

# Introduction to GACRC Teaching Cluster

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Georgia Advanced Computing Resource Center (GACRC)

EITS/University of Georgia

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# Outline

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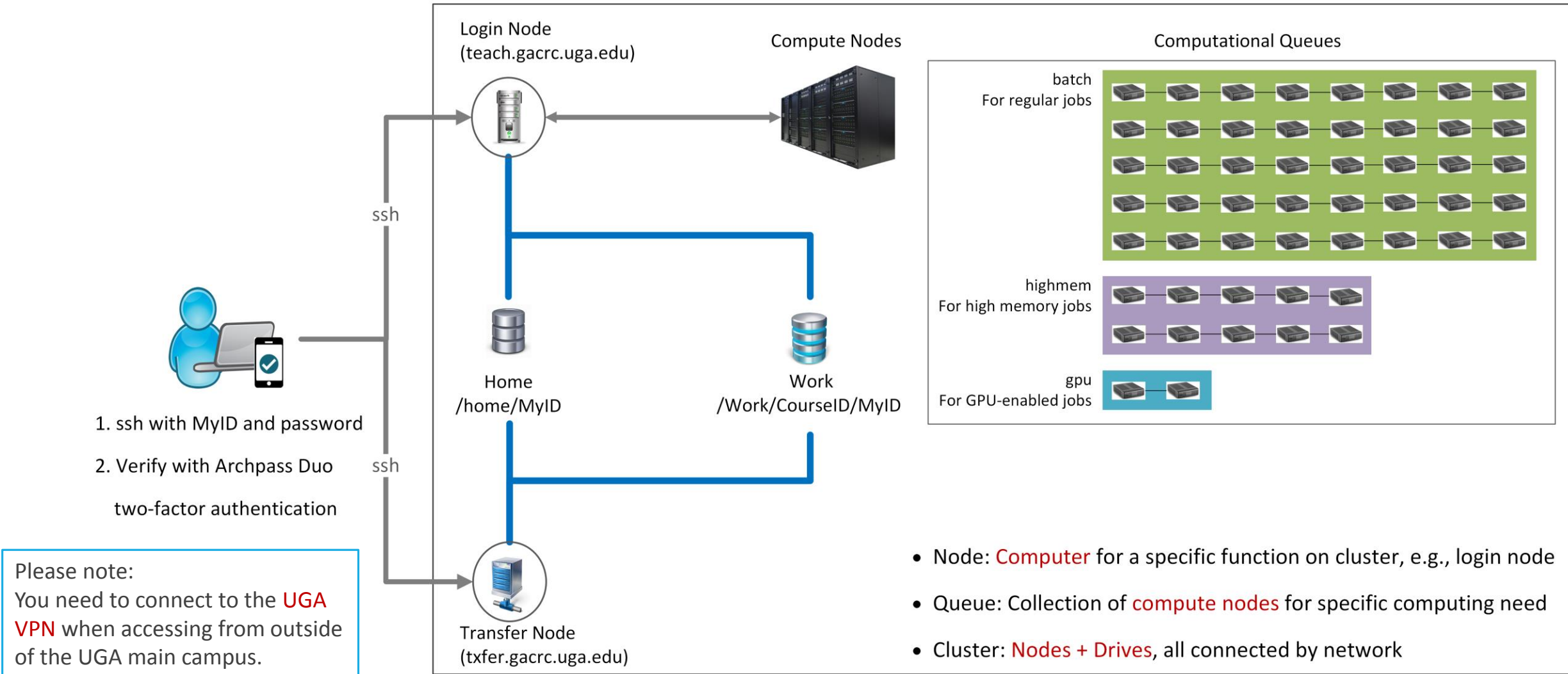
- GACRC
- Overview
- Computing Resources
  - Three Folders
  - Three Computational Queues
  - Software
- Submit Batch Job
- GACRC Wiki and Support

# GACRC

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- We are a high-performance-computing (HPC) center at UGA
- We 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
- <http://wiki.gacrc.uga.edu> (GACRC Wiki)
- [https://wiki.gacrc.uga.edu/wiki/Getting\\_Help](https://wiki.gacrc.uga.edu/wiki/Getting_Help) (GACRC Support)
- <http://gacrc.uga.edu> (GACRC Web)

# Teaching Cluster



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

# Computing Resources

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- Two Nodes:
  1. Login node (MyID@teach.gacrc.uga.edu): for submitting computational jobs
  2. Transfer node (MyID@txfer.gacrc.uga.edu): for transferring data files
- Three Directories:
  1. /home/MyID: working space for computational jobs
  2. /work/CourseID/MyID: data parking for individual user in the class (e.g., [GENE4220](#))
  3. /work/CourseID/instructor\_data: data shared with class by the instructors
- Three Queues:
  1. batch: for running regular computational jobs
  2. highmem: for running high-memory jobs
  3. gpu: for running GPU jobs

# Computing Resources (cont.)

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## ➤ 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/2.7.14-foss-2016b`
3. Software names are case-sensitive!
  - `module avail` : List all available software modules installed on cluster
  - `module load moduleName` : Load a module into your working environment
  - `module list` : List modules currently loaded
  - `module unload moduleName` : Remove a module from working environment
  - `ml spider pattern` : Search module names matching a pattern (case-insensitive)

# Submit Batch Job

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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 **SSH File Transfer** to connect Transfer node  
Transfer data on cluster to workDir : log on to Transfer node and then use `cp` or `mv`
5. Make a job submission script in workDir : `nano ./sub.sh`
6. Submit a job from workDir : `sbatch ./sub.sh`
7. Check job status : `squeue` or Cancel a job : `scancel JobID`

# 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 **MyID password**
4. Teaching cluster access requires ID 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/](https://eits.uga.edu/access_and_security/infosec/tools/archpass_duo/) on how to enroll

More information: [https://wiki.gacrc.uga.edu/wiki/Connecting#Connecting\\_to\\_the\\_teaching\\_cluster](https://wiki.gacrc.uga.edu/wiki/Connecting#Connecting_to_the_teaching_cluster)



## Step1 (Cont.) - Mac/Linux

Use Terminal utility  
on Mac or Linux!



ssh zhuofei@teach.gacrc.uga.edu ← Log on

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/infosec/tools/archpass/](https://eits.uga.edu/access_and_security/infosec/tools/archpass/)

Password: ← Input 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 (next code starts with: 1)

Passcode or option (1-5): 1 ← Select Duo login option!

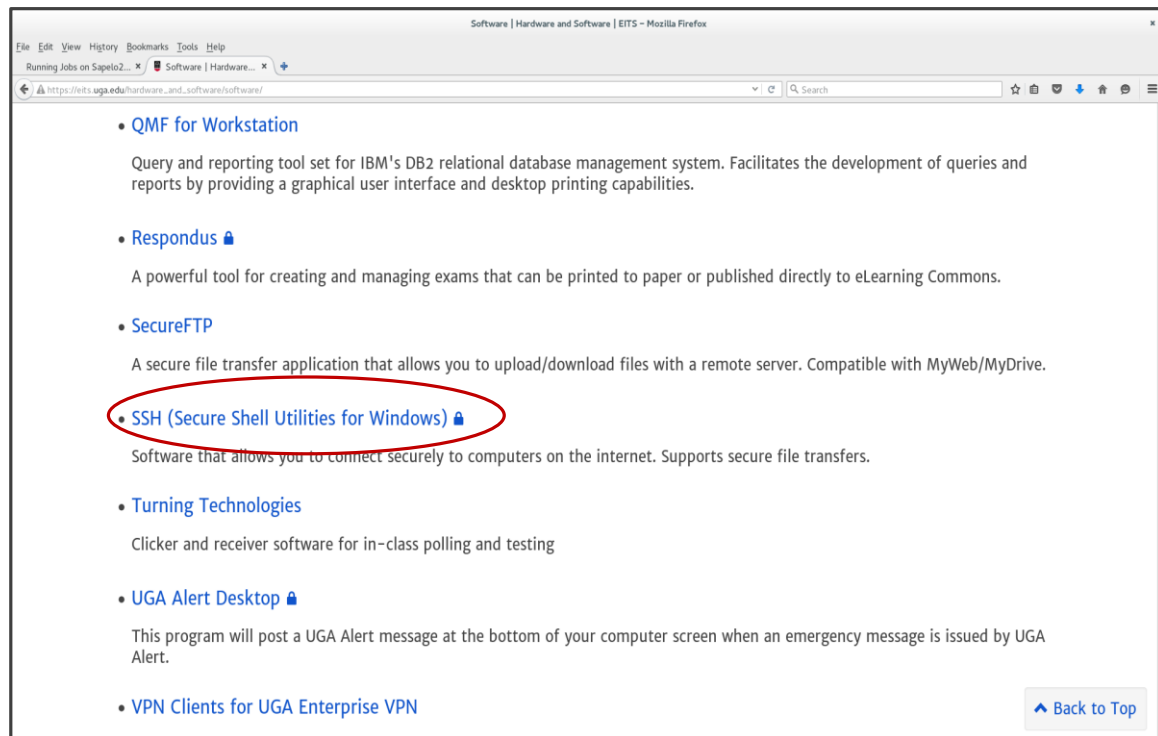
Success. Logging you in...

