https://wiki.gacrc.uga.edu/wiki/How_to_Install_and_Configure_PuTTY#Configuring_PuTTY)

Step1 (Cont.) - Windows using PuTTY

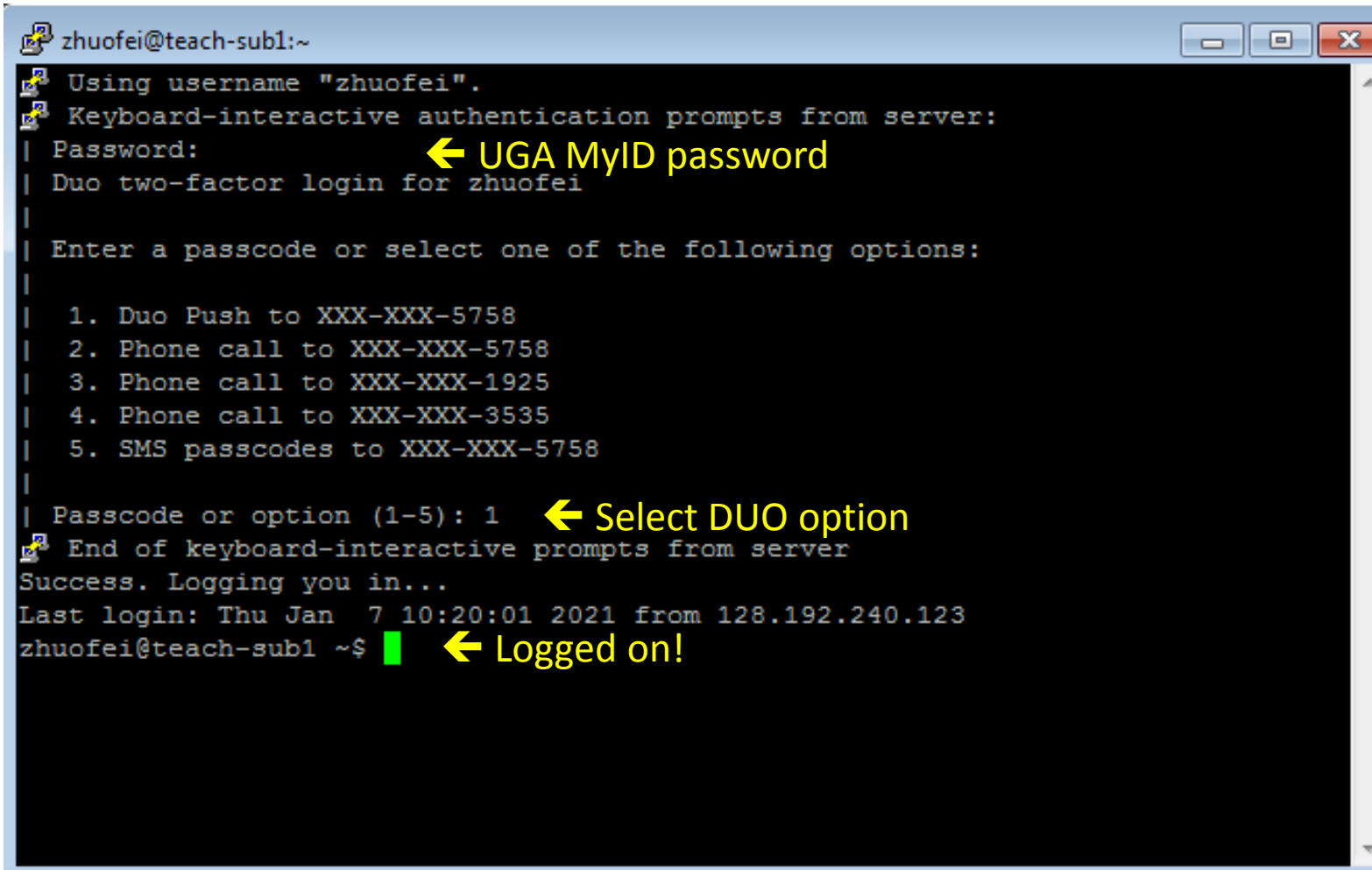


The first time you connect to login node, PuTTY will give you this security alert window. Please click "Yes"



