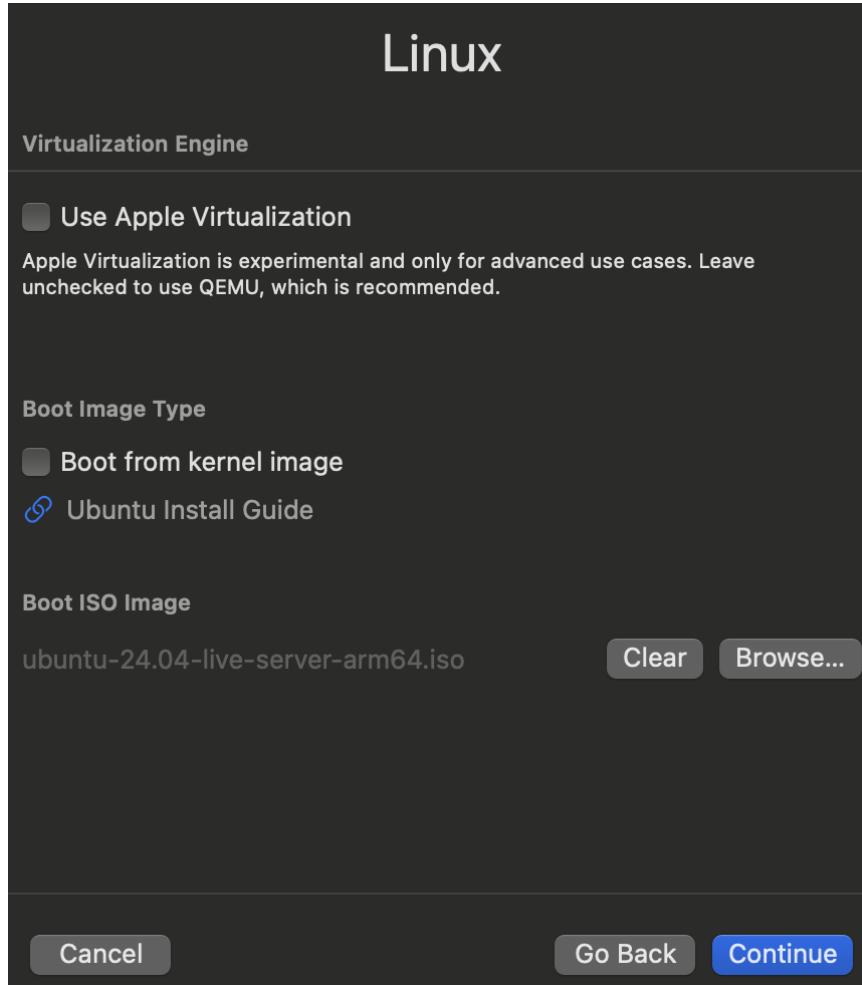


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1 VM setup



Hardware

Memory



CPU

CPU Cores

2

Hardware OpenGL Acceleration

Enable hardware OpenGL acceleration

There are known issues in some newer Linux drivers including black screen, broken compositing, and apps failing to render.

Storage

Size

Specify the size of the drive where data will be stored into.

25 GB

[Cancel](#)

[Go Back](#)

[Continue](#)

```
tilo2@tilo2:~$ sudo ufw enable
[sudo] password for tilo2:
Command may disrupt existing ssh connections. Proceed with operation (y|n)? y
Firewall is active and enabled on system startup
tilo2@tilo2:~$ sudo ufw default deny incoming
Default incoming policy changed to 'deny'
(be sure to update your rules accordingly)
tilo2@tilo2:~$ sudo ufw allow ssh
Rule added
Rule added (v6)
```

```
[tilo2@tilo2:~$ ssh-keygen
Generating public/private ed25519 key pair.
[Enter file in which to save the key (/home/tilo2/.ssh/id_ed25519):
[Enter passphrase (empty for no passphrase):
[Enter same passphrase again:
Your identification has been saved in /home/tilo2/.ssh/id_ed25519
Your public key has been saved in /home/tilo2/.ssh/id_ed25519.pub
The key fingerprint is:
SHA256:tCD8A1URvQ13biLEjl6fNzBe9NA0ptyC9k2l1GeNYI tilo2@tilo2
The key's randomart image is:
+--[ED25519 256]--+
|   .++ . |
|   . . . E ...o|
| + .o.o o *o+|
| + oo.. O =+|
| o S. = O **|
| . * X Bo+|
| . = * o|
| . |
| |
+---[SHA256]----+
[tilo2@tilo2:~$ ssh-copy-id tilo@192.168.64.6
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/tilo2/.ssh/id_ed25519.pub"
The authenticity of host '192.168.64.6 (192.168.64.6)' can't be established.
ED25519 key fingerprint is SHA256:tjhr2YUhlhayd23VoT3jXHaQqJrKxoigBsU0vc7SSs.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
tilo@192.168.64.6's password:

Number of key(s) added: 1
[tilo2@tilo2:~$ Now try logging into the machine, with: "ssh 'tilo@192.168.64.6'" and check to make sure that only the key(s) you wanted were added.

tilo2@tilo2:~$ ssh tilo@192.168.64.6
Welcome to Ubuntu 24.04 LTS (GNU/Linux 6.8.0-31-generic aarch64)

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

System information as of Fri May 31 08:38:39 PM UTC 2024

System load:          0.01
Usage of /:           45.2% of 10.70GB
Memory usage:         4%
Swap usage:          0%
Processes:            104
Users logged in:     1
IPv4 address for enp0s1: 192.168.64.6
IPv6 address for enp0s1: fd4e:9962:2a36:f074:b45f:80ff:fe1e:8650

Expanded Security Maintenance for Applications is not enabled.

12 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Last login: Fri May 31 20:36:32 2024 from 192.168.64.1
tilo@tilo:~$ ]
```

