



Bachelor of Science in Computer Science and  
Information Technology

**Laboratory**

**Report**

**On**

**Introduction to Cloud Computing**

**Submitted By :**

**Name :** Basanta Rai  
**Semester :** 8th  
**Section :** B  
**Rollno :** 23473/076

**Submitted To :**

**Department Of Computer  
Science & IT**

# VMWare/VirtualBox Installation

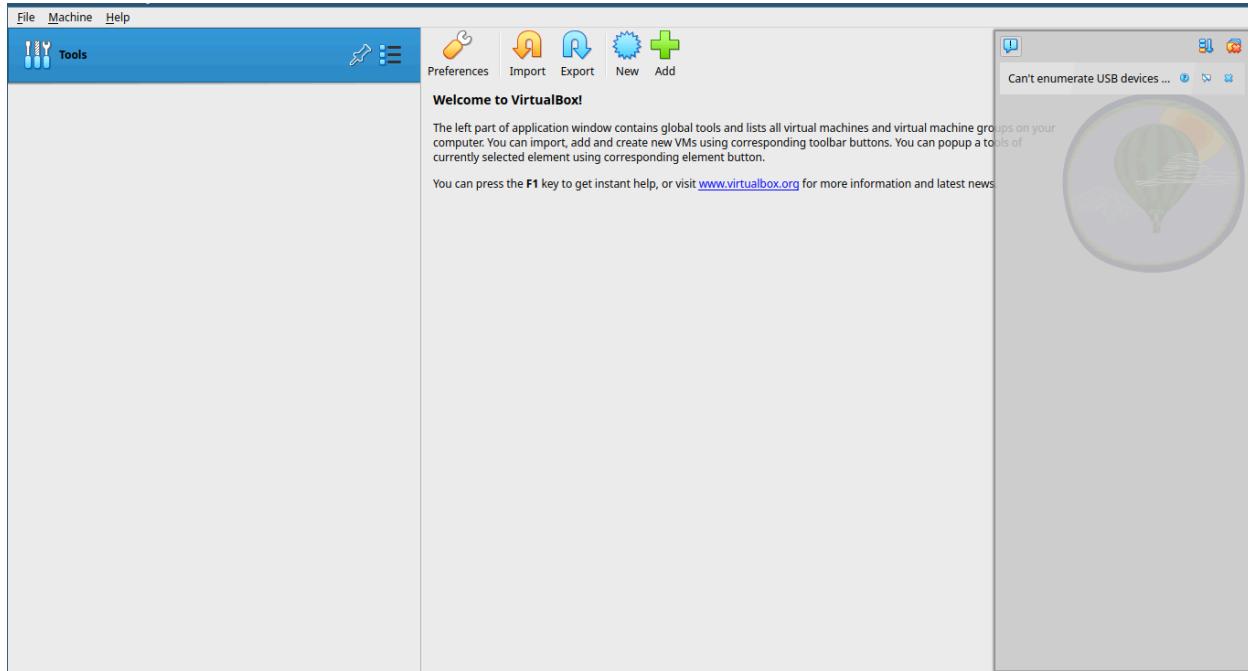
## Installing VirtualBox in linux.

To install virtualBox in linux (Ubuntu 24.04) we can use its package manager **apt**. The following command will install the oracle virtualBox.

```
$ sudo apt-get install virtualbox
```

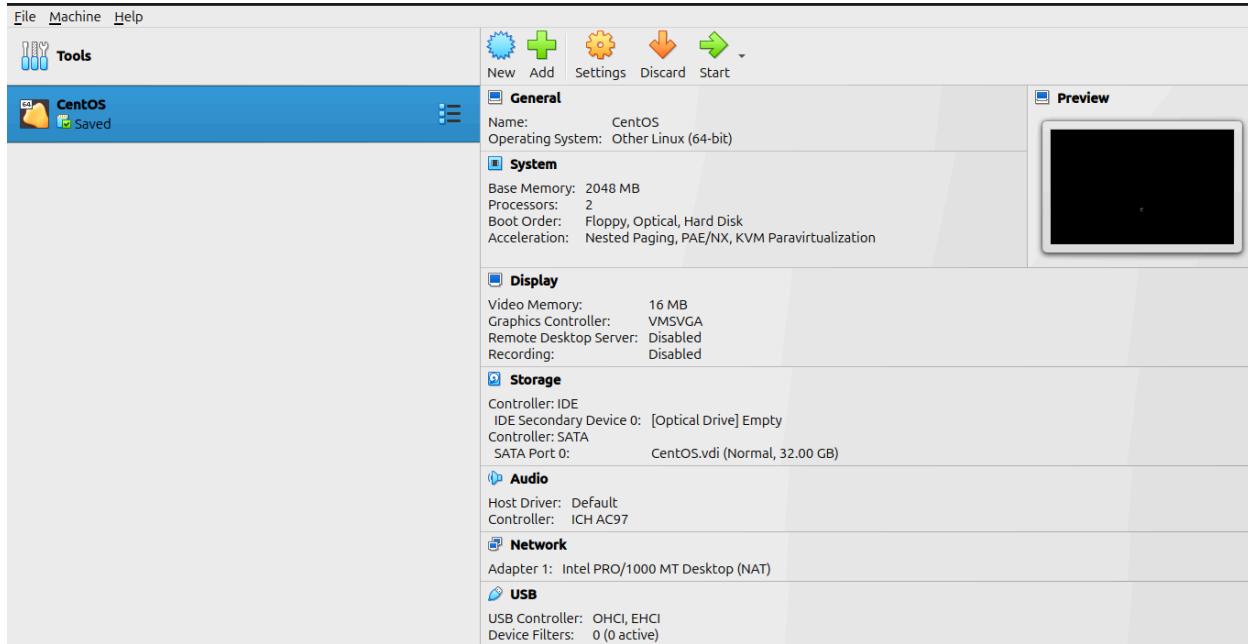
```
basanta@machine: ~
File Edit View Search Terminal Help
basanta@machine:~$ sudo apt-get install virtualbox
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
virtualbox-qt
Suggested packages:
vde2 virtualbox-guest-additions-iso
The following NEW packages will be installed:
virtualbox virtualbox-qt
0 upgraded, 2 newly installed, 0 to remove and 7 not upgraded.
Need to get 0 B/56.8 MB of archives.
After this operation, 190 M of additional disk space will be used.
Do you want to continue? [y/n] Y
Selecting previously unselected package virtualbox.
(Reading database ... 192347 files and directories currently installed.)
Preparing to unpack .../virtualbox_7.0.16-dfsg-2_amd64.deb ...
Unpacking virtualbox (7.0.16-dfsg-2) ...
Selecting previously unselected package virtualbox-qt.
Preparing to unpack .../virtualbox-qt_7.0.16-dfsg-2_amd64.deb ...
Unpacking virtualbox-qt (7.0.16-dfsg-2) ...
Setting up virtualbox (7.0.16-dfsg-2) ...
Setting up virtualbox-qt (7.0.16-dfsg-2) ...
Processing triggers for desktop-file-utils (0.27-2build1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1.ubuntu3) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for shared-mime-info (2.4-4) ...
basanta@machine:~$
```

After installation we can use the virtual box. Its dashboard is as shown in the picture below.