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 - 3: Create and change directory to workDir

```
[zhuofei@teach-sub1 ~]$ ls  
[zhuofei@teach-sub1 ~]$ mkdir workDir  
[zhuofei@teach-sub1 ~]$ ls  
workDir  
[zhuofei@teach-sub1 ~]$ cd workDir/  
[zhuofei@teach-sub1 workDir]$ ls  
[zhuofei@teach-sub1 workDir]$
```

← List folder contents

← Create a subdirectory

← Change directory

← workDir is empty

Step4: 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/ .
```

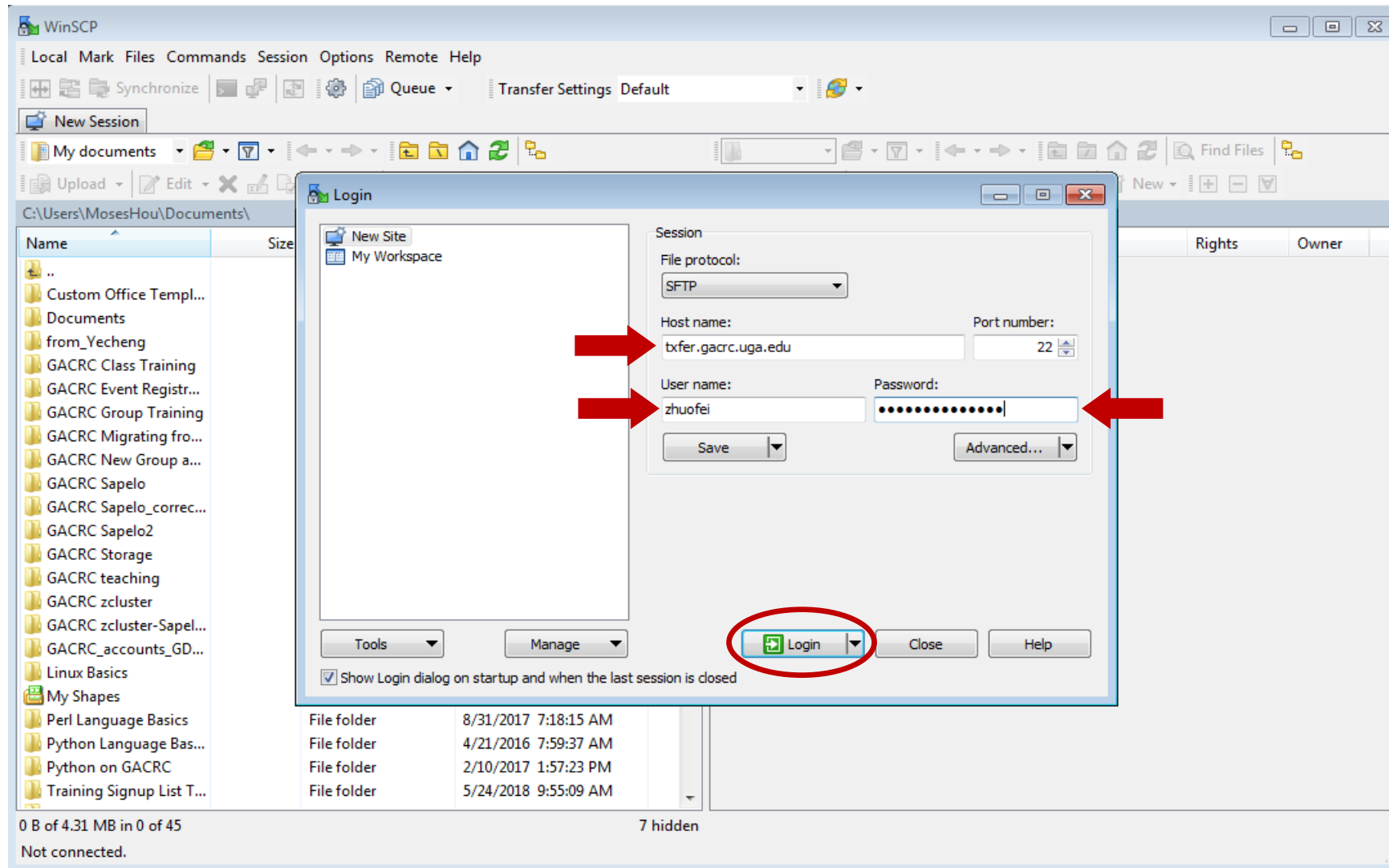
Step4 (Cont.) - Windows using WinSCP

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

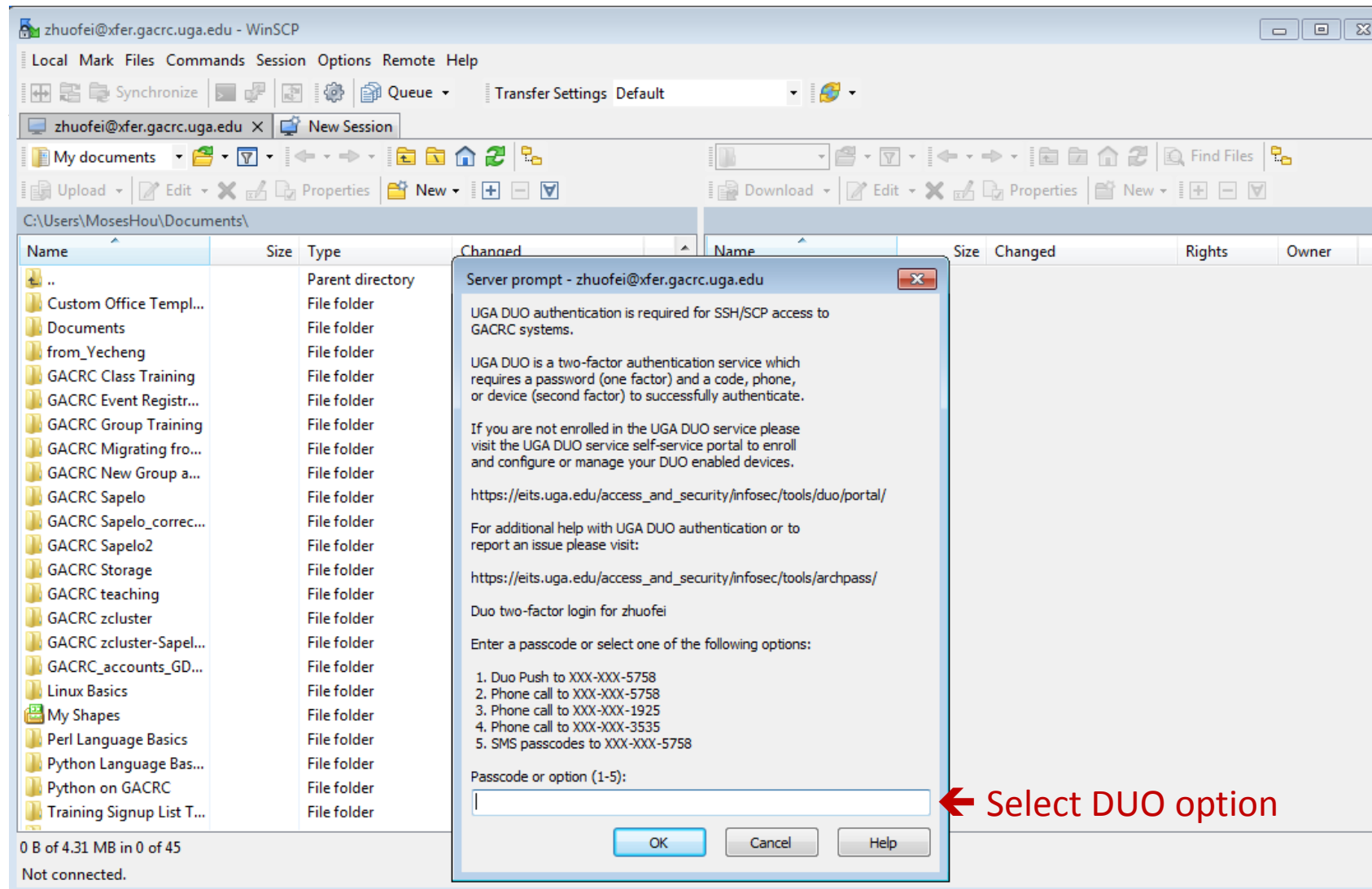
1. You need to connect to cluster's Transfer node (**txfer.gacrc.uga.edu**)
2. Use **WinSCP** on local computer
 - WinSCP can be downloaded from <https://winscp.net/eng/index.php>
 - Default installation procedure is simple
3. Alternative FileZilla https://wiki.gacrc.uga.edu/wiki/Transferring_Files#Using_FileZilla_2

Step4 (Cont.) - Windows using WinSCP

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



Step4 (Cont.) - Windows using WinSCP