2 Commands and Pictures

2.1 a. ssh

```
[tilo2@tilo2:~$ ssh tilo@192.168.64.6
Welcome to Ubuntu 24.04 LTS (GNU/Linux 6.8.0-31-generic aarch64)

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

System information as of Fri May 31 09:15:24 PM UTC 2024

  System load:          0.0
  Usage of /:           45.3% of 10.70GB
  Memory usage:         7%
  Swap usage:           0%
  Processes:            116
  Users logged in:     1
  IPv4 address for enp0s1: 192.168.64.6
  IPv6 address for enp0s1: fd4e:9962:2a36:f074:b45f:80ff:fe1e:8650

1 device has a firmware upgrade available.
Run `fwupdmgm get-upgrades` for more information.

Expanded Security Maintenance for Applications is not enabled.

12 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

1 device has a firmware upgrade available.
Run `fwupdmgm get-upgrades` for more information.

Last login: Fri May 31 21:03:04 2024 from 192.168.64.7
```

remotely access the terminal of another machine

2.2 b. ssh-keygen

```
[tilo@tilo:~$ ssh-keygen
Generating public/private ed25519 key pair.
[Enter file in which to save the key (/home/tilo/.ssh/id_ed25]
519): blah
[Enter passphrase (empty for no passphrase):
[Enter same passphrase again:
Your identification has been saved in blah
Your public key has been saved in blah.pub
The key fingerprint is:
SHA256:drWSCVme3D4AnyV4lj1gU1ziZdmC73yHAS9KtjQFAac tilo@tilo
The key's randomart image is:
+--[ED25519 256]--+
| oo%X+o+o |
| .@+BB+o . |
| Eo=.=+ . |
| .=*..+ |
| S+=+++.o |
| . .o. .+ o|
| .. |
| |
+----[ SHA256 ]----+
```

generate private and public crytpgraphic keys

2.3 c. scp

```
[tilo@tilo:~$ scp blah.pub tilo2@192.168.64.7:/home/tilo2
blah.pub                                100%   91    146.8KB/s  00:00
```

moves files between machines

2.4 d. history

```
[tilo@tilo:~$ history
 1 clear
 2 ssh-keygen
 3 clear
 4 cd blah
 5 cat blah
 6 clear
 7 scp blah.pub tilo2@192.168.64.7
 8 ls
 9 clear
10 scp blah.pub tilo2@192.168.64.7:home/tilo2
11 clear
12 scp blah.pub tilo2@192.168.64.7:home/tilo2/
13 scp blah.pub tilo2@192.168.64.7:/home/tilo2
14 clear
15 scp blah.pub tilo2@192.168.64.7:/home/tilo2
16 clear
17 history
```

see command history

2.5 e. sudo

```
[tilo2@tilo2:~$ sudo snap install emacs --classic
2024-05-31T21:25:31Z INFO Waiting for automatic snapd restart...
emacs 29.3 from Alex Murray (alexmurrayo) installed
```

allows you to run commands you wouldn't have permission to otherwise

2.6 f. ip

```
[tilo2@tilo2:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host noprefixroute
            valid_lft forever preferred_lft forever
2: enp0s1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 66:7e:f8:1a:67:7d brd ff:ff:ff:ff:ff:ff
    inet 192.168.64.7/24 metric 100 brd 192.168.64.255 scope global dynamic enp0s1
        valid_lft 80995sec preferred_lft 80995sec
        inet6 fd4e:9962:2a36:f074:647e:f8ff:fe1a:677d/64 scope global dynamic mngtmpaddr noprefixroute
            valid_lft 2591943sec preferred_lft 604743sec
        inet6 fe80::647e:f8ff:fe1a:677d/64 scope link
            valid_lft forever preferred_lft forever]
```

get info related to ip addresses and networking

2.7 g. dd

```
[tilo2@tilo2:~$ dd if=hola.txt of=hola_copy.txt
0+1 records in
0+1 records out
22 bytes copied, 0.000127874 s, 172 kB/s]
```

copy file and possibly change format

2.8 h. fdisk

```
[tilo2@tilo2:~$ sudo fdisk -l
Disk /dev/loop0: 33.71 MiB, 35344384 bytes, 69032 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/loop1: 59.75 MiB, 62652416 bytes, 122368 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/loop2: 345.31 MiB, 362082304 bytes, 707192 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/vda: 25 GiB, 26843545600 bytes, 52428800 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 887C8621-6533-4311-A58B-6E8B1CB3C303

      Device     Start    End  Sectors  Size Type
/dev/vda1      2048 2203647  2201600    1G EFI System
/dev/vda2  2203648   6397951  4194304    2G Linux filesystem
/dev/vda3   6397952 52426751 46028800 21.9G Linux filesystem

Disk /dev/mapper/ubuntu--vg-ubuntu--lv: 10.97 GiB, 11781799936 bytes,
23011328 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

partition disk

2.9 i. apt

```
[tilo2@tilo2:~$ sudo apt update
Warning: The unit file, source configuration file or drop-ins of apt-new.service changed on disk. Run 'systemctl daemon-reload' to reload units.
Warning: The unit file, source configuration file or drop-ins of esm-ache.service changed on disk. Run 'systemctl daemon-reload' to reload units.
Hit:1 http://ports.ubuntu.com/ubuntu-ports noble InRelease
Get:2 http://ports.ubuntu.com/ubuntu-ports noble-updates InRelease [12
6 kB]
Hit:3 http://ports.ubuntu.com/ubuntu-ports noble-backports InRelease
Hit:4 http://ports.ubuntu.com/ubuntu-ports noble-security InRelease
Fetched 126 kB in 3s (47.6 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
17 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

package installing, uninstalling, etc.

2.10 j. vi

```
hola. i am text file.  
  
new line|
```

lightweight version of vim

2.11 k. time

```
[tilo@tilo:~$ time ./a.out
Hello, World!

real    0m0.002s
user    0m0.000s
sys     0m0.002s
[tilo@tilo:~$ time python3 hello_world.py
Hello, world!

real    0m0.032s
user    0m0.024s
sys     0m0.008s
```

user for timing other commands

2.12 l. tar

```
[tilo@tilo:~$ tar -cvf hola_and_pkey.tar hola.txt blah.pub
hola.txt
blah.pub
[tilo@tilo:~$ ls
blah blah.pub hola_and_pkey.tar hola.txt new_dir snap tilo2@192.168.64.7 v
[tilo@tilo:~$ mv hola_and_pkey.tar new_dir
[tilo@tilo:~$ cd new_dir
[tilo@tilo:/new_dir$ tar -xvf hola_and_pkey.tar
hola.txt
blah.pub
[tilo@tilo:/new_dir$ ls
blah.pub hola_and_pkey.tar hola.txt
tilo@tilo:/new_dir$ ]
```

