



# Basic Shell Commands SSH Omega & Gamma servers

[www.luguta.org](http://www.luguta.org)

Rohit Rawat



# Using Linux Occasionally

- Install it on a virtual machine on your laptop
  - Virtual machines are safe – your actions cannot harm the data on your computer (unless you are sharing folders with the host)
  - Quickly switch between Windows/macOS and Linux
  - No need to reboot unlike with dual-booting
  - Installation help: [http://www.uta.edu/studentorgs/lug/files/LUG\\_Intro\\_Linux.pdf](http://www.uta.edu/studentorgs/lug/files/LUG_Intro_Linux.pdf)
- Use Cygwin - It directly interacts with your files, potentially risky
- Dual boot – risky meddling with partitions and bootloaders, reboot waiting times
- Use the Unix accounts provided by UTA
  - Uses SSH (Secure Shell) software
  - Omega and Gamma servers
  - More info: <http://www.uta.edu/oit/cs/unix/UNIX--Linux.php>
  - You cannot install new programs on these servers



# Accessing the terminal

- Why the shell?
  - Server computers do not have graphical interfaces; most don't even have monitors/keyboards plugged in and use remote shells
  - Shell commands can achieve the same or higher functionality than the graphical desktop
  - The shell can be harder to use, but is necessary sometimes
- On Ubuntu, open the program called “Terminal”
- On MacOS, run “Terminal” under /Applications/Utilities
- On Windows, if you don't have an Ubuntu VM, run the “SSH Client” program or “Putty”



# Filesystem Commands

- `pwd` – tells you which directory are you currently in
- `ls` – list files in current directory
- `cp` – copy files
  - `cp hello.txt world.txt` - copies hello.txt to/over world.txt
- `mv` – move files
  - `mv hello.txt world.txt` - renames hello.txt to world.txt
- `rm` – delete files
  - `rm hello.txt` - *permanently* deletes hello.txt – remember, there is no undo or recycle bin!
- `cd` – change directory
  - `cd Documents` - goes to the Documents folder
  - `cd ..` - goes one folder level up
- `mkdir` – create a new directory
  - `mkdir projects` - creates a new directory named projects under the current directory
- All commands and filenames are case sensitive
- Filenames with spaces and funny characters must be “quoted”, e.g., “Hello World.cpp”



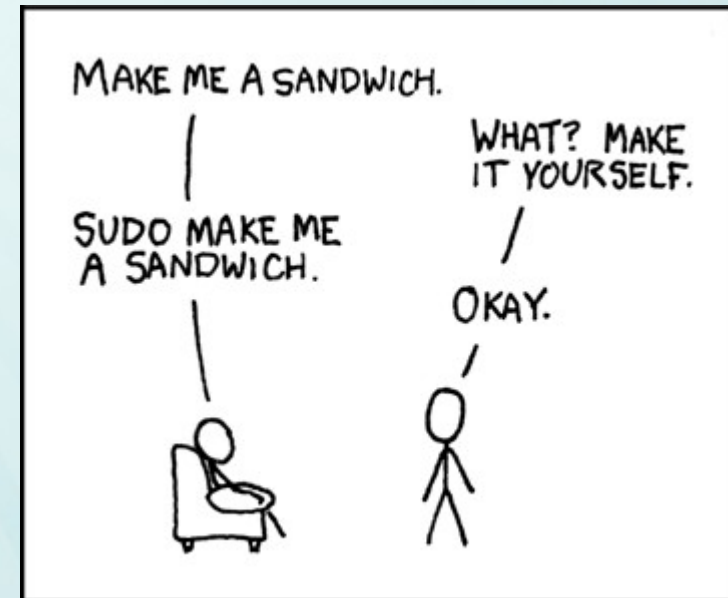
# File Creation and Processing

- `cat` – display the contents of a file
  - `cat hello.txt` - displays `hello.txt` in the current directory
  - `cat /home/rohit/Documents/hello.txt` - using absolute path for `hello.txt`
  - `cat ../Pictures/hello.txt` - uses a relative path
- `nano` – edit a text file
- `grep` – search text files or the output of other commands
  - `grep Linux hello.txt` - searches for `Linux` in `hello.txt`