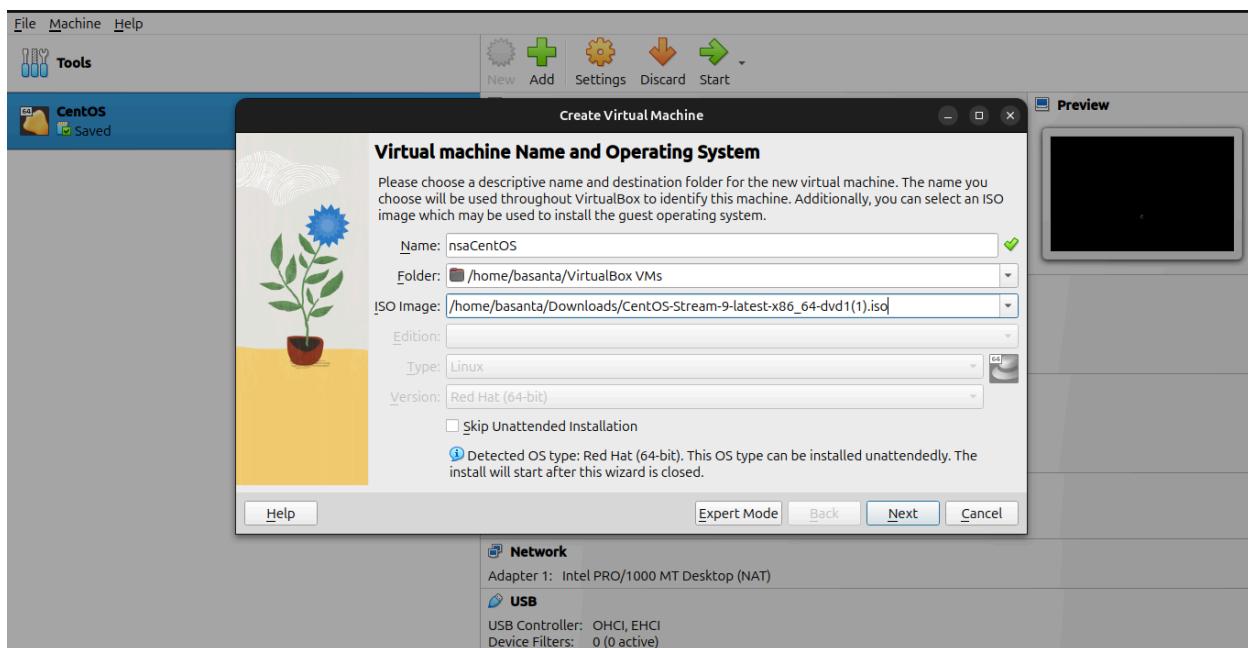


# CentOS Installation

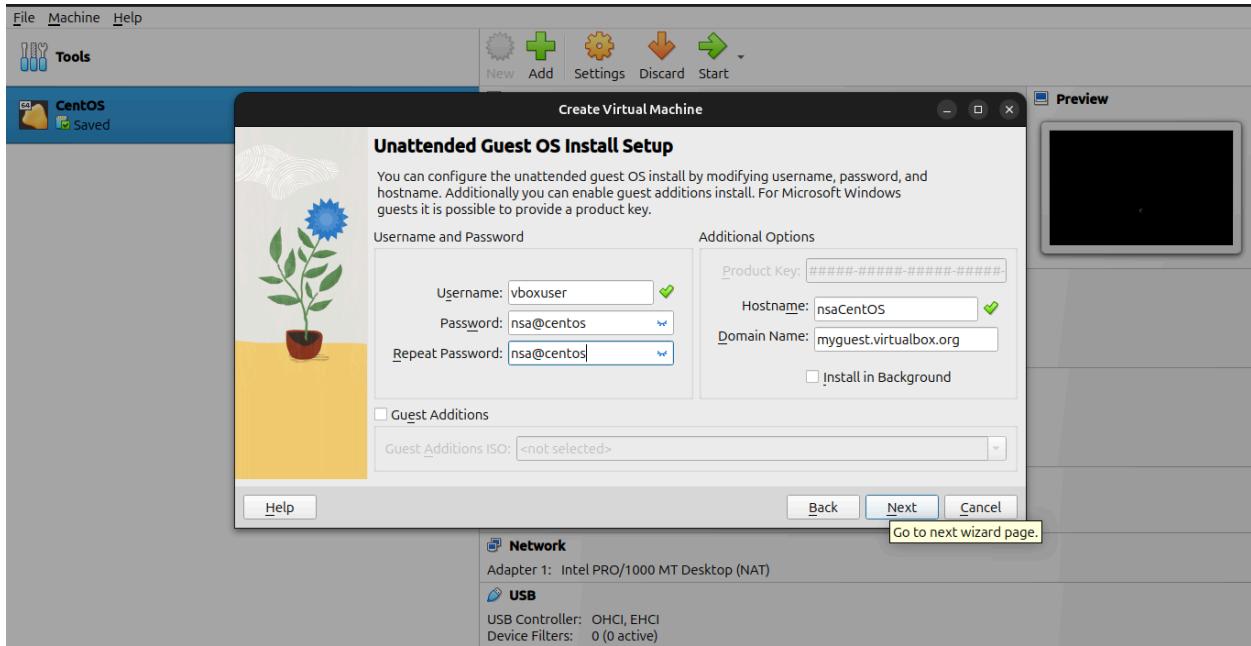
To install CentOS in virtual box, first of all download the ISO image of CentOS from its official documentation site and then Open virtualbox and click on **New** button.



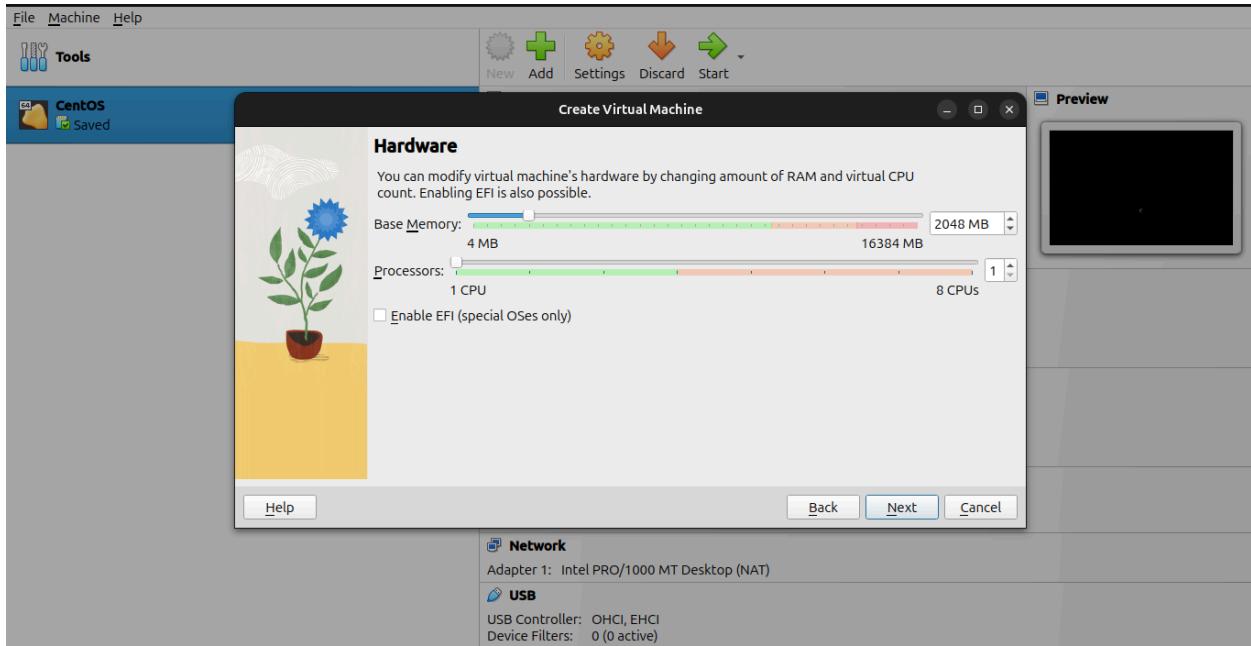
After clicking the new button you will be prompted with the popup menu as shown in the picture below. Here select the operating system of your choice. Here we are choosing **Linux** since we are going to install **CentOS**.



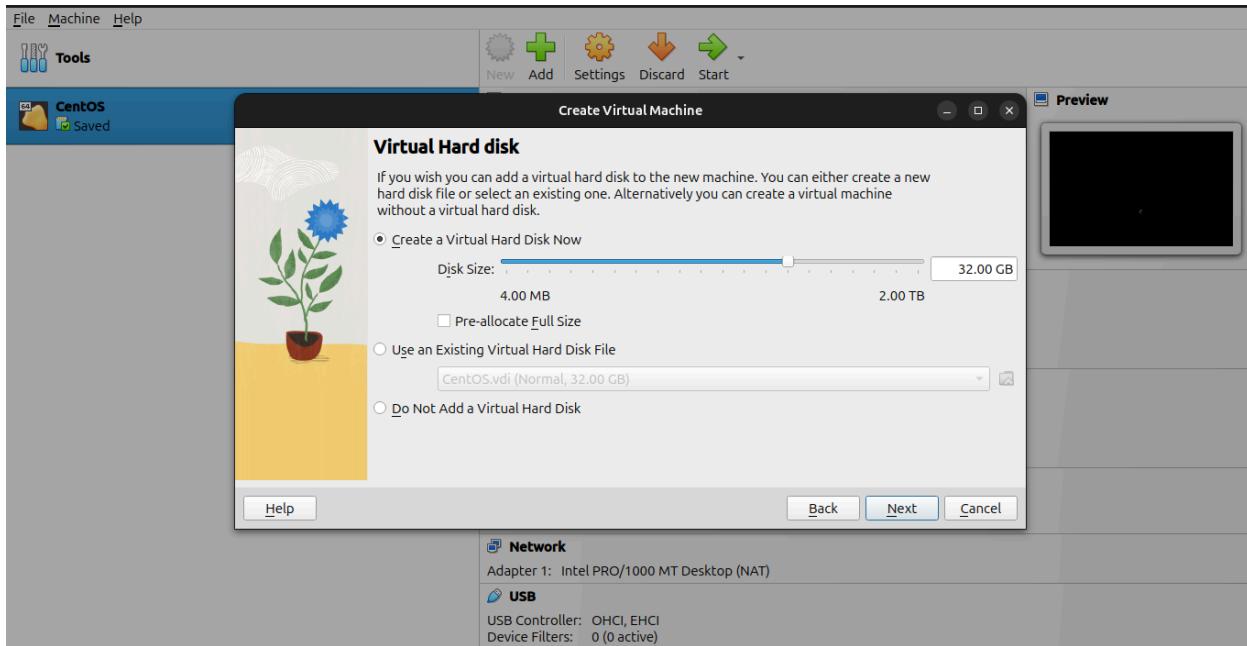
Once you select the click on **Next**. You will be promoted into another menu which would look like the picture below. You can set these values as default or change it with your desired values.



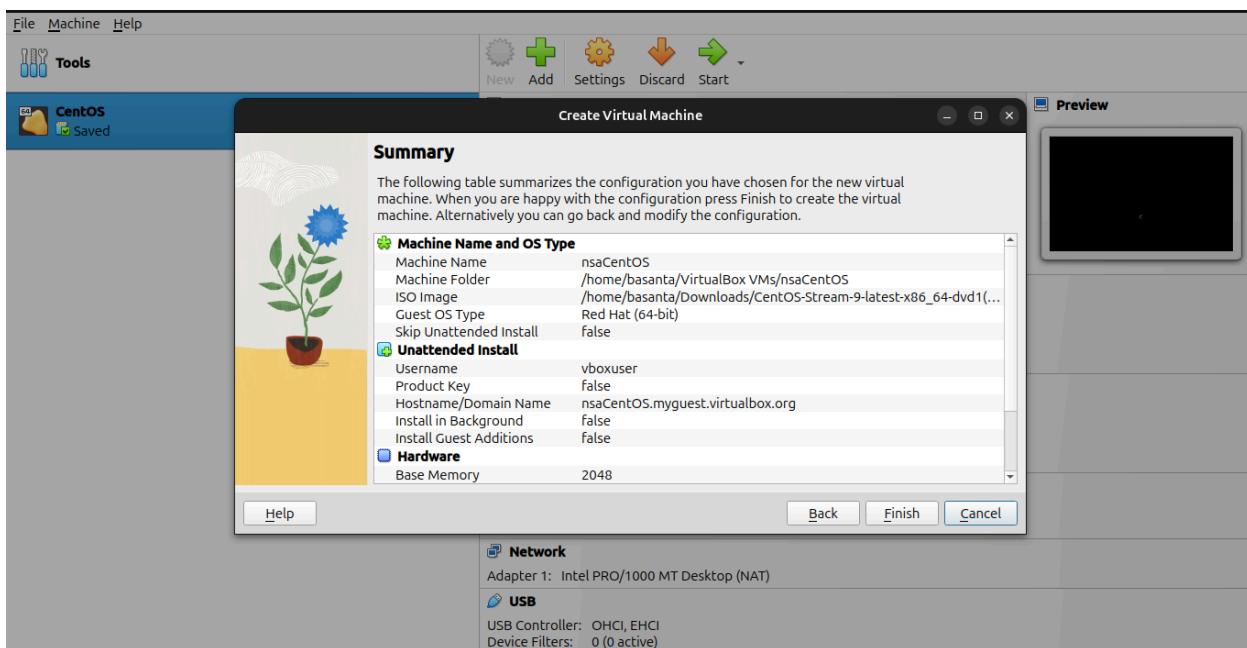
After doing it, you will see a menu like the following picture. Here you should define the hardware sizes to your virtual machine. I'll select 2048 MB i.e. 2GB of ram and 1 core CPU.