combine multiple files into one

2.13 m. cat

```
[tilo@tilo:~$ cat hola.txt
hola. i am text file.
```

print text

2.14 n. watch

```
Every 2.0s: date
Sun Jun  2 09:31:00 UTC 2024
tilo: Sun Jun  2 21:31:00 2024
```

repeatedly run command

2.15 o. ps

```
[tilo@tilo:~$ ps
      PID TTY          TIME CMD
    1491 pts/1        00:00:00 bash
    2256 pts/1        00:00:00 ps
[tilo@tilo:~$ ps --quick-pid 1539
      PID TTY          TIME CMD
    1539 pts/0        00:00:04 watch
```

see active processes

2.16 p. top

top - 21:42:01 up 48 min, 3 users, load average: 0.10, 0.05, 0.01										
Tasks: 184 total, 1 running, 103 sleeping, 0 stopped, 0 zombie										
%CPU(s): 0.3 us, 0.3 sy, 0.0 ni, 99.3 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st										
MiB Mem : 3903.2 total, 3472.7 free, 297.9 used, 279.0 buff/cache										
MiB Swap: 2205.0 total, 2205.0 free, 0.0 used. 3605.2 avail Mem										
PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
311	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/R-kmpat
312	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/R-kmpat
340	root	rt	0	290144	25984	7296	S	0.0	0.7	0:00.77 multipathd
361	root	20	0	29764	7808	4352	S	0.0	0.2	0:00.09 systemd-udevd
368	root	-2	0	0	0	0	S	0.0	0.0	0:00.00 psimon
494	root	20	0	0	0	0	I	0.0	0.0	0:00.43 kworker/u4:4-events_power_e+
468	root	20	0	0	0	0	S	0.0	0.0	0:00.00 jbd2/vda2-8
469	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/R-ext4-
532	systemd+	20	0	21496	12288	10112	S	0.0	0.3	0:00.08 systemd-resolve
541	systemd+	20	0	98760	6912	6144	S	0.0	0.2	0:00.07 systemd-timesyn
653	systemd+	20	0	18708	8320	7424	S	0.0	0.2	0:00.06 systemd-network
670	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/R-cfg80
693	root	19	-1	17872	7680	6784	S	0.0	0.2	0:00.04 systemd-logind
694	message+	20	0	9844	4352	3712	S	0.0	0.1	0:00.06 dbus-daemon
699	polkitd	20	0	309068	7168	6408	S	0.0	0.2	0:00.03 polkitd
704	root	20	0	1318820	28536	18944	S	0.0	0.7	0:01.05 snapd
706	root	20	0	472508	12416	10368	S	0.0	0.3	0:00.17 udisksd
726	root	20	0	110444	21760	12544	S	0.0	0.5	0:00.07 unattended-upgr
739	syslog	20	0	222808	4992	3712	S	0.0	0.1	0:00.02 rsyslogd
762	root	20	0	398868	11776	9728	S	0.0	0.3	0:00.05 ModemManager
834	root	20	0	6748	2432	2304	S	0.0	0.1	0:00.01 cron
840	root	20	0	5292	1792	1792	S	0.0	0.0	0:00.00 getty
844	root	20	0	8544	3584	3200	S	0.0	0.1	0:00.02 login
1012	root	-2	0	0	0	0	S	0.0	0.0	0:00.00 psimon
1014	tilo	20	0	28172	10880	8832	S	0.0	0.3	0:00.05 systemd
1015	tilo	20	0	22192	3136	1792	S	0.0	0.1	0:00.00 (sd-pam)
1024	tilo	20	0	8364	4992	3456	S	0.0	0.1	0:00.04 bash
1055	root	20	0	12048	7168	6144	S	0.0	0.2	0:00.00 sshd
1057	root	20	0	16396	6984	5632	S	0.0	0.2	0:00.01 sshd
1112	tilo	20	0	16556	6316	4736	S	0.0	0.2	0:04.70 sshd
1113	tilo	20	0	8888	5632	3584	S	0.0	0.1	0:00.48 bash
1217	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/R-tls-s
1325	root	20	0	0	0	0	I	0.0	0.0	0:00.00 kworker/0:0-cgroup_destroy
1431	root	20	0	0	0	0	I	0.0	0.0	0:00.00 kworker/1:0-cgroup_destroy
1434	root	20	0	0	0	0	I	0.0	0.0	0:00.03 kworker/u4:1-events_unbound
1435	root	20	0	16396	6984	5632	S	0.0	0.2	0:00.01 sshd
1490	tilo	20	0	16556	6316	4736	S	0.0	0.2	0:00.71 sshd
1491	tilo	20	0	8356	5120	3584	S	0.0	0.1	0:00.04 bash
2294	root	20	0	0	0	0	I	0.0	0.0	0:00.00 kworker/0:1