Last login: Fri Aug 3 11:24:43 2018 from 172.22.72.35

[zhuofei@teach ~]\$ ← I am teaching cluster login node

# Step1 (Cont.) - Windows




1. Download and install SSH Secure Utilities: [http://eits.uga.edu/hardware\\_and\\_software/software/](http://eits.uga.edu/hardware_and_software/software/)
2. You can use PuTTY as an alternative: <https://www.putty.org/>



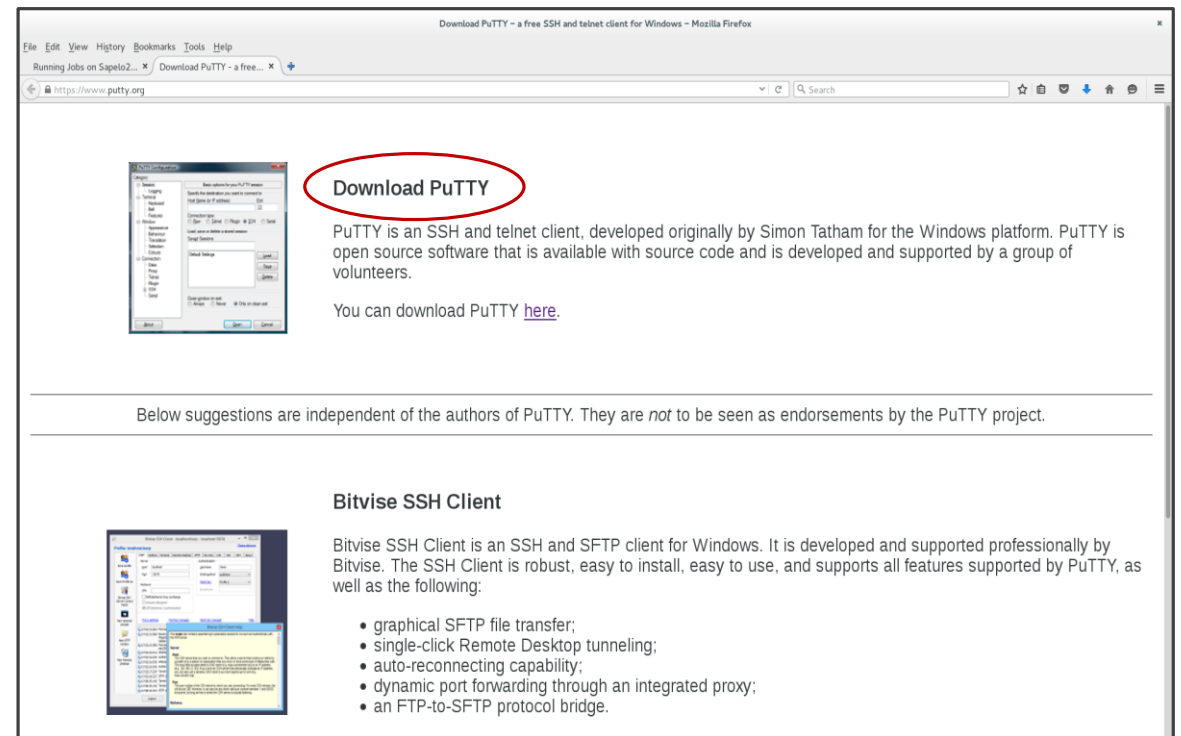
Software | Hardware and Software | EITS - Mozilla Firefox

Running Jobs on Sapelo2... x / Software | Hardware... x

[https://eits.uga.edu/hardware\\_and\\_software/software/](https://eits.uga.edu/hardware_and_software/software/)

- [QMF for Workstation](#)  
Query and reporting tool set for IBM's DB2 relational database management system. Facilitates the development of queries and reports by providing a graphical user interface and desktop printing capabilities.
- [Respondus](#)   
A powerful tool for creating and managing exams that can be printed to paper or published directly to eLearning Commons.
- [SecureFTP](#)  
A secure file transfer application that allows you to upload/download files with a remote server. Compatible with MyWeb/MyDrive.
- [SSH \(Secure Shell Utilities for Windows\)](#)   
Software that allows you to connect securely to computers on the internet. Supports secure file transfers.
- [Turning Technologies](#)  
Clicker and receiver software for in-class polling and testing
- [UGA Alert Desktop](#)   
This program will post a UGA Alert message at the bottom of your computer screen when an emergency message is issued by UGA Alert.
- [VPN Clients for UGA Enterprise VPN](#)

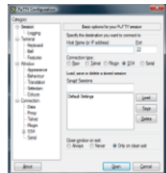
[Back to Top](#)



Download PuTTY - a free SSH and telnet client for Windows - Mozilla Firefox

Running Jobs on Sapelo2... x / Download PuTTY - a free... x

<https://www.putty.org/>




**Download PuTTY**

PuTTY is an SSH and telnet client, developed originally by Simon Tatham for the Windows platform. PuTTY is open source software that is available with source code and is developed and supported by a group of volunteers.

You can download PuTTY [here](#).

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Below suggestions are independent of the authors of PuTTY. They are *not* to be seen as endorsements by the PuTTY project.

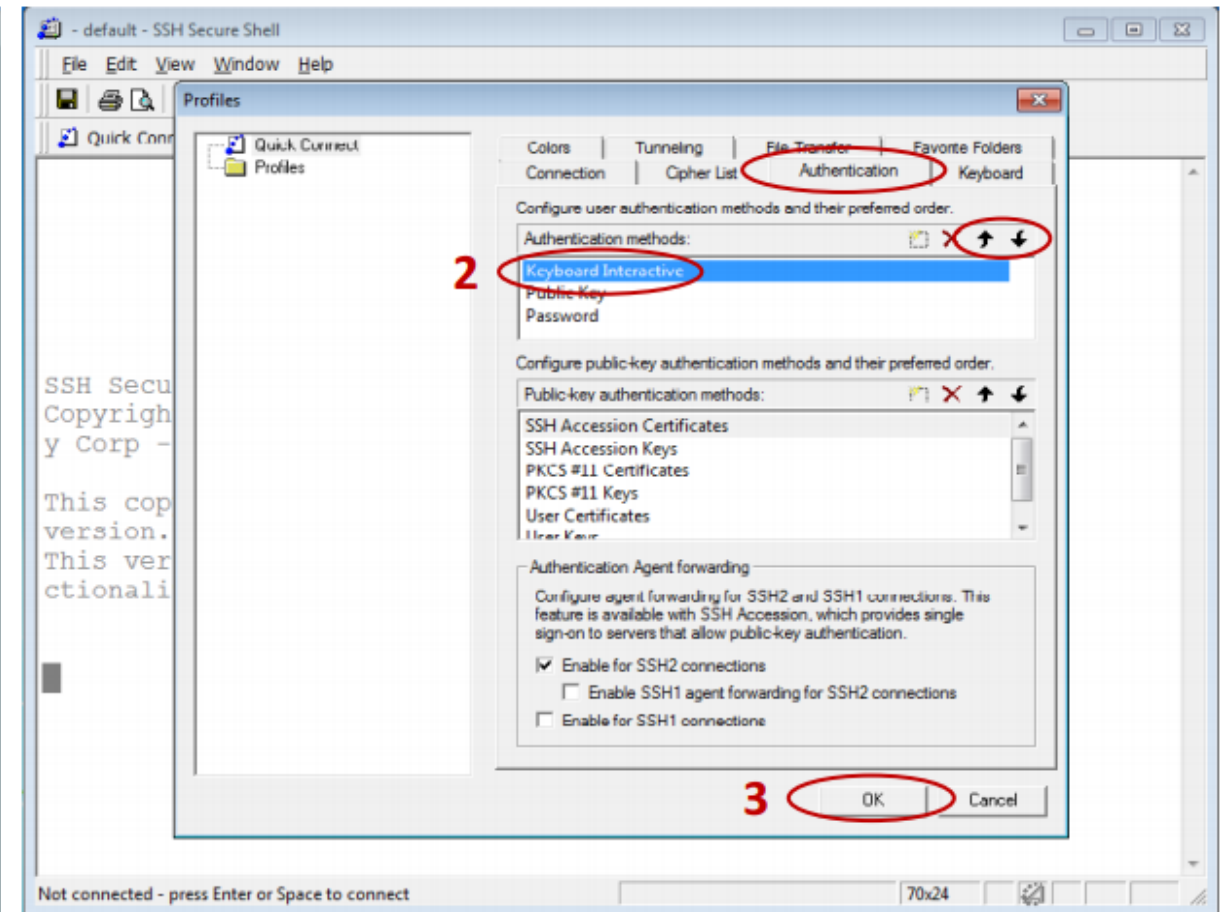
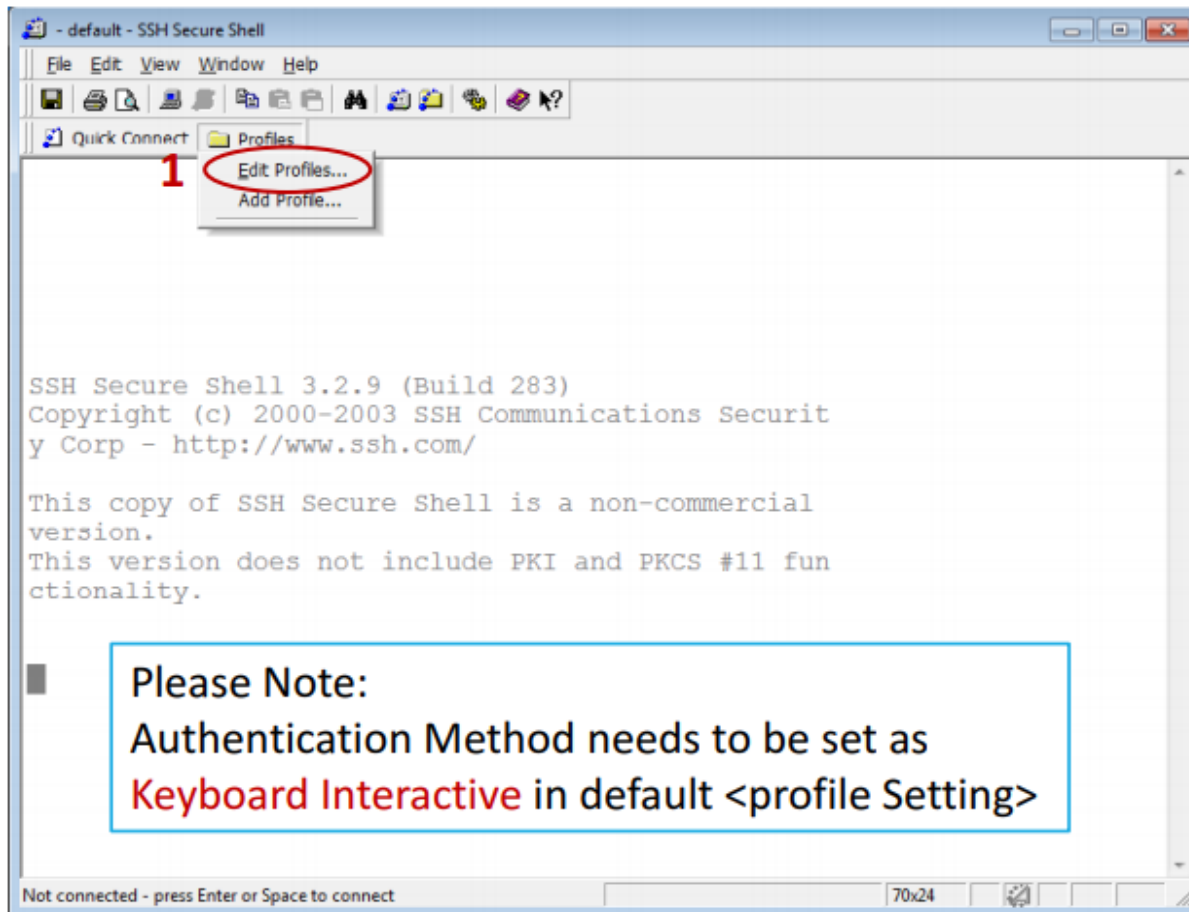


