

Lecture 04: Shell (SSH) practice 1

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Today: Log in, Practice Shell!

Part 1) Logging in to remote server using SSH

→ username/password.

Part 2) Basic practice → creating/navigating files

Part 3) Streams, redirecting, piping

Part 4) Information about the computer

Before we start 1: Prompt and decoration

I will write:

\$ ls -lah

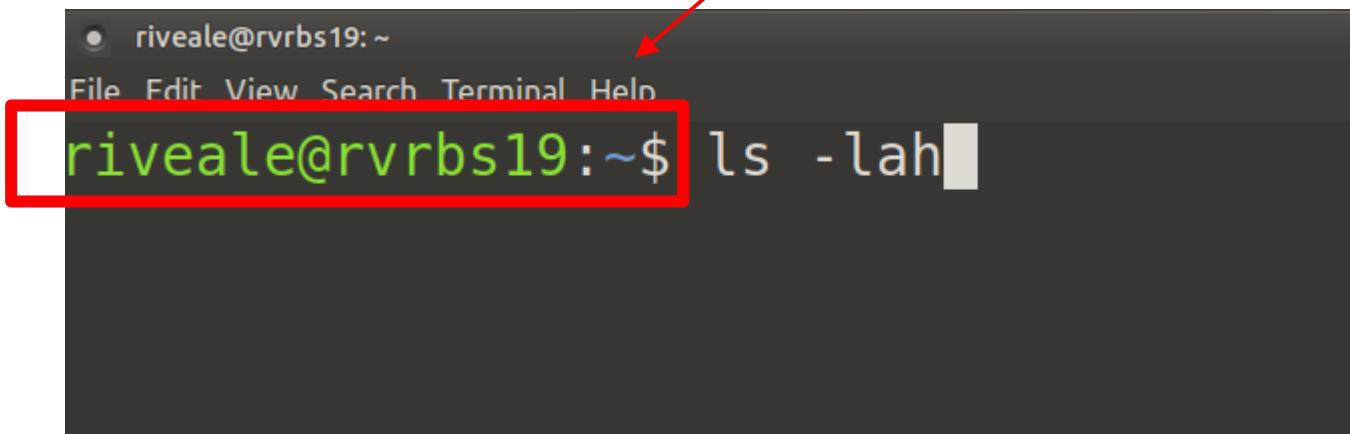
This is decoration

This is the (command) prompt

(you can actually set it to show whatever you want)

in windows, maybe it is

C:> dir



A screenshot of a terminal window with a dark background. At the top, there's a menu bar with options: File, Edit, View, Search, Terminal, Help. Below the menu, the prompt 'riveale@rvrbs19: ~\$' is displayed in green text. A red box highlights this entire line, and a red arrow points from the text 'This is the (command) prompt' to the '\$' sign at the end of the prompt.

```
riveale@rvrbs19: ~$ ls -lah
```

Before we start 1: Prompt and decoration

I will write:

\$ ls -lah

You should only
type this part!

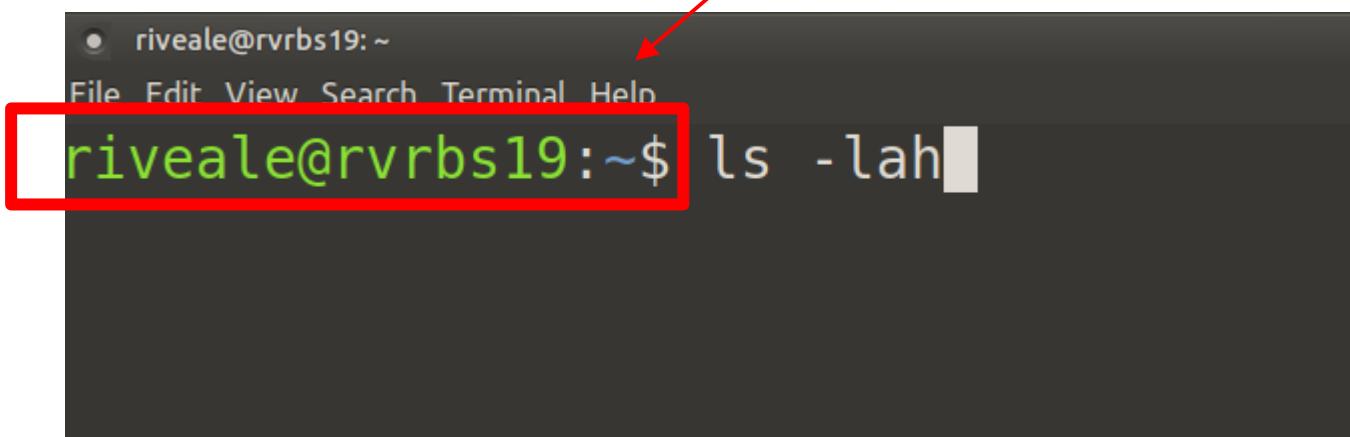
in windows, maybe it is

C:> dir

This is decoration

This is the (command) prompt

(you can actually set it to show whatever
you want)



A screenshot of a terminal window with a dark background and light-colored text. At the top, the title bar shows the user's name and the host: "riveale@rvrbs19: ~". Below the title bar is a menu bar with options: File, Edit, View, Search, Terminal, Help. The main area of the terminal shows a command line interface. The prompt "riveale@rvrbs19:~\$ " is highlighted with a red rectangle. To the right of the prompt, the command "ls -lah" is typed and followed by a cursor. A red arrow points from the text "This is the (command) prompt" to the red box around the prompt text "riveale@rvrbs19:~\$".

Before we start 2: Tab Completion

In command line, hitting TAB key may show possible completions.