# Administration

- `sudo` – run a command as the super user
  - Do not use `sudo` for every command you run!
- `apt-get` – package management & update
  - To update your Linux system:  
`sudo apt-get update && sudo apt-get upgrade`
  - To install packages: C/C++ compilers:  
`sudo apt-get install build-essential`
  - To install the Java compiler  
`sudo apt-get install openjdk-7-jdk`
  - To install the OpenCV library  
`sudo apt-get install libopencv-dev`





# Omega/Gamma accounts

- Omega is typically used for computer programming and database applications.
- Gamma has many engineering software installed.
- Both account are disabled by default (maybe)
  - To enable, login at: <https://ithelp.uta.edu/>
    - Use your net-ID and password
    - Complete the form as shown on the next page
  - CSE students' accounts might already be enabled
  - Your instructor may have already requested this for you
- You must be on the UTA network or on UTA VPN to access these servers.



# Requesting Unix accounts

|                 |                        |   |
|-----------------|------------------------|---|
| Type Of Ticket  | Request                | ▼ |
| Service         | *Accounts & Passwords  | ▼ |
| Category        | NetID                  | ▼ |
| SubCategory     | Student                | ▼ |
| Type Of Request | New Linux/Unix Account | ▼ |

The information below is required in order to resolve this service request in a timely manner.

|                            |                                     |   |
|----------------------------|-------------------------------------|---|
| Modification requested for | Individual                          | ▼ |
| NetID                      | jxd1234                             |   |
| Course Number              |                                     |   |
| Course Section             |                                     |   |
| Omega                      | <input checked="" type="checkbox"/> |   |
| Gamma                      | <input type="checkbox"/>            |   |
| MySQL                      | <input type="checkbox"/>            |   |
| Oracle                     | <input type="checkbox"/>            |   |





# Connecting to the server

- SSH is a protocol for secure communication between a **client** and a **server**
- The **server** in this case is omega.uta.edu
- You install an SSH **client** on your machine
  - Get the windows client from [here](#)
  - Linux/MacOS come with an SSH client pre-installed



# Software on Omega

- C, C++, Python, Java compilers
- Oracle and MySQL databases
- SAS
- Mathematica
- ...
- See: <http://omega.uta.edu/>



# Software on Gamma

- MATLAB
- Electronics
  - ADS
  - Cadence
  - EM Pro
  - IC Cap
- ANSYS
- ...



# High Performance Computing (HPC) Cluster

- Only for researchers and faculty
- Lengthy or parallel computing tasks
- Available software:
  - ANSYS, Materials Studio, MATLAB, Mathematica
  - Compilers for C, C++, Java, FORTRAN, MPI
- Knowledge of job scheduling tools required
- More information here:

<https://www.uta.edu/oit/eos/hpc/>



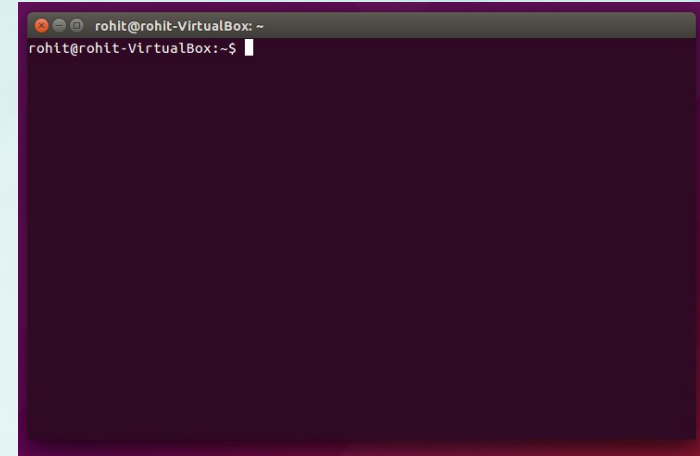
# Installing SSH client

- If you are running Linux no extra software is needed. The SSH client and X11 packages are pre-installed.
- On Windows, you need to install:
  - [SSH client](#) (UTA provided) or [Putty](#)  
and
  - [Xming](#) (this allows you to run graphical software over SSH)
- On MacOS, the SSH client is included.
  - You can install [XQuartz](#) to run graphical software



# Connecting

- On Linux/Mac/Cygwin, open a Terminal and run  
`ssh -X jxd1234@omega.uta.edu`  
where jxd1234 is your NetID. Uppercase 'X'.
  - *Jump to the next slide.*
- On Windows, install the Secure Shell Client
  - Create a new profile with
    - Hostname: omega.uta.edu
    - Port: 22
    - Username: jxd1234 (use your NetID)
    - Tunnelling → X11 → Enable X11 forwarding
    - Save each page by clicking OK, verify your settings
  - Create one more profile and replace omega.uta.edu with gamma.uta.edu for the Gamma server
  - [Video on installing and using the Windows SSH client](#)