**Bitvise SSH Client**

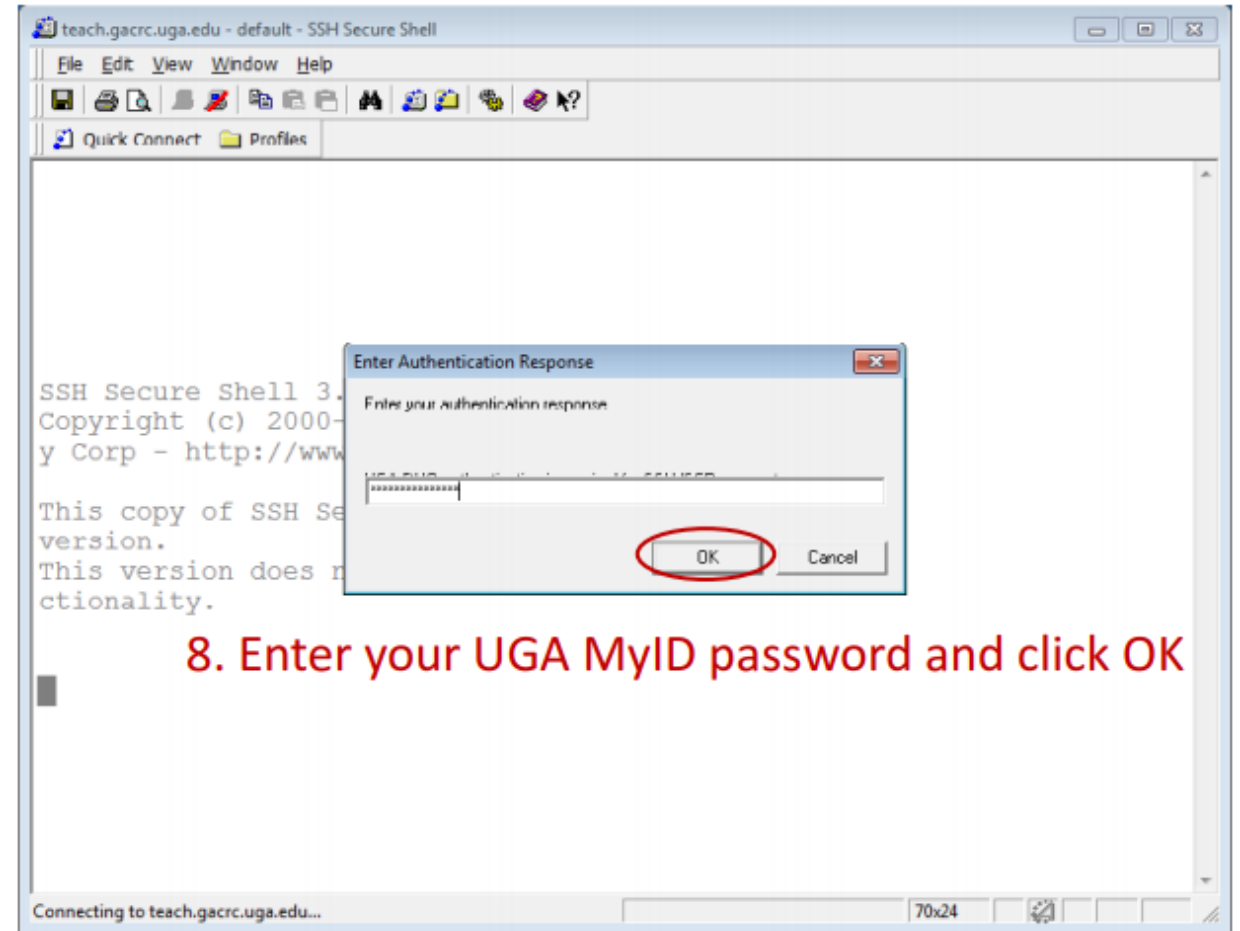
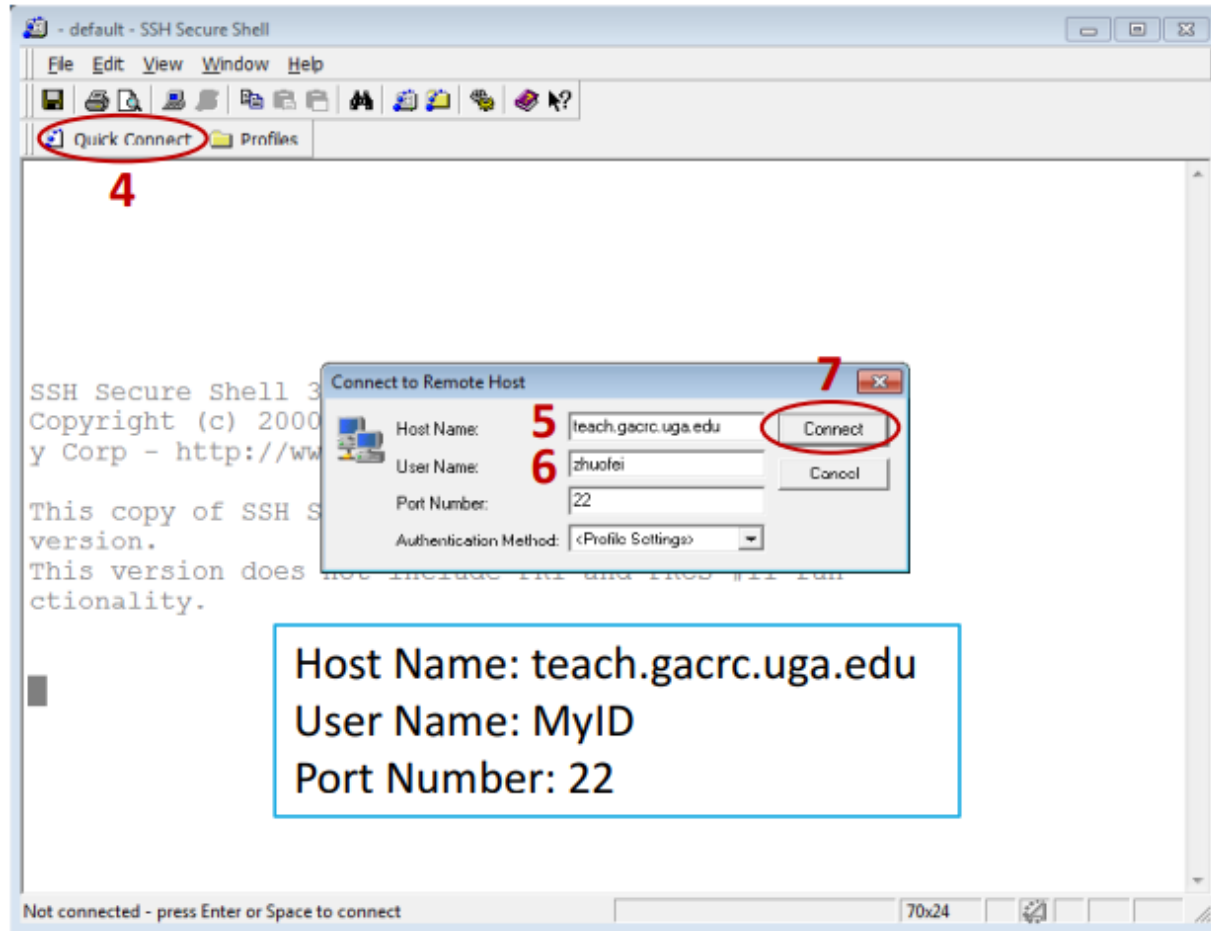
Bitvise SSH Client is an SSH and SFTP client for Windows. It is developed and supported professionally by Bitvise. The SSH Client is robust, easy to install, easy to use, and supports all features supported by PuTTY, as well as the following:

- graphical SFTP file transfer;
- single-click Remote Desktop tunneling;
- auto-reconnecting capability;
- dynamic port forwarding through an integrated proxy;
- an FTP-to-SFTP protocol bridge.

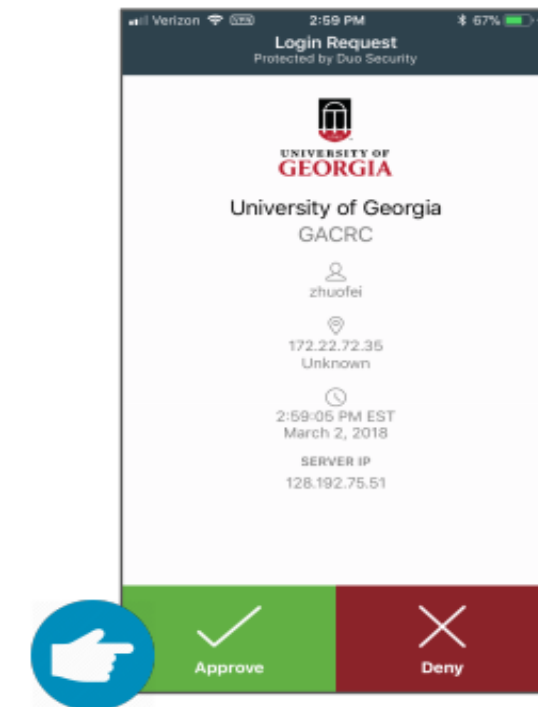
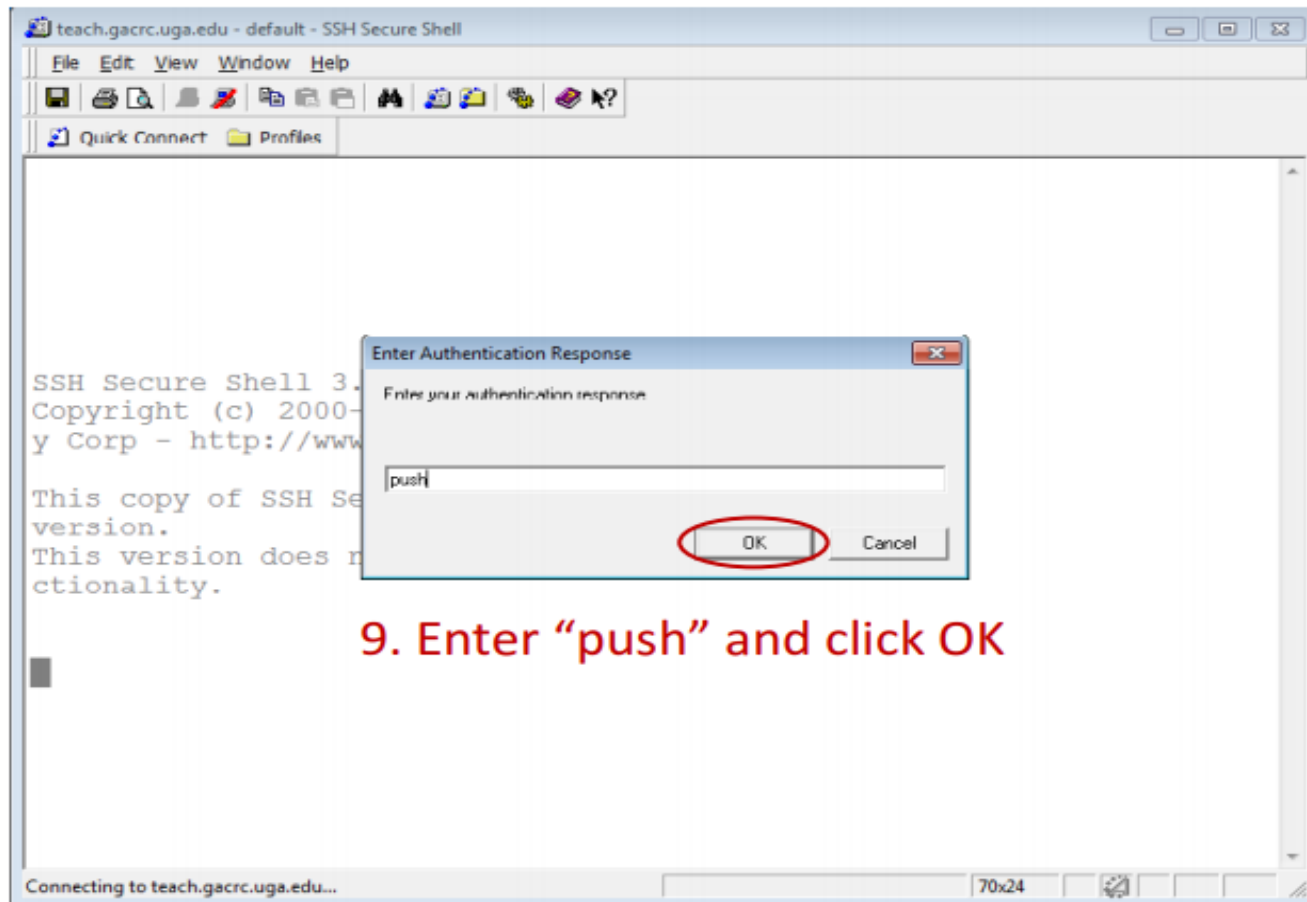
# Step1 (Cont.) - Windows using SSH Secure Utilities



