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Linux: A Command Line Perspective!

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ritlug.com/get-involved, rit-lug.slack.com

Command Rapid Fire



pwd

“Present Working Directory” Tells you the absolute path of the folder you are “in”

```
[jeff@LAPTOP-CVJ54CBV] - [~/dot_files/docker] - [2020-08-26 07:46:21]
[0] <git:(master 3d9584a) > pwd
/home/jeff/dot_files/docker
```

ls

“List” Tells you what is in your current directory.

Popular arguments:

- a all files(including hidden)
 - l list view rather than grid
- also shows you permissioning and ownership info

```
jeff@LAPTOP-CVJ54CBV:~/dot_files/docker$ ls
gitea  jupyterlab
jeff@LAPTOP-CVJ54CBV:~/dot_files/docker$ ls -la
total 16
drwxr-xr-x 4 jeff jeff 4096 Aug 26 19:50 .
drwxr-xr-x 4 jeff jeff 4096 Aug 21 12:04 ..
-rw-r--r-- 1 jeff jeff    0 Aug 26 19:50 .hidden_spooky_file
drwxr-xr-x 2 jeff jeff 4096 Aug 21 12:04 gitea
drwxr-xr-x 3 jeff jeff 4096 Aug 21 12:04 jupyterlab
jeff@LAPTOP-CVJ54CBV:~/dot_files/docker$
```

mv

“moves” Moves files. AKA: only way to rename a file

```
[jeff LAPTOP-CVJ54CBV] - [~/dot_files/docker] - [2020-08-26 07:52:19]
[0] <git:(master 3d9584a) > ls
./ ../ .hidden_spooky_file gitea/ jupyterlab/
[jeff LAPTOP-CVJ54CBV] - [~/dot_files/docker] - [2020-08-26 07:52:20]
[0] <git:(master 3d9584a) > mv .hidden_spooky_file ../.hidden_spooky_file
[jeff LAPTOP-CVJ54CBV] - [~/dot_files/docker] - [2020-08-26 07:52:44]
[0] <git:(master 3d9584a) > cd ..
./      .git/      .ideavimrc  README.md  fixSSHfilePermissions.sh
../     .gitconfig .vimrc     backup.sh  install.sh
.bashrc .hidden_spooky_file .zshrc     docker/    renew_certs.sh
[jeff LAPTOP-CVJ54CBV] - [~/dot_files] - [2020-08-26 07:52:49]
[0] <git:(master 3d9584a) >
```

cp

“Copy” Copy file/folder

```
[jeff LAPTOP-CVJ54CBV] - [~] - [2020-08-26 07:54:30]
[0] <> cd temp
./ ../
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:54:31]
[0] <> touch empty1.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:54:39]
[0] <> ls
./ ../ empty1.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:54:47]
[0] <> cp empty1.txt tempty2.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:55:00]
[0] <> ls -la
total 8
drwxr-xr-x  2 jeff jeff 4096 Aug 26 19:55 ./
drwxr-xr-x 15 jeff jeff 4096 Aug 26 19:55 ../
-rw-r--r--  1 jeff jeff   0 Aug 26 19:54 empty1.txt
-rw-r--r--  1 jeff jeff   0 Aug 26 19:55 tempty2.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:55:02]
[0] <>
```

chmod

```
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:55:02]
[0] <> man chmod
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 08:04:07]
[0] <> ls -la
total 8
drwxr-xr-x  2 jeff jeff 4096 Aug 26 19:55 ./
drwxr-xr-x 15 jeff jeff 4096 Aug 26 20:04 ../
-rw-r--r--  1 jeff jeff   0 Aug 26 19:54 empty1.txt
-rw-r--r--  1 jeff jeff   0 Aug 26 19:55 empty2.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 08:04:11]
[0] <> chmod 700 empty1.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 08:04:29]
[0] <> ls -la
total 8
drwxr-xr-x  2 jeff jeff 4096 Aug 26 19:55 ./
drwxr-xr-x 15 jeff jeff 4096 Aug 26 20:04 ../
-rwx----- 1 jeff jeff   0 Aug 26 19:54 empty1.txt
-rw-r--r--  1 jeff jeff   0 Aug 26 19:55 empty2.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 08:04:32]
[0] <> chmod 777 empty1.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 08:04:45]
[0] <> ls -la
total 8
drwxr-xr-x  2 jeff jeff 4096 Aug 26 19:55 ./
drwxr-xr-x 15 jeff jeff 4096 Aug 26 20:04 ../
-rwxrwxrwx  1 jeff jeff   0 Aug 26 19:54 empty1.txt
-rw-r--r--  1 jeff jeff   0 Aug 26 19:55 empty2.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 08:04:47]
[0] <>
```

“Changes File Mode”

Allows you to change to read/write/execute permissions on your file.