- If it is ambiguous it will print possibilities
- If it is unambiguous it will fill it in for you.
- Completion of program name

```
riveale@rvrbs19:~$ vl
vlc          vlc-wrapper  vlna
riveale@rvrbs19:~$ vl█
```

Before we start 2: Tab Completion

Completion of file name:

```
riveale@rvrbs19:~$ cp tmp  
tmp/  
tmpdistroc.txt tmpgit/  
tmpgit2/_ tmpgit_rteye/ tmpsam/  
tmpstore/  
tmp.txt tmpgit_salmap_rv/ tmpstats/
```

```
riveale@rvrbs19:~$ ls /dev/nvme0  
nvme0 nvme0n1 nvme0n1p1 nvme0n1p2 nvme0n1p3  
riveale@rvrbs19:~$ ls /dev/nvme0n1  
nvme0n1 nvme0n1p1 nvme0n1p2 nvme0n1p3  
riveale@rvrbs19:~$ ls /dev/nvme0n1p  
nvme0n1p1 nvme0n1p2 nvme0n1p3
```

Note: tab completion is a functionality in the SHELL program you use.
So, it may not work (the same, or at all) in every shell.

It is not magic – the shell program just searches:

- In \$PATH (for commands)
- In specified directory (for locations)
- In XXX-completion.bash for option/argument autocomplete?

Part 1) Logging in with SSH

Logging in

**Log in to the windows machine using your university SPS-ID
(EPS-ID?)**

(staff): richard408veale

- or -

(students): a10291001

Your password is the same as for kulasis

(Authenticated via an authentication server...)

Opening a command line shell

In WINDOWS, you can open cmd.exe

super+r → “cmd”

super → “cmd”

Super: the super key (usually looks like)



→ Or, apple mark on mac?

→ Or sun mark, etc.

On windows in CMD (Checking your IP)

\$ ipconfig

\$ ipconfig /all

→ 10.252.237.11

(255.255.255.128)

CMD.EXE

You are now using CMD.EXE

→ This is a DOS-based command-line interface

“dir” to print contents (=ls)

“cd” to switch directories

CMD.EXE

You are now using CMD.EXE

→ This is a DOS-based command-line interface

“dir” to print contents (=ls)

“cd” to switch directories

I won't cover DOS/windows command line in this class. But the idea is the same.

PING

PING uses ICMP to check connectivity (and delay) to target machine.

E.g.:

```
$ ping 130.54.88.9
```

OpenSSH & python (anaconda)

Two pieces of software we may use:

- OpenSSH client (for ssh)
- Anaconda (for python)

Anaconda (python implementation)

Just for example:

Open the anaconda (python) interpreter:

```
$ python
```

```
a=2
```

```
b=2
```

```
c=a+b
```

```
print(c)
```

```
exit()
```

Ctrl-C

To cancel something in CLI, usually:

CTRL + C

→ ABORT current task and return control to me

(POSIX: sends SIGINT – interrupt signal – to current process)

Reminder: POSIX

POSIX: Portable Operating System Interface

Standards to ensure interoperability between operating system shells.

OpenSSH

OpenSSH is a suite of networking utilities using secure shell (SSH).

OpenSSH client – on your machine to connect to a remote server.
Only runs when you invoke it.

OpenSSH server – Software running on a machine that waits for SSH connections. Always running.

Try SSH

I made a host. In cmd:

\$ ping 130.54.88.9

```
riveale@rvrbs19:~$ ping 130.54.88.9
PING 130.54.88.9 (130.54.88.9) 56(84) bytes of data.
64 bytes from 130.54.88.9: icmp_seq=2 ttl=53 time=36.1 ms
64 bytes from 130.54.88.9: icmp_seq=5 ttl=53 time=17.4 ms
64 bytes from 130.54.88.9: icmp_seq=7 ttl=53 time=15.2 ms
64 bytes from 130.54.88.9: icmp_seq=8 ttl=53 time=16.6 ms
^C
--- 130.54.88.9 ping statistics ---
8 packets transmitted, 4 received, 50% packet loss, time 7082ms
rtt min/avg/max/mdev = 15.196/21.318/36.146/8.595 ms
riveale@rvrbs19:~$ ping neurorobotics.med.kyoto-u.ac.jp
ping: neurorobotics.med.kyoto-u.ac.jp: Name or service not known
```

\$ ssh 130.54.88.9

Ping sends a special kind of ICMP packet to the target IP. It is a way of finding if machines are there/connected/power on.

But, it can be abused, so often servers will be set to drop ping requests.

Try SSH

I made a host. In cmd:

```
$ ssh 130.54.88.9
```

```
$ ssh USERNAME@130.54.88.9
```

→ Replace USERNAME with your username

It will prompt for password – no characters should appear when you type it.

An example (shared) user!

I will create a user

(it will be shared by all of us for now)

User: dataproc2021

Temporary Server (130.54.88.9)

```
riveale@rvlenovom715q:~$ sudo adduser dataproc2021
[sudo] password for riveale:
Sorry, try again.
[sudo] password for riveale:
Adding user `dataproc2021' ...
Adding new group `dataproc2021' (1001) ...
Adding new user `dataproc2021' (1001) with group `dataproc2021' ...
Creating home directory `/home/dataproc2021' ...
Copying files from `/etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for dataproc2021
Enter the new value, or press ENTER for the default
      Full Name []: Data Proc 2021
      Room Number []:
      Work Phone []:
      Home Phone []:
      Other []:
Is the information correct? [Y/n]
riveale@rvlenovom715q:~$ █
```

Create a user!

I created a user

(it will be shared by all of us for now)

User: dataproc2021

Password: dataproc2021a9e8@

Try to log in (in a new CMD window).

```
riveale@rvrbs19:~$ ssh dataproc2021@130.54.88.9  
dataproc2021@130.54.88.9's password:  
Welcome to Ubuntu 20.04.3 LTS (GNU/Linux 5.4.0-90-generic x86_64)
```

```
* Documentation: https://help.ubuntu.com  
* Management: https://landscape.canonical.com  
* Support: https://ubuntu.com/advantage
```

```
System information as of Thu 11 Nov 2021 09:27:56 AM UTC
```

System load:	0.0
Usage of /:	2.5% of 467.96GB
Memory usage:	1%
Swap usage:	0%
Temperature:	35.0 C
Processes:	208
Users logged in:	1
IPv4 address for enp1s0f0:	10.238.67.168
IPv4 address for enxa0cec8c28b28:	130.54.88.9
IPv4 address for wlp2s0:	10.238.67.169

```
* Super-optimized for small spaces - read how we shrunk the memory footprint of MicroK8s to make it the smallest full K8s around.
```

<https://ubuntu.com/blog/microk8s-memory-optimisation>

0 updates can be applied immediately.

