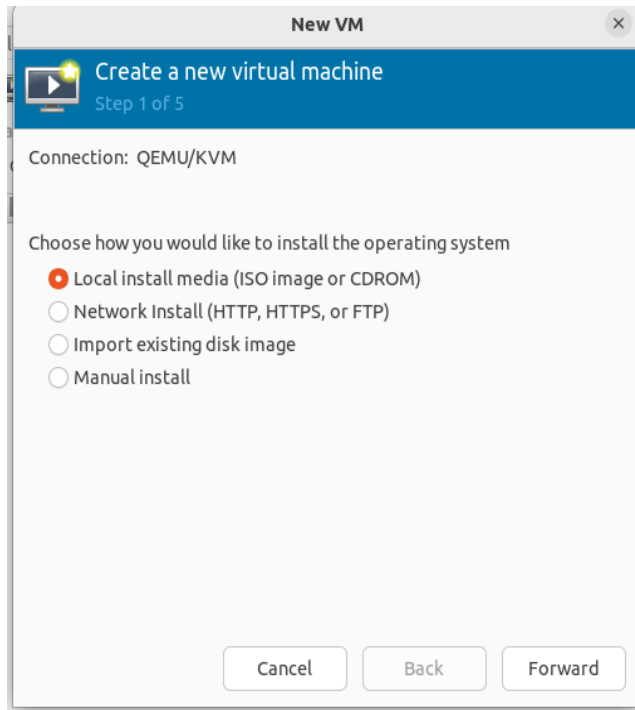
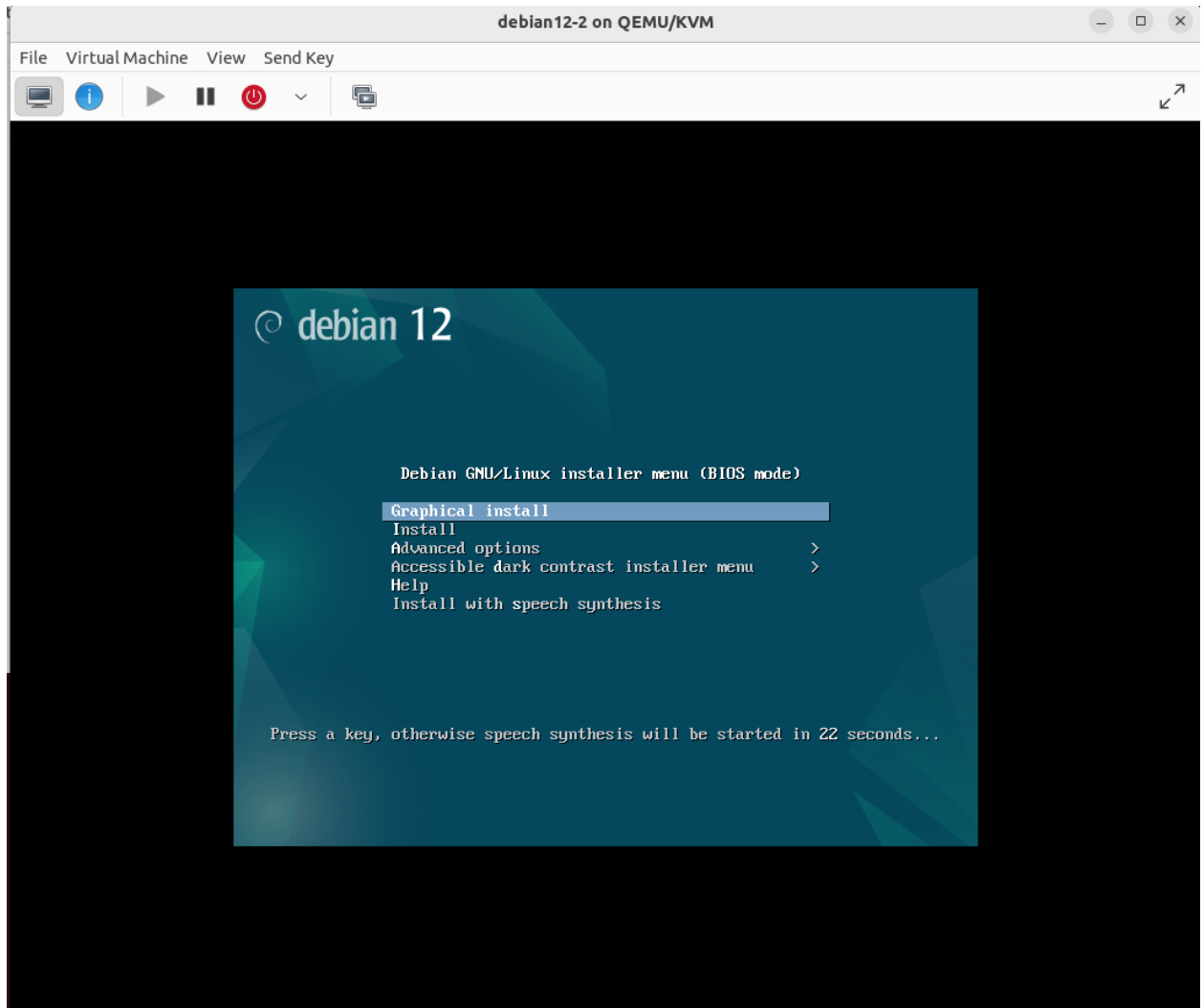


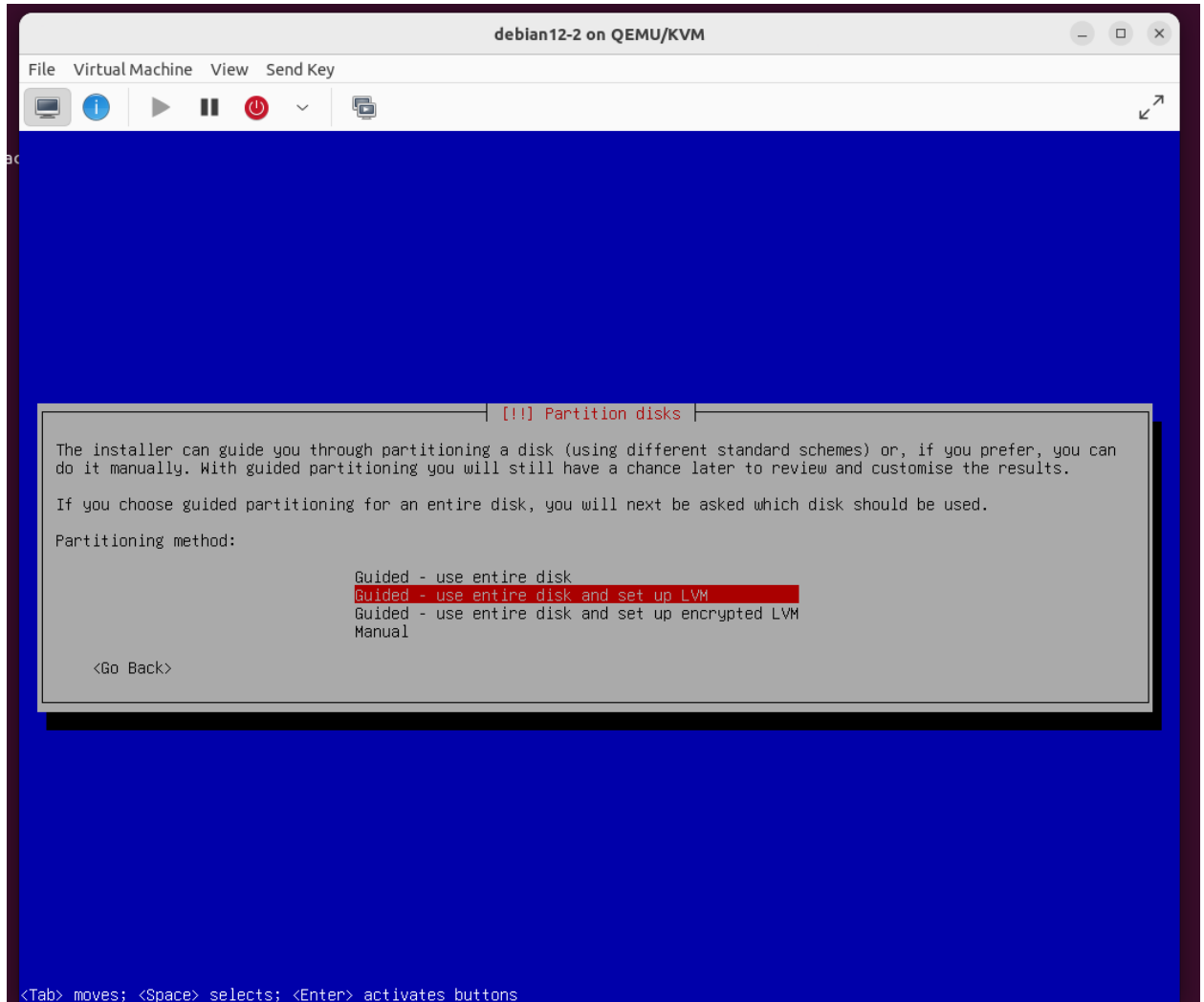
CSCI-201 Final Lab

For the final lab, we built a Debian VM using the kvm hypervisor. This document will be temporary and for submission only, this information will be reformatted and hosted via GitHub pages on [my repository](#).