Format: `chmod mode file_name`

Popular modes:

- R recursive
- +x executable (for single file)
- 644
- 666
- 755

Mode Format:

- user:group:other
- 4 = read
- 2 = write
- 1 = execute
- 0 = no permissions

chown

“Change file Owner and Group”

Command format:

`chown user:group filename`

Popular Flags:

`-R` recursive

```
root@LAPTOP-CVJ54CBV:/home/jeff/temp# ls -la
total 8
drwxr-xr-x  2 jeff jeff 4096 Aug 26 19:55 .
drwxr-xr-x 15 jeff jeff 4096 Aug 26 20:08 ..
-rwxrwxrwx  1 jeff jeff   0 Aug 26 19:54 empty1.txt
-rw-r--r--  1 jeff jeff   0 Aug 26 19:55 tempty2.txt
root@LAPTOP-CVJ54CBV:/home/jeff/temp# chown root:jeff empty1.txt
root@LAPTOP-CVJ54CBV:/home/jeff/temp# ls -la
total 8
drwxr-xr-x  2 jeff jeff 4096 Aug 26 19:55 .
drwxr-xr-x 15 jeff jeff 4096 Aug 26 20:08 ..
-rwxrwxrwx  1 root jeff   0 Aug 26 19:54 empty1.txt
-rw-r--r--  1 jeff jeff   0 Aug 26 19:55 tempty2.txt
root@LAPTOP-CVJ54CBV:/home/jeff/temp# chown root:root empty1.txt
root@LAPTOP-CVJ54CBV:/home/jeff/temp# ls -la
total 8
drwxr-xr-x  2 jeff jeff 4096 Aug 26 19:55 .
drwxr-xr-x 15 jeff jeff 4096 Aug 26 20:08 ..
-rwxrwxrwx  1 root root   0 Aug 26 19:54 empty1.txt
-rw-r--r--  1 jeff jeff   0 Aug 26 19:55 tempty2.txt
root@LAPTOP-CVJ54CBV:/home/jeff/temp#
```


cat

“conCATenates” file and prints to STDOUT

Command format:

cat filename

```
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 08:10:59]
[0] <> vim empty1.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 08:11:24]
[0] <> cat empty1.txt
No longer an empty file.

Cat!

[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 08:11:27]
[0] <>
```

more, less

Files that enable you to page through output of a large files/logs/commands

Command format:

more/less **filename**

More:

“Basic”

Less:

More, but, you can also do things like go backwards.

```
# Alias for markdown paragraph formatter
alias pp="python3 /home/jeff/scripts/RandomScripts/other/markd

# Alias for moving to common directories
alias blog="cd /home/jeff/Documents/git/NodeJSBlog/blogContent

# auto ls when you change directories
function cd {
    builtin cd "$@" && ls
}

# Function that removes all files with a specific extension.
function begone
{
    if [ $# -eq 1 ]
--More--(83%)
```

grep

Allows you to search for text in files via text matching or by using regular expressions. If it matches your pattern, it will print out that line in the folder

Command format:

```
grep flags search_pattern file/folder
```

Popular Flags:

- n print line number
- r recursive -- useful when searching entire folder

```
[jeff LAPTOP-CVJ54CBV] - [~] - [2020-08-26 08:31:24]
[0] > grep -nr "roosay" scripts/
Binary file scripts/bash_manager/src/__pycache__/configuration
scripts/bash_manager/src/configuration.py:141: alias
scripts/bash_manager/src/.zshrc:90:alias roosay="python3
scripts/bash_manager/README.md:18:roosay is a simple pyth
scripts/bash_manager/README.md:22:python3 roosay.py Super
scripts/bash_manager/README.md:26:roosay super cool messa
[jeff LAPTOP-CVJ54CBV] - [~] - [2020-08-26 08:31:46]
[0] <>
```

top, htop

```
last pid: 21417; load averages: 0.35, 0.31, 0.31
65 processes: 1 running, 64 sleeping
CPU: 1.3% user, 0.0% nice, 0.8% system, 0.0% idle
Mem: 374M Active, 1913M Inact, 28G Wired, 887M Buff, 0.0% MemFree
ARC: 23G Total, 2812M MFU, 20G MRU, 235K Anon, 1.28:1 Ratio
Swap: 8192M Total, 8192M Free
```