Part 2)

Tools to Create / Navigate / Print files

→ A tool is just a program

usually with specific limited functionality

Tools for files/folders

Create/Modify/Delete

\$ touch – “touch” a file (update modification time)

\$ mkdir – MaKe directory

\$ rm / rmdir – remove a file/directory

Change Permissions

\$ chown – change OWNership group/user

\$ chmod – change MODe (permissions)

Move/Copy

\$ mv – MoVe a file/directory

\$ cp – CoPy a file/directory

Print/Display

\$ cat – conCATenate – concatenate contents and print

\$ echo – echo a single line to stdout

\$ printf – PRINT & Format data

\$ head – print beginning of file

\$ tail – print end of file

\$ less – display file one part at a time (scrolling)

File properties

\$ stat – print status/size of file/directory

\$ ls – LiSt directory

\$ wc – Word Count (-l → line count)

Navigate

\$ cd – Change Directory

1) Create / Modify

```
$ touch test.txt
```

```
$ mkdir newdir
```

```
$ mkdir -p newdir/blahdir/hello
```

```
$ rm test.txt
```

```
$ rmdir newdir
```

```
$ rm -r newdir
```

2) File permissions

```
$ chmod 777 test.txt
```

```
$ chmod 644 test.txt
```

```
$ chmod -R 777 mydir
```

```
$ chown -R dataproc2021:datagroup mydir
```

3) Move / Copy

\$ mv test.txt hi.txt

\$ mv test.txt mydir

→ Will create mydir/test.txt

\$ mv mydir otherdir

\$ cp test.txt hi.txt

\$ cp mydir otherdir

→ error, can't copy directories (need recursive -r)

\$ cp -r mydir otherdir

4) Print / Display

```
$ cat file1 file2 file3
```

```
$ echo "Hello, this is me!"
```

→ Always prints line break (\n) at end

```
$ printf "That you may be %f forever\n" 3.14
```

```
$ head file1
```

```
$ tail file1
```

```
$ less file1
```

Useful Tools

CAT (concatenate/print strings)

```
riveale@rvrbs19:~/tmp$ cat todo.txt
```

```
Yolo 840 haha
```

```
riveale@rvrbs19:~/tmp$ cat blah.txt
```

```
Hello this is an example file.
```

```
Blah blah blah.
```

```
riveale@rvrbs19:~/tmp$ cat blah.txt todo.txt
```

```
Hello this is an example file.
```

```
Blah blah blah.
```

```
Yolo 840 haha
```

```
riveale@rvrbs19:~/tmp$ cat blah.txt todo.txt >> blahtodo.txt
```

```
riveale@rvrbs19:~/tmp$ cat blahtodo.txt
```

```
Hello this is an example file.
```

Printing (standard output stream)

ECHO – display line of text (always ends in newline)

```
riveale@rvrbs19:~$ echo "Hello"
Hello
```

PRINTF – format and print data

```
riveale@rvrbs19:~$ printf "This is a\nSentence on lines\n"
This is a
Sentence on lines
```

```
riveale@rvrbs19:~$ printf "This is a\nSentence on lines\nA big number %f\n" 329281.22420
This is a
Sentence on lines
A big number 329281.224200
```

Just a wrapper around C printf()
Lots of basic tools are!

Scrolling / Summarizing

Sometimes, there is lots of output.

You just want a bit at a time.

- 1) You could redirect it to a file (it might get big)
- 2) Or, you could use :

\$ less

\$ head

\$ tail

```
riveale@rvrbs19:~$ ls | wc -l  
309
```

Scrolling / Summarizing

```
riveale@rvrbs19:~$ ls | head
1may2020bu
25 Most Amazing Ancient Ruins of the World-fq70UHD8DrM.mkv
amandabu.txt
amex_25oct_gold.pdf
amex_business_card.pdf
amex_giftcards_2021
amexgold
Android
android-studio
AndroidStudioProjects
riveale@rvrbs19:~$ ls | tail
video.webm
vids2021may20
vidxx.m4v
VirtualBox VMs
vnc_setup.sh
why7notes.txt
wtfsoftbank.txt
xrdpsetup.txt
XXXX8387_Transactions_20200428-181804.ods
係分担_2020604.xlsx
```

5) File info / Navigation

```
$ ls file1
```

```
$ ls -lah file1
```

```
$ stat file1
```

```
$ wc file1
```

```
$ wc -l file1
```

Navigate!

```
$ cd mydir
```

```
$ cd -      #go back ← this is a comment!
```

```
$ cd ..     #go to parent directory
```

Useful Tools

WC (word count)

WC – word count (-l counts lines)

```
$ ls . | wc -l
```

→ This will count the number of folders and directories in “.” and print the number to stdout

→ we will learn about pipe (“|”) next time

Part 3) Streams & Piping

Standard STREAMS

0: STDIN – standard input

1: STDOUT – standard output

2: STDERR – standard error

Streams are just things that connect two points.

→ If something goes in one side, it is consumed and output at the other side in the same order.

Redirecting Streams

Piping Streams

Redirect – changes the end point of a stream.

E.g.:

```
$ ls > contents.txt
```

(Overwrites contents.txt)

Why?

LS writes to STDOUT by default.