Step4 (Cont.) - Windows using WinSCP

The screenshot shows the WinSCP interface with the following components:

- Local File System (Left Panel):** Path is `C:\Users\MosesHou\`. The file list includes:

Name	Size	Type	Changed
..		Parent directory	7/10/2020 6:29:42 AM
Contacts		File folder	6/24/2020 5:30:50 AM
Desktop		File	1/6/2021 9:32:41 AM
Documents		File folder	11/18/2020 1:04:09 PM
Downloads		File folder	1/5/2021 6:40:34 AM
Favorites		File folder	6/24/2020 5:30:50 AM
Links		File folder	
Music		File folder	
Pictures		File folder	
Saved Games		File folder	
Searches		File folder	6/24/2020 5:30:50 AM
Tracing		File folder	7/7/2015 10:45:05 AM
Videos		File folder	6/24/2020 5:30:50 AM
- Remote File System (Right Panel):** Path is `/home/zhuofei/`. The file list includes:

Name	Size	Changed	Rights	Owner
..		12/22/2020 2:35:28 PM	rw-r--r--	root
class_test		9/5/2019 9:26:34 AM	rw-r--r--	zhuofei
CytoscapeConfigurati...		8/11/2020 10:47:52 AM	rw-r--r--	zhuofei
ens		10/13/2020 8:39:53 AM	rw-r--r--	zhuofei
intel		10/9/2020 10:03:39 AM	rw-r--r--	zhuofei