PID	USER	PRI	NI	VIRT	RES	S	CPU%	MEM%	TIME+	Command
3141	root	22	0	161M	147M	S	0.2	0.5	0:11.44	/usr/local/sbin/smbd --daemon --configfile=/usr/local/etc/smbd.conf
21425	jeff	20	0	9232	4392	R	0.0	0.0	0:00.01	htop
21391	jeff	21	0	8936	5948	S	0.0	0.0	0:00.04	-zsh
21390	jeff	20	0	12916	8072	S	0.0	0.0	0:00.00	sshd: jeff@pts/0
21388	root	21	0	12916	8036	S	0.0	0.0	0:00.01	sshd: jeff [priv]
1629	public	20	0	10164	6124	S	0.0	0.0	0:00.56	/usr/libexec/sftp-server -l ERROR -f AUTH
1629	public	20	0	12916	8224	S	0.0	0.0	0:00.75	sshd: public@notty
64691	989	63	20	788M	701M	uw	0.0	0.0	0:00.01	sshd: public [priv]
21417	jeff	1	21	7940K	4072K	CP	0.0	0.0	0:00.62	/usr/libexec/sftp-server -l ERROR -f AUTH
2267	nobody	1	20	6928K	3096K	se	0.0	0.0	0:01.03	sshd: jeff@notty
54248	nobody	1	20	6928K	3016K	se	0.0	0.0	0:00.01	sshd: jeff [priv]
53137	root	1	20	29404K	18456K	se	0.0	0.0	0:00.30	/usr/libexec/sftp-server -l ERROR -f AUTH
231	root	21	20	315M	258M	kq	0.0	0.0	0:00.53	sshd: jeff@notty
5079	root	6	20	122M	42276K	se	0.0	0.0	0:00.01	sshd: jeff [priv]
1629	public	1	20	12916K	8224K	se	0.0	0.0	0:00.20	nginx: worker process
1621	jeff	1	20	12916K	8268K	se	0.0	0.0	0:00.71	/usr/sbin/cron -J 15 -s
3158	root	8	20	33600K	11612K	select	14	4:41	0.00%	rrdcached
21390	jeff	1	20	12916K	8052K	select	13	0:00	0.00%	sshd
2936	root	1	20	12488K	12596K	select	8	0:18	0.00%	ntpd
3325	root	1	20	115M	100M	kqread	7	0:17	0.00%	uwsgi-3.6
53147	root	1	20	37376K	23424K	select	9	0:04	0.00%	winbindd
3532	root	11	20	148M	104M	nanslp	4	28:33	0.00%	collectd
340	root	2	20	122M	106M	piperd	12	1:32	0.00%	python3.6
344	root	2	20	122M	107M	usem	9	1:30	0.00%	python3.6
343	root	2	20	122M	107M	usem	6	1:29	0.00%	python3.6
341	root	2	20	122M	107M	usem	14	1:29	0.00%	python3.6
342	root	2	20	122M	107M	usem	11	1:28	0.00%	python3.6
3475	root	15	20	178M	140M	umtxn	9	0:21	0.00%	uwsgi-3.6
64680	www	1	20	23728K	8380K	kqread	5	0:14	0.00%	nginx

“TOP” CPU processes

du

“Disk Usage”

Command format:

du *flags*

Flags:

- h human readable Gb, MB not bits
- s summary view, total for folder not each file

```
[jeff LAPTOP-CVJ54CBV] - [~] - [2020-08-26 08:20:54]
[0] <> cd .ssh
./ authorized_keys id_rsa known_hosts
./ config id_rsa.pub known_hosts.old
[jeff LAPTOP-CVJ54CBV] - [~/ssh] - [2020-08-26 08:20:54]
[0] > du -sh
36K .
[jeff LAPTOP-CVJ54CBV] - [~/ssh] - [2020-08-26 08:21:00]
[0] <>
```

history

Simply lists the recent commands that you have executed

```
340 vim empty1.txt
341 cat empty1.txt
342 more
343 man more
344 cd /var/logs
345 cd /var
346 cd log
347 ls
348 cd ~
349 more .zsh_history
350 less .zsh_history
351 more .zshrc
-[jeff LAPTOP-CVJ54CBV] - [~] - [
-[0] <>
```

man

“Manual”