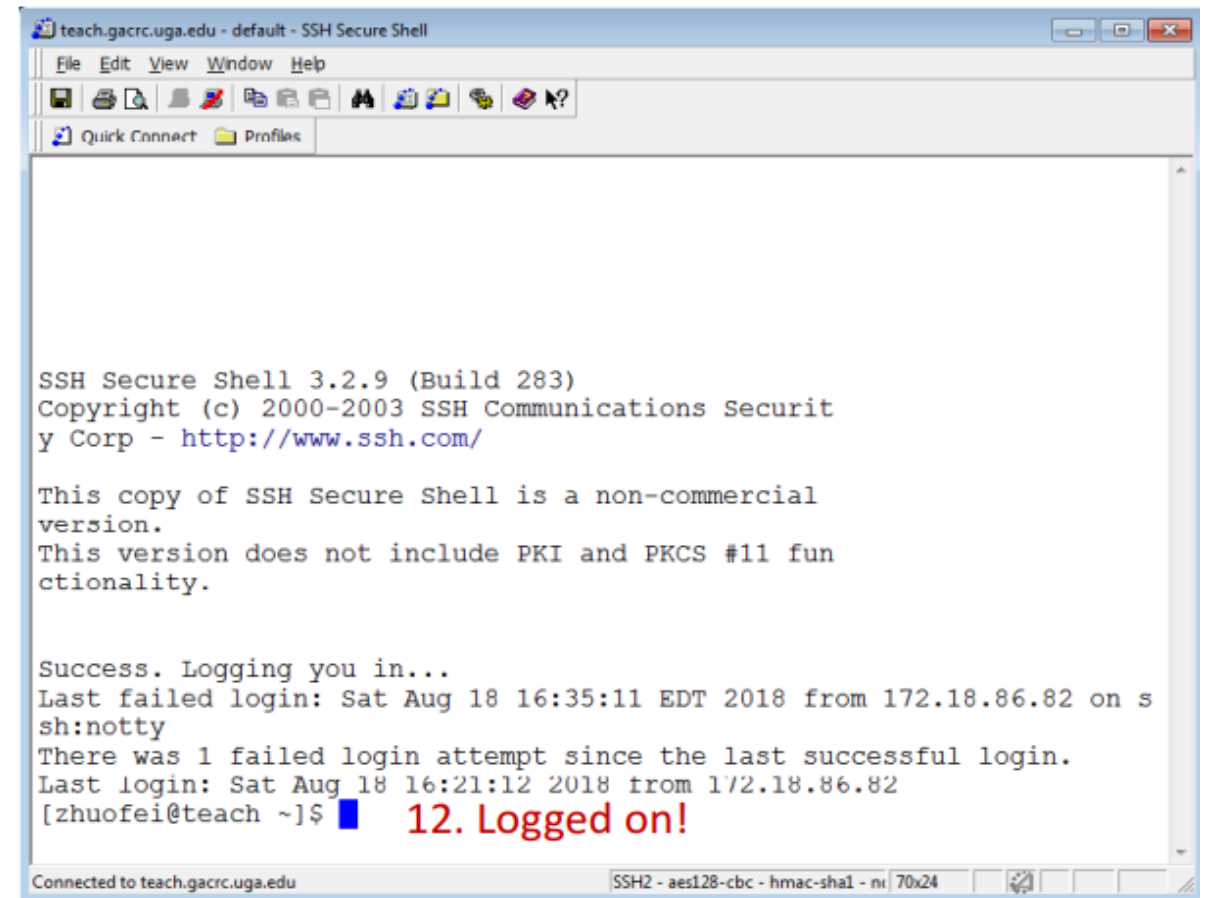
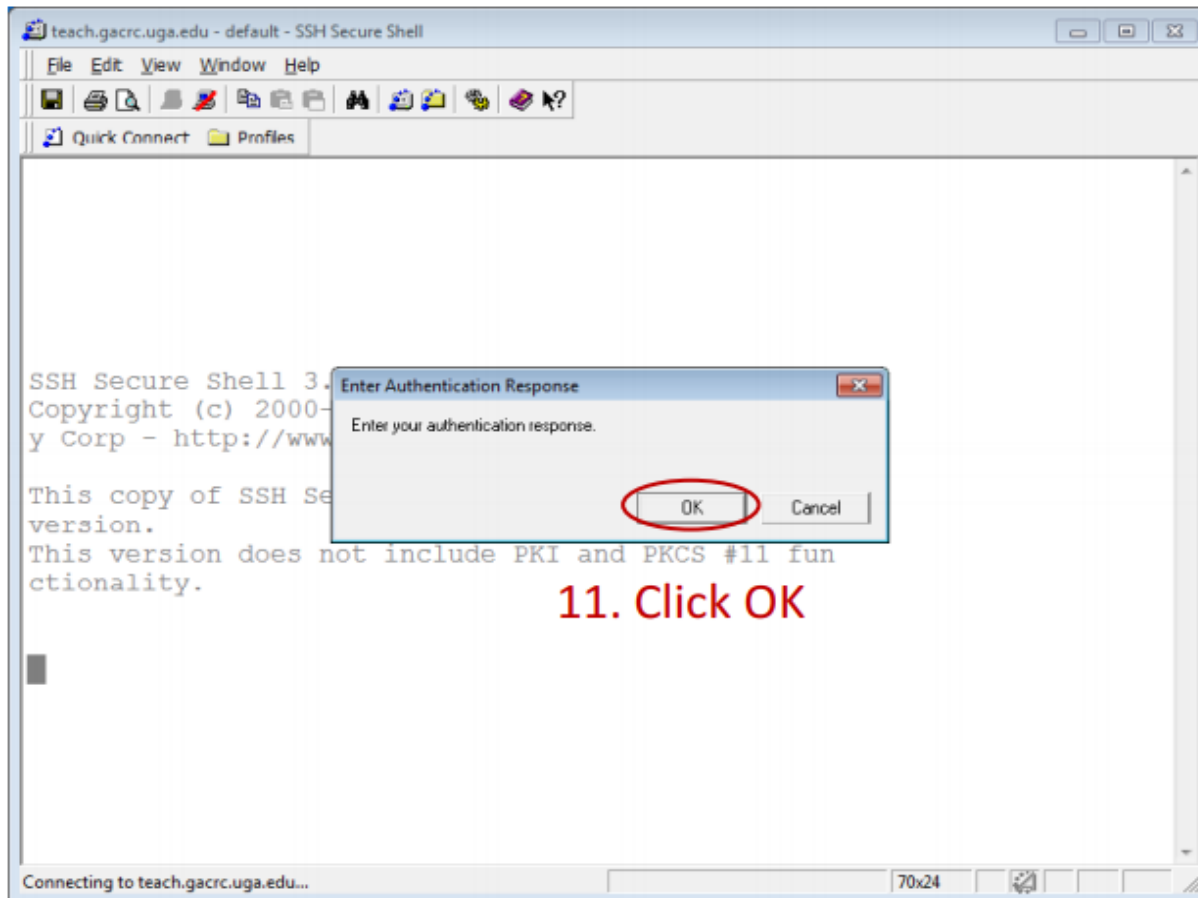
# Step1 (Cont.) - Windows using SSH Secure Utilities