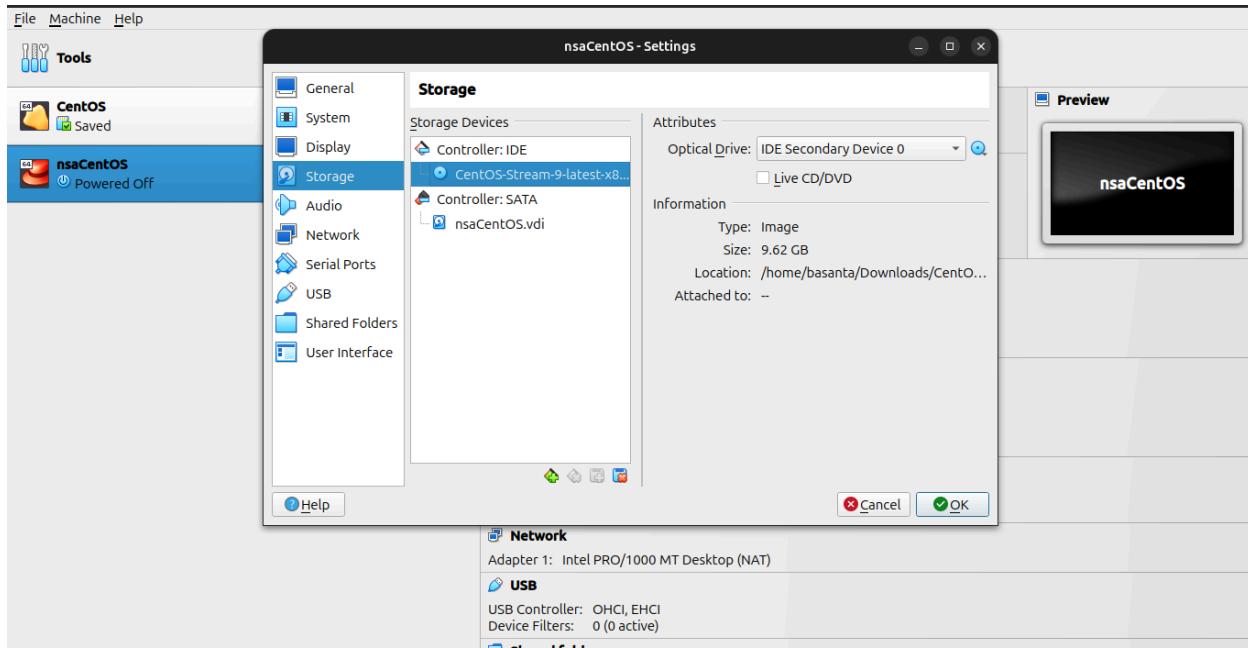
After choosing the appropriate RAM and CPU cores, you can press on the Next button. After pressing on the Next button you will have an interface to set the storage for your virtual machine. Choose it according to your need and press on **Next** button. Here I'll choose 32GB.



After doing this press on the **Next** button.

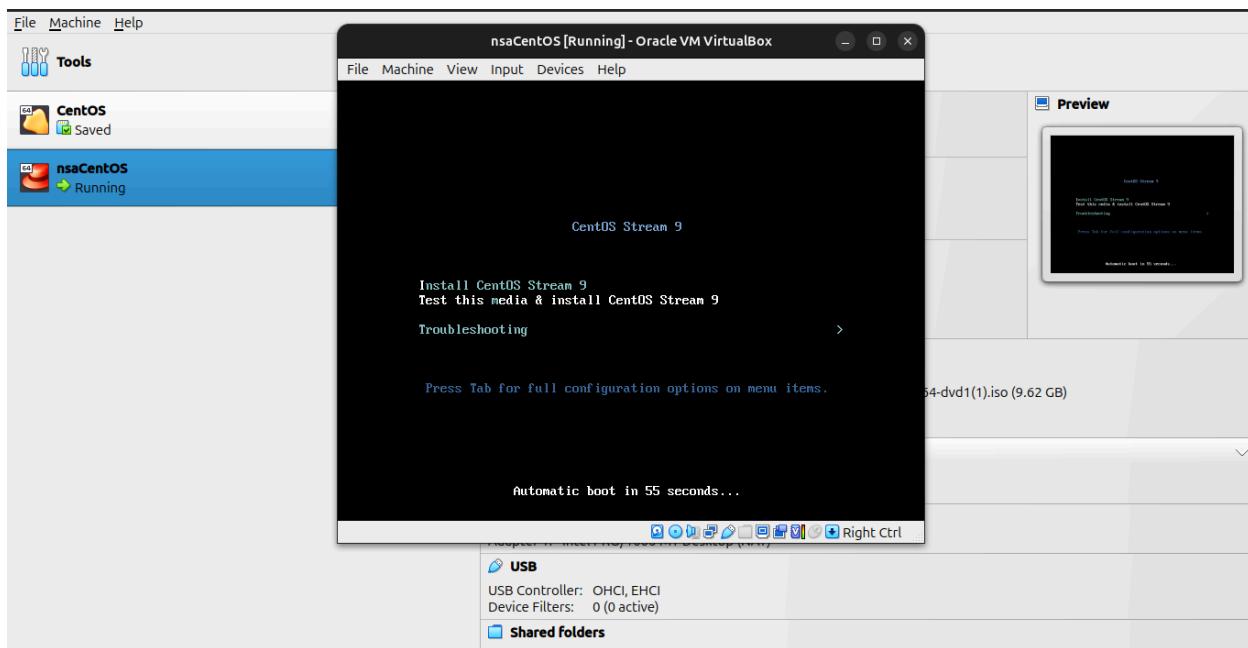


Once you set up all of the physical requirements for your virtual machine you can now choose the ISO file of the linux distribution you wish to install on. To do that, press on **Settings**, **Storage** and on the **Controller: IDE**, choose the ISO file for your system. Here I'll be selecting the iso image of a CentOS.

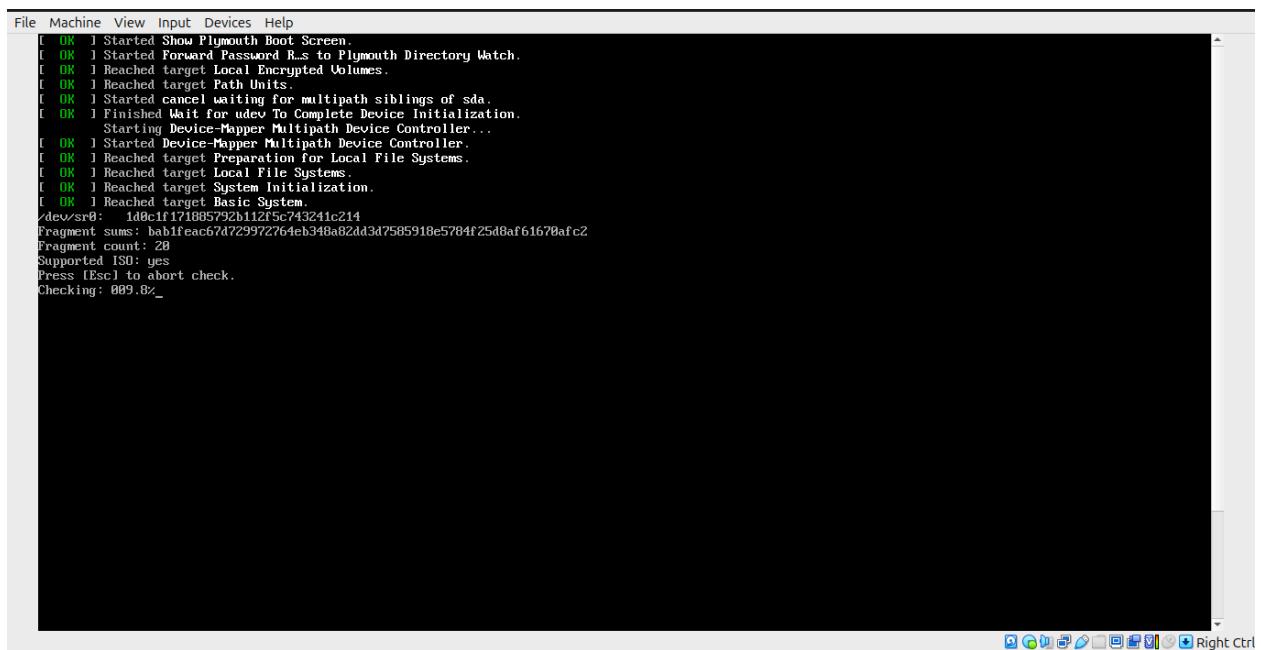


After selecting the ISO image press on **OK**.