LS writes errors to STDERR

This is *redirecting* STDOUT to the file contents.txt (which is opened as a new FILE STREAM)

```
$ ls >> contents.txt
```

(APPENDS to contents.txt)

```
$ wc -l < contents.txt #Redirect INPUT
```

Redirecting Streams

These are the same (stream 1 is implied):

```
$ ls > file.txt
```

```
$ ls 1> file.txt
```

Redirect stdout to stderr

```
$ ls 1>&2
```

Redirect stdout to stderr and stderr to file

```
$ ls 2>file.txt 1>&2 #Note: right-to-left...
```

Redirecting Streams

These are the same (stream 1 is implied):

```
$ ls > file.txt
```

```
$ ls 1> file.txt
```

Redirect stdout to stderr

```
$ ls 1>&2
```

Redirect stdout to stderr, (append to) file

```
$ ls 2>>file.txt 1>&2
```

Examples

```
riveale@rvrbs19:~/tmp/tmp2$ ls
file1.txt  file2.txt
riveale@rvrbs19:~/tmp/tmp2$ ls 1>lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
file1.txt
file2.txt
lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ ls 1>lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
file1.txt
file2.txt
lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ ls 1>>lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
file1.txt
file2.txt
lsfile.txt
file1.txt
file2.txt
lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ ls >lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
file1.txt
file2.txt
lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ ls 2>lsfile.txt
file1.txt  file2.txt  lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$
```

```
riveale@rvrbs19:~/tmp/tmp2$ ls
file1.txt  file2.txt
riveale@rvrbs19:~/tmp/tmp2$ ls nonexistent.txt
ls: cannot access 'nonexistent.txt': No such file or directory
riveale@rvrbs19:~/tmp/tmp2$ ls nonexistent.txt 2> lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
ls: cannot access 'nonexistent.txt': No such file or directory
riveale@rvrbs19:~/tmp/tmp2$ ls nonexistent.txt 1> lsfile.txt
ls: cannot access 'nonexistent.txt': No such file or directory
riveale@rvrbs19:~/tmp/tmp2$ ls file1.txt 1> lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
file1.txt
riveale@rvrbs19:~/tmp/tmp2$ ls file1.txt 2> lsfile.txt
file1.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ ls file1.txt 2>> lsfile.txt
file1.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ ls nonexistent.txt 2>> lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
ls: cannot access 'nonexistent.txt': No such file or directory
riveale@rvrbs19:~/tmp/tmp2$ ls file1.txt 1>> lsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
ls: cannot access 'nonexistent.txt': No such file or directory
file1.txt
riveale@rvrbs19:~/tmp/tmp2$ ls file1.txt 1>> lsfile.txt 2>&1
riveale@rvrbs19:~/tmp/tmp2$ ls blahblahblahfile.txt 1>> lsfile.txt 2>&1
riveale@rvrbs19:~/tmp/tmp2$ cat lsfile.txt
ls: cannot access 'nonexistent.txt': No such file or directory
file1.txt
file1.txt
ls: cannot access 'blahblahblahfile.txt': No such file or directory
riveale@rvrbs19:~/tmp/tmp2$ █
```

STDIN...examples

```
riveale@rvrbs19:~/tmp/tmp2$ wc -l < lsfile.txt
4
riveale@rvrbs19:~/tmp/tmp2$ wc -l < lsfile.txt 1> linesinlsfile.txt
riveale@rvrbs19:~/tmp/tmp2$ cat linesinlsfile.txt
4
riveale@rvrbs19:~/tmp/tmp2$ wc -l < doesntexist 1> linesinlsfile.txt
bash: doesntexist: No such file or directory
riveale@rvrbs19:~/tmp/tmp2$ wc -l < doesntexist 2> linesinlsfile.txt
bash: doesntexist: No such file or directory
riveale@rvrbs19:~/tmp/tmp2$ cat linesinlsfile.txt
4
riveale@rvrbs19:~/tmp/tmp2$ wc -l 2> linesinlsfile.txt < doesntexist
riveale@rvrbs19:~/tmp/tmp2$ cat linesinlsfile.txt
bash: doesntexist: No such file or directory
riveale@rvrbs19:~/tmp/tmp2$ █
```

> redirect overwrites

```
riveale@rvrbs19:~/tmp$ ls > contents.txt
riveale@rvrbs19:~/tmp$ cat contents.txt
blahtodo.txt
blah.txt
contents.txt
hostname-tmp
tasdftxt
todo.txt
riveale@rvrbs19:~/tmp$ ls > contents.txt
riveale@rvrbs19:~/tmp$ cat contents.txt
blahtodo.txt
blah.txt
contents.txt
hostname-tmp
tasdftxt
todo.txt
riveale@rvrbs19:~/tmp$ ls >> contents.txt
riveale@rvrbs19:~/tmp$ cat contents.txt
blahtodo.txt
blah.txt
contents.txt
hostname-tmp
tasdftxt
todo.txt
blahtodo.txt
blah.txt
contents.txt
hostname-tmp
tasdftxt
todo.txt
```

>> redirect appends

Now it's there 3 times...

```
riveale@rvrbs19:~/tmp$ ls >> contents.txt
riveale@rvrbs19:~/tmp$ cat contents.txt
blahtodo.txt
blah.txt
contents.txt
hostname-tmp
tasdftxt
todo.txt
blahtodo.txt
blah.txt
contents.txt
hostname-tmp
tasdftxt
todo.txt
blahtodo.txt
blah.txt
contents.txt
hostname-tmp
tasdftxt
todo.txt
```

Redirecting Streams

Piping Streams

```
$ ls . | wc -l >&2
```

- 1) Print contents of current directory
- 2) Pipe it to wc -l (count the lines), print to stdout
- 3) Redirect it to stderr stream

Piping

```
$ ls | grep “^a-zA-Z\{3\}.txt”
```

→ Prints files in current directory of exactly 3 lower-case letters followed by text.

^ matches empty beginning of string

\$ matches empty end of string

Piping/Redirecting Sometimes changes Program Behavior

Some tools (like LS) change behavior based on the stream they are printing to.

- LS when piped will print one directory per line (e.g. -1)
- LS when run normally will “format” everything nicely...

Practice 1 – Navigation and Files

Practice 1 – Create a file

Log in to dataproc2021:

You are all logged in to same account.

Create file using your KYOTO ID (so no overlap)

```
$ touch [yourid].txt
```

```
$ echo "Hello! My name is [yourname]" >> [yourid].txt
```

```
$ cat [yourid].txt
```

Practice 1 –

What are the permissions of your file?

```
$ ls -lah [yourid].txt
```

Part 4) Tools to: Check system state

Users

\$ w – print logged in users/processes

\$ who – print logged in users

Processes

\$ ps – print running ProceSses

\$ top / htop – interactive process display

Filesystems / Disks

\$ fdisk

\$ parted

\$ lsblk – print info about BlocK devices (disks etc.)

