

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:

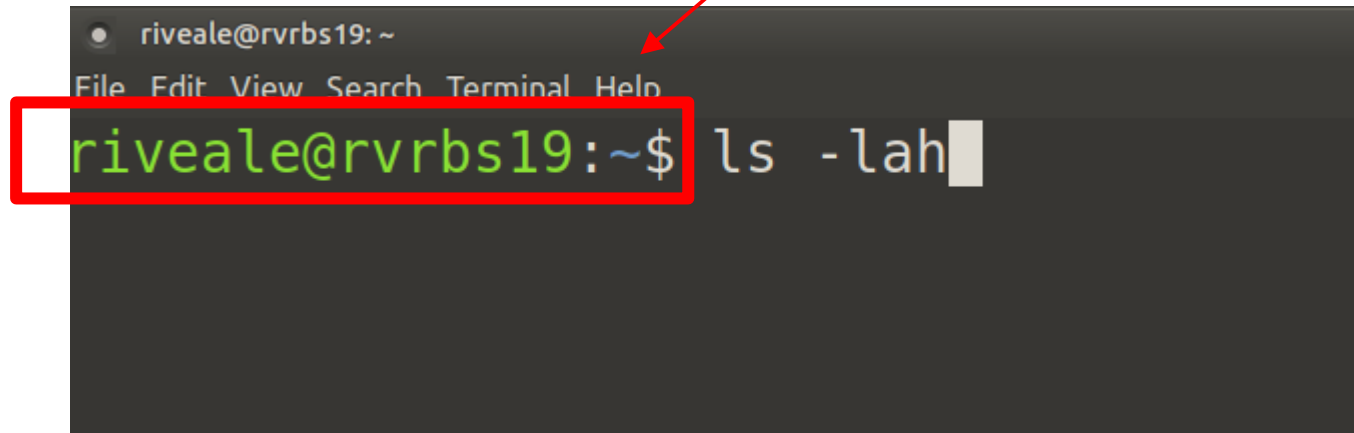
\$ ls -lah

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)



```
riveale@rvrbs19: ~  
File Edit View Search Terminal Help  
riveale@rvrbs19:~$ ls -lah
```

Before we start 1:

Prompt and decoration

I will write:

\$ **ls -lah**

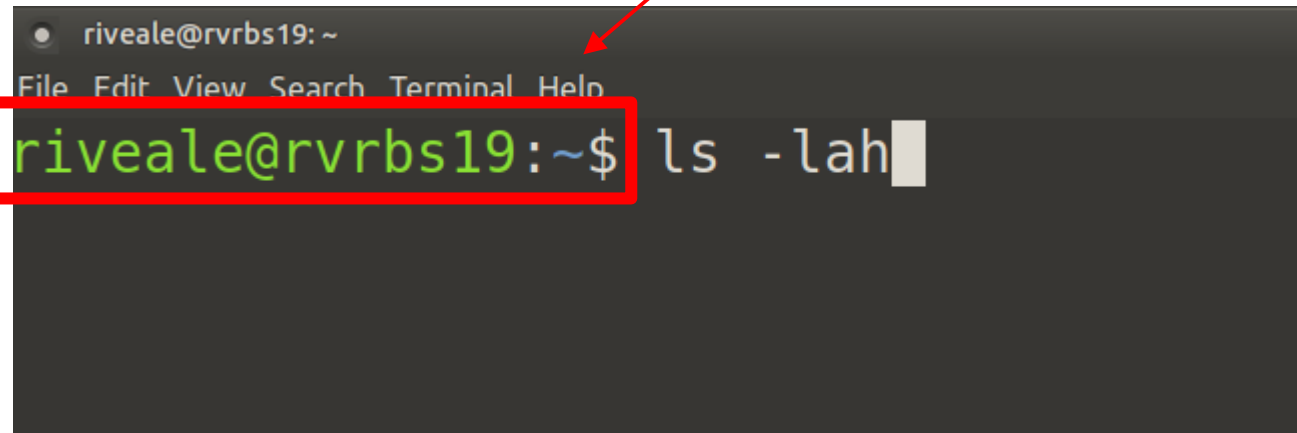
You should only
type this part!

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 Linux terminal window. The title bar shows 'riveale@rvrbs19: ~'. The menu bar includes 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The prompt 'riveale@rvrbs19:~\$' is highlighted with a red box. The command 'ls -lah' is entered after the prompt. A red arrow points from the text 'This is decoration' to the prompt, and another red arrow points from the text 'This is the (command) prompt' to the command.

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

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/          tmpgit/          tmpgit_rteye/    tmpsam/          tmpstore/
tmpdistroc.txt tmpgit2/        tmpgit_salmap_rv/ tmpstats/        tmp.txt

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/powered 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 shrank 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.
```

User:
dataproc2021

Password:
dataproc2021a9e8@

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.
```

```
Blah blah blah.
```

```
Yolo 840 haha
```

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)

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

(APPENDS to contents.txt)

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

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)

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-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  [|||] 2.0% 5  [|||] 2.7%
2  [|||] 0.0% 6  [|||] 3.2%
3  [|||||] 10.1% 7  [|||] 0.0%
4  [|||||] 7.0% 8  [|||] 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	2:40.22	/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 mtrr 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 aperfmperf pni pclmulqdq monitor 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 nrip
mcb_clean flushbyasid decodeassists pausefilter pfthreshold avic v_vmsave_vmload 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_alignmen : 64
address sizes   : 43 bits physical, 48 bits virtual
power managemen : 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 aperfmperf 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 misalignsse
```

```
3dnowprefetch osvw skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_llc mwaitx cpb hw_pstate sme ssbd sev ibpb vmmcall
```

```
fsgsbase bmi1 avx2 smep bmi2 rdseed adx smap clflushopt sha_ni xsaveopt xsavec xgetbv1 xsaves clzero irperf xsaveerptr arat npt lbrv
```

```
store_nri _lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter pfthreshold avic v_vmsave_vmload vgif overflow_recover
```

```
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
```


More info with root...

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

```
rvlenovom715q
```

```
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 int13floppy60  
screen int14serial int17printer acpi usb biosboot specification 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 [<u>options</u>] [<u>file</u>]	
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