# Step1 (Cont.) - Windows using SSH Secure Utilities



# Step1 (Cont.) - Windows using SSH Secure Utilities



## Step2 - 3: Create and change directory to workDir

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```
[zhuofei@teach ~]$ ls          ← ls command to list folder's contents
[zhuofei@teach ~]$ mkdir workDir ← mkdir command to create a subdirectory
[zhuofei@teach ~]$ ls
workDir
[zhuofei@teach ~]$ cd workDir/ ← cd command to change directory
[zhuofei@teach workDir]$ ls
[zhuofei@teach workDir]$      ← it is empty in workDir!
```

## Step4: Transfer data from local computer to workDir - Mac/Linux

---

1. Connect to Transfer node (MyID@txfer.gacrc.uga.edu) in Terminal on local computer
2. Type scp command: scp (-r) [Source] [Target]
3. Once you input MyID password, scp command will send “push” to your Duo Enrolled mobile device for verification

*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

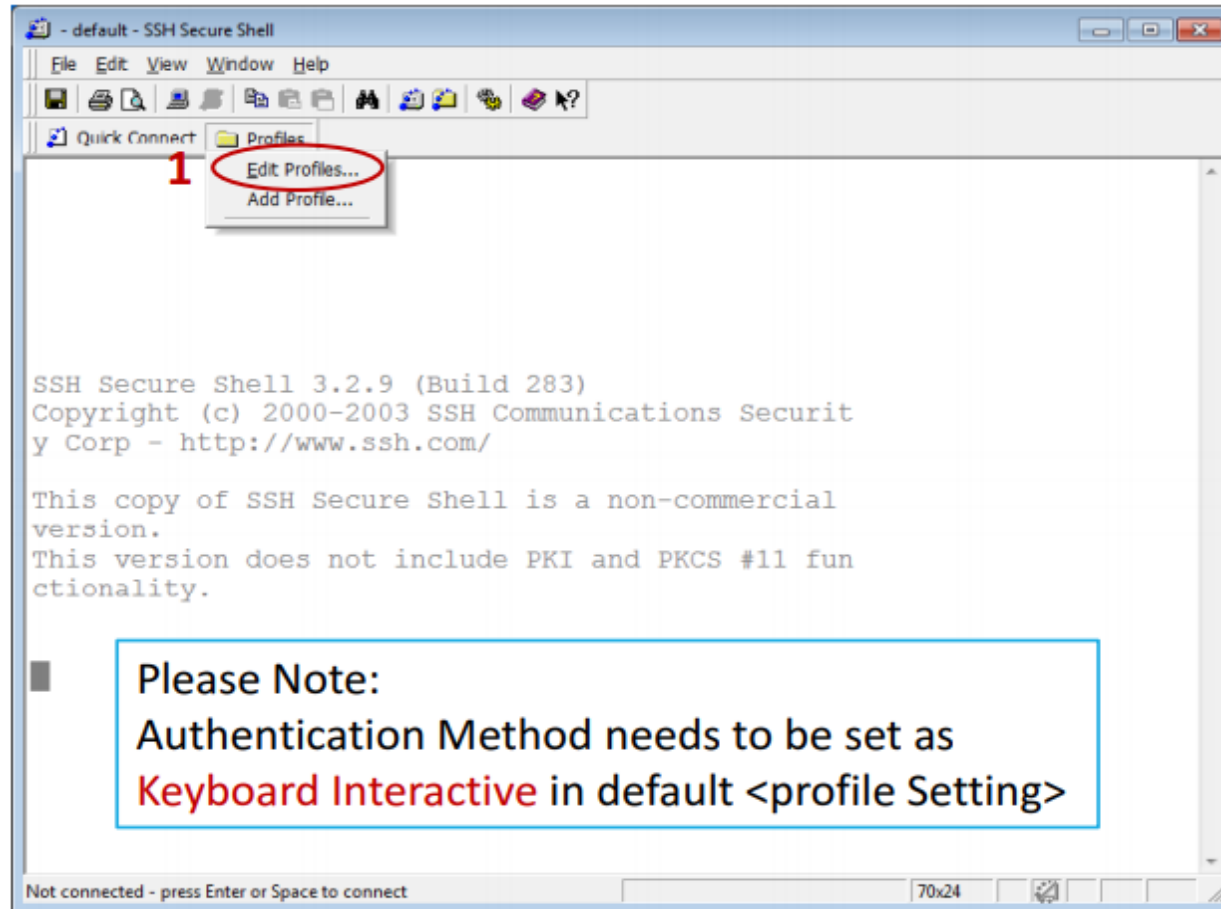
```
scp zhuofei@txfer.gacrc.uga.edu:/home/zhuofei/workDir/file .
```

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

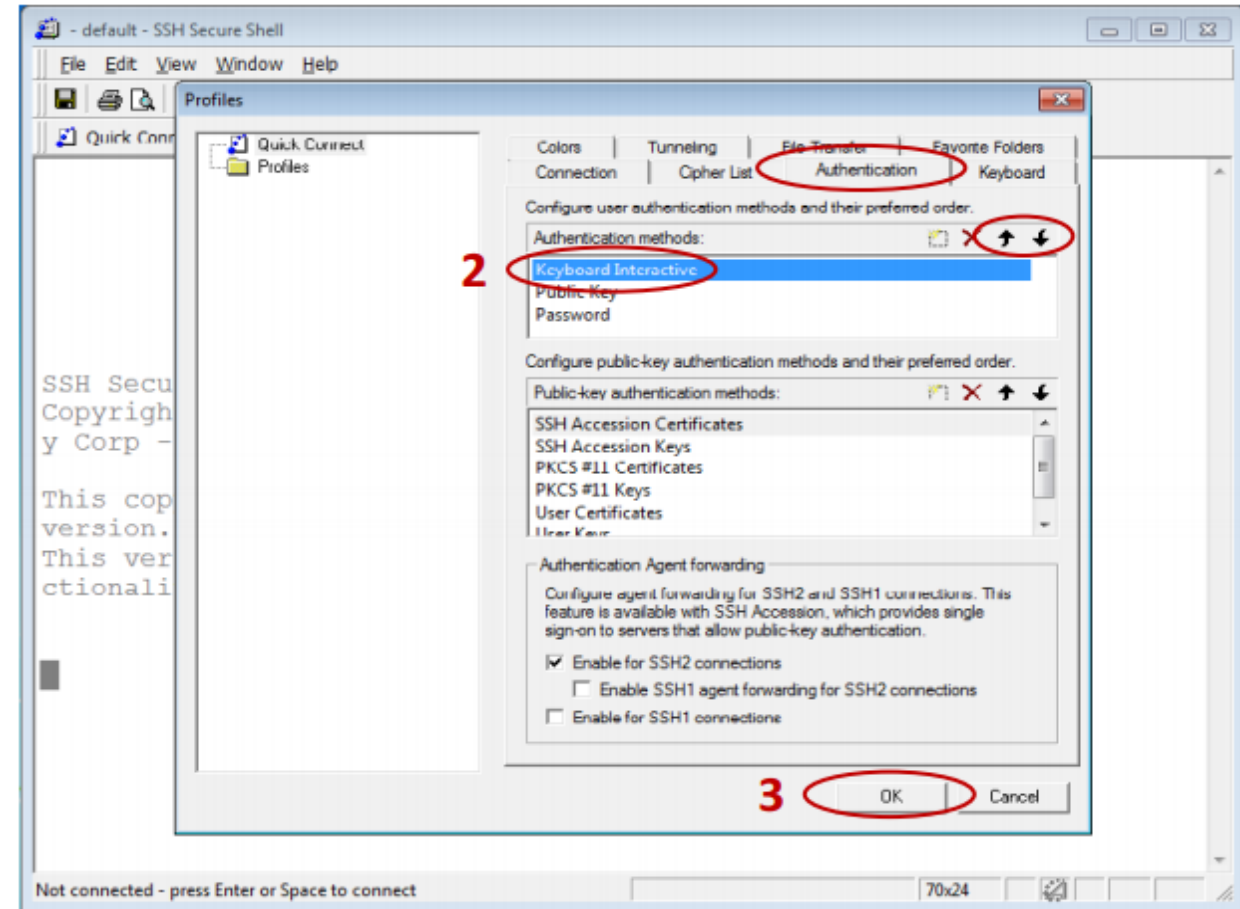
[https://wiki.gacrc.uga.edu/wiki/Transferring\\_Files#The\\_File\\_Transfer\\_node\\_for\\_the\\_teaching\\_cluster\\_.28txfer.gacrc.uga.edu.29](https://wiki.gacrc.uga.edu/wiki/Transferring_Files#The_File_Transfer_node_for_the_teaching_cluster_.28txfer.gacrc.uga.edu.29)



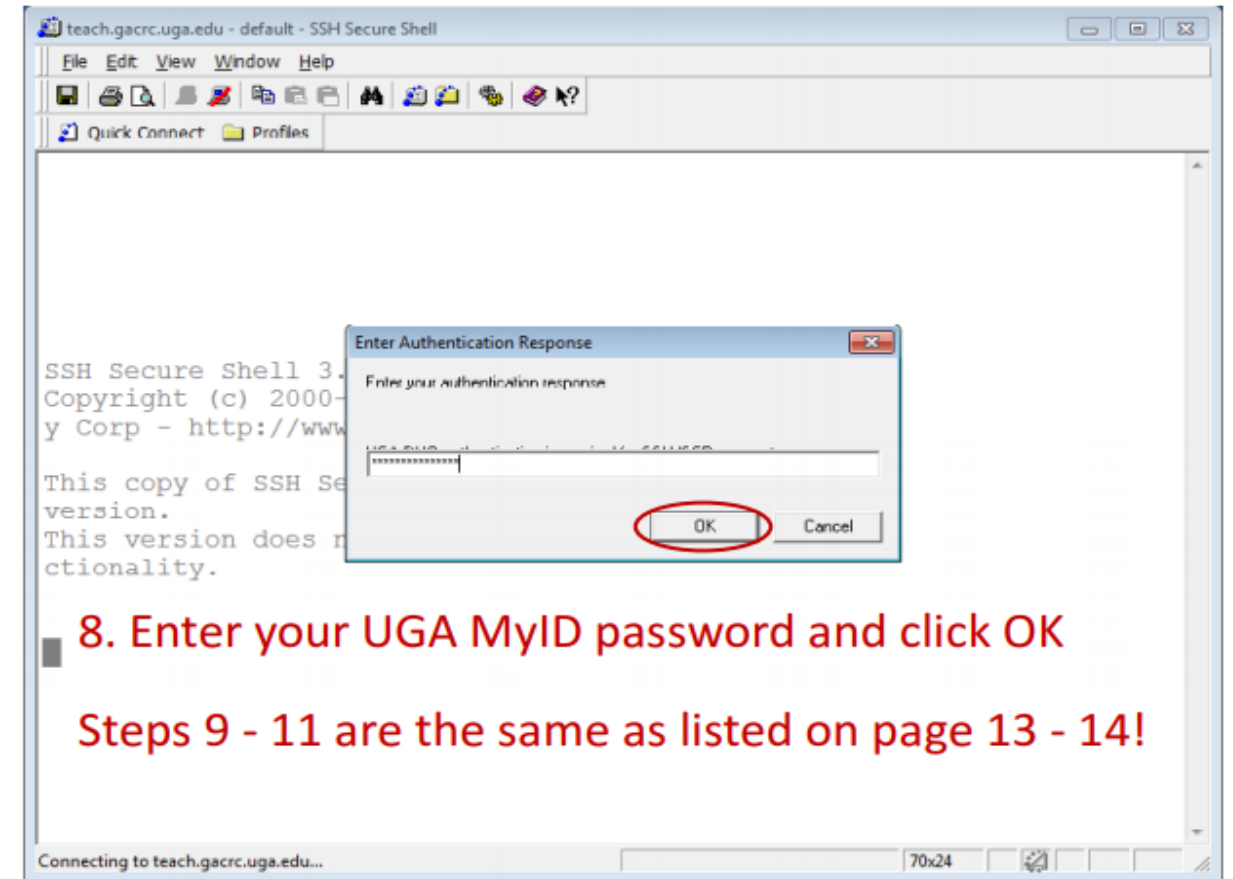
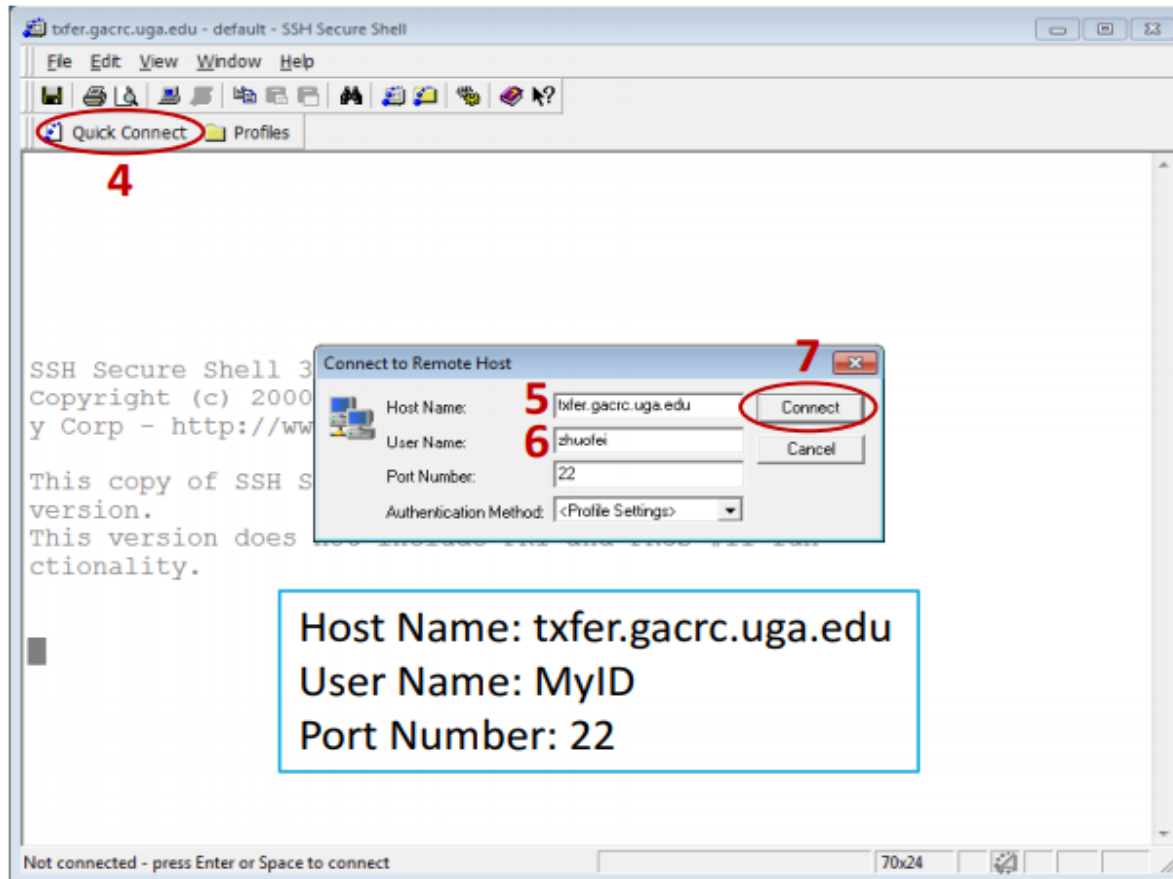
## Step 4 (Cont.) - Windows using SSH Secure Utilities



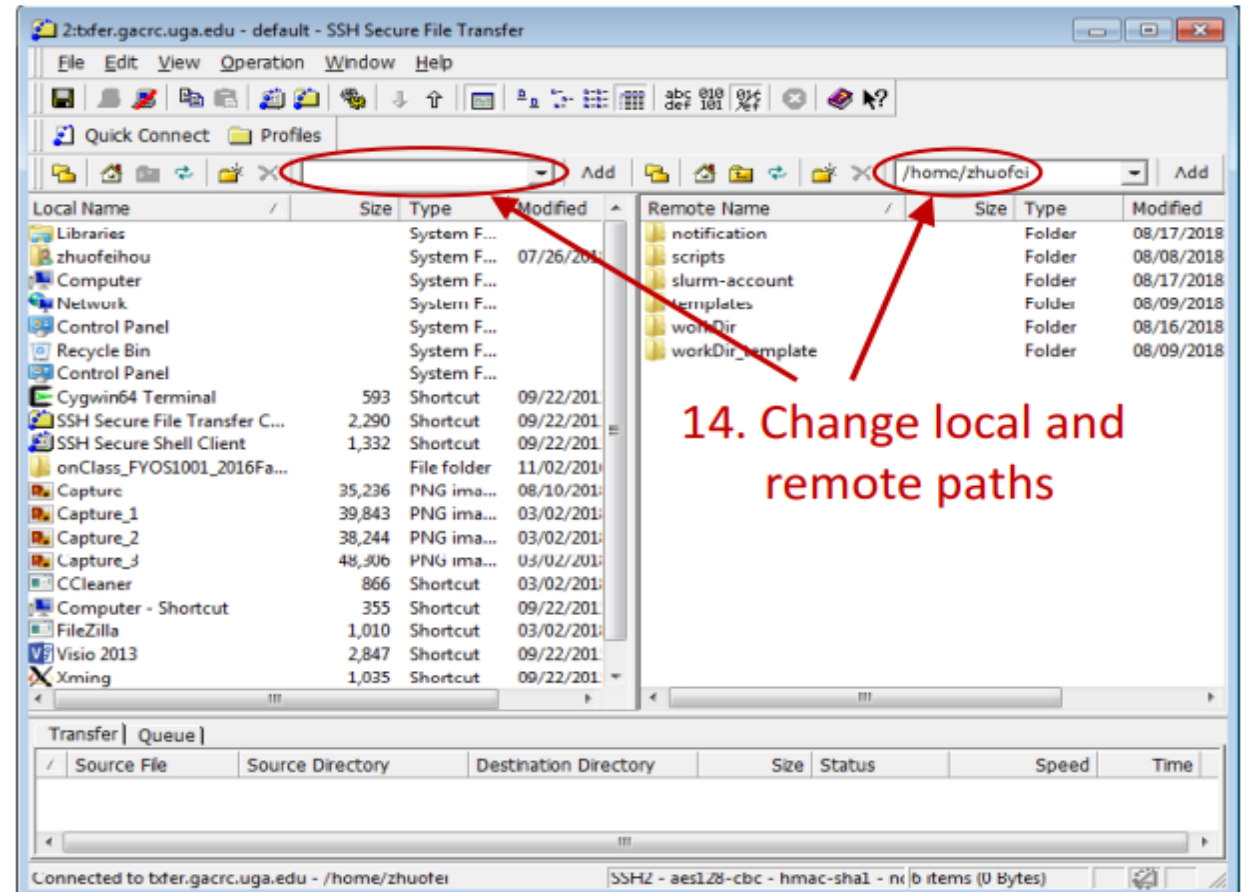
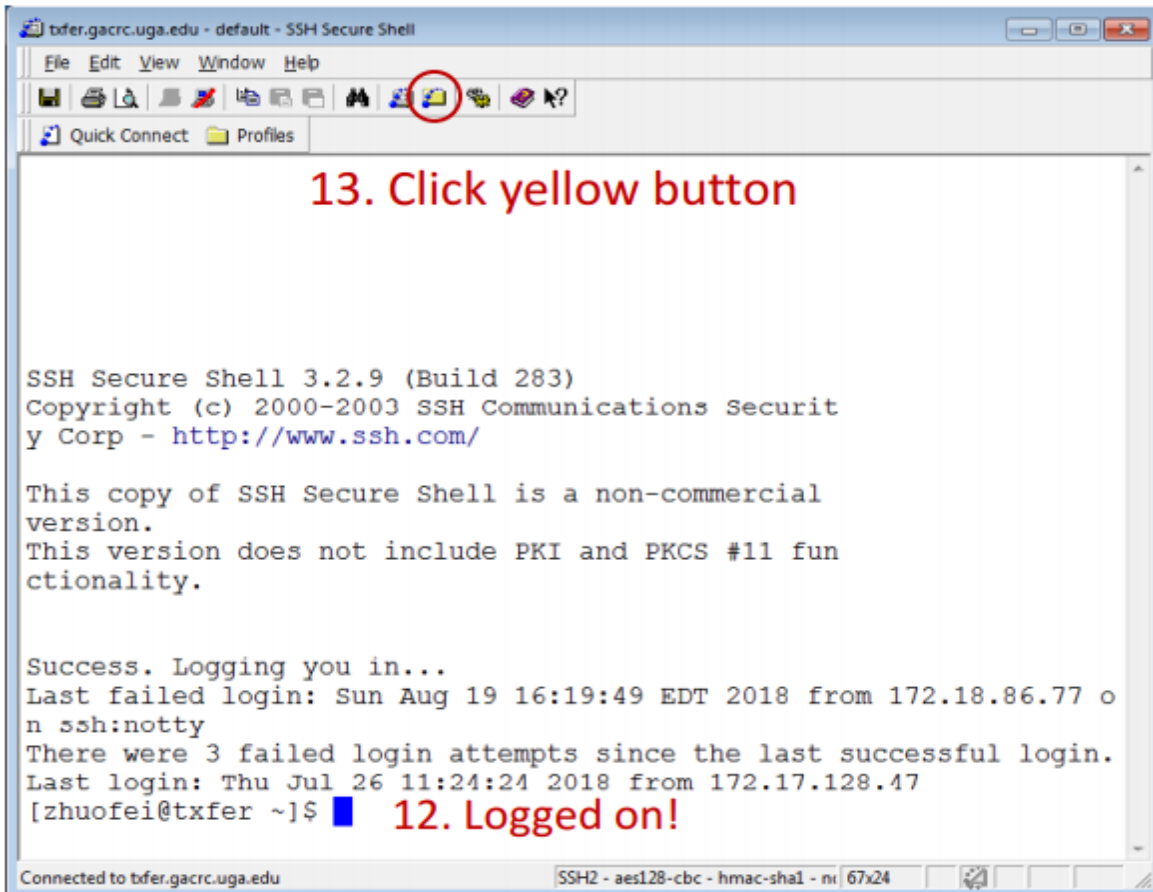
Please Note:  
Authentication Method needs to be set as  
**Keyboard Interactive** in default <profile Setting>



## Step 4 (Cont.) - Windows using SSH Secure Utilities



## Step 4 (Cont.) - Windows using SSH Secure Utilities



## Step 4 (Cont.) - Windows using SSH Secure Utilities

The screenshot shows the SSH Secure File Transfer interface. The local file list on the left includes 'Capture\_1.PNG' (39,843 