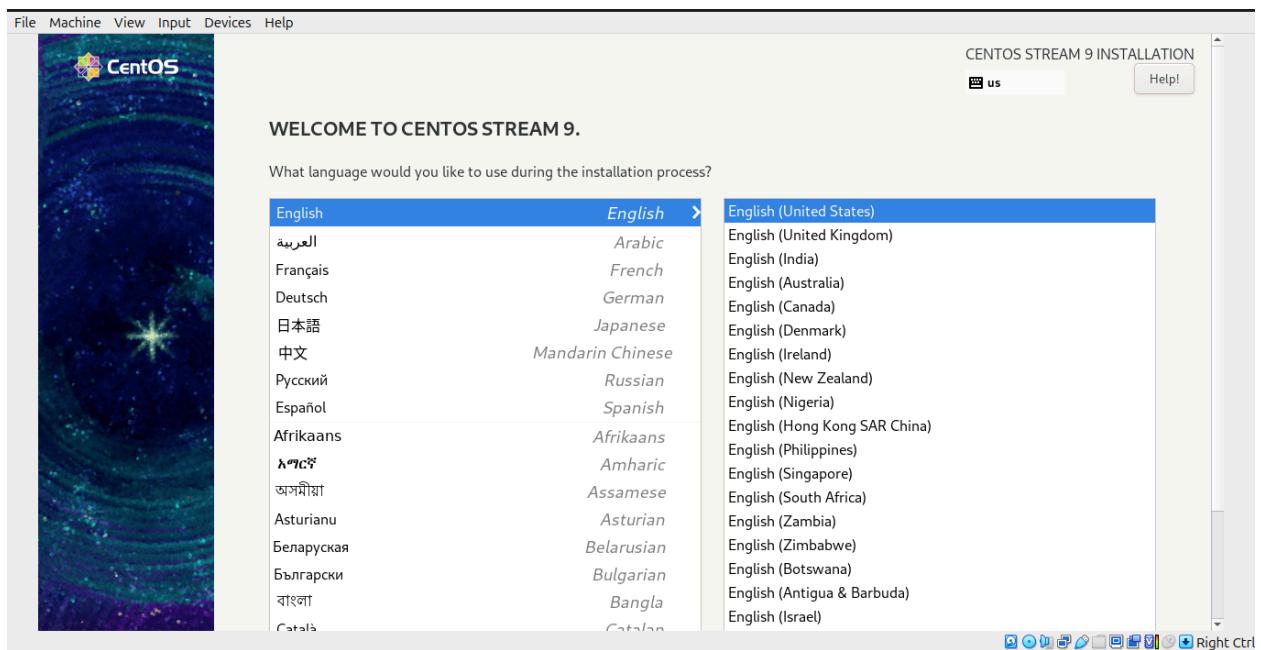
After that press on the start button and you will see the following screen, to install CentOS.



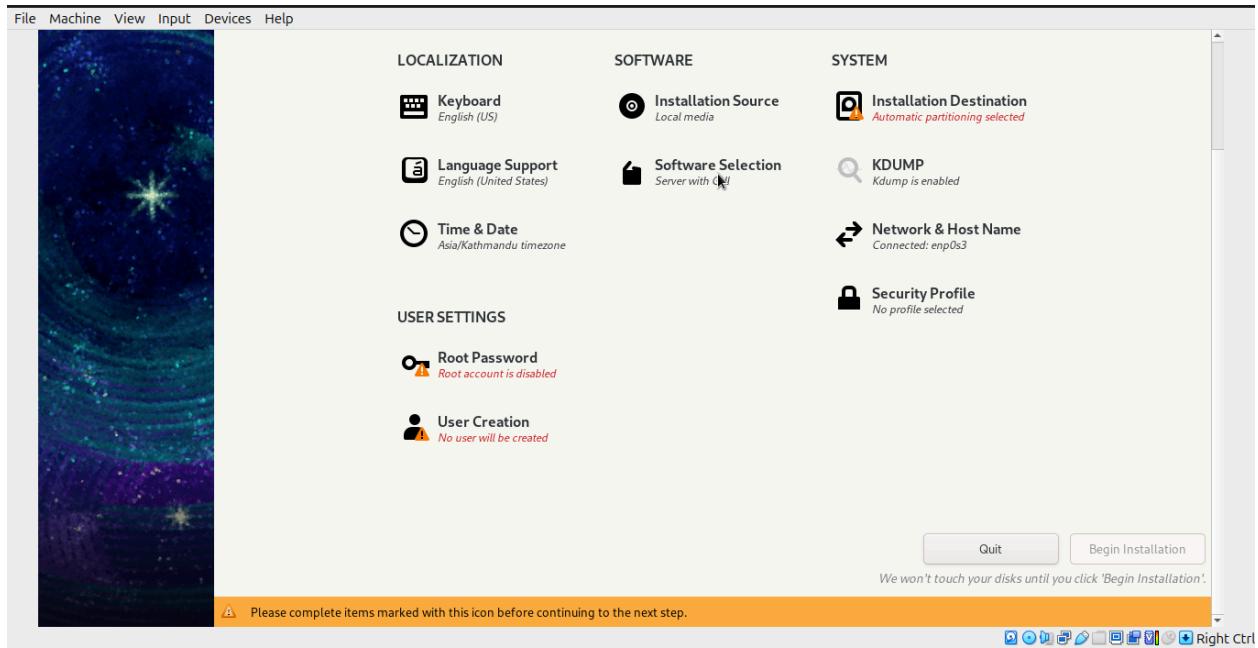
## Installation screen.



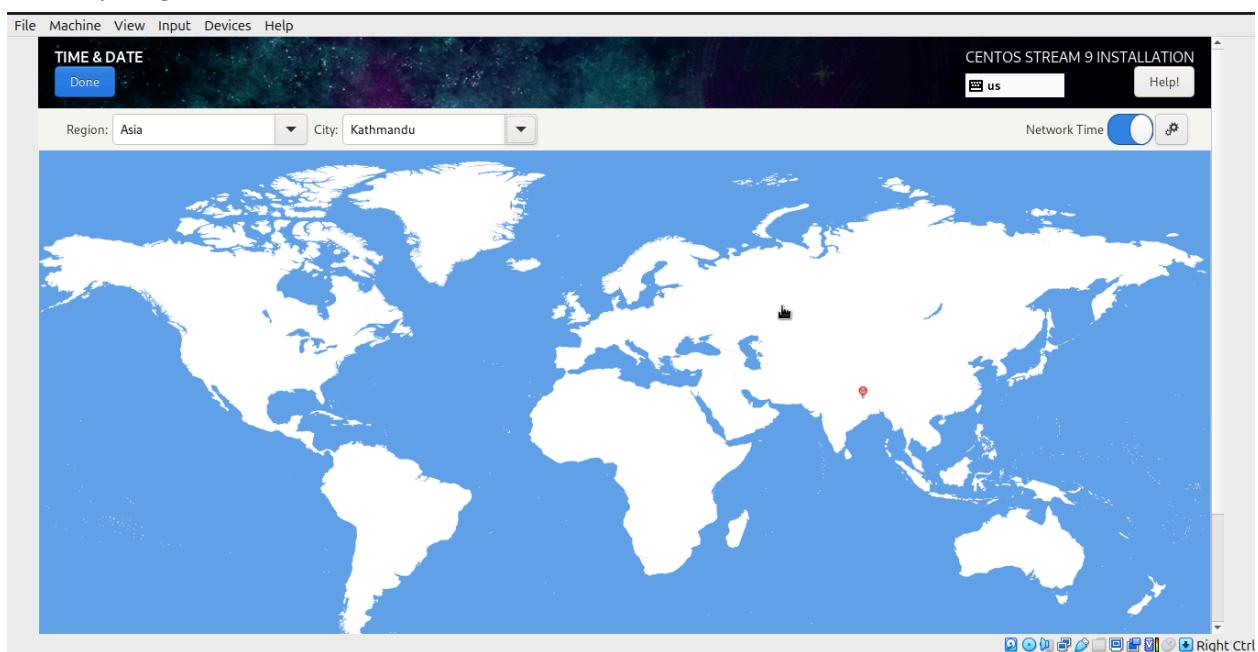
After this choose the language of your choice.



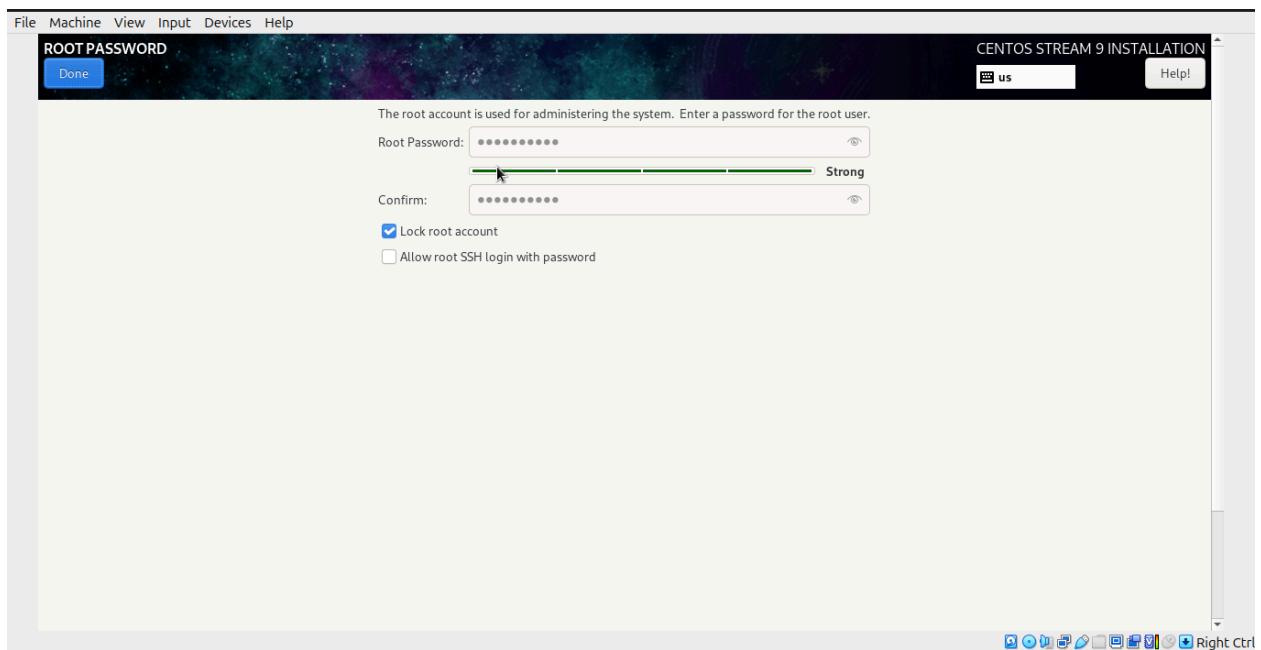
After choosing the language of your choice, continue the installation and you will see the following interface. Here you need to configure **Date & time**, **Root Password**, **User Creation** and **Installation Destination**.