display information about system

2.17 q. htop

```

0[|          0.7%] Tasks: 31, 35 thr, 73 kthr; 1 running
1[|||        2.0%] Load average: 0.10 0.07 0.01
Mem[|||||    162M/3.81G] Uptime: 00:50:56
Swp[          0K/2.15G]

Main I/O
PID USER PRI NI VIRT RES SHR S CPU% MEM% TIME+ Command
653 systemd-ne 20 0 18708 8320 7424 S 0.0 0.2 0:00.06 /usr/lib/systemd/systemd-networkd
693 root 19 -1 17872 7680 6784 S 0.0 0.2 0:00.04 /usr/lib/systemd/systemd-logind
694 messagebus 20 0 9944 4608 3712 S 0.0 0.1 0:00.10 @dbus-daemon --system --address=s
699 polkitd 20 0 301M 7168 6400 S 0.0 0.2 0:00.03 /usr/lib/polkit-1/polkitd --no-de
704 root 20 0 1287M 28536 18944 S 0.0 0.7 0:00.70 /usr/lib/snapd/snapd
706 root 20 0 461M 12416 10368 S 0.0 0.3 0:00.03 /usr/libexec/udisks2/udisksd
726 root 20 0 107M 21760 12544 S 0.0 0.5 0:00.07 /usr/bin/python3 /usr/share/unatt
728 root 20 0 461M 12416 10368 S 0.0 0.3 0:00.13 /usr/libexec/udisks2/udisksd
729 root 20 0 461M 12416 10368 S 0.0 0.3 0:00.00 /usr/libexec/udisks2/udisksd
732 root 20 0 461M 12416 10368 S 0.0 0.3 0:00.00 /usr/libexec/udisks2/udisksd
739 syslog 20 0 217M 4992 3712 S 0.0 0.1 0:00.01 /usr/sbin/rsyslogd -n -iNONE
745 polkitd 20 0 301M 7168 6400 S 0.0 0.2 0:00.00 /usr/lib/polkit-1/polkitd --no-de
746 polkitd 20 0 301M 7168 6400 S 0.0 0.2 0:00.00 /usr/lib/polkit-1/polkitd --no-de
748 polkitd 20 0 301M 7168 6400 S 0.0 0.2 0:00.00 /usr/lib/polkit-1/polkitd --no-de
758 syslog 20 0 217M 4992 3712 S 0.0 0.1 0:00.00 /usr/sbin/rsyslogd -n -iNONE
759 syslog 20 0 217M 4992 3712 S 0.0 0.1 0:00.00 /usr/sbin/rsyslogd -n -iNONE
760 syslog 20 0 217M 4992 3712 S 0.0 0.1 0:00.00 /usr/sbin/rsyslogd -n -iNONE
761 root 20 0 461M 12416 10368 S 0.0 0.3 0:00.00 /usr/libexec/udisks2/udisksd
762 root 20 0 389M 11776 9728 S 0.0 0.3 0:00.04 /usr/sbin/ModemManager
764 root 20 0 461M 12416 10368 S 0.0 0.3 0:00.00 /usr/libexec/udisks2/udisksd
767 root 20 0 389M 11776 9728 S 0.0 0.3 0:00.00 /usr/sbin/ModemManager
768 root 20 0 389M 11776 9728 S 0.0 0.3 0:00.00 /usr/sbin/ModemManager
770 root 20 0 389M 11776 9728 S 0.0 0.3 0:00.00 /usr/sbin/ModemManager
777 root 20 0 107M 21760 12544 S 0.0 0.5 0:00.00 /usr/bin/python3 /usr/share/unatt
778 root 20 0 1287M 28536 18944 S 0.0 0.7 0:00.03 /usr/lib/snapd/snapd
779 root 20 0 1287M 28536 18944 S 0.0 0.7 0:00.08 /usr/lib/snapd/snapd
780 root 20 0 1287M 28536 18944 S 0.0 0.7 0:00.04 /usr/lib/snapd/snapd
781 root 20 0 1287M 28536 18944 S 0.0 0.7 0:00.00 /usr/lib/snapd/snapd
783 root 20 0 1287M 28536 18944 S 0.0 0.7 0:00.00 /usr/lib/snapd/snapd
786 root 20 0 1287M 28536 18944 S 0.0 0.7 0:00.00 /usr/lib/snapd/snapd
820 root 20 0 1287M 28536 18944 S 0.0 0.7 0:00.08 /usr/lib/snapd/snapd
834 root 20 0 6748 2432 2304 S 0.0 0.1 0:00.01 /usr/sbin/cron -f -P
840 root 20 0 5292 1792 1792 S 0.0 0.0 0:00.00 /sbin/getty -o -p --- \u --keep-b
844 root 20 0 8544 3584 3200 S 0.0 0.1 0:00.02 /bin/login -p --
905 root 20 0 1287M 28536 18944 S 0.0 0.7 0:00.08 /usr/lib/snapd/snapd
1014 tilo 20 0 20172 10880 8832 S 0.0 0.3 0:00.05 /usr/lib/systemd/systemd --user
1015 tilo 20 0 22192 3136 1792 S 0.0 0.1 0:00.00 (sd-pam)
1024 tilo 20 0 8364 4992 3456 S 0.0 0.1 0:00.04 -bash
1055 root 20 0 12048 7168 6144 S 0.0 0.2 0:00.00 sshd: /usr/sbin/sshd -D [listener]
1057 root 20 0 16396 6984 5632 S 0.0 0.2 0:00.01 sshd: tilo [priv]
1112 tilo 20 0 16556 6316 4736 S 0.0 0.2 0:04.72 sshd: tilo@pts/0
1113 tilo 20 0 8888 5632 3584 S 0.0 0.1 0:00.48 -bash
1435 root 20 0 16396 6984 5632 S 0.0 0.2 0:00.02 sshd: tilo [priv]
1490 tilo 20 0 16556 6316 4736 S 0.0 0.2 0:01.66 sshd: tilo@pts/1
1491 tilo 20 0 8356 5120 3584 S 0.0 0.1 0:00.04 -bash
2546 root 20 0 466M 35840 30976 S 0.0 0.9 0:00.06 /usr/libexec/fwupd/fwupd
2547 root 20 0 466M 35840 30976 S 0.0 0.9 0:00.00 /usr/libexec/fwupd/fwupd
2548 root 20 0 466M 35840 30976 S 0.0 0.9 0:00.00 /usr/libexec/fwupd/fwupd
2549 root 20 0 466M 35840 30976 S 0.0 0.9 0:00.00 /usr/libexec/fwupd/fwupd
2550 root 20 0 466M 35840 30976 S 0.0 0.9 0:00.00 /usr/libexec/fwupd/fwupd
2552 root 20 0 466M 35840 30976 S 0.0 0.9 0:00.01 /usr/libexec/fwupd/fwupd
2584 tilo 20 0 8272 4996 3072 R 0.0 0.1 0:00.66 htop
F1Help F2Setup F3Search F4Filter F5Tree F6SortBy F7Nice -F8Nice +F9Kill F10Quit

```

top but nicer

2.18 r. gcc

```
[tilo@tilo:~$ gcc hello_world.c
[tilo@tilo:~$ ./a.out
Hello, World!
```

compiles c files

2.19 s. tail

```
[tilo@tilo:~$ tail hello_world.c -n 3
    return 0;
}
```

prints the last n lines of file

2.20 t. grep

```
[tilo@tilo:~$ history >> history.txt
[tilo@tilo:~$ grep touch history.txt
12 touch hello_world.c
12 touch hello_world.c
36 grep touch history.txt
37 grep touch history
12 touch hello_world.c
36 grep touch history.txt
37 grep touch history
40 grep touch history
```

search file for text that matches pattern

2.21 u. kill

```
[tilo@tilo:~$ grep watch ps.txt
root      47  0.0  0.0      0      0 ?          S    20:53   0:00 [watchdogd]
tilo     2559  0.9  0.0   6540  2944 pts/0      S+   21:43   0:05 watch date
[tilo@tilo:~$ kill 2559
```