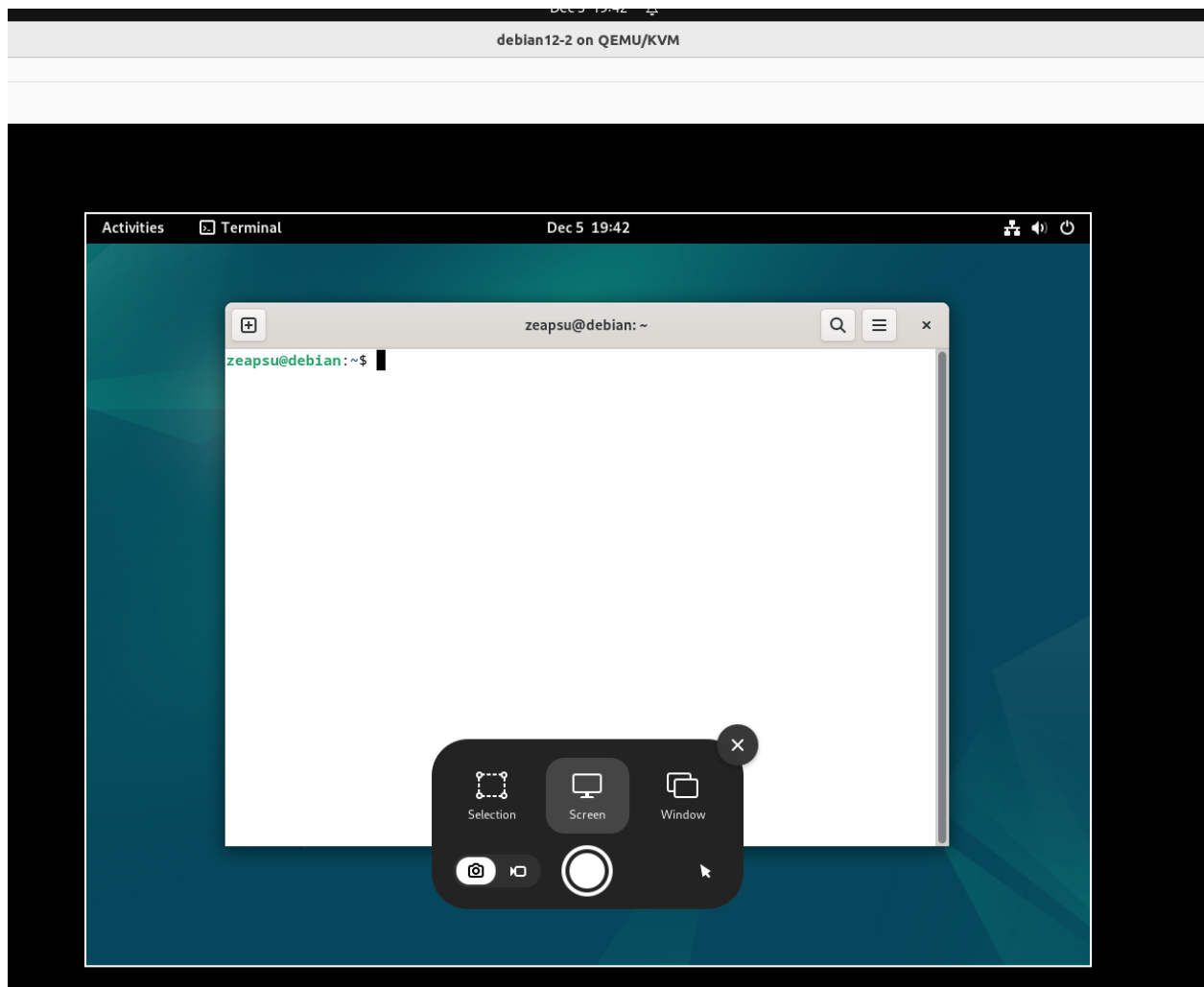
1. **Build the VM using virt-manager and the ISO provided on the local machine.**