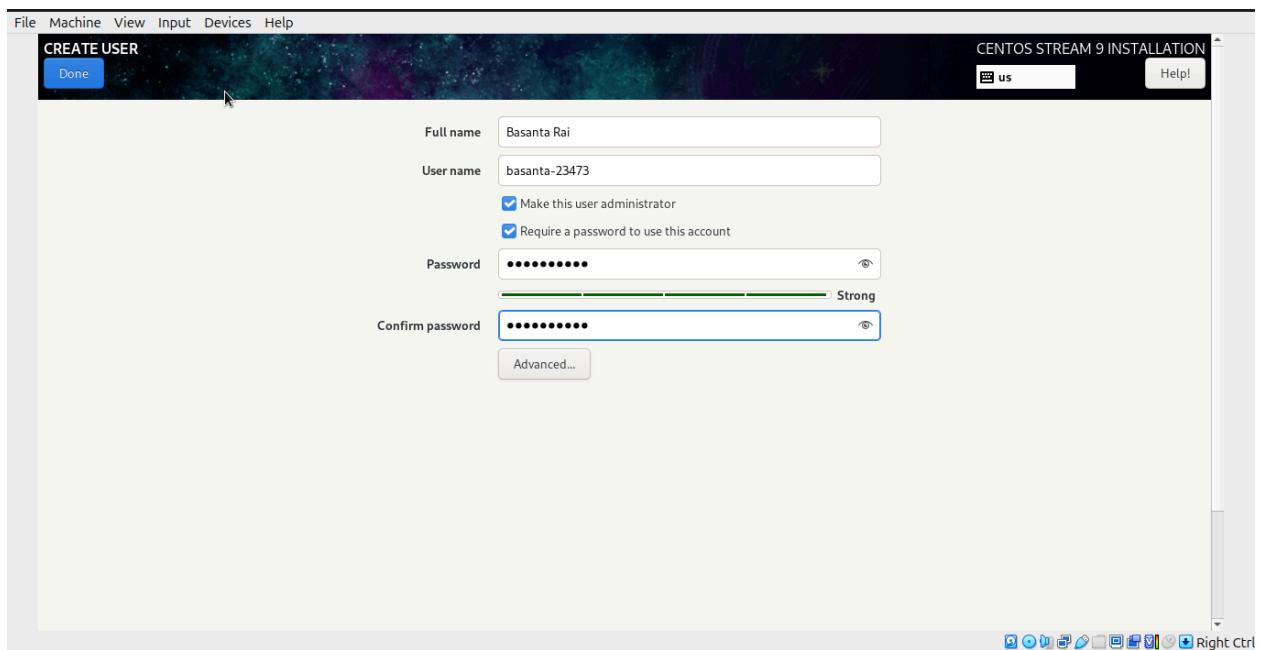
Choose your geolocation for Date and time.



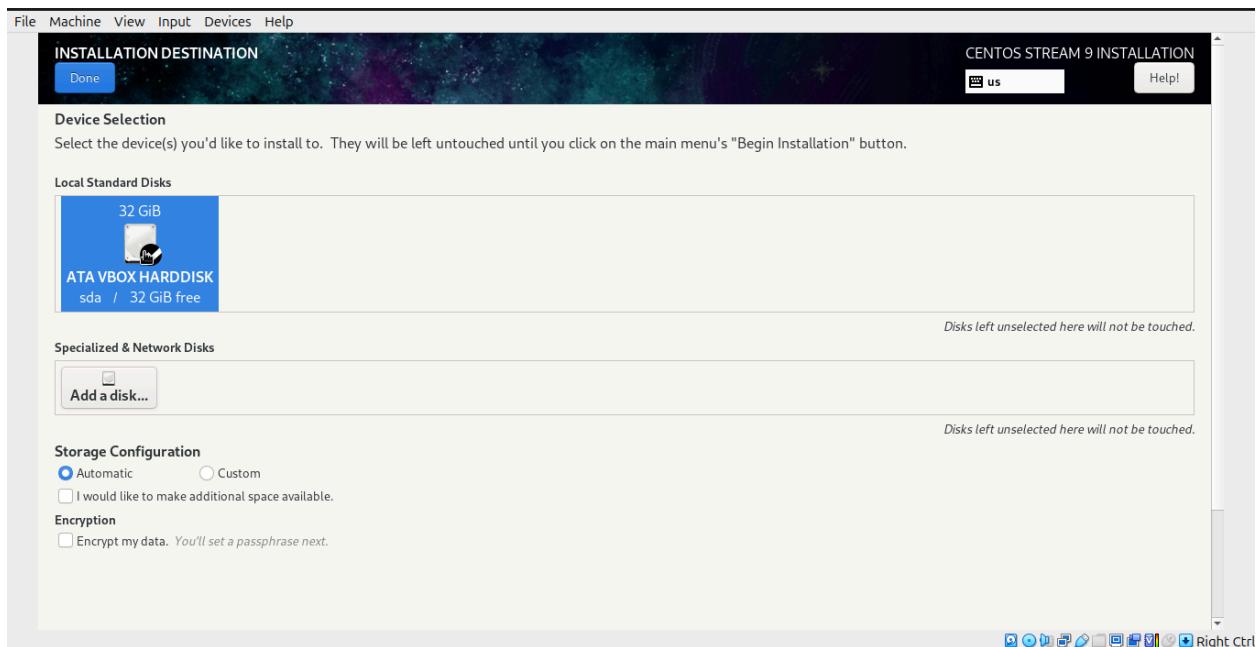
## Setup root password.



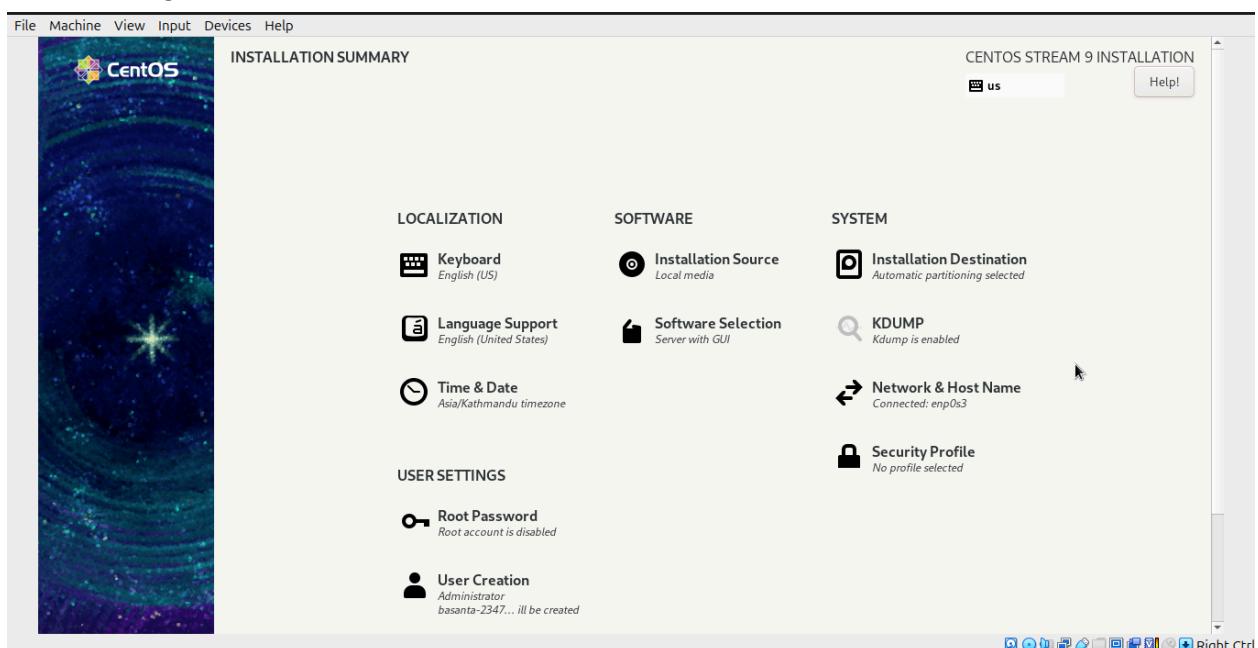
## User Creation. Create a new user .



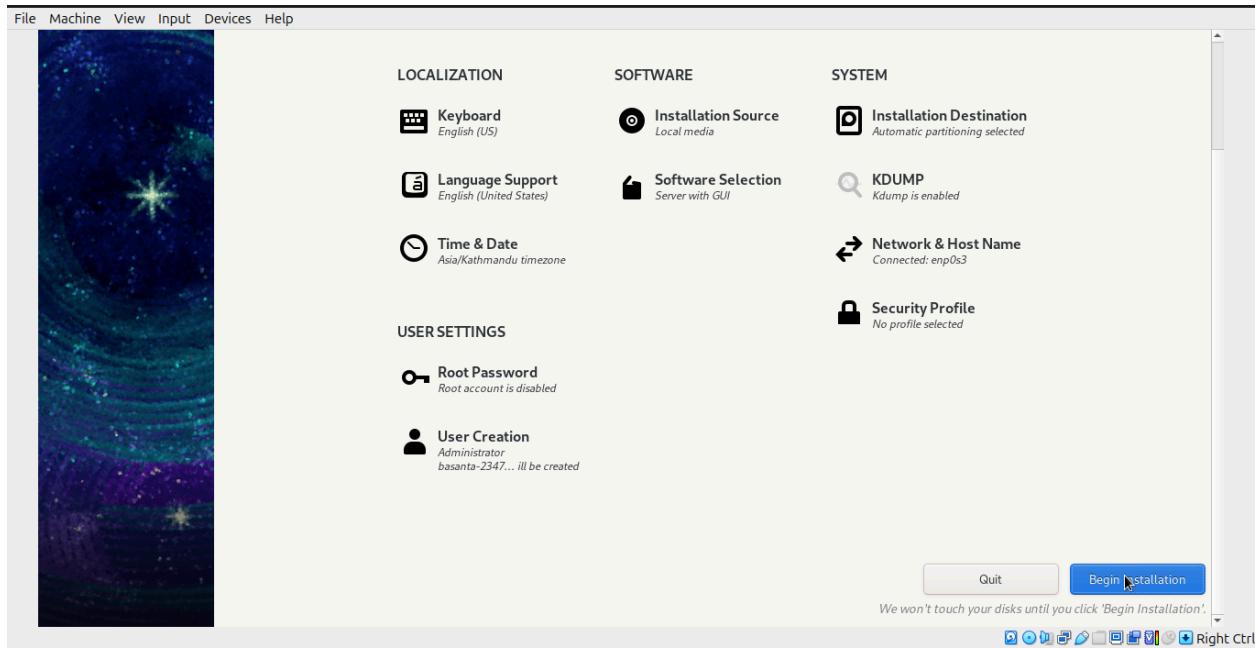
After creating a user, now you need to choose the installation destination for your CentOS. Here select the device we decided earlier of the installation process.