kill process with a given pid

2.22 v. killall

```
[tilo@tilo:~$ ps aux | grep watch
root      47  0.0  0.0      0      0 ?        S     20:53   0:00 [watchdogd]
tilo     4147  1.0  0.0  6540  2944 pts/0    S+    21:56   0:01 watch date
tilo     4320  0.0  0.0  6140  2048 pts/1    S+    21:58   0:00 grep --color=auto watch
[tilo@tilo:~$ killall watch
[tilo@tilo:~$ ps aux | grep watch
root      47  0.0  0.0      0      0 ?        S     20:53   0:00 [watchdogd]
tilo     4329  0.0  0.0  6140  2048 pts/1    S+    21:58   0:00 grep --color=auto watch
```

kill all processes with a given name

2.23 w. du

```
[tilo@tilo:~$ du -h
24K      ./new_dir
4.0K     ./cache
4.0K     ./config/procps
4.0K     ./config/htop
12K      ./config
128K    ./emacs.d/eln-cache/29.3-351764c2
132K    ./emacs.d/eln-cache
136K    ./emacs.d
8.0K     ./snap/emacs/common/.cache/immodules
4.0K     ./snap/emacs/common/.cache/fontconfig
20K     ./snap/emacs/common/.cache
28K     ./snap/emacs/common
4.0K     ./snap/emacs/2468
36K     ./snap/emacs
40K     ./snap
24K     ./ssh
328K    .
```

see how much space folders are using up

2.24 x. df

```
[tilo@tilo:~$ df -h
Filesystem           Size  Used Avail Use% Mounted on
tmpfs                 391M  1.3M  390M   1% /run
efivars                256K   26K  231K  10% /sys/firmware/efi/efivars
/dev/mapper/ubuntu--vg-ubuntu--lv   11G   5.1G  5.2G  50% /
tmpfs                  2.0G     0  2.0G   0% /dev/shm
tmpfs                  5.0M     0  5.0M   0% /run/lock
/dev/vda2                2.0G   99M  1.7G   6% /boot
/dev/vda1                1.1G   6.4M  1.1G   1% /boot/efi
tmpfs                 391M   12K  391M   1% /run/user/1000
```

see how much space available in system

2.25 y. screen

```
[tilo@tilo:~$ screen -ls
There are screens on:
    4954.pts-1.tilo (06/02/2024 10:20:22 PM)          (Detached)
    4367.new_window (06/02/2024 10:12:29 PM)          (Detached)
2 Sockets in /run/screen/S-tilo.
[tilo@tilo:~$ screen -X -S 4367 quit
[tilo@tilo:~$ screen -ls
There is a screen on:
    4954.pts-1.tilo (06/02/2024 10:20:22 PM)          (Detached)
1 Socket in /run/screen/S-tilo.
```

manage multiple terminal windows

2.26 z. vim

A screenshot of the Vim text editor interface. The main window displays a C program:#include <stdio.h>
int main() {
 printf("Hello, World!\n");
 return 0;
}The code consists of a single function definition. The function header is `#include <stdio.h>`, followed by the `int main()` block, which contains a `printf` statement and a `return 0;` statement. Below the code, there is a large number of vertical scroll marks (~) indicating that the file is much longer than what is currently visible on the screen. At the bottom of the editor window, the status bar shows the file name "hello_world.c", the line count "7L", the byte count "81B", the cursor position "7,0-1", and the mode indicator "All".

file editor

2.27 aa. chmod

```
[tilo@tilo:~$ cat secret.txt
i am secret
[tilo@tilo:~$ chmod 000 secret.txt
[tilo@tilo:~$ cat secret.txt
cat: secret.txt: Permission denied
```

change user permissions on files

2.28 bb. chown

```
[tilo@tilo:~$ ls -l
total 76
-rwxrwxr-x 1 tilo tilo 70312 Jun  2 21:48 a.out
-rw----- 1 tilo tilo    399 May 31 21:16 blah
-rw-r--r-- 1 tilo tilo     91 May 31 21:16 blah.pub
-rw-rw-r-- 1 tilo tilo     81 Jun  2 22:27 hello_world.c
-rw-rw-r-- 1 tilo tilo   2307 Jun  2 21:50 history.txt
-rw-rw-r-- 1 tilo tilo   1643 Jun  2 21:28 hola.txt
drwxrwxr-x 2 tilo tilo   4096 Jun  2 21:15 new_dir
-rw-rw-r-- 1 tilo tilo   9788 Jun  2 21:52 ps.txt
----- 1 tilo tilo      12 Jun  2 22:44 secret.txt
drwx----- 3 tilo tilo   4096 May 31 21:22 snap
-rw-r--r-- 1 tilo tilo     91 May 31 21:18 tilo2@192.168.64.7
-rw-rw-r-- 1 tilo tilo  10240 Jun  2 21:14 v
[tilo@tilo:~$ sudo chown spyuser secret.txt
[tilo@tilo:~$ ls -l
total 76
-rwxrwxr-x 1 tilo      tilo 70312 Jun  2 21:48 a.out
-rw----- 1 tilo      tilo  399 May 31 21:16 blah
-rw-r--r-- 1 tilo      tilo   91 May 31 21:16 blah.pub
-rw-rw-r-- 1 tilo      tilo   81 Jun  2 22:27 hello_world.c
-rw-rw-r-- 1 tilo      tilo  2307 Jun  2 21:50 history.txt
-rw-rw-r-- 1 tilo      tilo  1643 Jun  2 21:28 hola.txt
drwxrwxr-x 2 tilo      tilo  4096 Jun  2 21:15 new_dir
-rw-rw-r-- 1 tilo      tilo  9788 Jun  2 21:52 ps.txt
----- 1 spyuser  tilo      12 Jun  2 22:44 secret.txt
drwx----- 3 tilo      tilo  4096 May 31 21:22 snap
-rw-r--r-- 1 tilo      tilo   91 May 31 21:18 tilo2@192.168.64.7
-rw-rw-r-- 1 tilo      tilo  10240 Jun  2 21:14 v
```

change owners of files

2.29 cc. useradd

```
[tilo@tilo:~$ sudo useradd -m spy2
[tilo@tilo:~$ ls ..
spy2  spyuser  tilo
```