notification		8/17/2018 5:43:27 AM	rw-r--r--	zhuofei
scripts		8/8/2018 2:14:03 PM	rw-r--r--	zhuofei
term-account		1/4/2021 1:01:58 PM	rw-r--r--	zhuofei
templates		8/9/2018 8:18:34 AM	rw-r--r--	zhuofei
workDir		10/29/2020 9:00:13 AM	rw-r--r--	zhuofei
workDir_template		7/30/2020 12:17:24 PM	rw-r--r--	zhuofei
gcc-4.4.sif	128,788 KB	10/9/2020 10:25:27 AM	rw-r--r--	zhuofei
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

Annotations:

- Red circles highlight the local path `C:\Users\MosesHou\` and the remote path `/home/zhuofei/`.
- A text box with an arrow pointing to the local path says: "Change paths on your local computer and transfer node".
- A text box with an arrow pointing to the remote path says: "Drag to transfer files or folders".
- A large green double-headed arrow is positioned between the two panels.

Status Bar: 0 B of 0 B in 0 of 12 | 27 hidden | 0 B of 125 MB in 0 of 14 | SFTP-3 | 0:04:52

Step4 (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/phys8602/MyID`
 3. `/work/phys8602/instructor_data`
- Transfer data between two folders on cluster using `cp` or `mv`, e.g.:

```
mv /work/phys8602/MyID/datafile /home/MyID/workDir
```

Step5: Compile C code *mult.c* into a binary

```
zhuofei@teach-sub1 workDir$ qlogin
zhuofei@tcn26 workDir$ cp /usr/local/training/phys8602/mult.c .
zhuofei@tcn26 workDir$ cat mult.c
/* Program mult
 * Multiple two integer numbers */
#include <stdio.h>
int main(void)
{
    int i=3, j=4, iprod;
    FILE *fp;
    fp = fopen("output.txt","w");
    iprod=i*j;
    fprintf(fp, "The product of %d and %d is %d\n", i,j,iprod);
    fclose(fp);
    return 0;
}
zhuofei@tcn26 workDir$ module load GCC/8.3.0
zhuofei@tcn26 workDir$ gcc mult.c -o mult.x
zhuofei@tcn26 workDir$ ls
mult.c  mult.x
zhuofei@tcn26 workDir$ exit
```

← Start an interactive session

← Copy source code to your working dir

← Load GCC compiler module

← Compile source code into a binary

← Binary is generated in your working dir

← Exit from interactive session

Step6: Make a job submission script *sub.sh* using *nano*

```
zhuofei@teach-sub1 workDir$ cp /usr/local/training/phys8602/sub.sh .
zhuofei@teach-sub1 workDir$ cat sub.sh
#!/bin/bash
#SBATCH --job-name=test           # Job name
#SBATCH --partition=fsr8602       # Submit job to fsr8602, which is PHYS8602 partition
#SBATCH --ntasks=1               # Single task job
#SBATCH --cpus-per-task=1        # Number of cores per task
#SBATCH --mem=2gb                # Total memory for job
#SBATCH --time=00:10:00          # Time limit hrs:min:sec; fsr8602 TIMELIMIT 10 min
#SBATCH --output=log.%j          # Standard output and error log
#SBATCH --mail-user=MyID@uga.edu # Where to send mail
#SBATCH --mail-type=ALL          # Mail events (BEGIN, END, FAIL, ALL)

cd $SLURM_SUBMIT_DIR
module load GCC/8.3.0
time ./mult.x                    # run the binary code you compiled in step 5 in this job
zhuofei@teach-sub1 workDir$ nano sub.sh
```

← Copy sub.sh to your working dir

← Show contents of sub.sh

← Use nano to make modifications to sub.sh, e.g., email address

Step7: 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](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 12109
```

Tips: sub.sh is a job submission script for

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

Step7: 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)
12109	fsr8602	test	zhuofei	R	0:05	1	tcn18

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

```
Mon Jan 11 12:03:14 2021
```

JOBID	PARTITION	NAME	USER	STATE	TIME	TIME_LIMI	NODES	NODELIST (REASON)
12109	fsr8602	test	zhuofei	RUNNING	0:11	10:00	1	tcn18

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

Step7 (Cont.): Check job details using scontrol show job

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

```
zhuofei@teach-sub1 workDir$ scontrol show job 12109
JobId=12109 JobName=test
  UserId=zhuofei(1772) GroupId=gacrc-instruction(21004) MCS_label=N/A
.....
JobState=RUNNING Reason=None Dependency=(null)
Requeue=1 Restarts=0 BatchFlag=1 Reboot=0 ExitCode=0:0
RunTime=00:00:27 TimeLimit=00:10:00 TimeMin=N/A
.....
Partition=fsr8602 AllocNode:Sid=10.31.32.252:92156
NodeList=tcn18
NumNodes=1 NumCPUs=1 NumTasks=1 CPUs/Task=1 ReqB:S:C:T=0:0:*:*
MinCPUsNode=1 MinMemoryNode=2G MinTmpDiskNode=0
Command=/home/zhuofei/workDir/sub.sh
WorkDir=/home/zhuofei/workDir
StdErr=/home/zhuofei/workDir/log.12109
StdOut=/home/zhuofei/workDir/log.12109
MailUser=zhuofei@uga.edu MailType=BEGIN,END,FAIL,REQUEUE,STAGE_OUT
```

Step7 (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 12109
```

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

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

Step7 (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
batch*        up 7-00:00:00     1 down* tcn17
batch*        up 7-00:00:00    24  idle tcn[1-16,18-25]
interactive   up 7-00:00:00     5  idle tcn[26-30]
gpu           up 7-00:00:00     1  idle tcgn1
highmem       up 7-00:00:00     2  idle tchmn[1-2]
fsr4601       up      1:00         1 down* tcn17
fsr4601       up      1:00        24  idle tcn[1-16,18-25]
fsr8602       up     10:00         1 down* tcn17
fsr8602       up     10:00        24  idle tcn[1-16,18-25]
```