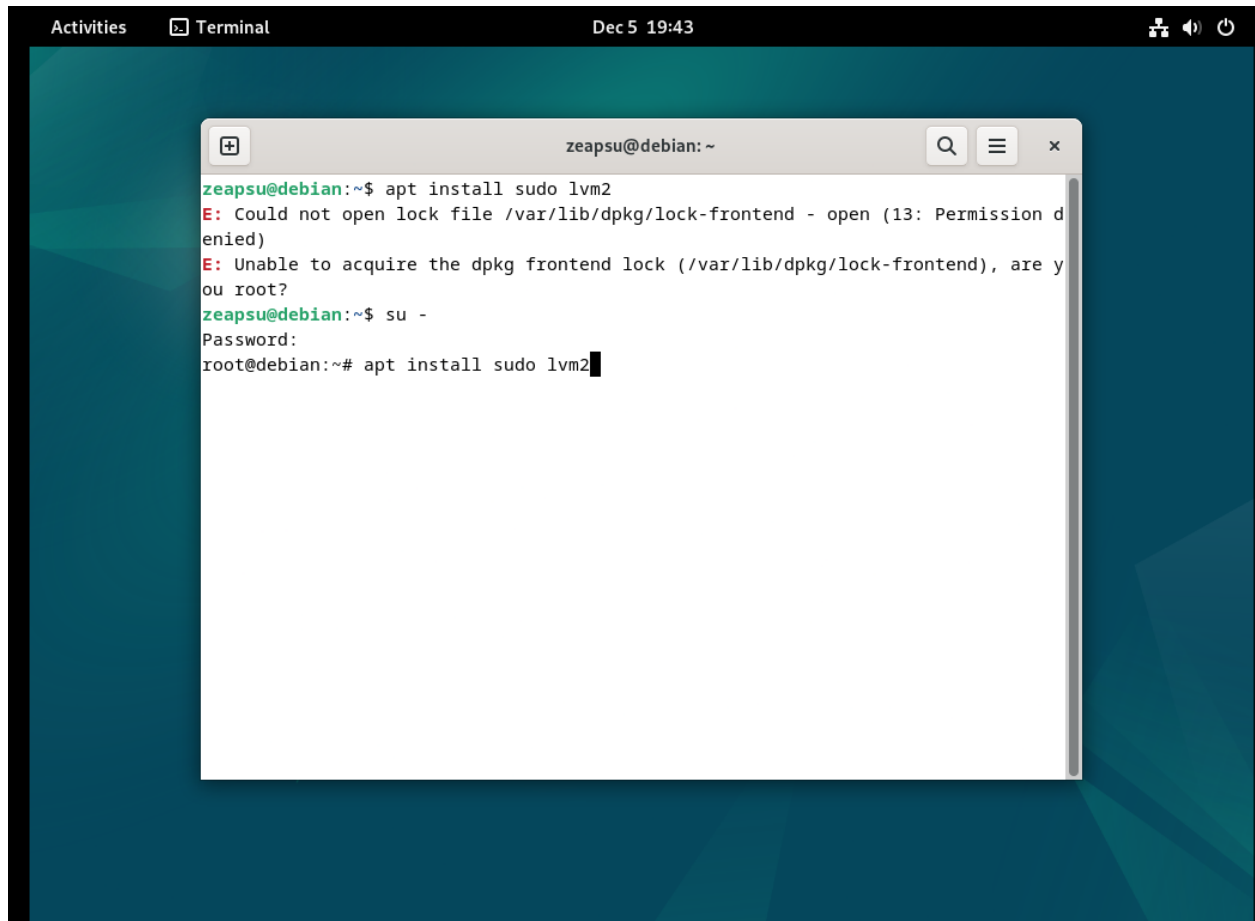




2. Completed VM is displayed below equipped with the GNOME Desktop environment.



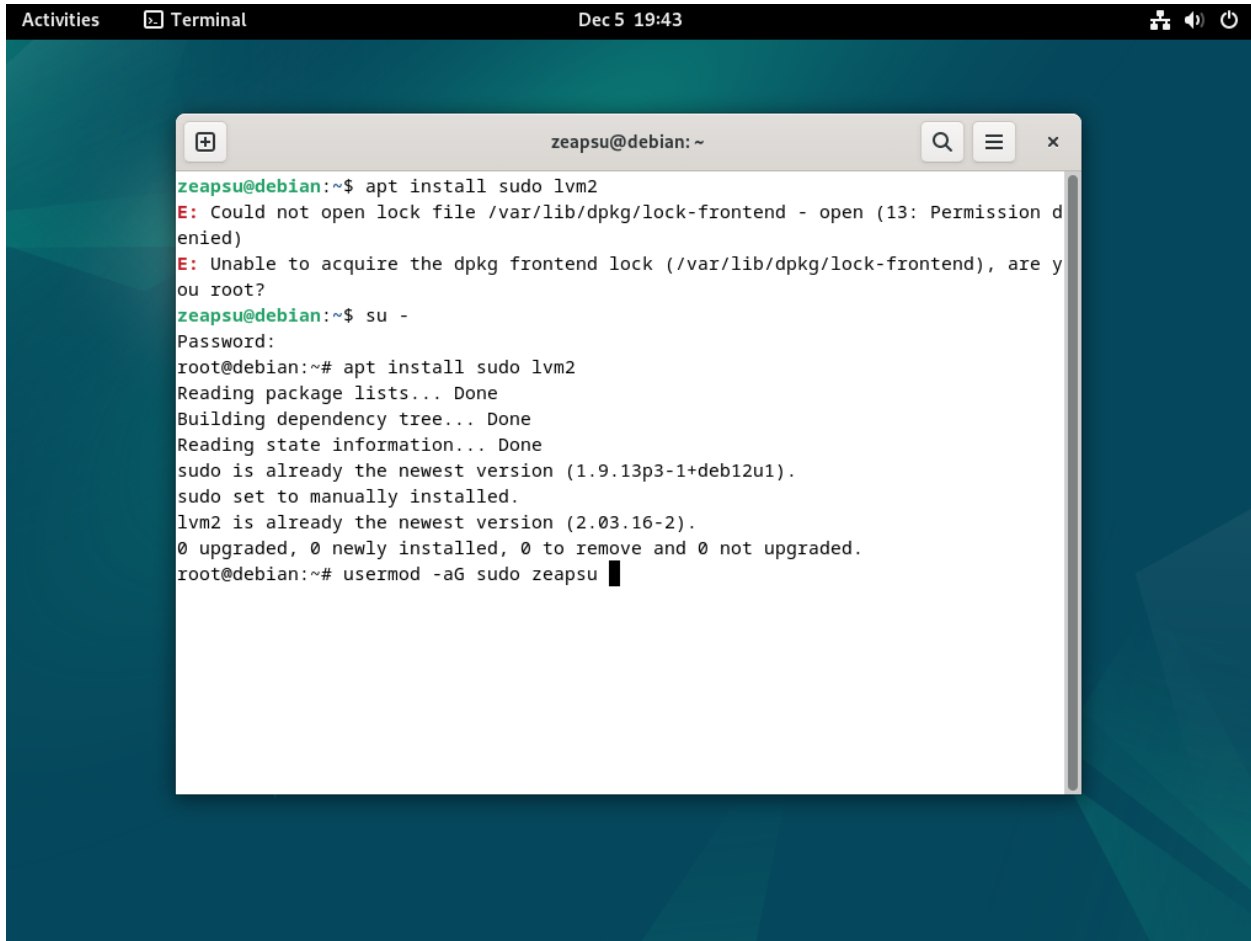
3. Next we install `sudo` and `lvm2` to be able to add `sudo` users and be able to create our logical volumes later



The image shows a terminal window titled "zeapsu@debian: ~" with a search icon, a menu icon, and a close button. The terminal output is as follows:

```
zeapsu@debian:~$ apt install sudo lvm2
E: Could not open lock file /var/lib/dpkg/lock-frontent - open (13: Permission denied)
E: Unable to acquire the dpkg frontend lock (/var/lib/dpkg/lock-frontent), are you root?
zeapsu@debian:~$ su -
Password:
root@debian:~# apt install sudo lvm2
```

4. We add the default user created during VM installation to the sudo group



```
Activities Terminal Dec 5 19:43
zeapsu@debian: ~
zeapsu@debian:~$ apt install sudo lvm2
E: Could not open lock file /var/lib/dpkg/lock-frontent - open (13: Permission denied)
E: Unable to acquire the dpkg frontend lock (/var/lib/dpkg/lock-frontent), are you root?
zeapsu@debian:~$ su -
Password:
root@debian:~# apt install sudo lvm2
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
sudo is already the newest version (1.9.13p3-1+deb12u1).
sudo set to manually installed.
lvm2 is already the newest version (2.03.16-2).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
root@debian:~# usermod -aG sudo zeapsu
```

5. We install the tools for the openssh server, testing out our new sudo privileges for the user and ssh into the VM from the local machine


```

zeapsu@debian: ~
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
sudo is already the newest version (1.9.13p3-1+deb12u1).
sudo set to manually installed.
lvm2 is already the newest version (2.03.16-2).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
root@debian:~# usermod -aG sudo zeapsu
root@debian:~# su - zeapsu
zeapsu@debian:~$ sudo apt install openssh-server
[sudo] password for zeapsu:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  openssh-sftp-server runit-helper
Suggested packages:
  molly-guard monkeysphere ssh-askpass ufw
The following NEW packages will be installed:
  openssh-server openssh-sftp-server runit-helper
0 upgraded, 3 newly installed, 0 to remove and 0 not upgraded.
Need to get 528 kB of archives.
After this operation, 2,214 kB of additional disk space will be used.
Do you want to continue? [Y/n]

```

```

tux@jmkll16c:~/csci-201-final/final/docs/assets$ ssh tux@192.168.122.197
The authenticity of host '192.168.122.197 (192.168.122.197)' can't be established.
ED25519 key fingerprint is SHA256:iqLFwxHZiJtImJKus8+kPlx5K6SSbsbjwSYcEE1skGQ.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.122.197' (ED25519) to the list of known hosts.
tux@192.168.122.197's password:
Permission denied, please try again.
tux@192.168.122.197's password:

tux@jmkll16c:~/csci-201-final/final/docs/assets$ ssh zeapsu@192.168.122.197
zeapsu@192.168.122.197's password:
Permission denied, please try again.
zeapsu@192.168.122.197's password:
Linux debian 6.1.0-13-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.1.55-1 (2023-09-29) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
zeapsu@debian:~$ █
[0] 0:nvim 1:python3 2:bash- 3:ssh*

```

6. We enable the serial console and verify it is running via our ssh connection to the VM

```

zeapsu@debian:~$ systemctl enable serial-getty@ttyS0.service
==== AUTHENTICATING FOR org.freedesktop.systemd1.manage-unit-files ====
Authentication is required to manage system service or unit files.
Authenticating as: zeapsu,,, (zeapsu)
Password:
==== AUTHENTICATION COMPLETE ====
Created symlink /etc/systemd/system/getty.target.wants/serial-getty@ttyS0.service → /lib/systemd/system/serial-getty@.service.
==== AUTHENTICATING FOR org.freedesktop.systemd1.reload-daemon ====
Authentication is required to reload the systemd state.
Authenticating as: zeapsu,,, (zeapsu)
Password:
==== AUTHENTICATION COMPLETE ====
zeapsu@debian:~$ su -
Password:
root@debian:~# systemctl start serial-getty@ttyS0.service
root@debian:~# systemctl status serial-getty@ttyS0.service
● serial-getty@ttyS0.service - Serial Getty on ttyS0
   Loaded: loaded (/lib/systemd/system/serial-getty@.service; enabled; preset: enabled)
   Active: active (running) since Tue 2023-12-05 19:56:10 PST; 11s ago
     Docs: man:agetty(8)
           man:systemd-getty-generator(8)
           https://0pointer.de/blog/projects/serial-console.html
    Main PID: 3288 (agetty)
      Tasks: 1 (limit: 9336)
     Memory: 276.0K
        CPU: 8ms
    CGroup: /system.slice/system-serial\x2dgetty.slice/serial-getty@ttyS0.service
            └─3288 /sbin/agetty -o "-p -- \u" --keep-baud 115200,57600,38400,9600 - vt220

Dec 05 19:56:10 debian systemd[1]: Started serial-getty@ttyS0.service - Serial Getty on ttyS0.
root@debian:~# █
[0] 0:nvim 1:python3 2:bash- 3:ssh*
```