# Your remote shell

```
rohit@MyPC:~$ ssh -X rxr1234@omega.uta.edu
The authenticity of host 'omega.uta.edu (129.107.56.23)' can't be established.
RSA key fingerprint is 25:0c:8a:b2:3c:d5:dd:dd:0c:3d:6b:0c:24:45:9e:77.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'omega.uta.edu,129.107.56.23' (RSA) to the list of known
hosts.
```

```
This UT Arlington information resource, including all related equipment,
networks and network devices, is provided for authorized use only. All
unauthorized use of this information resource is prohibited. Misuse is
subject to criminal prosecution and/or administrative or other
disciplinary action.
```

```
...
```

```
Usage of this information resource constitutes consent to all policies
and procedures set forth by UT Arlington and there is no expectation of
privacy except as otherwise provided by applicable privacy laws.
```

```
rxr1234@omega.uta.edu's password: <invisible password>
Last login: Tue Oct 6 07:03:52 2015 from asa-resnet.uta.edu
[rxr1234@omega ~]$
```

You won't see your password as you type it – which is normal.



# Basic commands

```
[rxr1234@omega ~]$ pwd  
/home/r/rx/rxr1234
```

```
[rxr1234@omega ~]$ ls  
abc.cpp  hello_world.m  hpeesof  launcher.120.log
```

```
[rxr1234@omega ~]$ logout
```

```
Connection to omega.uta.edu closed.  
rohit@MyPC:~$
```





# Example: MATLAB on Gamma

```
[rxr1234@gamma ~]$ matlab
```

You should see the MATLAB GUI load on your machine.

If you receive a message:

“Warning: No display specified. You will not be able to display graphics on the screen.”

It means that you forgot to enable X11 tunneling or the -X flag in the SSH client. Go back to profile settings to make sure your settings are correct.

To verify:

```
[rxr1234@gamma bin]$ echo $DISPLAY  
localhost:10.0
```



# Example: Compiling C++ code

```
[rxr1234@omega ~]$ pwd
/home/r/rx/rxr1234
[rxr1234@omega ~]$ gedit hello_world.cpp
[rxr1234@omega ~]$ g++ hello_world.cpp -o hello_world.run
[rxr1234@omega ~]$ ./hello_world.run
Hello World
[rxr1234@omega ~]$
```

Without X11 forwarding, “gedit” will not work. You can use a text-only editor like nano  
`nano hello_world.cpp`

Press Ctrl-x, then press y, then Enter to save the file and exit.



# Example: Background execution

```
[rxr1234@omega ~]$ nohup ./hello_world.run &
[1] 8204
[rxr1234@gamma ~]$ nohup: appending output to `nohup.out'

[rxr1234@gamma ~]$ cat nohup.out
10
9
[rxr1234@gamma ~]$ cat nohup.out
10
9
8
7
6
5
4
3
2
1
[1]+  Done                  nohup ./hello_world.run
[rxr1234@gamma ~]$
```



# Transferring files

- You can use the SFTP client

The image shows a terminal window on the left and an SFTP client window on the right. The terminal window displays the prompt 'login: Tue Feb 10 01:12:23 2015 from asa-r' followed by a series of asterisks and the text 'UNIVERSITY OF TEXAS A'. The SFTP client window shows a file list with columns for Local Name, Size, Type, Remote Name, Size, and Type. The file list includes 'Libraries', 'Rohit', 'Computer', 'Network', 'Control Panel', 'Recycle Bin', 'Control Panel', 'Mozilla Firefox', 'SSH Secure File Transfer C...', and 'SSH Secure Shell Client'. The 'SSH Secure File Transfer C...' entry is highlighted with a red arrow. Below the file list is a 'Transfer Queue' table with columns for Source File, Source Directory, Destination Dire..., Size, Status, Speed, and Time.