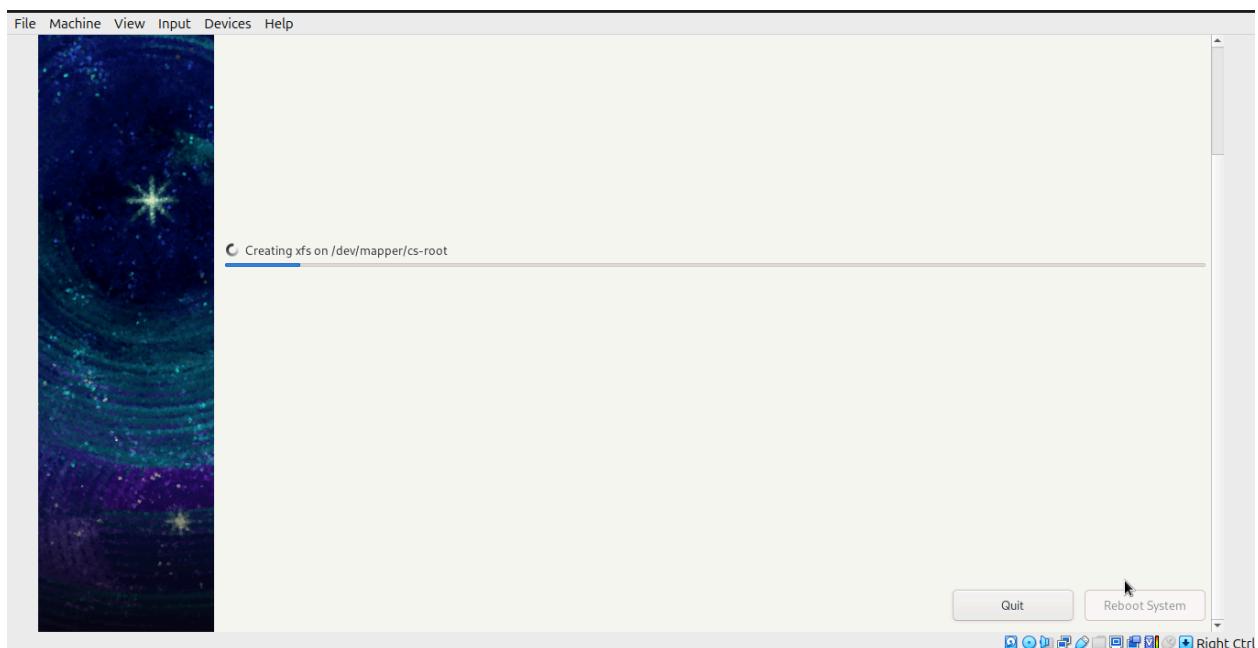
After choosing it click on the Done button.



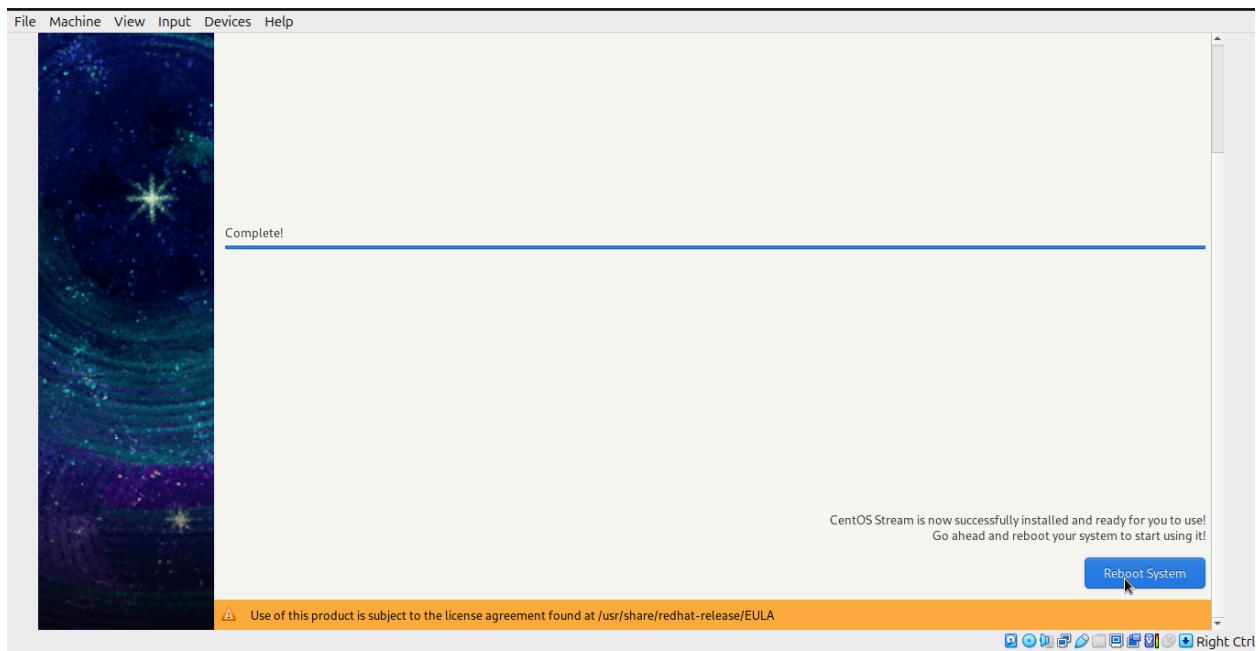
After that Click on the **Begin Installation** button to begin installation.



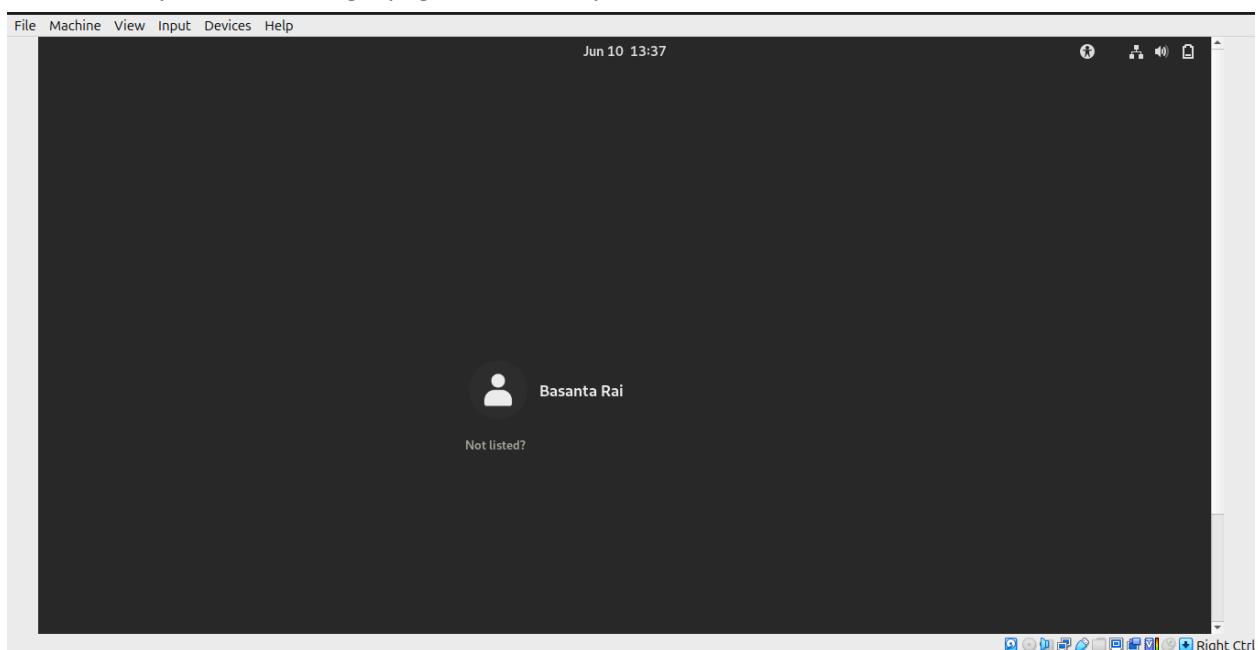
Installation in process.