7. We switch back to the VM to finish the rest of the lab instead of maintaining the ssh connection and see the disks with the prefix vd by piping the output of `fdisk -l` to `grep vd`

```

Disk identifier: 0x4263889d

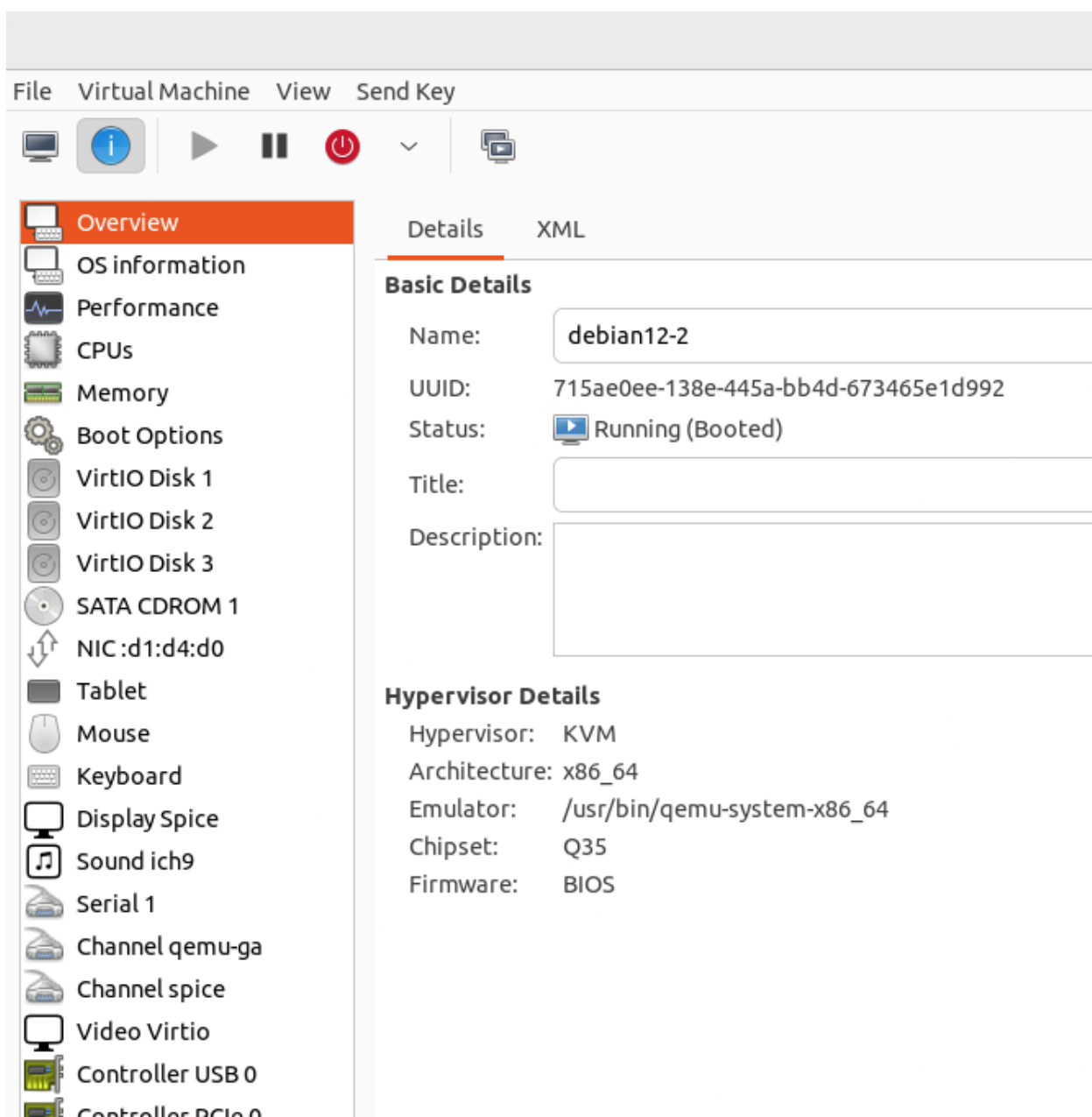
Device      Boot  Start      End  Sectors  Size Id Type
/dev/vda1   *           2048   999423   997376  487M 83 Linux
/dev/vda2             1001470 41940991 40939522 19.5G  5 Extended
/dev/vda5             1001472 41940991 40939520 19.5G 8e Linux LVM

Disk /dev/mapper/debian--vg-root: 18.56 GiB, 19931332608 bytes, 38928384 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/mapper/debian--vg-swap_1: 980 MiB, 1027604480 bytes, 2007040 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
root@debian:~# fdisk -l | grep vd
Disk /dev/vda: 20 GiB, 21474836480 bytes, 41943040 sectors
/dev/vda1 *           2048   999423   997376  487M 83 Linux
/dev/vda2             1001470 41940991 40939522 19.5G  5 Extended
/dev/vda5             1001472 41940991 40939520 19.5G 8e Linux LVM
root@debian:~#

```

8. We notice that we don't have our vdb and vdc disks (disk 2 and disk 3) so we jump to VM settings to allocate 2 disks of size 5G.



9. Now we have our vdb and vdc disks

```
zeapsu@debian: ~  
Changes will remain in memory only, until you decide to write them.  
Be careful before using the write command.  
  
fdisk: cannot open /dev/vdb: No such file or directory  
root@debian:~# fdisk /dev/vdc  
  
Welcome to fdisk (util-linux 2.38.1).  
Changes will remain in memory only, until you decide to write them.  
Be careful before using the write command.  
  
fdisk: cannot open /dev/vdc: No such file or directory  
root@debian:~# fdisk -l | grep vd  
Disk /dev/vda: 20 GiB, 21474836480 bytes, 41943040 sectors  
/dev/vda1 *      2048    999423    997376   487M 83 Linux  
/dev/vda2      1001470 41940991 40939522 19.5G  5 Extended  
/dev/vda5      1001472 41940991 40939520 19.5G 8e Linux LVM  
root@debian:~# fdisk -l | grep vd  
Disk /dev/vda: 20 GiB, 21474836480 bytes, 41943040 sectors  
/dev/vda1 *      2048    999423    997376   487M 83 Linux  
/dev/vda2      1001470 41940991 40939522 19.5G  5 Extended  
/dev/vda5      1001472 41940991 40939520 19.5G 8e Linux LVM  
Disk /dev/vdb: 5 GiB, 5368709120 bytes, 10485760 sectors  
Disk /dev/vdc: 5 GiB, 5368709120 bytes, 10485760 sectors  
root@debian:~# fdisk /dev/vdb
```

10. We omit to create partition 1 and partition 2 on vdb and vdc to simply create the physical volume using the disks and list the volumes to confirm.