add new users

2.30 dd. man

```
CAT(1)                               User Commands                               CAT(1)

NAME
    cat - concatenate files and print on the standard output

SYNOPSIS
    cat [OPTION]... [FILE]...

DESCRIPTION
    Concatenate FILE(s) to standard output.

    With no FILE, or when FILE is -, read standard input.

    -A, --show-all
        equivalent to -vET

    -b, --number-nonblank
        number nonempty output lines, overrides -n

    -e
        equivalent to -vE

    -E, --show-ends
        display $ at end of each line

    -n, --number
        number all output lines

    -s, --squeeze-blank
        suppress repeated empty output lines

    -t
        equivalent to -vT

    -T, --show-tabs
        display TAB characters as ^I

    -u
        (ignored)

    -v, --show-nonprinting
        use ^ and M- notation, except for LFD and TAB

    --help display this help and exit

    --version
        output version information and exit

EXAMPLES
    cat f - g
        Output f's contents, then standard input, then g's contents.

    cat
        Copy standard input to standard output.

AUTHOR
    Written by Torbjorn Granlund and Richard M. Stallman.

REPORTING BUGS
    GNU coreutils online help: <https://www.gnu.org/software/coreutils/>
    Report any translation bugs to <https://translationproject.org/team/>

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    Copyright © 2023 Free Software Foundation, Inc. License GPLv3+: GNU GPL version 3 or
    later; see file(1) for details. This is free software: you are free to change it and/or
    redistribute it under the terms of the GNU General Public License version 3 or later.
    There is NO WARRANTY, to the extent permitted by law.
```

read manual page for a given command

2.31 ee. locate

```
[tilo@tilo:~$ locate spy2  
/home/spy2
```

find and print absolute path to a folder somewhere on system

2.32 ff. find

```
[tilo@tilo:~$ find -name "hiding_file.txt"  
./new_dir/hiding_file.txt
```

find and print absolute path to a file (or folder?) somewhere on system

2.33 gg. sed

```
[tilo@tilo:~$ cat hola.txt  
hola. i am text file.  
[tilo@tilo:~$ sed 's/hola/hello/' hola.txt  
hello. i am text file.
```

advanced find and replace

2.34 hh. awk

```
[tilo@tilo:~$ cat hola.txt  
hola. i am text file.  
i am line two.  
  
[tilo@tilo:~$ awk '{print $1}' hola.txt  
hola.  
i
```

find text that matches pattern and run code on it

2.35 ii. diff

```
[tilo@tilo:~$ diff hola.txt hola2.txt
3c3
<
-----
> i am a copy.
```

see differences between two files

2.36 jj. sort

```
[tilo@tilo:~$ cat animals.txt
cat
bat
dog
snake
[tilo@tilo:~$ sort animals.txt
bat
cat
dog
snake
```

sorts lines of text

2.37 kk. export

```
[tilo@tilo:~$ export MY_VAR="i am a variable"
[tilo@tilo:~$ echo $MY_VAR
i am a variable
```

store variable in system

2.38 ll. pwd

```
[tilo@tilo:~$ pwd  
/home/tilo  
[tilo@tilo:~$ cd new_dir/  
[tilo@tilo:~/new_dir$ pwd  
/home/tilo/new_dir
```

get current absolute file path

2.39 mm. crontab

```
■ Edit this file to introduce tasks to be run by cron.
#
# Each task to run has to be defined through a single line
# indicating with different fields when the task will be run
# and what command to run for the task
#
# To define the time you can provide concrete values for
# minute (m), hour (h), day of month (dom), month (mon),
# and day of week (dow) or use '*' in these fields (for 'any').
#
# Notice that tasks will be started based on the cron's system
# daemon's notion of time and timezones.
#
# Output of the crontab jobs (including errors) is sent through
# email to the user the crontab file belongs to (unless redirected).
#
# For example, you can run a backup of all your user accounts
# at 5 a.m every week with:
# 0 5 * * 1 tar -zcvf /var/backups/home.tgz /home/
#
# For more information see the manual pages of crontab(5) and cron(8)
#
# m h dom mon dow   command
* * * * * echo "hola" >> hola.txt
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"/tmp/crontab.brqkU7/crontab" 25L, 924B           1,1          All
```

way to automate tasks (e.g. run some script every monday morning)

2.40 nn. mount

```
[tilo@tilo:~$ mount
sysfs on /sys type sysfs (rw,nosuid,nodev,noexec,relatime)
proc on /proc type proc (rw,nosuid,nodev,noexec,relatime)
udev on /dev type devtmpfs (rw,nosuid,relatime,size=194160k,nr_inodes=485400,mode=755,inode64)
devpts on /dev/pts type devpts (rw,nosuid,noexec,relatime,gid=5,mode=020,ptmxmode=000)
tmpfs on /run type tmpfs (rw,nosuid,nodev,noexec,relatime,size=399684k,mode=755,inode64)
efivarfs on /sys/firmware/efi/efivars type efivarfs (rw,nosuid,nodev,noexec,relatime)
/dev/mapper/ubuntu--vg-ubuntu--lv on / type ext4 (rw,relatime)
securityfs on /sys/kernel/security type securityfs (rw,nosuid,nodev,noexec,relatime)
tmpfs on /dev/shm type tmpfs (rw,nosuid,nodev,inode64)
tmpfs on /run/lock type tmpfs (rw,nosuid,nodev,noexec,relatime,size=5120k,inode64)
cgroup2 on /sys/fs/cgroup type cgroup2 (rw,nosuid,nodev,noexec,relatime,nsdelegate,memory_recursiveprot)
pstore on /sys/fs/pstore type pstore (rw,nosuid,nodev,noexec,relatime)
bpf on /sys/fs/bpf type bpf (rw,nosuid,nodev,noexec,relatime,mode=700)
systemd-1 on /proc/sys/fs/binfmt_misc type autofs (rw,relatime,fd=32,pgrp=1,timeout=0,minproto=5,maxproto=5,direct,pipe_ino=2029)
hugetlbfs on /dev/hugepages type hugetlbfs (rw,nosuid,nodev,relatime,pagesize=2M)
mqueue on /dev/mqueue type mqueue (rw,nosuid,nodev,noexec,relatime)
debugfs on /sys/kernel/debug type debugfs (rw,nosuid,nodev,noexec,relatime)
tracefs on /sys/kernel/tracing type tracefs (rw,nosuid,nodev,noexec,relatime)
fusectl on /sys/fs/fuse/connections type fusectl (rw,nosuid,nodev,noexec,relatime)
configfs on /sys/kernel/config type configfs (rw,nosuid,nodev,noexec,relatime)
/var/lib/snaps/core20_2321.snap on /snap/core20/2321 type squashfs (ro,nodev,relatime,errors=continue,threads=single,x-gdu.hide,x-gvfs-hide)
/var/lib/snaps/emacs_2468.snap on /snap/emacs/2468 type squashfs (ro,nodev,relatime,errors=continue,threads=single,x-gdu.hide,x-gvfs-hide)
/var/lib/snaps/snappy_21761.snap on /snap/snappyd/21761 type squashfs (ro,nodev,relatime,errors=continue,threads=single,x-gdu.hide,x-gvfs-hide)
/dev/vda2 on /boot type ext4 (rw,relatime)
/dev/vda1 on /boot/efi type vfat (rw,relatime,fmask=0022,dmask=0022,codepage=437,iocharset=iso8859-1,shortname=mixed,errors=remount-ro)
binfmt_misc on /proc/sys/fs/binfmt_misc type binfmt_misc (rw,nosuid,nodev,noexec,relatime)
tmpfs on /run/user/1000 type tmpfs (rw,nosuid,nodev,relatime,size=399680k,nr_inodes=99920,mode=700,uid=1000,gid=1000,inode64)
```