Only command you really need to know. This will provide you documentation on how to use most unix commands and other things like c++ functions, etc.

```
MAN(1)                                Manual pager utils                                MAN(1)

NAME
  man - an interface to the system reference manuals

SYNOPSIS
  man [man options] [[section] page ...] ...
  man -k [apropos options] regexp ...
  man -K [man options] [section] term ...
  man -f [whatis options] page ...
  man -l [man options] file ...
  man -w|-W [man options] page ...

DESCRIPTION
  man is the system's manual pager. Each page argument given to
  man is normally the name of a program, utility or function. The
  manual page associated with each of these arguments is then found
  and displayed. A section, if provided, will direct man to look
  only in that section of the manual. The default action is to
  search in all of the available sections following a pre-defined
  order (see DEFAULTS), and to show only the first page found, even
  if page exists in several sections.

  The table below shows the section numbers of the manual followed
  by the types of pages they contain.

  1  Executable programs or shell commands
  2  System calls (functions provided by the kernel)
  3  Library calls (functions within program libraries)
  4  Special files (usually found in /dev)

Manual page man(1) line 1 (press h for help or q to quit)
```

Others Worth Knowing:

- clear
- who
- echo
- whoami
- ping
- ip address
- rsync
- vim
- nano
- |
- >, <
- curl, wget
- diff
- exit
- finger
- head
- tail
- kill
- mkdir
- tree
- passwd
- tar
- gzip
- uname
- w
- ps

ZSH

```
[jeff LAPTOP-CVJ54CBV] - [~] - [2020-08-26 07:54:30]
[0] <> cd temp
./ ../
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:54:31]
[0] <> touch empty1.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:54:39]
[0] <> ls
./ ../ empty1.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:54:47]
[0] <> cp empty1.txt tempty2.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:55:00]
[0] <> ls -la
total 8
drwxr-xr-x  2 jeff jeff 4096 Aug 26 19:55 ./
drwxr-xr-x 15 jeff jeff 4096 Aug 26 19:55 ../
-rw-r--r--  1 jeff jeff   0 Aug 26 19:54 empty1.txt
-rw-r--r--  1 jeff jeff   0 Aug 26 19:55 tempty2.txt
[jeff LAPTOP-CVJ54CBV] - [~/temp] - [2020-08-26 07:55:02]
[0] <>
```



What is ZSH



Z shell

- Written by Paul Falstad in 1990 while attending Princeton University.
 - The name came from a Professor Zhong Shao since his username was zsh.
 - ZSH is an interactive unix shell that is an extension of Bash with many improvements.
 - ZSH Config file is in the home directory called `.zshrc`
-

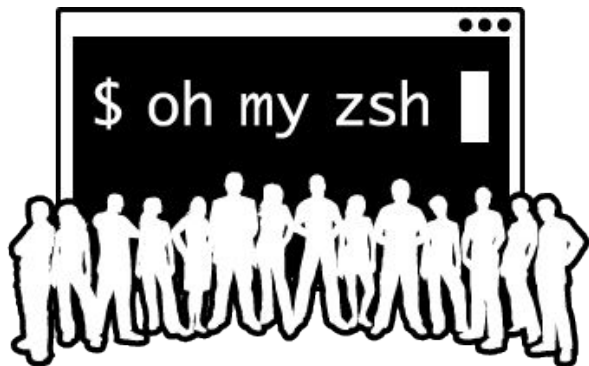


Z shell

Why is ZSH Cool

- Lots of syntactic sugar to make your terminal use easier.
 - Automatic cd if you type name of directory
 - Recursive path expansion
 - Spell correction and approximate completion if you hit tab
 - Plugin and theme support
-

Oh-My-Zsh



- Open source framework for managing Zsh configurations
 - Has 250+ extensions
 - Has 125+ themes
 - Auto updates!
-

Installing Oh-My-Zsh

[Oh My ZSH](#) has a fancy install script you can run if you trust scripts from the internet.

```
sh -c "$(wget  
https://raw.githubusercontent.com/robbyrussell/oh-my-zsh/master/tools/install.sh -O -)"
```



Some of my favorite Oh-my-zsh themes:

birra

```
jeff@zion /mnt/Jeff-Work/Programming/javascript/JrtechsV2
└─$ cd NodeJSBlog
admin          includes          package.json      run
blog           jrtechs.service  photography       server.js
blogContent    LICENSE          previewer.js     sitemap.txt
CODE_OF_CONDUCT.md node_modules     README.md        sites
jeff@zion /mnt/Jeff-Work/Programming/javascript/JrtechsV2/NodeJSBlog <master* >
└─$
```

rkj-repos

```
[jeff jrtechs-laptop] - [~] - [2019-09-25 06:07:00]
└─[0] <> cd dot_files
./      .bashrc          .git/            .ideavimrc     README.md      .zshrc
../     fixSSHfilePermissions.sh .gitconfig      install.sh     .vimrc
[jeff jrtechs-laptop] - [~/dot_files] - [2019-09-25 06:07:13]
└─[0] <git:(master 9a610e6) > cat .zshrc
./      .bashrc          .gitconfig      .vimrc
../     .git/            .ideavimrc     .zshrc
```