The screenshot shows a terminal window titled 'zeapsu@debian: ~' with the following commands and output:

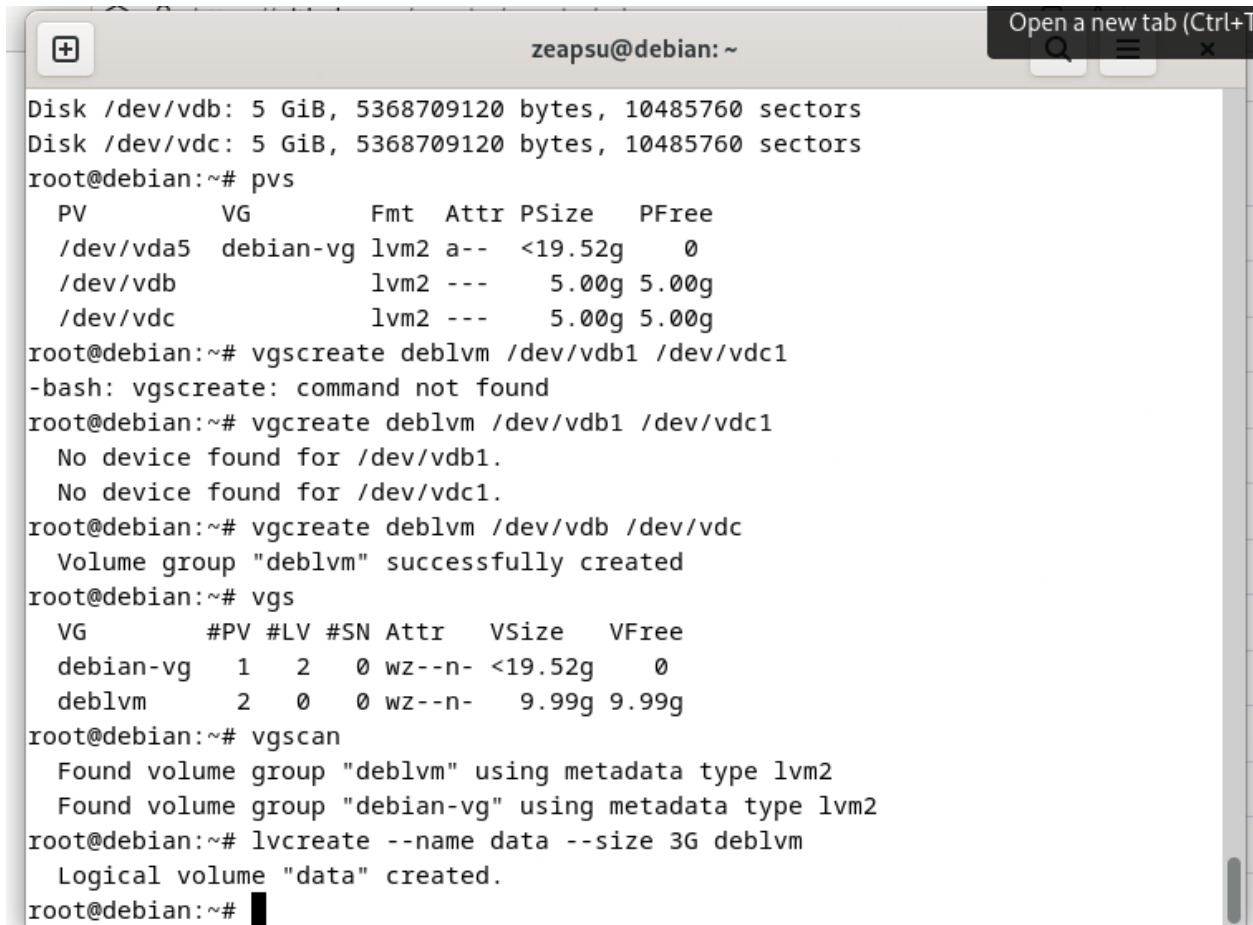
```

root@debian:~# fdisk -l | grep vd
Disk /dev/vda: 20 GiB, 21474836480 bytes, 41943040 sectors
/dev/vda1 *          2048    999423    997376    487M    83 Linux
/dev/vda2          1001470 41940991 40939522 19.5G    5 Extended
/dev/vda5          1001472 41940991 40939520 19.5G    8e Linux LVM
Disk /dev/vdb: 5 GiB, 5368709120 bytes, 10485760 sectors
Disk /dev/vdc: 5 GiB, 5368709120 bytes, 10485760 sectors
root@debian:~# pvcreate /dev/vdb /dev/vdc
  Physical volume "/dev/vdb" successfully created.
  Physical volume "/dev/vdc" successfully created.
root@debian:~# ldisk -l | grep vd
-bash: ldisk: command not found
root@debian:~# fdisk -l | grep vd
Disk /dev/vda: 20 GiB, 21474836480 bytes, 41943040 sectors
/dev/vda1 *          2048    999423    997376    487M    83 Linux
/dev/vda2          1001470 41940991 40939522 19.5G    5 Extended
/dev/vda5          1001472 41940991 40939520 19.5G    8e Linux LVM
Disk /dev/vdb: 5 GiB, 5368709120 bytes, 10485760 sectors
Disk /dev/vdc: 5 GiB, 5368709120 bytes, 10485760 sectors
root@debian:~# pvs
  PV          VG          Fmt Attr PSize  PFree
  /dev/vda5   debian-vg  lvm2 a--  <19.52g  0
  /dev/vdb          lvm2 ---   5.00g  5.00g
  /dev/vdc          lvm2 ---   5.00g  5.00g

```

The terminal window is overlaid on a web browser showing a 'Releases · neovim/neovim' page. The browser tabs include 'Welcome to Firefox', 'zeapsu/lazy-nvim: config', and 'Releases · neovim/neovim'. The terminal window also shows a search bar and a list of dates (Oct 9) on the right side.

11. We create a volume group called `deblvm` and add both of these physical volumes to it, then list the groups to verify



A terminal window titled 'zeapsu@debian: ~' with a search bar and 'Open a new tab (Ctrl+T)' button. The terminal shows the following commands and output:

```
Disk /dev/vdb: 5 GiB, 5368709120 bytes, 10485760 sectors
Disk /dev/vdc: 5 GiB, 5368709120 bytes, 10485760 sectors
root@debian:~# pvs
  PV          VG          Fmt  Attr  PSize   PFree
  /dev/vda5   debian-vg  lvm2  a--   <19.52g    0
  /dev/vdb                lvm2  ---    5.00g  5.00g
  /dev/vdc                lvm2  ---    5.00g  5.00g
root@debian:~# vgcreate deblvm /dev/vdb1 /dev/vdc1
-bash: vgcreate: command not found
root@debian:~# vgcreate deblvm /dev/vdb1 /dev/vdc1
No device found for /dev/vdb1.
No device found for /dev/vdc1.
root@debian:~# vgcreate deblvm /dev/vdb /dev/vdc
Volume group "deblvm" successfully created
root@debian:~# vgs
  VG          #PV #LV #SN Attr   VSize   VFree
  debian-vg    1  2  0 wz--n- <19.52g    0
  deblvm       2  0  0 wz--n-  9.99g  9.99g
root@debian:~# vgscan
Found volume group "deblvm" using metadata type lvm2
Found volume group "debian-vg" using metadata type lvm2
root@debian:~# lvcreate --name data --size 3G deblvm
Logical volume "data" created.
root@debian:~#
```