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_Sapelo2#How_to_check_resource_utilization_of_a_running_or_finished_job

Option 1: `scontrol show job JobID` for details of a running or pending jobs

Option 2: `seff` for details of computing resource usage of a finished job

Option 3: `sacct-gacrc` or `sacct-gacrc-v` for details of computing resource usage of
a running or finished job

Option 4: Email notification from finished jobs (completed, canceled, or crashed), if using:

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

```
#SBATCH --mail-type=END,FAIL
```

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> .
[28txfer.gacrc.uga.edu.29](https://wiki.gacrc.uga.edu/wiki/Transferring Files#The File Transfer node for the teaching cluster)

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!

GACRC Service Catalog

Georgia Advanced Computing Resource Center (GACRC) service catalog

Services (11)

Account Creation

For a research group's PI to request user accounts for group members on the GACRC computing systems.

Class Account Creation

For an instructor to request user accounts for students attending a course that will need to use GACRC computing systems.

Class Account Modification

For instructors to request changes to be made in previously requested class account.

Computing Lab Modification/Deletion

General Internal



General Support

Report issues and request help with GACRC systems, except for software installation requests and account/lab creation requests.

Lab Creation

For a research group's PI to register a computing lab on the GACRC computing systems

Modify/Delete Account

For PIs to request changes in or deletion of user accounts on GACRC computing systems.



Software Installation/Update

Request software and common application database (e.g. NCBI blast databases) installation and upgrade.

My Recent Requests

[home directory is not fully provisioned: ss57215](#)

[GACRC Sapelo2 New Lab/Use Account Request 2018-11-14_preTraining](#)

[GACRC Sapelo2 Cluster New Lab/Use Account Request 2018-11-05_preTraining](#)

[provision 5 user accounts for ugahelpdesk group](#)

[GACRC Sapelo2 New Lab/Use Account Request 2018-10-22_preTraining](#)

[View All Recent Requests >](#)

Popular Services

[EITS Help Desk Support Request](#)

[MyID Account Request](#)

[Change Request](#)

[02 Restricted VPN Access](#)

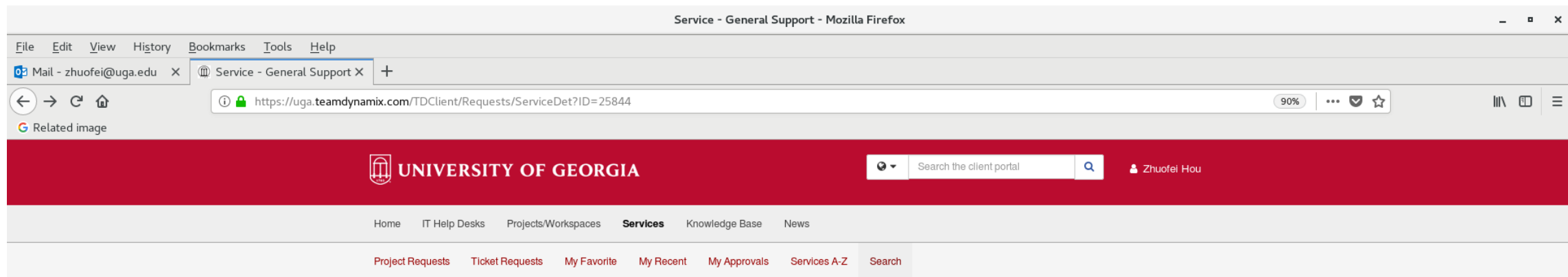
[Terry Classroom & Meeting Room Support](#)

[View All Popular Services >](#)

My Recently Visited Services

[Modify/Delete Account](#)

[Class Account Creation](#)



[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](#)

[Share](#)

[Add to Favorites](#)

← Click to request

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

Thank You!

Telephone Support

EITS Help Desk: 706-542-3106

Monday – Thursday: 7:30 a.m. – 7:30 p.m.

Friday: 7:30 a.m. – 6 p.m.

Saturday – Sunday: 1 p.m. – 7 p.m.

Georgia Advanced Computing Resource Center

101-108 Computing Services building

University of Georgia

Athens, GA 30602

<https://gacrc.uga.edu/>