\$ df

Help:

\$ man – open MANual pages

Memory

\$ lsmem

\$ free

General Hardware / Buses

\$ dmidecode (decode Desktop Memory Interface)

\$ lshw – print info about hardware

\$ lspci / lsusb

Kernel information / errors

\$ dmesg – print kernel log

\$ lsb_release

\$ uname

\$ lsmod – kernel modules

1) Users

Checking who else is logged in:

\$ who

\$ w (also shows their current process)

This command will show who else is logged in.

```
dataproc2021@rvlenovom715q:~$ w
 09:28:31 up  2:23,  3 users,  load average: 0.00, 0.00, 0.00
USER   TTY      FROM             LOGIN@    IDLE     JCPU    PCPU WHAT
riveale pts/0    122.22.90.163    09:24      2:10    0.04s  0.04s -bash
dataproc pts/1    122.22.90.163    09:27      2.00s  0.02s  0.00s w
riveale pts/3    103.5.140.178    08:22      1:05m  0.08s  0.08s -bash
dataproc2021@rvlenovom715q:~$ █
```

2) Processes

\$ ps

\$ ps ax

\$ top # type q to quit

\$ htop # type q to quit

Useful Tools

PS (print running processes)

```
riveale@rvrbs19:~$ ps a
 PID TTY      STAT   TIME COMMAND
 1499 tty7    Ssl+  64:59 /usr/lib/xorg/Xorg -core :0 -seat seat0 -auth /var/run/lightdm/root/:0 -nolisten tcp vt7 -novtswitch
 1502 tty1    Ss+   0:00 /sbin/agetty -o -p -- \u --noclear tty1 linux
 92574 pts/11   Ss+   0:00 bash
105592 pts/18   Ss+   0:00 bash
111711 pts/0    Ss   0:00 bash
111865 pts/0    Sl+   0:00 /usr/lib/libreoffice/program/oosplash dataproc_lecture_04_ssh_practice.odp
111899 pts/0    Sl+   8:12 /usr/lib/libreoffice/program/soffice.bin dataproc_lecture_04_ssh_practice.odp
112201 pts/1    Ss+   0:00 bash
112338 pts/2    Ss+   0:00 bash
115442 pts/3    Ss+   0:00 bash
116507 pts/4    Ss+   0:00 bash
121118 pts/5    Ss+   0:00 bash
121421 pts/6    Ss   0:00 bash
122033 pts/6    S+   0:00 ssh dataproc2021@130.54.88.9
123135 pts/7    Ss   0:00 bash
123143 pts/7    S+   0:00 ssh 130.54.88.9
126707 pts/8    Ss+   0:00 bash
126849 pts/9    Ss+   0:00 bash
128737 pts/13   Ss+   0:00 bash
130301 pts/10   Ss+   0:00 bash
131055 pts/12   Ss+   0:00 bash
131451 pts/14   Ss+   0:00 bash
132080 pts/15   Ss+   0:00 bash
132704 pts/16   Ss+   0:00 bash
133663 pts/17   Ss+   0:00 bash
137307 pts/19   Ss+   0:00 bash
138274 pts/20   Ss   0:00 bash
138285 pts/20   R+   0:00 ps a
```

PS for a specific program... (we will learn GREP)

```
riveale@rvrbs19:~$ ps ax | grep libreoffice
111865 pts/0    Sl+    0:00 /usr/lib/libreoffice/program/oosplash dataproc_lecture_04_ssh_practice.odp
111899 pts/0    Sl+    8:16 /usr/lib/libreoffice/program/soffice.bin dataproc_lecture_04_ssh_practice.odp
138424 pts/20   S+    0:00 grep --color=auto libreoffice
```

Useful Tools

HTOP / TOP (view running processes)

```
1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7 [ ] 8 [ ] 2.0%] 0.0%] 10.1%] 7.0%] 2.7%] 3.2%] 0.0%] 1.3%]
Mem[|||||] 2.13G/15.5G Tasks: 152, 438 thr; 1 running
Swp[|||||] 268M/1.72G Load average: 0.48 0.48 0.54
Uptime: 2 days, 15:36:20
```

PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEM%	TIME+	Command
1499	root	20	0	1667M	232M	172M	S	13.9	1.5	1h05:05	/usr/lib/xorg/Xorg -core :0 -seat seat0 -auth /var/run/lightdm/root/:0
3280	riveale	20	0	910M	112M	83036	S	2.7	0.7	14:30.20	marco
2943	riveale	20	0	3677M	14276	11752	S	0.0	0.1	13:44.68	/usr/bin/pulseaudio --daemonize=no --log-target=journal
3206	riveale	20	0	3677M	14276	11752	S	0.0	0.1	13:04.92	/usr/bin/pulseaudio --daemonize=no --log-target=journal
111899	riveale	20	0	1398M	337M	115M	S	0.0	2.1	8:14.92	/usr/lib/libreoffice/program/soffice.bin dataproc lecture_04_ssh_practi
1226	rabbitmq	20	0	5213M	59772	6352	S	0.0	0.4	7:55.95	/usr/lib/erlang/erts-10.6.4/bin/beam.smp -W w -A 128 -MBas ageffcbf -MH
1859	root	20	0	1667M	232M	172M	S	2.0	1.5	4:24.73	/usr/lib/xorg/Xorg -core :0 -seat seat0 -auth /var/run/lightdm/root/:0
3073	riveale	20	0	159M	36112	22636	S	0.0	0.2	4:04.04	/usr/bin/fcitx -d
1812	rabbitmq	20	0	5213M	59772	6352	S	0.7	0.4	3:49.22	/usr/lib/erlang/erts-10.6.4/bin/beam.smp -W w -A 128 -MBas ageffcbf -MH