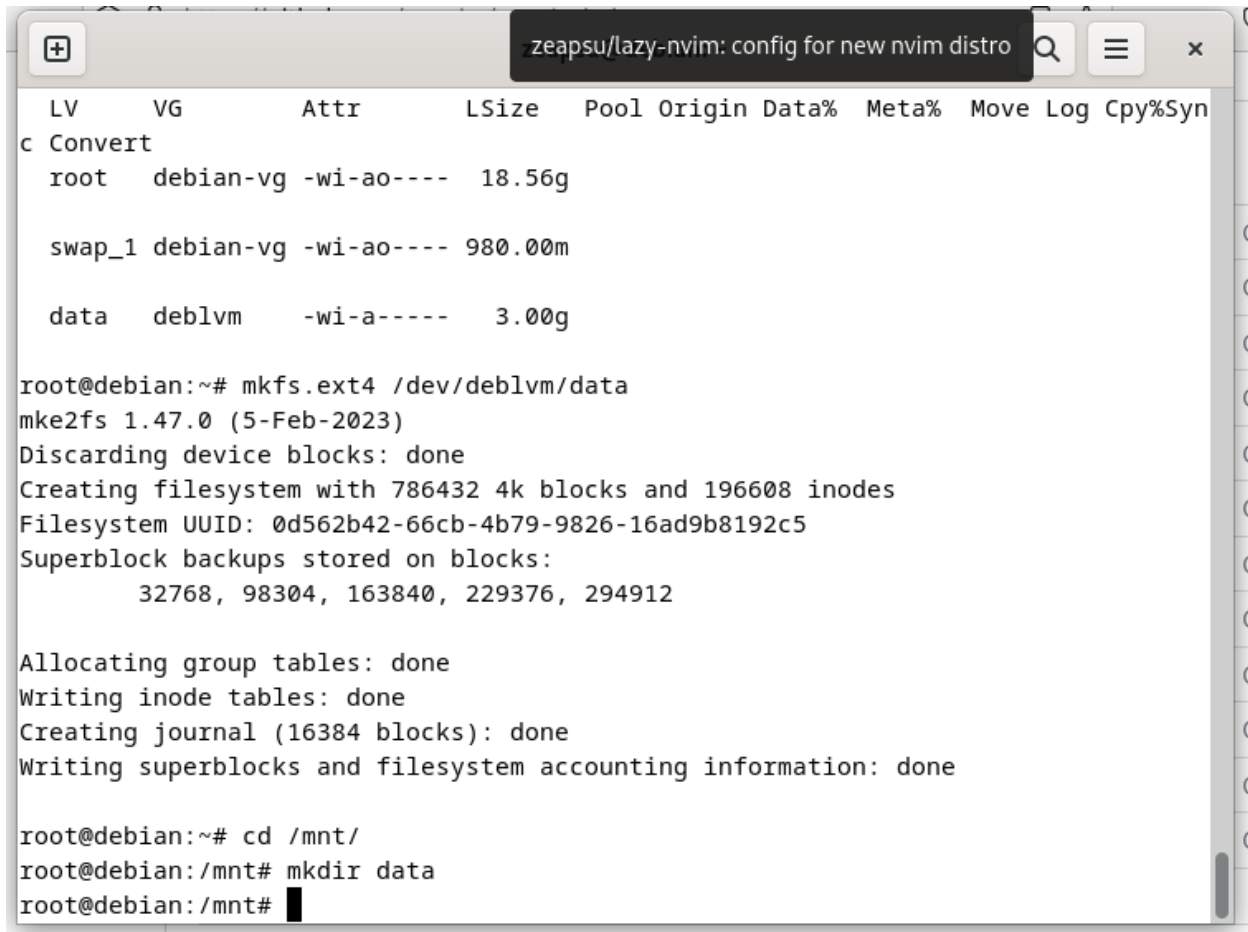
12. We now create the logical volume named data that is allocated 3G and is linked to the deblvm group and list it to confirm

```

zeapsu@debian: ~
root@debian:~# vgcreate deblvm /dev/vdb1 /dev/vdc1
No device found for /dev/vdb1.
No device found for /dev/vdc1.
root@debian:~# vgcreate deblvm /dev/vdb /dev/vdc
Volume group "deblvm" successfully created
root@debian:~# vgs
VG          #PV #LV #SN Attr   VSize   VFree
debian-vg   1   2   0 wz--n- <19.52g   0
deblvm      2   0   0 wz--n-   9.99g 9.99g
root@debian:~# vgscan
Found volume group "deblvm" using metadata type lvm2
Found volume group "debian-vg" using metadata type lvm2
root@debian:~# lvcreate --name data --size 3G deblvm
Logical volume "data" created.
root@debian:~# lvs
LV      VG          Attr          LSize   Pool Origin Data%  Meta%  Move Log Cpy%Syn
c Convert
root    debian-vg -wi-ao----- 18.56g
swap_1  debian-vg -wi-ao----- 980.00m
data    deblvm      -wi-a-----  3.00g
root@debian:~# █

```

13. Then we format this logical volume to the standard ext4 format for most Linux file systems and create a dir in the `/mnt` dir called data to prep for mounting this volume to this point



The image shows a terminal window with a title bar that reads "zeapsu/lazy-nvim: config for new nvim distro". The terminal output displays the results of the 'c' command from the 'lvm' utility, showing a table of logical volumes. Below the table, the user runs 'mkfs.ext4 /dev/deblvm/data', which initiates the creation of an ext4 filesystem. The output of this command shows the progress of creating the filesystem, including the number of blocks and inodes, the UUID, and the superblock backups. Finally, the user navigates to '/mnt/' and creates a directory named 'data'.

```
LV      VG      Attr      LSize   Pool Origin Data%  Meta%  Move Log Cpy%Syn
c Convert
root    debian-vg -wi-ao---- 18.56g
swap_1  debian-vg -wi-ao---- 980.00m
data    deblvm    -wi-a----- 3.00g

root@debian:~# mkfs.ext4 /dev/deblvm/data
mke2fs 1.47.0 (5-Feb-2023)
Discarding device blocks: done
Creating filesystem with 786432 4k blocks and 196608 inodes
Filesystem UUID: 0d562b42-66cb-4b79-9826-16ad9b8192c5
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912

Allocating group tables: done
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done

root@debian:~# cd /mnt/
root@debian:/mnt# mkdir data
root@debian:/mnt#
```

14. We mount the logical volume to the /mnt/data dir and list to confirm that it was successfully mounted

```

zeapsu@debian: ~
Creating filesystem with 786432 4k blocks and 196608 inodes
Filesystem UUID: 0d562b42-66cb-4b79-9826-16ad9b8192c5
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912

Allocating group tables: done
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done

root@debian:~# cd /mnt/
root@debian:/mnt# mkdir data
root@debian:/mnt# mount /dev/deblvm/data /mnt/data
root@debian:/mnt# df
Filesystem                1K-blocks      Used Available Use% Mounted on
udev                      3983408         0   3983408  0% /dev
tmpfs                      803292      1356    801936  1% /run
/dev/mapper/debian--vg-root 18982140 5940192 12052356 34% /
tmpfs                     4016456         0   4016456  0% /dev/shm
tmpfs                      5120         8      5112  1% /run/lock
/dev/vda1                  465124   118555    321635 27% /boot
tmpfs                      803288      156    803132  1% /run/user/1000
/dev/mapper/deblvm-data    3021608        24   2847916  1% /mnt/data
root@debian:/mnt#

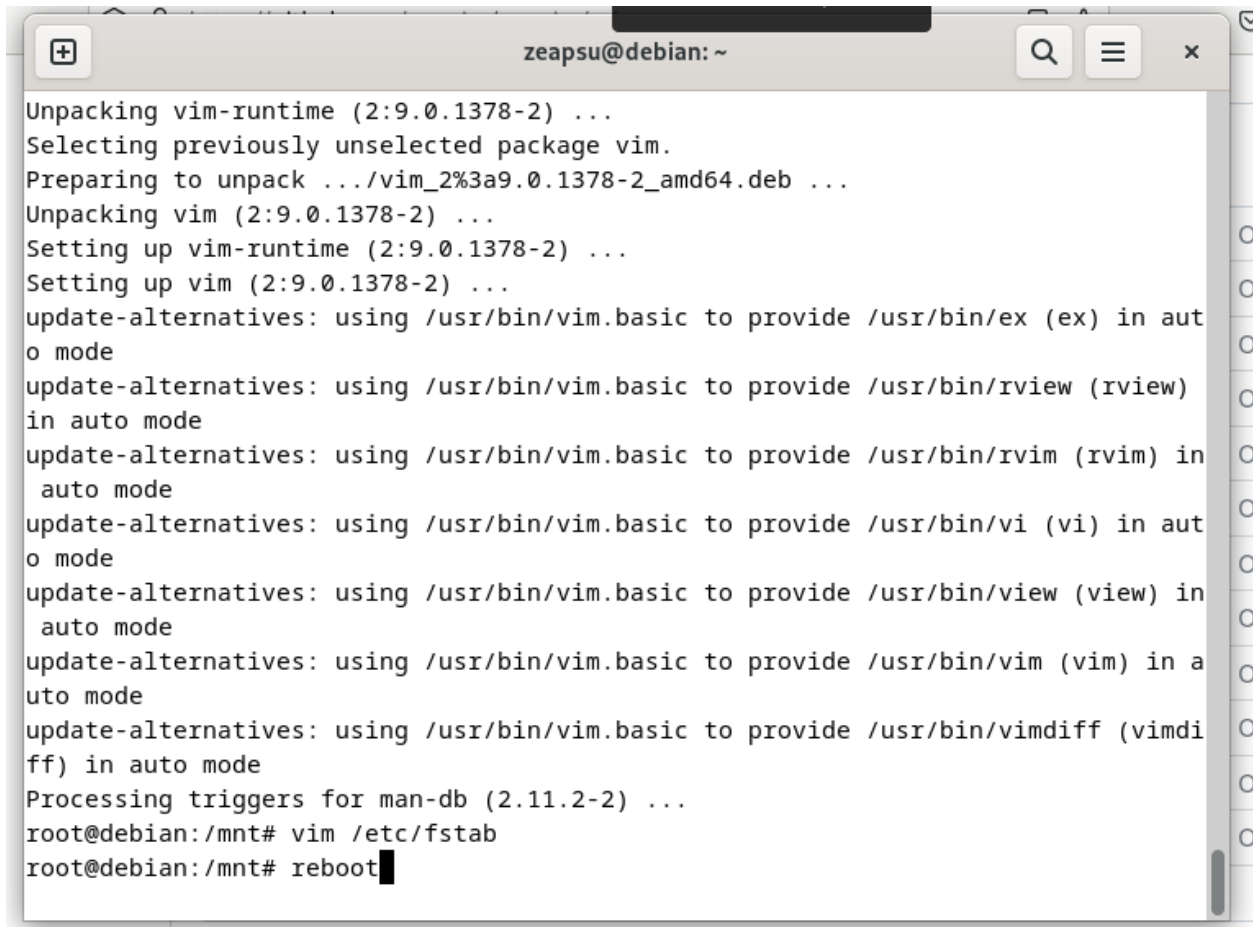
```