Favorite Shells Continued

[Agnosterzak](#):

- Custom Oh-my-zsh theme based on powerline vim plugin and agnoster theme

```
♥ 85% Wed 25 Sep - 18:00 ~
@jeff cd dot_files
./ .bashrc .git/ .ideavimrc README.md .zshrc
../ fixSSHfilePermissions.sh .gitconfig install.sh .vimrc

♥ 85% Wed 25 Sep - 18:01 ~/dot_files | origin Ω master ✓
@jeff cat .zshrc
./ .bashrc .gitconfig .vimrc
../ .git/ .ideavimrc .zshrc
```

Plugins

```
36 # Which plugins would you like to load?
37 # Standard plugins can be found in ~/.oh-my-zsh/plugins/*
38 # Custom plugins may be added to ~/.oh-my-zsh/custom/plugins/
39 # Example format: plugins=(rails git textmate ruby lighthouse)
40 # Add wisely, as too many plugins slow down shell startup.
41 plugins=(
42     git
43     history-substring-search
44     z
45     extract
46 )
```

Bash Aliases Still and custom commands Works in ZSH!

```
55 # general bash aliases
56 alias ls="ls -abp --color=auto"
57 alias nano="vim"
58 alias ..="cd .."
59 alias size="echo du -sh && du -sh"
60
61
62 # Bash Manager Things
63 alias roosay="python3 /home/jeff/scripts/bash_manager/src/roosay.py"
64 alias ss="python3 /home/jeff/scripts/bash_manager/src/ssh_manager.py"
65 alias ssh_manager="python3 /home/jeff/scripts/bash_manager/src/ssh_manager.py"
66 alias mm="python3 /home/jeff/scripts/bash_manager/src/mount_ssh_drive.py"
67 alias ssh-mount="python3 /home/jeff/scripts/bash_manager/src/mount_ssh_drive.py"
68 alias quote="python3 /home/jeff/scripts/bash_manager/src/quote.py"
```

More customizations for .bashrc

```
# auto ls when you change directories
function cd {
    builtin cd "$@" && ls
}
```

```
# displays quote when terminal opens
quote
```

What is SSH?

Other than my favorite Linux command.



SSH is...



- AKA: Secure Socket Shell
 - Open source tool used for connecting to a remote computer in a secure manner
 - Version 1 developed in 1995 and second version developed in 2006
 - Authentication with Diffie-Hellman key exchange
-

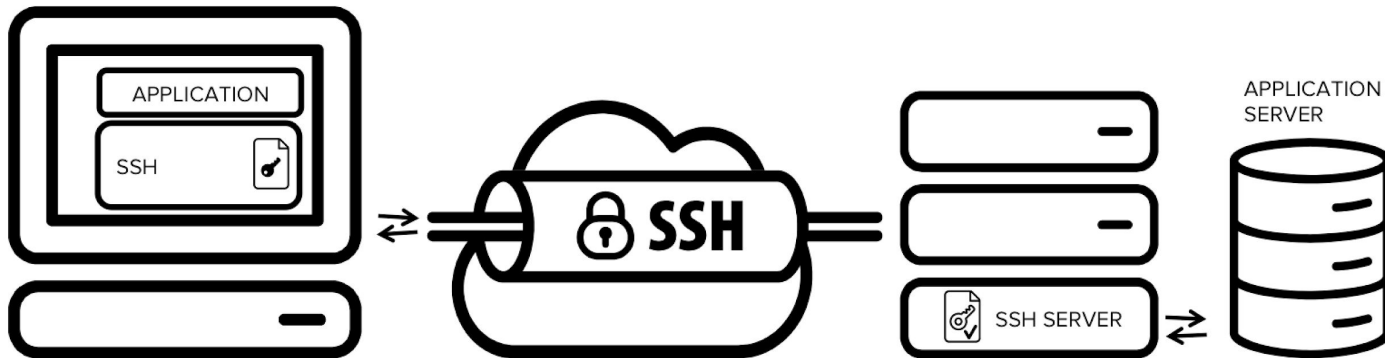
WHY?



SSH is powerful...



- SSH makes connecting to remote computers **very easy**
- Widely implemented
- Supports a plethora of features:
 - Passwordless login with keys
 - File transfer
 - Network port forwarding
 - SSH config files



HOW?



Just pop open a terminal!