3) Filesystems / Disks / Partitions

\$ df -lahT # -T option prints filesystem Type

\$ lsblk

\$ blkid

\$ fdisk -l

Partition – a division of a disk

\$ lshw # more general – prints all hardware

LSBLK

DF

```
dataproc2021@rvlenovom715q:~$ lsblk
NAME      MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
loop0      7:0    0  55.4M  1 loop /snap/core18/2128
loop1      7:1    0  70.3M  1 loop /snap/lxd/21029
loop2      7:2    0  32.3M  1 loop /snap/snapd/12704
sr0       11:0   1 1024M  0 rom
nvme0n1   259:0  0  477G  0 disk
└─nvme0n1p1 259:1  0   512M  0 part /boot/efi
└─nvme0n1p2 259:2  0 476.4G  0 part /
```

```
riveale@rvrbs19:~$ df -Th
Filesystem  Type  Size  Used  Avail Use% Mounted on
udev        devtmpfs  7.8G   0  7.8G  0% /dev
tmpfs       tmpfs   1.6G  2.8M  1.6G  1% /run
/dev/nvme0n1p2 ext4   37G   31G  3.6G  90% /
tmpfs       tmpfs   7.8G  944K  7.8G  1% /dev/shm
tmpfs       tmpfs   5.0M  4.0K  5.0M  1% /run/lock
tmpfs       tmpfs   7.8G   0  7.8G  0% /sys/fs/cgroup
/dev/loop1  squashfs 145M  145M   0 100% /snap/chromium/1801
/dev/loop2  squashfs  56M   56M   0 100% /snap/core18/2128
/dev/loop4  squashfs 211M  211M   0 100% /snap/eclipse/48
/dev/loop5  squashfs  56M   56M   0 100% /snap/core18/2246
/dev/loop3  squashfs 165M  165M   0 100% /snap/gnome-3-28-1804/161
/dev/loop6  squashfs  66M   66M   0 100% /snap/gtk-common-themes/1519
/dev/loop7  squashfs  66M   66M   0 100% /snap/gtk-common-themes/1515
/dev/nvme0n1p1 vfat   487M  5.3M  481M  2% /boot/efi
/dev/loop8  squashfs  33M   33M   0 100% /snap/snapd/13640
/dev/loop0  squashfs 128K  128K   0 100% /snap/bare/5
/dev/loop9  squashfs 163M  163M   0 100% /snap/gnome-3-28-1804/145
/dev/loop10 squashfs  16M   16M   0 100% /snap/ubuntu-mate-welcome/646
/dev/nvme0n1p3 btrfs  1.9T  1.9T  2.8G 100% /home
/dev/loop11 squashfs  16M   16M   0 100% /snap/ubuntu-mate-welcome/639
/dev/loop12 squashfs  43M   43M   0 100% /snap/snapd/13831
/dev/loop13 squashfs 145M  145M   0 100% /snap/chromium/1810
/dev/loop14 squashfs 128K  128K   0 100% /snap/software-boutique/54
tmpfs       tmpfs   1.6G  68K  1.6G  1% /run/user/1000
/dev/sda1   btrfs  932G  77G  855G  9% /media/riveale/rveale_ssng_1tb_b
/dev/sdb1   exfat  58G   58G  95M 100% /media/riveale/0123-4567
```

4) Help

MANual pages

\$ man lsblk

\$ man man

\$ man cat

5) Memory

\$ free

\$ lsmem

\$ dmidecode --type=17

```
dataproc2021@rvlenovom715q:~$ free -h
              total        used        free      shared  buff/cache   available
Mem:       30Gi       289Mi       27Gi       1.0Mi       2.8Gi       29Gi
Swap:      8.0Gi          0B       8.0Gi
```

Note: htop / top etc. will show how much memory, processor, etc. is being used.

6) Buses (PCI/USB)

\$ lsusb

\$ lspci

\$ lshw

\$ dmidecode

7) Kernel / system distro information

```
$ lsb_release # Linux Standard Base
```

```
$ uname # print running kernel information
```

```
$ lsmod # print kernel modules
```

Errors etc:

```
$ journalctl xe
```

```
$ dmesg #Diagnostic Message – kernel msg buf
```

Kernel/Distro info

```
riveale@rvrbs19:~$ lsb_release -a
LSB Version: core-11.1.0ubuntu2-noarch:security-11.1.0ubuntu2-noarch
Distributor ID: Ubuntu
Description:    Ubuntu 20.04.3 LTS
Release:        20.04
Codename:       focal
riveale@rvrbs19:~$ uname -a
Linux rvrbs19 5.11.0-38-generic #42~20.04.1-Ubuntu SMP Tue Sep 28 20:41:07 UTC 2021 x86_64 x86_64 x86_64 GNU/Linux
```

Check CPU(s)

```
dataproc2021@rvlenovom715q:~$ cat /proc/cpuinfo
processor      : 0
vendor_id     : AuthenticAMD
cpu family    : 23
model         : 17
model name    : AMD Ryzen 5 PRO 2400GE w/ Radeon Vega Graphics
stepping       : 0
microcode     : 0x8101007
cpu MHz        : 1466.674
cache size    : 512 KB
physical id   : 0
siblings       : 8
core id        : 0
cpu cores     : 4
apicid         : 0
initial apicid: 0
fpu            : yes
fpu_exception  : yes
cpuid level   : 13
wp             : yes
flags          : fpu vme de pse tsc msr pae mce cx8 apic sep mttr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 ht
                fxsr_opt pdpe1gb rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid aperfmpf perfmon s
                4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnow
                nit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_llc mwaitx cpb hw_pstate sme ssbd sev ibpb vmmcall fsgsbase b
                2 rdseed adx smap clflushopt sha_ni xsaveopt xsavec xgetbv1 xsaves clzero irperf xsaveerptr arat npt lbrv svm_lock nrrip
                mcb_clean flushbyasid decodeassists pausefilter pfthreshold avic v_vmsave_vmlload vgif overflow_recov succor smca
bugs           : sysret_ss_attrs null_seg spectre_v1 spectre_v2 spec_store_bypass
bogomips      : 6388.16
TLB size       : 2560 4K pages
clflush size   : 64
cache_alignment: 64
address sizes  : 43 bits physical, 48 bits virtual
power management: ts ttp tm hwpstate eff freq ro [13] [14]
```