mount a file system

2.41 oo. passwd

```
[tilo@tilo:~$ passwd spy2
passwd: You may not view or modify password information for spy2.
[tilo@tilo:~$ sudo passwd spy2
[sudo] password for tilo:
[New password:
[Retype new password:
passwd: password updated successfully
```

change or set password for user

2.42 pp. uname

```
[tilo@tilo:~$ uname -v
#31-Ubuntu SMP PREEMPT_DYNAMIC Sat Apr 20 02:32:42 UTC 2024
```

get OS/system info

2.43 qq. whereis

```
[tilo@tilo:~$ whereis cat
cat: /usr/bin/cat /usr/share/man/man1/cat.1.gz
```

get paths to command code and manual description for command

2.44 rr. whatis

```
[tilo@tilo:~$ whatis cat
cat (1)           - concatenate files and print on the standard output
```

get brief description of command

2.45 ss. su

```
[tilo@tilo:~$ su spy2
[Password:
[$ ls
ls: cannot open directory '.': Permission denied
[$ cd ..
[$ ls
spy2  spyuser  tilo
[$ cd spy2
[$ ls
[$ ls -a
.  ..  .bash_logout  .bashrc  .profile
$ ]
```

change users

2.46 tt. ping

```
[tilo@tilo:~$ ping google.com
PING google.com (142.250.191.206) 56(84) bytes of data.
64 bytes from ord38s31-in-f14.1e100.net (142.250.191.206): icmp_seq=1 ttl=56 time=6.53 ms
64 bytes from ord38s31-in-f14.1e100.net (142.250.191.206): icmp_seq=2 ttl=56 time=13.9 ms
64 bytes from ord38s31-in-f14.1e100.net (142.250.191.206): icmp_seq=3 ttl=56 time=15.0 ms
64 bytes from ord38s31-in-f14.1e100.net (142.250.191.206): icmp_seq=4 ttl=56 time=13.8 ms
64 bytes from ord38s31-in-f14.1e100.net (142.250.191.206): icmp_seq=5 ttl=56 time=14.9 ms
64 bytes from ord38s31-in-f14.1e100.net (142.250.191.206): icmp_seq=6 ttl=56 time=15.8 ms
64 bytes from ord38s31-in-f14.1e100.net (142.250.191.206): icmp_seq=7 ttl=56 time=16.1 ms
64 bytes from ord38s31-in-f14.1e100.net (142.250.191.206): icmp_seq=8 ttl=56 time=16.1 ms
```

constantly send messages to website to see if it's online

2.47 uu. traceroute



part2/traceroute.png

(missing)

2.48 vv. date

```
[tilo@tilo:~$ date
Mon Jun  3 02:05:47 AM UTC 2024
```

get current time and date

2.49 ww. time

```
[tilo@tilo:~$ time ./a.out
Hello, World!

real    0m0.002s
user    0m0.000s
sys     0m0.002s
[tilo@tilo:~$ time python3 hello_world.py
Hello, world!

real    0m0.032s
user    0m0.024s
sys     0m0.008s
```

repeat, see prev def

2.50 xx. wget

```
[tilo@tilo:~$ wget http://datasys.cs.iit.edu/grants/BigDataX/2024/index.html
--2024-06-03 02:12:02--  http://datasys.cs.iit.edu/grants/BigDataX/2024/index.html
Resolving datasys.cs.iit.edu (datasys.cs.iit.edu)... 216.47.155.57
Connecting to datasys.cs.iit.edu (datasys.cs.iit.edu)|216.47.155.57|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 10402 (10K) [text/html]
Saving to: 'index.html'

index.html      100%[=====] 10.16K --.-KB/s   in 0.001s
2024-06-03 02:12:02 (15.6 MB/s) - 'index.html' saved [10402/10402]
[tilo@tilo:~$ grep highlights index.html
<p>For REU BigDataX program highlights from prior years,
```

request file/webpage from url

2.51 yy. wc

```
[tilo@tilo:~$ wc index.html
      248    890  10402 index.html
[tilo@tilo:~$ wc hola.txt
      22    28  133 hola.txt
[tilo@tilo:~$ cat hola.txt
hola. i am text file.
i am line two.
```

```
hola
```