- Command syntax
 - `ssh user@hostname -p port -i keyFile`
- The default port used for ssh is 22
- If no user is provided, it will use your current user name

```
[jeff@jrtechs-laptop] - [~] - [2019-09-03 07:51:32]
[1] <> ssh jxr@glados.cs.rit.edu
The authenticity of host 'glados.cs.rit.edu (129.21.22.196)' can't be established.
ECDSA key fingerprint is SHA256:pbfV7PLN905l5ubqUckN2ahZ2iJ9TCG/DGPVxDgMgek.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'glados.cs.rit.edu,129.21.22.196' (ECDSA) to the list of known hosts.
Password: 
```

Keys!

**YOU GET AN SSH KEY
AND YOU GET AN SSH KEY**



EVERYBODY GETS AN SSH KEY





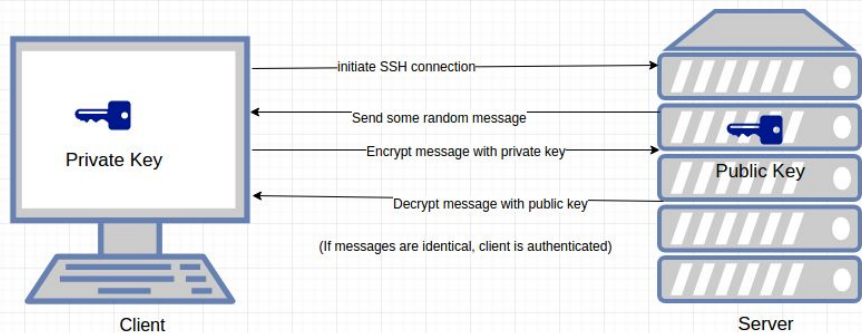
Keys!

- Keys allow you to log into an SSH server without a password.
- SSH uses a public-private key pairing
 - Private key is kept on local machine
 - Public key is distributed to the remote computer

Commands

- ssh-keygen
 - Generates new key pair
- ssh-copy-id
 - Copies your public key to remote server
- ssh-add
 - Adds a private key to the list of keys that ssh will try to connect to remote servers with by default

SSH Authentication

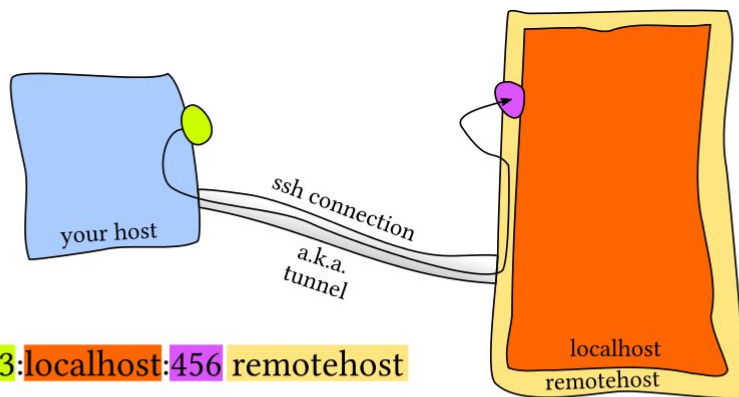


Local Port Forwarding

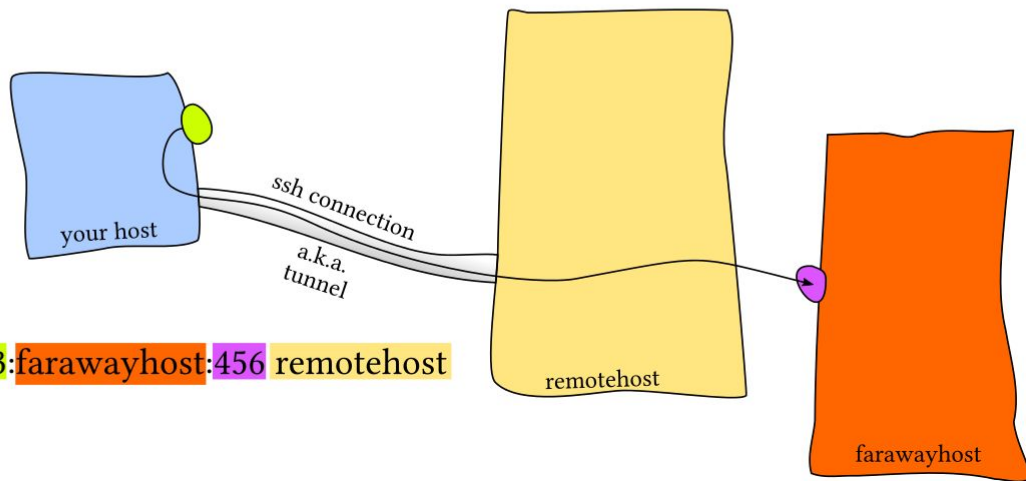


Local Port forwarding

- Allows you to forward traffic from a port on your computer to a remote destination available to a remote computer.
- Often used to access remote web servers or resources that are behind a firewall.