15. We edit (using vim) /etc/fstab, our filesystem table configuration file to include and control this new mount point (sorry I did not format the file)

•

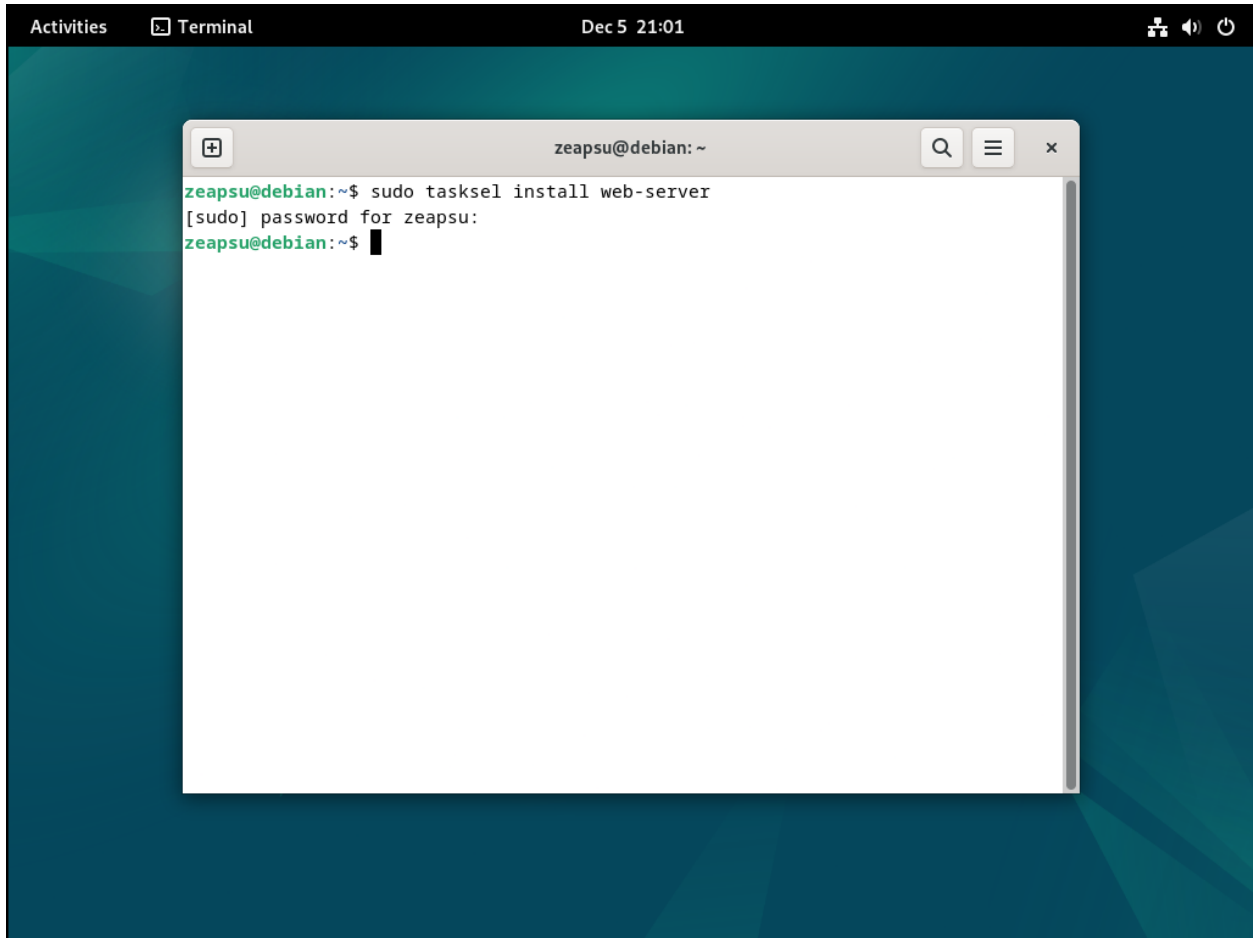
•

16. We then reboot the system

A terminal window titled 'zeapsu@debian: ~' showing the installation of vim. The output includes messages about unpacking vim-runtime and vim, setting them up, and updating alternatives for various vim-related commands. The prompt then changes to root@debian:/mnt, and the user enters 'vim /etc/fstab' and 'reboot'.

```
zeapsu@debian: ~
Unpacking vim-runtime (2:9.0.1378-2) ...
Selecting previously unselected package vim.
Preparing to unpack .../vim_2%3a9.0.1378-2_amd64.deb ...
Unpacking vim (2:9.0.1378-2) ...
Setting up vim-runtime (2:9.0.1378-2) ...
Setting up vim (2:9.0.1378-2) ...
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/ex (ex) in aut
o mode
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/rview (rview)
in auto mode
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/rvim (rvim) in
auto mode
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/vi (vi) in aut
o mode
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/view (view) in
auto mode
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/vim (vim) in a
uto mode
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/vimdiff (vimdi
ff) in auto mode
Processing triggers for man-db (2.11.2-2) ...
root@debian:/mnt# vim /etc/fstab
root@debian:/mnt# reboot
```

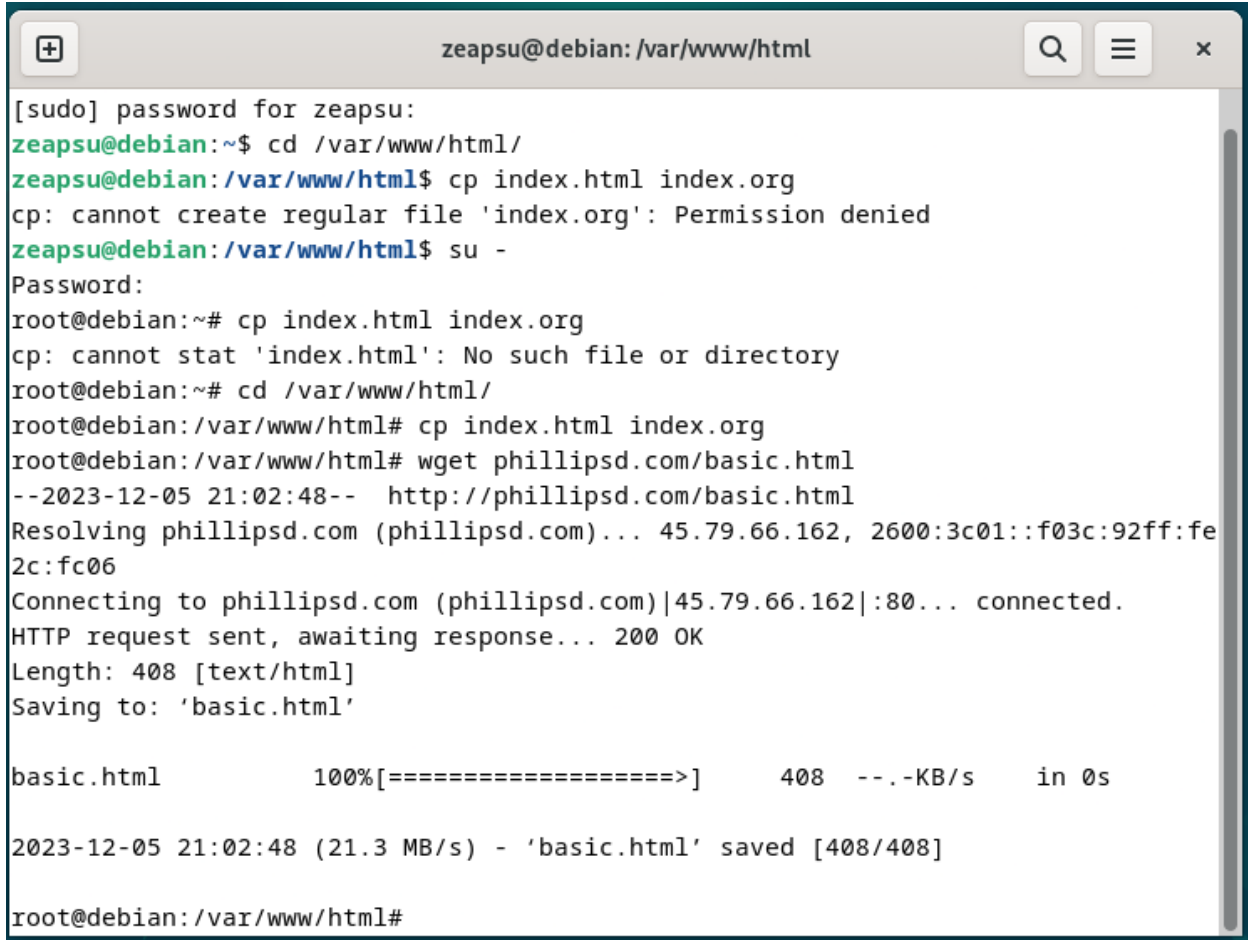
17. As the last part, we see if we can visit and make a simple webserver using our VM, so we first get the necessary dependencies.