| Local Name                    | Size  | Type      | Remote Name      | Size | Type    |
|-------------------------------|-------|-----------|------------------|------|---------|
| Libraries                     |       | System F. | hpeesof          |      | Folder  |
| Rohit                         |       | System F. | hello_world.m    | 47   | M File  |
| Computer                      |       | System F. | launcher.120.log | 114  | Text Do |
| Network                       |       | System F. |                  |      |         |
| Control Panel                 |       | System F. |                  |      |         |
| Recycle Bin                   |       | System F. |                  |      |         |
| Control Panel                 |       | System F. |                  |      |         |
| Mozilla Firefox               | 1,151 | Shortcut  |                  |      |         |
| SSH Secure File Transfer C... | 2,294 | Shortcut  |                  |      |         |
| SSH Secure Shell Client       | 1,336 | Shortcut  |                  |      |         |

| Source File | Source Directory | Destination Dire... | Size | Status | Speed | Time |
|-------------|------------------|---------------------|------|--------|-------|------|
|-------------|------------------|---------------------|------|--------|-------|------|

Connected to gamma.uta.edu - /hor SSH2 - arcfour - hmac-sha1 - none 3 items (161 B)

You can drag and drop files from the server.



# Transferring files

- Or you can use SCP. Copy file.zip on your machine to your home directory on Gamma (determined using pwd earlier).

```
[rohit@MyPC ~]$ scp file.zip rxr1234@gamma.uta.edu:/home/r/rx/rxr1234/
```

```
This UT Arlington information resource, including all related equipment,  
...
```

```
rxr1234@gamma.uta.edu's password: <invisible password>
```

```
file.zip                100% 1492      1.5KB/s   00:00
```

```
[rohit@MyPC ~]$ ssh -X rxr1234@gamma.uta.edu
```

```
[rxr1234@gamma ~]$ ls
```

```
file.zip
```

```
[rxr1234@gamma ~]$ unzip file.zip
```

```
scp file.zip rxr1234@gamma.uta.edu:/home/r/rx/rxr5243/
```

and

```
scp file.zip rxr1234@gamma.uta.edu:
```

are equivalent. For any other destination folder, you must provide the full path after the ":"



# Transferring files

- Copy file.zip on the Gamma server to the current local folder (./).

```
[rohit@MyPC ~]$ scp rxr1234@gamma.uta.edu:/home/r/rx/rxr1234/file.zip ./
This UT Arlington information resource, including all related equipment,
...
rxr1234@gamma.uta.edu's password: <invisible password>
file.zip                               100% 1492      1.5KB/s   00:00

[rohit@MyPC ~]$ ls
file.zip
[rohit@MyPC ~]$ unzip file.zip
```

```
scp file.zip rxr1234@gamma.uta.edu:/home/r/rx/rxr5243/
and
scp file.zip rxr1234@gamma.uta.edu:
```

are equivalent. For any other destination folder, you must provide the full path after the “:”



# QnA

- What is Xming / XQuartz?
  - Linux uses a client (application sends drawing commands) – server (draws them on the screen) approach to graphics. Read about X11. With X forwarding, the program runs on the remote machine but sends drawing commands to you over the SSH link and your local X server draws them here on your machine.
  - Xming is an X server written for Windows.
  - XQuartz is an X server written for MacOSX.



# QnA

- Can we access Omega/Gamma from home?
  - You must be on the UTA network or on ResNet to access these servers.
  - From home, you can establish a VPN connection to get on the UTA network. See:

<http://www.uta.edu/oit/cs/software/vpn/>





# QnA

- Tar and Zip usage?
  - Create a ZIP archive from two files:
    - `zip output.zip input_file1 input_file2`
  - Create a ZIP archive from all files in a directory
    - `cd ..` (go to the parent directory)
    - `zip -r output.zip directory_name`
  - Unzip:
    - `unzip output.zip`
  - Create a compressed tarball from two files:
    - `tar -cvzf output.tar.gz input_file1 input_file2`
  - Create a ZIP archive from all files in a directory
    - `cd ..` (go to the parent directory)
    - `tar -cvzf output.tar.gz directory_name`
  - Untar:
    - `tar -xvzf output.tar.gz`



# QnA

- Why do I need to use “./program-name” instead of “program-name” to run it?
  - A system variable called PATH defines where all the programs are installed and usable on your machine  
rohit@rohit-VirtualBox:~\$ echo \$PATH  
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games
  - Only programs stored in these folders are allowed to be run by typing “program-name”. This is a security feature to prevent unintended execution of files in the current directory having the same name as another program.
  - To run a program stored anywhere outside of your \$PATH, you must explicitly specify its path. “.” is the path of the current folder, so “./program-name” is used to execute a program in the current directory.