bytes). The remote file list on the right shows 'Capture\_1.PNG' (39,843 bytes) at the destination '/home/zhuofei'. A green arrow indicates the transfer direction. The transfer queue at the bottom shows the file 'Capture\_1.PNG' being transferred from 'C:\Users\zhuofei\D...' to '/home/zhuofei' with a status of 'Complete'.

Local Name	Size	Type	Modified	Remote Name	Size	Type	Modified
Libraries		System F...		notification		Folder	08/17/2018
zhuofeihou		System F...	07/26/2018	scripts		Folder	08/08/2018
Computer		System F...		slurm-account		Folder	08/17/2018
Network		System F...		templates		Folder	08/09/2018
Control Panel		System F...		workDir		Folder	08/16/2018
Recycle Bin		System F...		workDir_template		Folder	08/09/2018
Cygwin64 Terminal	593	Shortcut	09/22/2018	Capture_1.PNG	39,843	PNG ima...	03/02/2018
SSH Secure File Transfer C...	2,290	Shortcut	09/22/2018				
SSH Secure Shell Client	1,332	Shortcut	09/22/2018				
onClass_FYOS1001_2016Fa...		File folder	11/11/2018				
Capture	35,236	PNG ima...	08/10/2018				
Capture_1	39,843	PNG ima...	03/02/2018				
Capture_2	38,244	PNG ima...	03/02/2018				
Capture_3	48,306	PNG ima...	03/02/2018				
CCleaner	866	Shortcut	03/02/2018				
Computer - Shortcut	355	Shortcut	09/22/2018				
FileZilla	1,010	Shortcut	03/02/2018				
Visio 2013	2,847	Shortcut	09/22/2018				
Xming	1,035	Shortcut	09/22/2018				

Source File	Source Directory	Destination Directory	Size	Status	Speed	Time
Capture_1.PNG	C:\Users\zhuofei\D...	/home/zhuofei	39,843	Complete	51.0 kB/s	00:00:00

15. Drag data between local computer and remote cluster

## Step4 (Cont.): Transfer data on cluster to workDir

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- Log on to Transfer node (MyID@txfer.gacrc.uga.edu)
  - ✓ Mac/Linux: ssh MyID@txfer.gacrc.uga.edu (page 8-9)
  - ✓ Windows: use SSH Secure Client app (page 14-16)

- Directories you can access on txfer:

1. /home/MyID (Landing home)
2. /work/CourseID/MyID
3. /work/CourseID/instructor\_data

- Transfer data between two folders on cluster using **cp** or **mv**, e.g.:

```
mv /work/gene4220/MyID/datafile /home/MyID/workDir
```

## Step5: Make a job submission script in workDir using nano

```
$ nano sub.sh
```

nano is a small and friendly text editor on Linux.

Ctrl-x to save file and quit from nano



```
zhuofei@n124:/lustre1/zhuofei/workDir
GNU nano 2.0.9 File: sub.sh Modified
hello nano! I am Zhuofei!
[ New File ]
^G Get Help      ^O WriteOut     ^R Read File    ^Y Prev Page   ^K Cut Text     ^C Cur Pos
^X Exit          ^J Justify      ^W Where Is    ^V Next Page   ^U UnCut Text   ^T To Spell
```

## Step5 (Cont) .

---

- In /home/MyID/gene4220: Following files are available for all students

```
[pakala@teach gene4220]$ ls
ens ens.def ens.f ens.i01 ens.i02 ens.i12 ens.notes ens.notes~ ens.o00
ens.o01 ens.o02 ens.o04 ens.sh Makefile
```

- Compile source code before submitting the job:
  - gfortran compiler from GCC/4.4.7 to compile FORTRAN source code

```
[pakala@teach gene4220]$ module load GCC/4.4.7
[pakala@teach gene4220]$ ml
Currently Loaded Modules:
  1) StdEnv  2) GMP/4.3.2  3) MPFR/2.4.2  4) GCC/4.4.7
[pakala@teach gene4220]$ make ens
gfortran  ens.f -o ens
```

## Step5: Job Submission Script

---

```
#!/bin/bash
#SBATCH --job-name=ens_job      # Job name
#SBATCH --partition=batch      # Partition (queue) name
#SBATCH --ntasks=1            # Run on a single CPU
#SBATCH --mem=4gb             # Job memory request
#SBATCH --time=168:00:00      # Time limit hrs:min:sec
#SBATCH --output=log.%j.out    # Standard output log
#SBATCH --error=log.%j.err     # Standard error log

cd $SLURM_SUBMIT_DIR
time ./ens
```

More Information: [https://wiki.gacrc.uga.edu/wiki/Running\\_Jobs\\_on\\_the\\_teaching\\_cluster](https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster)



## Step6: Submit a job from workDir using sbatch

---

```
[pakala@teach gene4220]$ sbatch ens.sh  
Submitted batch job 878
```

**Tips:** ens.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 the blast commands

## Step7: Check job status using squeue

---

```
[pakala@teach gene4220]$ squeue -l
Thu Sep 20 13:53:24 2018
JOBID      PARTITION  NAME      USER      STATE      TIME      TIME_LIMI  NODES  NODELIST (REASON)
878        batch     ens_job   pakala     RUNNING    0:17      7-00:00:00  1      c1-38

[pakala@teach gene4220]$ squeue
JOBID PARTITION  NAME      USER      ST  TIME  NODES  NODELIST (REASON)
878    batch     ens_job   pakala     R   1:00    1  c1-38
```

Common STATE: R for Running; PD for PenDing; TO for TimedOut; S for Suspended; 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

```
$ scontrol show job 878
  JobId=878 JobName=ens_job
  UserId=pakala(1941) 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=00:06:01 TimeLimit=7-00:00:00 TimeMin=N/A
  SubmitTime=2018-09-20T13:53:07 EligibleTime=2018-09-20T13:53:07
  StartTime=2018-09-20T13:53:07 EndTime=2018-09-27T13:53:07 Deadline=N/A
  .....
  Partition=batch AllocNode:Sid=teach:15666
  NodeList=c1-38
  NumNodes=1 NumCPUs=1 NumTasks=1 CPUs/Task=1 ReqB:S:C:T=0:0:*:*
  ...
  Command=/home/pakala/gene4220/ens.sh
  WorkDir=/home/pakala/gene4220
  StdErr=/home/pakala/gene4220/log.878.err
  StdOut=/home/pakala/gene4220/log.878.out
```

## Step7 (Cont.): Cancel job using scancel

---

```
[pakala@teach gene4220]$ squeue -l
Thu Sep 20 14:09:12 2018
JOBID PARTITION      NAME      USER      STATE      TIME      TIME_LIMI      NODES NODELIST (REASON)
878      batch      ens_job   pakala    RUNNING    16:05      7-00:00:00     1      c1-38

[pakala@teach gene4220]$ scancel 878

[pakala@teach gene4220]$ squeue -l
Thu Sep 20 14:09:51 2018
JOBID PARTITION      NAME      USER      STATE      TIME      TIME_LIMI      NODES NODELIST (REASON)
```

## Step7 (Cont.): Check node info using sinfo

```
$ sinfo
PARTITION AVAIL  TIMELIMIT  NODES  STATE NODELIST
highmem   up    7-00:00:00    5   idle c1-[36-37,40],c2-[9-10]
gpu       up    1-00:00:00    1   idle c2-2
interq    up    1-00:00:00    3   idle c2-[4-6]
batch     up    7-00:00:00   39   idle c1-[1-35,38-39],c2-[11-12]
```

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

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

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Running Jobs: [https://wiki.gacrc.uga.edu/wiki/Running Jobs on the teaching cluster](https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster)

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

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)

Linux Command: [https://wiki.gacrc.uga.edu/wiki/Command List](https://wiki.gacrc.uga.edu/wiki/Command_List)

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

## GACRC Support [https://wiki.gacrc.uga.edu/wiki/Getting\\_Help](https://wiki.gacrc.uga.edu/wiki/Getting_Help)

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### ➤ Job Troubleshooting:

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

- ✓ Your user name
- ✓ Job ID
- ✓ Job submission script and command you used to submit the job
- ✓ Your working directory on cluster

### ➤ Software Installation:

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

Please note:

1. In general only software widely used by the GACRC computing community will be centrally installed.
2. Make sure of the correctness of datasets being used by your jobs!



## Request Support

\* indicates Required fields.

**Your Name \***

**MyID \***

**E-mail \***

**Phone Number**

**Brief Description**

**Request Details \***

**Cluster**  sapelo2  sapelo  teach  other

- \* For questions on cluster or software, please include the command/script used, working path and working nodes (interactive / queue name) if applicable.
- \* For software installation, please specify software name, version and include link to the software if applicable.
- \* Please review your message on the next page and then click the Submit button.





Thank You!