Check PCI

```
dataproc2021@rvlenovom715q:~$ lspci
00:00.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Root Complex
00:00.2 IOMMU: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 IOMMU
00:01.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-1fh) PCIe Dummy Host Bridge
00:01.2 PCI bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 PCIe GPP Bridge [6:0]
00:01.3 PCI bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 PCIe GPP Bridge [6:0]
00:01.4 PCI bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 PCIe GPP Bridge [6:0]
00:08.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-1fh) PCIe Dummy Host Bridge
00:08.1 PCI bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Internal PCIe GPP Bridge 0 to Bus A
00:08.2 PCI bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Internal PCIe GPP Bridge 0 to Bus B
00:14.0 SMBus: Advanced Micro Devices, Inc. [AMD] FCH SMBus Controller (rev 61)
00:14.3 ISA bridge: Advanced Micro Devices, Inc. [AMD] FCH LPC Bridge (rev 51)
00:18.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Device 24: Function 0
00:18.1 Host bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Device 24: Function 1
00:18.2 Host bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Device 24: Function 2
00:18.3 Host bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Device 24: Function 3
00:18.4 Host bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Device 24: Function 4
00:18.5 Host bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Device 24: Function 5
00:18.6 Host bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Device 24: Function 6
00:18.7 Host bridge: Advanced Micro Devices, Inc. [AMD] Raven/Raven2 Device 24: Function 7
01:00.0 Ethernet controller: Realtek Semiconductor Co., Ltd. RTL8111/8168/8411 PCI Express Gigabit Ethernet Controller (rev 0e)
01:00.1 Serial controller: Realtek Semiconductor Co., Ltd. Device 816a (rev 0e)
01:00.2 Serial controller: Realtek Semiconductor Co., Ltd. Device 816b (rev 0e)
01:00.3 IPMI Interface: Realtek Semiconductor Co., Ltd. Device 816c (rev 0e)
01:00.4 USB controller: Realtek Semiconductor Co., Ltd. Device 816d (rev 0e)
02:00.0 Network controller: Intel Corporation Wireless-AC 9260 (rev 29)
03:00.0 Non-Volatile memory controller: Sandisk Corp WD Black 2018/PC SN720 NVMe SSD
04:00.0 VGA compatible controller: Advanced Micro Devices, Inc. [AMD/ATI] Raven Ridge [Radeon Vega Series / Radeon Vega Mobile Series] rev d6
04:00.1 Audio device: Advanced Micro Devices, Inc. [AMD/ATI] Raven/Raven2/Fenghuang HDMI/DP Audio Controller
04:00.2 Encryption controller: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 10h-1fh) Platform Security Processor
04:00.3 USB controller: Advanced Micro Devices, Inc. [AMD] Raven USB 3.1
04:00.4 USB controller: Advanced Micro Devices, Inc. [AMD] Raven USB 3.1
04:00.5 Multimedia controller: Advanced Micro Devices, Inc. [AMD] Raven/Raven2/FireFlight/Renoir Audio Processor
04:00.6 Audio device: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 10h-1fh) HD Audio Controller
```

Check USB

```
dataproc2021@rvlenovom715q:~$ lsusb
Bus 005 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 004 Device 005: ID 8087:0025 Intel Corp.
Bus 004 Device 004: ID 152d:2339 JMicron Technology Corp. / JMicron USA Technology Corp. JM20339 SATA Bridge
Bus 004 Device 003: ID 046d:c52b Logitech, Inc. Unifying Receiver
Bus 004 Device 002: ID 05e3:0610 Genesys Logic, Inc. 4-port hub
Bus 004 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 003 Device 002: ID 0bda:8153 Realtek Semiconductor Corp. RTL8153 Gigabit Ethernet Adapter
Bus 003 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 002 Device 002: ID 04d9:a131 Holtek Semiconductor, Inc. USB-HID Keyboard
Bus 002 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

US: more details (-v = verbose)

```
dataproc2021@rvlenovom715q:~$ lsusb -v
```

```
Bus 005 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub  
Couldn't open device, some information will be missing
```

```
Device Descriptor:
```

bLength	18
bDescriptorType	1
bcdUSB	3.10
bDeviceClass	9 Hub
bDeviceSubClass	0
bDeviceProtocol	3
bMaxPacketSize0	9
idVendor	0x1d6b Linux Foundation
idProduct	0x0003 3.0 root hub
bcdDevice	5.04
iManufacturer	3
iProduct	2
iSerial	1
bNumConfigurations	1

```
Configuration Descriptor:
```

bLength	9
bDescriptorType	2
wTotalLength	0x001f
bNumInterfaces	1
bConfigurationValue	1
iConfiguration	0
bmAttributes	0xe0
	Self Powered
	Remote Wakeup
MaxPower	0mA

Memory etc. types

```
dataproc2021@rvlenovom715q:~$ dmidecode --type 17
# dmidecode 3.2
/sys/firmware/dmi/tables/smbios_entry_point: Permission denied
Scanning /dev/mem for entry point.
/dev/mem: Permission denied
```

Desktop Management
Interface (DMI)

→ Print computer
hardware...

```
Handle 0x0031, DMI type 17, 40 bytes
Memory Device
    Array Handle: 0x002A
    Error Information Handle: 0x0030
    Total Width: 64 bits
    Data Width: 64 bits
    Size: 16384 MB
    Form Factor: SODIMM
    Set: None
    Locator: DIMM 0
    Bank Locator: P0 CHANNEL A
    Type: DDR4
    Type Detail: Synchronous Unbuffered (Unregistered)
    Speed: 2666 MT/s
    Manufacturer: Samsung
    Serial Number: 41C78936
    Asset Tag: Not Specified
    Part Number: M471A2K43CB1-CTD
    Rank: 2
    Configured Memory Speed: 1333 MT/s
    Minimum Voltage: 1.2 V
    Maximum Voltage: 1.2 V
    Configured Voltage: 1.2 V
```

LSHW

```
dataproc2021@rvlenovom715q:~$ lshw
WARNING: you should run this program as super-user.
rvlenovom715q
      description: Computer
      width: 64 bits
      capabilities: smp vsyscall32
*-core
      description: Motherboard
      physical id: 0
*-memory
      description: System memory
      physical id: 0
      size: 31GiB
*-cpu
      product: AMD Ryzen 5 PRO 2400GE w/ Radeon Vega Graphics
      vendor: Advanced Micro Devices [AMD]
      physical id: 1
      bus info: cpu@0
      size: 2720MHz
      capacity: 3200MHz
      width: 64 bits
      capabilities: fpu fpu_exception wp vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse :
e2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp x86-64 constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid aperfmpfperf pni pclmulqdq
      monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misal
nsse 3dnnowprefetch osvw skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_llc mwaitx cpb hw_pstate sme ssbd sev ibpb vmmcal
fsgsbase bmi1 avx2 smep bmi2 rdseed adx smap clflushopt sha_ni xsaveopt xsavec xgetbv1 xsaves clzero irperf xsaveerptr arat npt lbrv sv
      _lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter pfthreshold avic v_vmsave_vmload vgif overflow_recov succor
mca cpufreq
      *-pci:0
          description: Host bridge
          product: Raven/Raven2 Root Complex
          vendor: Advanced Micro Devices, Inc. [AMD]
          physical id: 100
          bus info: pci@0000:00:00.0
```

```
riveale@rvlenovom715q:~$ sudo lshw  
rvlenovom715q
```

More info with root...