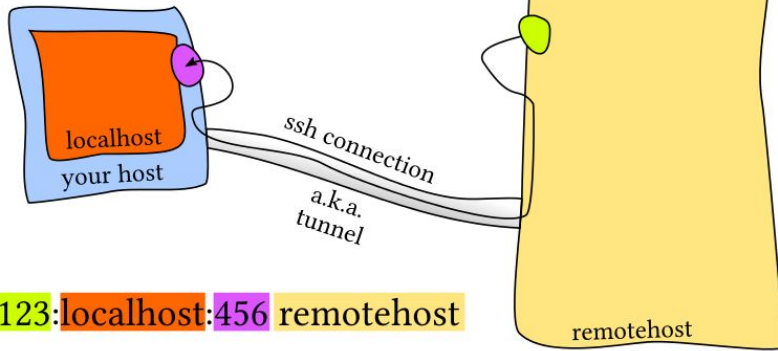
```
ssh -L 123:localhost:456 remotehost
```



```
ssh -L 123:farawayhost:456 remotehost
```

Remote Port Forwarding

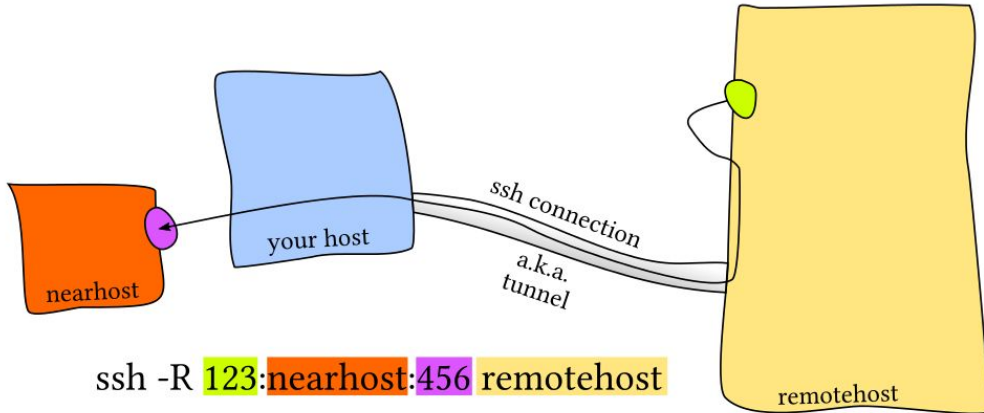




```
ssh -R 123:localhost:456 remotehost
```

Remote Port Forwarding

- Forwards traffic on a remote computer to your local machine.
- Often used to expose dev environment to the internet.



```
ssh -R 123:nearhost:456 remotehost
```

Socks Proxies, SSHFS, SFTP, SSH Configs

```
~/.ssh/config
```

```
Host dev  
  HostName dev.example.com  
  User john  
  Port 2322
```



Challenge!



Challenge!

Try to be the first one to make it through 5 ssh challenges and change the website demo.ritlug.com

Host: demo.ritlug.com

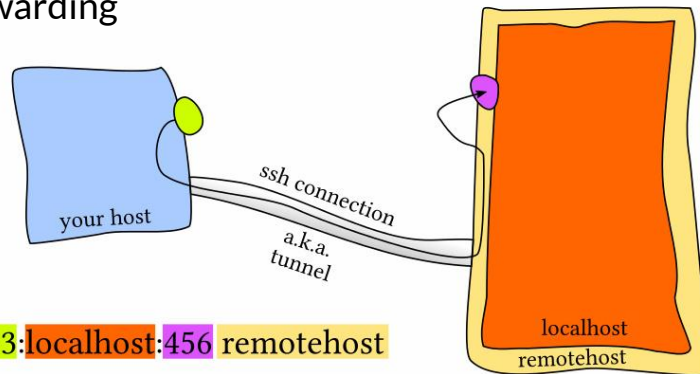
User: ritlug

Password: ritLugAug28!

Parts of this are difficult, ask for help!