The image shows a terminal window titled 'zeapsu@debian: ~' with search, menu, and close buttons. The terminal output is as follows:

```
zeapsu@debian:~$ sudo taskset install web-server
[sudo] password for zeapsu:
zeapsu@debian:~$
```

18. We then prep the web server by modifying/copying the necessary files and getting a template from the professor's website.

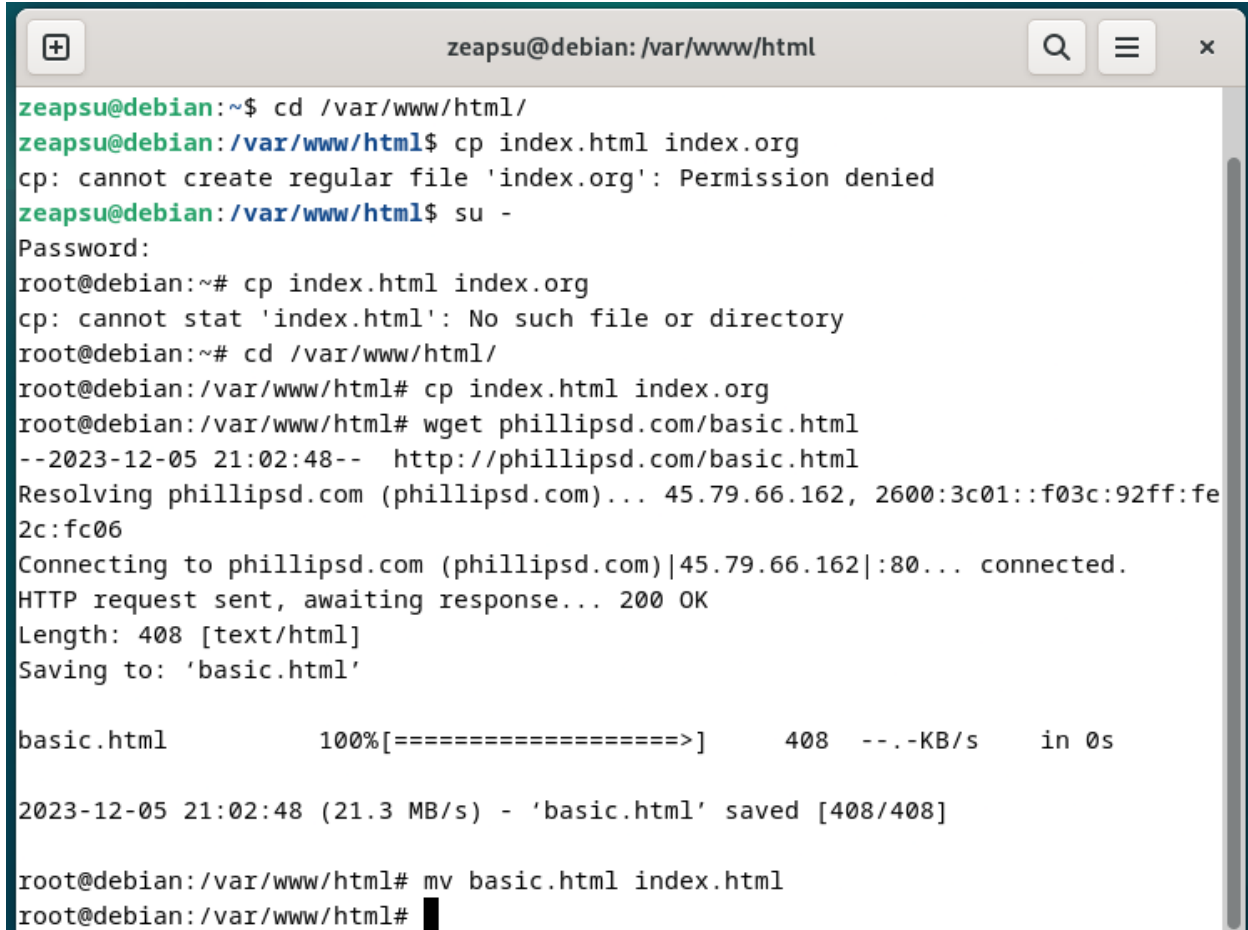


```
zeapsu@debian: /var/www/html
[sudo] password for zeapsu:
zeapsu@debian:~$ cd /var/www/html/
zeapsu@debian:/var/www/html$ cp index.html index.org
cp: cannot create regular file 'index.org': Permission denied
zeapsu@debian:/var/www/html$ su -
Password:
root@debian:~# cp index.html index.org
cp: cannot stat 'index.html': No such file or directory
root@debian:~# cd /var/www/html/
root@debian:/var/www/html# cp index.html index.org
root@debian:/var/www/html# wget phillipsd.com/basic.html
--2023-12-05 21:02:48-- http://phillipsd.com/basic.html
Resolving phillipsd.com (phillipsd.com)... 45.79.66.162, 2600:3c01::f03c:92ff:fe
2c:fc06
Connecting to phillipsd.com (phillipsd.com)|45.79.66.162|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 408 [text/html]
Saving to: 'basic.html'

basic.html          100%[=====>]          408  --.-KB/s    in 0s

2023-12-05 21:02:48 (21.3 MB/s) - 'basic.html' saved [408/408]

root@debian:/var/www/html#
```



```
zeapsu@debian: /var/www/html
zeapsu@debian:~$ cd /var/www/html/
zeapsu@debian:/var/www/html$ cp index.html index.org
cp: cannot create regular file 'index.org': Permission denied
zeapsu@debian:/var/www/html$ su -
Password:
root@debian:~# cp index.html index.org
cp: cannot stat 'index.html': No such file or directory
root@debian:~# cd /var/www/html/
root@debian:/var/www/html# cp index.html index.org
root@debian:/var/www/html# wget phillipsd.com/basic.html
--2023-12-05 21:02:48-- http://phillipsd.com/basic.html
Resolving phillipsd.com (phillipsd.com)... 45.79.66.162, 2600:3c01::f03c:92ff:fe
2c:fc06
Connecting to phillipsd.com (phillipsd.com)|45.79.66.162|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 408 [text/html]
Saving to: 'basic.html'

basic.html          100%[=====>]          408  --.-KB/s    in 0s

2023-12-05 21:02:48 (21.3 MB/s) - 'basic.html' saved [408/408]

root@debian:/var/www/html# mv basic.html index.html
root@debian:/var/www/html#
```

19. Lastly, we visit the VM IP address in the browser to confirm that it is now a simple web server.