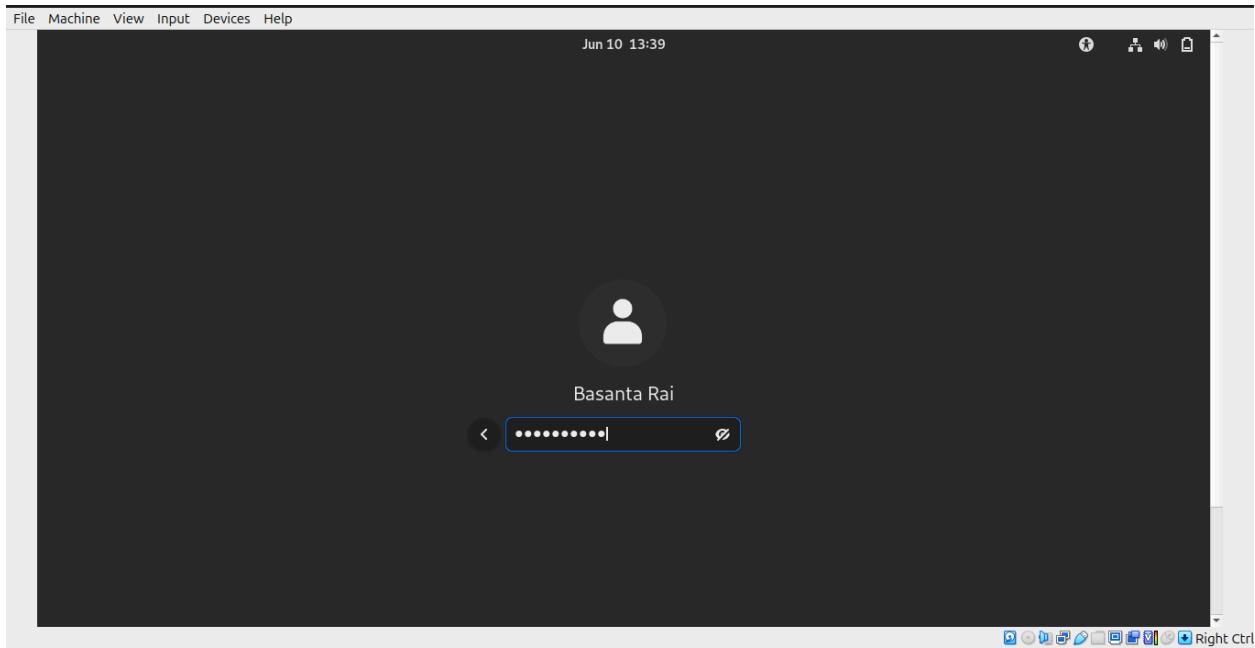


Once the installation is finished, you will see the following screen to reboot the system.

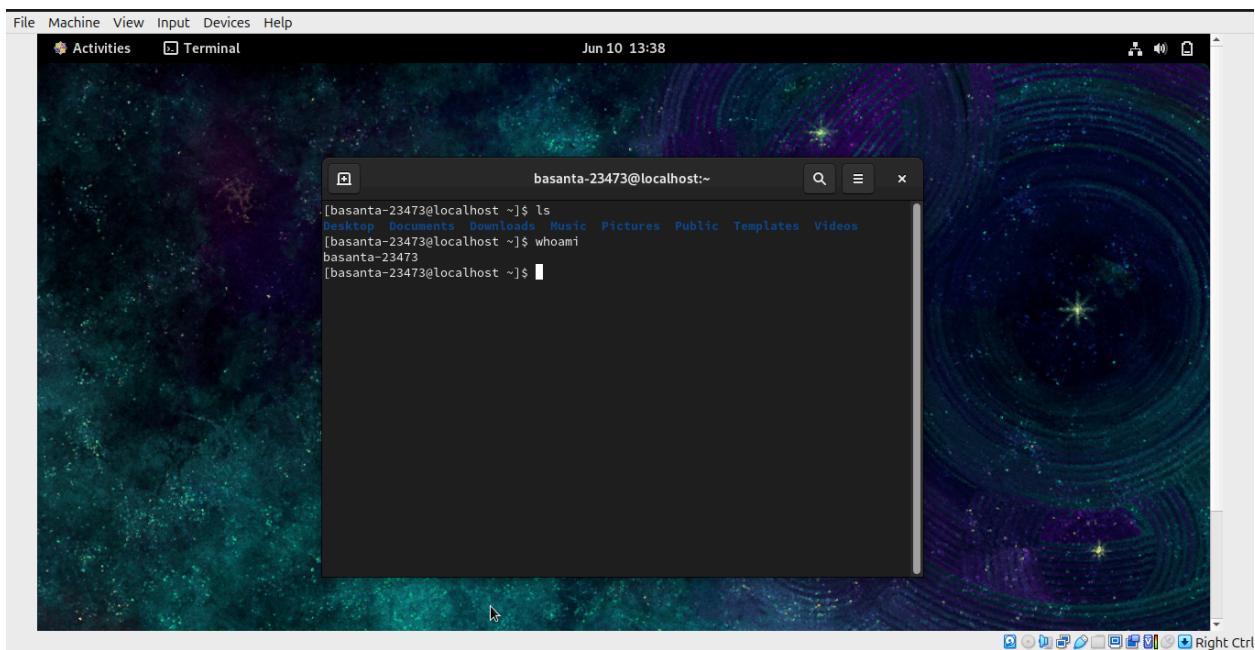


After reboot you will see a login page, here enter your credentials.





After entering your credentials you have successfully installed and entered the CentOS. Now you can perform whatever operation you wish to.



## 2FA RSA Authentication

Before RSA authentication implementation we can login with the user's password as shown in images below.

### From machine 1.

```
basanta@machine:~$ ssh basanta-23473@192.168.18.57
The authenticity of host '192.168.18.57 (192.168.18.57)' can't be established.
ED25519 key fingerprint is SHA256:cgUgPVJojx4HoXtG/0vJ5CSBsJ4SYGz9voVrZhwFW5o.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.18.57' (ED25519) to the list of known hosts.
basanta-23473@192.168.18.57's password:
Activate the web console with: systemctl enable --now cockpit.socket

Last login: Tue Jun 11 18:49:48 2024
[basanta-23473@localhost ~]$ █
```

### From machine 2.

```
~ # ssh basanta-23473@192.168.18.57
The authenticity of host '192.168.18.57 (192.168.18.57)' can't be established.
ED25519 key fingerprint is SHA256:cgUgPVJojx4HoXtG/0vJ5CSBsJ4SYGz9voVrZhwFW5o.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.18.57' (ED25519) to the list of known hosts.
basanta-23473@192.168.18.57's password:
Activate the web console with: systemctl enable --now cockpit.socket

Last login: Tue Jun 11 18:51:36 2024 from 192.168.18.53
[basanta-23473@localhost ~]$ █
```

In our host remote server there is no **.ssh** folder.

```
[basanta-23473@localhost ~]$ ls -lah
total 28K
drwx----- 14 basanta-23473 basanta-23473 4.0K Jun 11 19:09 .
drwxr-xr-x  3 root      root          27 Jun 11 18:33 ..
-rw-----  1 basanta-23473 basanta-23473 153 Jun 11 18:58 .bash_history
-rw-r--r--  1 basanta-23473 basanta-23473 18 Feb 15 21:16 .bash_logout
-rw-r--r--  1 basanta-23473 basanta-23473 141 Feb 15 21:16 .bash_profile
-rw-r--r--  1 basanta-23473 basanta-23473 492 Feb 15 21:16 .bashrc
drwx-----  9 basanta-23473 basanta-23473 4.0K Jun 11 18:36 .cache
drwx----- 10 basanta-23473 basanta-23473 4.0K Jun 11 18:49 .config
drwxr-xr-x  2 basanta-23473 basanta-23473  6 Jun 11 18:36 Desktop
drwxr-xr-x  2 basanta-23473 basanta-23473  6 Jun 11 18:36 Documents
drwxr-xr-x  2 basanta-23473 basanta-23473  6 Jun 11 18:36 Downloads
drwx-----  4 basanta-23473 basanta-23473 32 Jun 11 18:36 .local
drwxr-xr-x  4 basanta-23473 basanta-23473 39 Jun 11 18:25 .mozilla
drwxr-xr-x  2 basanta-23473 basanta-23473  6 Jun 11 18:36 Music
drwxr-xr-x  2 basanta-23473 basanta-23473  6 Jun 11 18:36 Pictures
drwxr-xr-x  2 basanta-23473 basanta-23473  6 Jun 11 18:36 Public
drwxr-xr-x  2 basanta-23473 basanta-23473  6 Jun 11 18:36 Templates
drwxr-xr-x  2 basanta-23473 basanta-23473  6 Jun 11 18:36 Videos
[basanta-23473@localhost ~]$ mkdir .ssh
[basanta-23473@localhost ~]$ ls .ssh
[basanta-23473@localhost ~]$ █
```

Generate a ssh key in the machine we want to authorize.

```
basanta@machine:~$ ssh-keygen -t rsa -C "Basanta Rai"
Generating public/private rsa key pair.
Enter file in which to save the key (/home/basanta/.ssh/id_rsa): /home/basanta/.ssh/id_rsa_cloud_computing
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/basanta/.ssh/id_rsa_cloud_computing
Your public key has been saved in /home/basanta/.ssh/id_rsa_cloud_computing.pub
The key fingerprint is:
SHA256:oQZeX3nsTchKLji1dWL75f5PLRyLsF9pmGXLTxnpmpU Basanta Rai
The key's randomart image is:
+---[RSA 3072]---+
|          |
|          |
|          + . .|
| . o B * . o|
| . o = O B 0.o+|
| . = S = . *Eo|
| . . . + X+=o|
| . =o0 +|
| . + o |
| . . .+|
+---[SHA256]---+
basanta@machine:~$
```

After generating our ssh keys. Copy it to the remote server using **scp** command.

```
$ scp path/to/id_rsa.pub user@ipaddress:~/ssh/authorized_keys
```

```
basanta@machine:~$ scp /home/basanta/.ssh/id_rsa_cloud_computing.pub basanta-23473@192.168.18.57:~/ssh/authorized_keys
18.57:~/ssh/authorized_keys
basanta-23473@192.168.18.57's password:
id_rsa_cloud_computing.pub
100% 565 855.0KB/s 00:00
```

Here we can view the copied value.

```
[basanta-23473@localhost ~]$ ls .ssh
authorized_keys
[basanta-23473@localhost ~]$ cat .ssh/authorized_keys
ssh-rsa AAAAB3NzaC1yc2EAAAQABgQD0G4i5tkVxEfc2cxDgdPhnqgi+TJGkheZ8qcLV0g7gXEIZnLjlVs03q37tiw9RAKivvJRs4Q/oWN3
oSAVqu6dfguynIyJkjClYuK/S6kboMXCD26VTl6DnVL9sLxwA7Sw3bYv6neagV5M718SIFM/ISXPz0T05o/50rDjMdJZqGQtjRYJ5gFXeIx94BhMnya
tdbyGqsKSN/vKL8s31awG9Sd/kN+iEh8kIzjbmSeJ8verE/oQ+tXeab6PGv5z1SA7qhFMk2kFYuHvj9InM/5oiwNE+dlfHYx7zdZJCVA1iBV9FDWY6So+
Bpg2oqUY59C95FZa0MAKysgsGc5ko5z/69v8h9T2Ab3aMoQYDdahGNFnRy/h81dsT4gqKP+s0FEmdTUPa5Y2wL96llEtKgbjCx73dnCR8jZJKhGtC0N4D
/pm5RLu7l0UwZ+wnFap/0q2kXe5bwFZkgHm3zVpEpxf/hsQMefyX+y/N9dB3rtJj4mmppnshyMmHos5q/isE= Basanta Rai
[basanta-23473@localhost ~]$
```

Now we need to disable the **PasswordAuthentication** and **PermitRootLogin**.