```
    description: Mini PC  
    product: 10VGCT01WW (LENOVO_MT_10VG_BU_Think_FM_ThinkCentre M715q)  
    vendor: LENOVO  
    version: ThinkCentre M715q  
    serial: PC12ED50  
    width: 64 bits  
    capabilities: smbios-3.1.1 dmi-3.1.1 smp vsyscall32  
    configuration: administrator_password=disabled boot=normal chassis=mini family=ThinkCentre M715q  
password=disabled sku=LENOVO_MT_10VG_BU_Think_FM_ThinkCentre M715q uuid=80C3DB2A-FF39-E911-B9E4-E0  
*-core  
    description: Motherboard  
    product: 3130  
    vendor: LENOVO  
    physical id: 0  
    version: SDK0J40700 WIN 3258129964733  
    slot: Default string  
*-firmware  
    description: BIOS  
    vendor: LENOVO  
    physical id: 0  
    version: M1XKT34A  
    date: 09/04/2018  
    size: 64KiB  
    capacity: 16MiB  
    capabilities: pci upgrade shadowing cdboot bootselect socketedrom edd int13floppy1200 in  
screen int14serial int17printer acpi usb biosbootspecification uefi  
*-memory  
    description: System Memory  
    physical id: 2a  
    slot: System board or motherboard  
    size: 32GiB  
    *-bank:0
```

Other Useful Tools: filesystems, permissions, users

\$ useradd / userdel / usermod

Nicer interface: adduser / deluser

\$ groupadd / groupdel / groupmod

Nicer interface: addgroup / delgroup

\$ mount – mount filesystem

→ mount /dev/sda1 ./mydir # mounts to ./mydir

\$ umount – unmount filesystem

→ umount ./mydir

Other Useful Tools: Network-Related

\$ ip – print/change routing and addresses

Sometimes (older): ifconfig

\$ ip link (layer 1 – physical i.e. your cards)

\$ ip neighbor show (layer 2 – link i.e. MAC)

\$ ip addr (layer 3 – internet protocol IP)

\$ ethtool

\$ nstat / netstat – network statistics & conns

\$ ss – sockets information

Sockets are interface to connect and send/receive data between endpoints – either processes on different machines (connected by network) or different processes, same machine.

\$ ss -tunlp4

\$ ping (ICMP request)

\$ traceroute / tracepath – also uses ICMP – so often will not work

\$ nslookup – look up in nameserver

\$ whois – print registration information for domain name

\$ telnet – connect to target host/port using telnet protocol – over TCP

\$ netcat – listen in on TCP/UDP connections

\$ nmap – complex tool for scanning ports, mapping network

String Manipulation Tools

\$ grep – stream string search

\$ sed – stream string substitution

\$ (g)awk – pattern scanning/processing

\$ xargs – build command line from stdin

\$ tr – translate/delete characters

Useful Tools

GREP (print lines containing regex)

“...from the ed command g/re/p (globally search for a regular expression and print matching lines)”

(ed is line-oriented text editor)

MAN PAGES:

```
ED(1)                               User Commands                         ED(1)

NAME
    ed - line-oriented text editor

SYNOPSIS
    ed [options] [file]

DESCRIPTION
    GNU ed is a line-oriented text editor. It is used to create, display, modify and otherwise manipulate text files, both interactively and via shell scripts. A restricted version of ed, red, can only edit files in the current directory and cannot execute shell commands. Ed is the 'standard' text editor in the sense that it is the original editor for Unix, and thus widely available. For most purposes, however, it is superseded by full-screen editors such as GNU Emacs or GNU Moe.

OPTIONS
    -h, --help
        display this help and exit
    -V, --version
```

Tools for running programs

\$ chroot – run with different filesystem root

\$ sudo – run as superuser

\$ [COMMAND] & – run in background

\$ nohup – run separated from shell

\$ screen – tool to keep persistent screen session that can be attached/detached to different shells

Useful Tools

Screen (keep shell alive)

SCREEN – virtual screen to keep contents alive over shell sessions

```
$ screen
```

```
$ screen -r
```

```
$ screen -d
```

Useful Tools

history (history of shell commands)

```
$ history | grep rsync
```

(problem: if you have multiple sessions of same user only most recently closed will write to ~/.history file)

Useful Tools

Comparing Files

CMP (byte-by-byte comparison)

```
riveale@rvrbs19:~/tmp$ cmp blah.txt blahtodo.txt
cmp: EOF on blah.txt after byte 49, line 4
riveale@rvrbs19:~/tmp$ █
```

DIFF (string comparison – insertions/deletions)

```
riveale@rvrbs19:~/tmp$ diff blahtodo.txt blah.txt
5d4
< Yolo 840 haha
riveale@rvrbs19:~/tmp$ diff blah.txt blahtodo.txt
4a5
> Yolo 840 haha
riveale@rvrbs19:~/tmp$ diff todo.txt blahtodo.txt
0a1,4
> Hello this is an example file.
>
>
> Blah blah blah.
riveale@rvrbs19:~/tmp$ █
```

Useful Tools

Remote copy

Copying files remotely

SCP – secure copy

RSYNC – (secure) remote sync

Lecture 04: Shell practice 1

Summary

- Logging in (via SSH)
- basic file printing commands
- streams, redirecting, piping
- basic computer information commands
- other useful tools