get wordcount of file

2.52 zz. pwgen

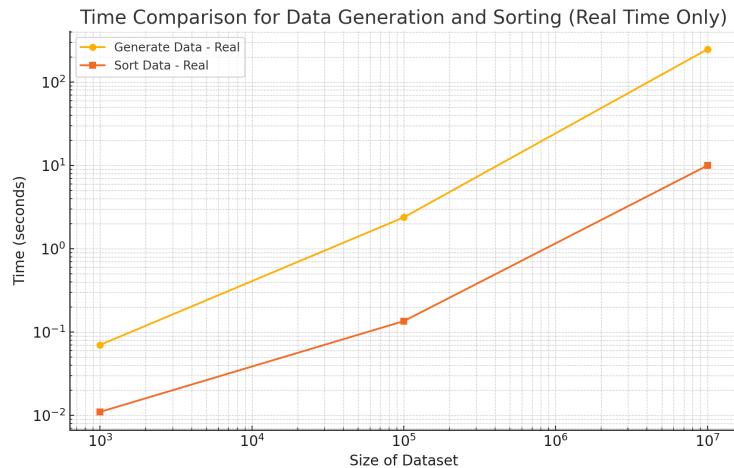
```
[tilo@tilo:~$ pwgen
Them6kim BieNgah1 oZohs3oh rai5ohLi Aoch2ac0 choZ4Jei eiX7veoS JaDoht50
Coovaek0 ea4aiN2e ru2ahJob Ai0Tahro aeKae0Ee ohbai70h ojue30hd Ec7eidei
nee9elie Wieja7gu thai8Atu Iez0tiFa Ziew0wou boh6Gopi yoho1Ahd eRieni9d
mu8och2u az0que5U ciod0ohF No7iec5z NePi0Eej aiw5da14 eiBacah8 Zirei0ei
jaimeP8s xoo4Eeli Ui9mieng faez9Esh Gai6yuch og8eiLee saF9ohmi Ceu0meim
Su7gooz6 peec4eiC oce9Goh5 leiph3AV eish0Cae AeNa0lah ahNuu5ch AKooD8yu
Fiefae2o iego7Iep Eef4iuye Eejeop3i aegeef1U eutooK3o Thange3r aengeiM2
oon0oz5E Ais4bog7 Chie0Eih Ahroh5op ooLei7ah Ax1bohSh oop90hw1 kahNae00
the0UToo Or7caib9 eo9jeuCu yaix4Lie OhYu8aev Oh9giek Es9kahwi ok6Xoo7h
aich60o8 Boo7ohng Ohwool3Y eicei1Cu thech2UL Eethee6y aiWigee4 ieT0goo6
iN9pahn4 Osh5aeth aetaCh0D Boo7ahX0 Oi1osh6S yooQuug3 Iong0cae ur1AhTh5
ichoo7Je oon2Aing Tiew5sah quohn80o tae7ooSh unggooVe6 UMiugoh0 ooKoo9oC
vi8Wieha ViiB2see hooVe16b isoh3EeM weiGai1i iuQueNg0 At7ohz4u Cei9Gee
quui7OoK Chool8ra aif6thae boo5oiK9 Eedi1ed9 pieN2iej wi9Ahch2 ki6Oufah
Pahquah2 Saith2de GeiD9fu7 ew3Aiqua ho1eiZou iTahl4UU aeLah8co tei4Quee
ci5UJaig Aehe2tah iequiDc pheiWee8 aepe4Ik7 Ahx6peig phah30u1 thairu9A
Yie7EKeY iuguHo9p Peegh0p aequ5OoK Laz7joof ubei1Tho ooth9es8 zi5Aijoo
Ohchoh2o aeQu6poh euphei1P olooc2Ve aem3Rei6 ohw1Shee Akei5com aeng3eiB
ahch4Quo pue7Shie Fahk5Aet ieG2raa8 Eelae4oo Aich7bah aew6ahGh KieThe2g
Eefai3sh tahk8ohR Decha5ke ooSha2qu Rea1ough gaphiiF0 ahw0Ieve Bierozo9
```

generate password

3 Bash Script

```
[tilo@tilo:~$ time ./generate-dataset.sh 1000.txt 1000
real    0m0.070s
user    0m0.073s
sys     0m0.020s
[tilo@tilo:~$ time ./generate-dataset.sh 100000.txt 100000
real    0m2.375s
user    0m2.986s
sys     0m0.109s
[tilo@tilo:~$ time ./generate-dataset.sh 10000000.txt 10000000
real    4m6.814s
user    5m7.380s
sys     0m11.476s
```

```
[tilo@tilo:~$ time ./sort-data.sh 1000.txt
real    0m0.011s
user    0m0.004s
sys     0m0.007s
[tilo@tilo:~$ time ./sort-data.sh 100000.txt
real    0m0.135s
user    0m0.050s
sys     0m0.081s
[tilo@tilo:~$ time ./sort-data.sh 1000000.txt
real    0m9.945s
user    0m11.161s
sys     0m2.648s
```



4 VM Configuration Questions

4.1 1. System Configuration of the VM

4.1.1 a. Changing the Number of Processors

Less VMs could be good if you don't need a lot of processing power or if the processes you're running can't be parallelized much and thus can't

benefit from multiple cores. A lot of processors would be good in applications needing a lot of power and where computation can be parallelized efficiently. Using all processors might slow down your computer a lot.

4.2 2. Acceleration Tab

4.2.1 b. Paravirtualization Options

I couldn't find anything about UTM so I'm just going by the virtual box documentation.

Minimal: Announces the presence of a virtualized environment. Additionally, reports the TSC and APIC frequency to the guest operating system. This provider is mandatory for running any Mac OS X guests.

KVM: Presents a Linux KVM hypervisor interface which is recognized by Linux kernels version 2.6.25 or later. Oracle VM VirtualBox's implementation currently supports paravirtualized clocks and SMP spinlocks. This provider is recommended for Linux guests.

Hyper-V: Presents a Microsoft Hyper-V hypervisor interface which is recognized by Windows 7 and newer operating systems. Oracle VM VirtualBox's implementation currently supports paravirtualized clocks, APIC frequency reporting, guest debugging, guest crash reporting and relaxed timer checks. This provider is recommended for Windows guests.

Source: [VirtualBox Documentation](<https://www.virtualbox.org/manual/ch10.html#gimproviders>).

Not sure about none and legacy. KVM is the best choice for Ubuntu Linux.

4.3 3. Storage Devices

4.3.1 c. Types of Storage Controllers

Different storage technologies. Newer ones are probably generally faster/better if the OS you're trying to virtualize can handle them.

4.4 4. Network Configuration

4.4.1 d. Types of Network Adapters

NAT: Suitable for general internet access from the VM, with automatic network configuration. Use it when the VM needs to access external networks but does not require inbound connections. Bridged Adapter: Good for situations where the VM needs to appear as a separate device on the same network as the host, such as for network testing or running network services. Internal Network: Useful for setting up isolated networks between VMs that do not need external network access, often used in development or testing environments. Host-only Network: Used for direct communication between the host and the VM, without external network access. Ideal for testing or development environments where external connectivity is not needed.

4.5 5. USB Configuration

USB1.1 is worse than 2.0, and 3.0 is better than 2.0. You would probably want to select the best option that the machine you were creating the VM on could handle.