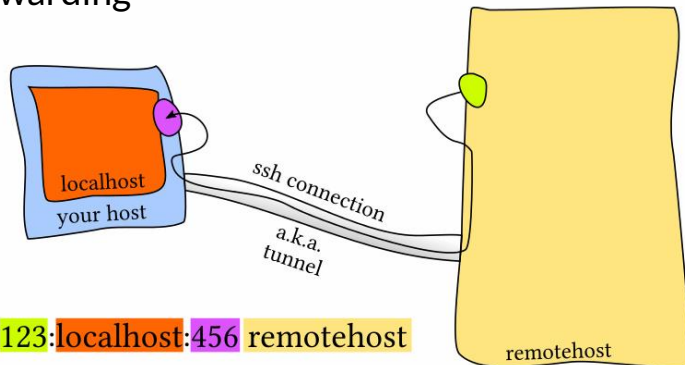
```
ssh user@hostname -p port -i keyFile
```

Local forwarding



```
ssh -L 123:localhost:456 remotehost
```

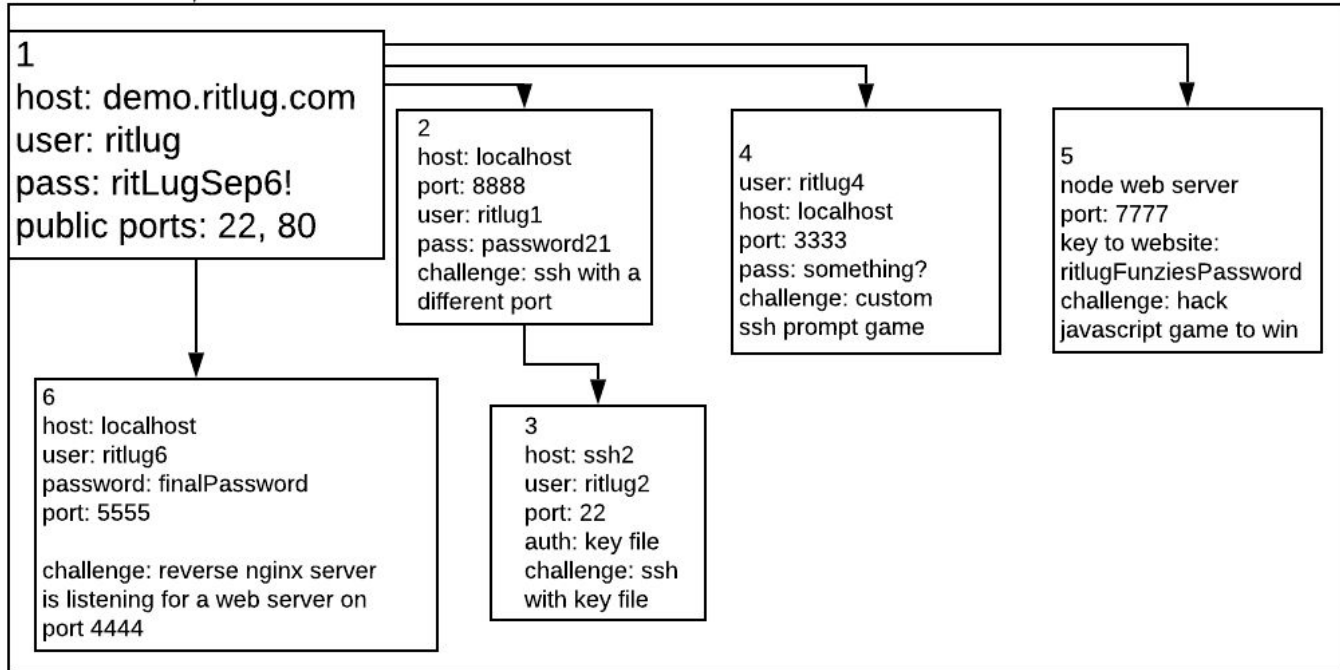
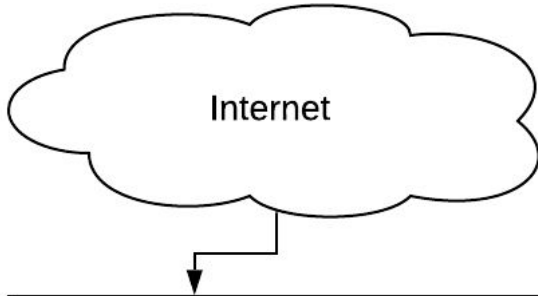
Remote forwarding



```
ssh -R 123:localhost:456 remotehost
```

Challenge Solution Demo





Questions



Resources



- [SSH Essentials](#)
 - [SSH Config Files](#)
 - [Git Repo and Write Up for Challenge](#)
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