**PasswordAuthentication no**

**PermitRootLogin no**

```
[basanta-23473@localhost ~]$ sudo vi /etc/ssh/sshd_config
[basanta-23473@localhost ~]$ sudo tail /etc/ssh/sshd_config -n 3
# Disable password authentication and rootlogin
PasswordAuthentication no
PermitRootLogin no
[basanta-23473@localhost ~]$
```

After doing this, we need to enable and start the service for ssh.

```
[basanta-23473@localhost ~]$ sudo systemctl restart sshd
[sudo] password for basanta-23473:
[basanta-23473@localhost ~]$ sudo systemctl status sshd
● sshd.service - OpenSSH server daemon
    Loaded: loaded (/usr/lib/systemd/system/sshd.service; enabled; preset: enabled)
    Active: active (running) since Tue 2024-06-11 19:17:04 +0545; 5s ago
      Docs: man:sshd(8)
             man:sshd_config(5)
   Main PID: 3402 (sshd)
     Tasks: 1 (limit: 10962)
    Memory: 1.4M
      CPU: 15ms
     CGroup: /system.slice/sshd.service
             └─3402 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Jun 11 19:17:04 localhost.localdomain systemd[1]: Starting OpenSSH server daemon...
Jun 11 19:17:04 localhost.localdomain sshd[3402]: Server listening on 0.0.0.0 port 22.
Jun 11 19:17:04 localhost.localdomain sshd[3402]: Server listening on :: port 22.
Jun 11 19:17:04 localhost.localdomain systemd[1]: Started OpenSSH server daemon.
[basanta-23473@localhost ~]$
```

After performing this, If we try to do the authentication using password, we can not log in to the server.

```
~ $ ssh basanta-23473@192.168.18.57
basanta-23473@192.168.18.57: Permission denied (publickey,gssapi-keyex,gssapi-with-mic).
~ $
```

And from the machine where we have configured our ssh key. We can login without any authentication as our ssh keys will be verified.

```
basanta@machine:~$ ssh basanta-23473@192.168.18.57
Activate the web console with: systemctl enable --now cockpit.socket

Last login: Tue Jun 11 19:17:50 2024 from 192.168.18.10
[basanta-23473@localhost ~]$ ls .ssh
authorized_keys
[basanta-23473@localhost ~]$
```

## Apache and mysql server installation

### Apache web server installation

Install **httpd** server using the following command.

```
$ sudo su
$ yum install httpd -y
```

```
[basanta-23473@localhost ~]$ sudo su
[root@localhost basanta-23473]# exit
exit
[basanta-23473@localhost ~]$ exit
logout
Connection to 192.168.18.57 closed.
basanta@machine:~$ ssh basanta-23473@192.168.18.57
Activate the web console with: systemctl enable --now cockpit.socket

Last login: Tue Jun 11 19:28:50 2024 from 192.168.18.53
[basanta-23473@localhost ~]$ sudo su
[sudo] password for basanta-23473:
[root@localhost basanta-23473]# yum install httpd -y
Last metadata expiration check: 0:54:06 ago on Tue 11 Jun 2024 06:40:07 PM +0545
.
Dependencies resolved.
=====
Package           Architecture Version      Repository  Size
=====
Installing:
httpd            x86_64        2.4.57-8.el9    appstream   48 k
Installing dependencies:
apr              x86_64        1.7.0-12.el9    appstream  123 k
```

Enable and start http server.

```
$ systemctl enable httpd
```

```
$ systemctl start httpd
```

```
[root@localhost basanta-23473]# systemctl enable httpd
Created symlink /etc/systemd/system/multi-user.target.wants/httpd.service → /usr
/lib/systemd/system/httpd.service.
[root@localhost basanta-23473]# systemctl start httpd
[root@localhost basanta-23473]# █
```

```
$ systemctl status httpd
```

```

● httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
   Active: active (running) since Tue 2024-06-11 19:35:26 +0545; 4min 37s ago
     Docs: man:httpd.service(8)
   Main PID: 36373 (httpd)
      Status: "Total requests: 5; Idle/Busy workers 100/0;Requests/sec: 0.0185; Bytes served/sec: 3.4KB/sec"
        Tasks: 177 (limit: 10962)
       Memory: 22.2M
          CPU: 283ms
        CGroup: /system.slice/httpd.service
                  ├─36373 /usr/sbin/httpd -DFOREGROUND
                  ├─36374 /usr/sbin/httpd -DFOREGROUND
                  ├─36375 /usr/sbin/httpd -DFOREGROUND
                  ├─36376 /usr/sbin/httpd -DFOREGROUND
                  └─36377 /usr/sbin/httpd -DFOREGROUND

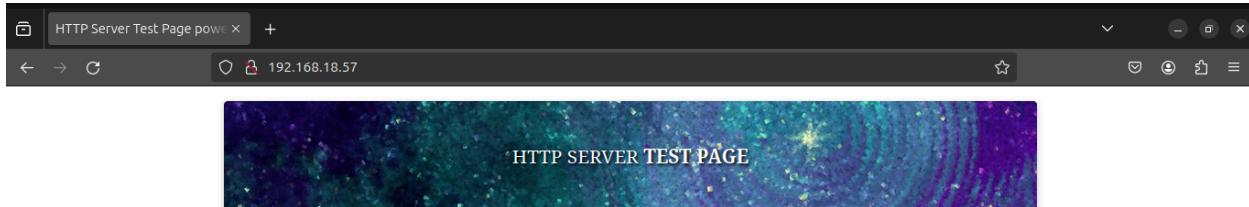
Jun 11 19:35:26 localhost.localdomain systemd[1]: Starting The Apache HTTP Server...
Jun 11 19:35:26 localhost.localdomain httpd[36373]: AH00558: httpd: Could not reliably determine the server's fully qualified name, using localhost.localdomain for Port 80
Jun 11 19:35:26 localhost.localdomain httpd[36373]: Server configured, listening on: port 80
Jun 11 19:35:26 localhost.localdomain systemd[1]: Started The Apache HTTP Server.
~
```

Configure firewall.

```
$ firewall-cmd --add-service={http,https} --permanent
```

```
[root@localhost basanta-23473]# firewall-cmd --add-service={http,https} --permanent
success
[root@localhost basanta-23473]# firewall-cmd --reload
success
[root@localhost basanta-23473]#
```

Verify http server.



#### If you are a member of the general public:

The website you just visited is either experiencing problems or is undergoing routine maintenance.

If you would like to let the administrators of this website know that you've seen this page instead of the page you expected, you should send them e-mail. In general, mail sent to the name 'webmaster' and directed to the website's domain should reach the appropriate person.

For example, if you experienced problems while visiting www.example.com, you should send e-mail to 'webmaster@example.com'.

#### If you are the website administrator:

You may now add content to the webroot directory. Note that until you do so, people visiting your website will see this page, and not your content.

For systems using the Apache HTTP Server: You may now add content to the directory `/var/www/html/`. Note that until you do so, people visiting your website will see this page, and not your content. To prevent this page from ever being used, follow the instructions in the file `/etc/httpd/conf.d/welcome.conf`.

For systems using NGINX: You should now put your content in a location of your choice and edit the `root` configuration directive in the `nginx` configuration file `/etc/nginx/nginx.conf`.



#### Important note!

The CentOS Project has nothing to do with this website or its content, it just provides the software that makes the website run.

If you have issues with the content of this site, contact the owner of the domain, not the CentOS project. Unless you intended to visit CentOS.org, the CentOS Project does not have

## Mysql database server installation

Install mysql-server using the following command.

```
$ yum install mysql-server -y
```

```
[root@localhost basanta-23473]# yum install mysql-server -y
Last metadata expiration check: 1:01:23 ago on Tue 11 Jun 2024 06:40:07 PM +0545.
Dependencies resolved.
=====
Package           Architecture   Version      Repository    Size
=====
Installing:
mysql-server      x86_64        8.0.36-1.el9   appstream   17 M
Installing dependencies:
mariadb-connector-c-config  noarch       3.2.6-1.el9    appstream   11 k
mecab             x86_64        0.996-3.el9.4  appstream   356 k
mysql              x86_64        8.0.36-1.el9    appstream   2.8 M
mysql-common       x86_64        8.0.36-1.el9    appstream   74 k
mysqlerrmsg        x86_64        8.0.36-1.el9    appstream   505 k
mysql-selinux       noarch       1.0.10-1.el9   appstream   37 k
protobuf-lite      x86_64        3.14.0-13.el9   appstream   232 k

Transaction Summary
=====
Total Downloaded: 0 Packages
```

Enable and start service for mysql server.

```
$ yum enable mysqld
```

```
$ yum start mysqld
```

```
[root@localhost basanta-23473]# systemctl enable mysqld
Created symlink /etc/systemd/system/multi-user.target.wants/mysqld.service → /usr/lib/systemd/system/mysqld.service.
[root@localhost basanta-23473]# systemctl statrt mysqld
Unknown command verb statrt.
[root@localhost basanta-23473]# systemctl start mysqld
[root@localhost basanta-23473]# systemctl status mysqld
● mysqld.service - MySQL 8.0 database server
   Loaded: loaded (/usr/lib/systemd/system/mysqld.service; enabled; preset: disabled)
     Active: active (running) since Tue 2024-06-11 19:43:09 +0545; 11s ago
       Process: 37506 ExecStartPre=/usr/libexec/mysql-check-socket (code=exited, status=0/SUCCESS)
       Process: 37528 ExecStartPre=/usr/libexec/mysql-prepare-db-dir mysqld.service (code=exited, status=0/SUC>
     Main PID: 37602 (mysqld)
       Status: "Server is operational"
         Tasks: 38 (limit: 10962)
        Memory: 416.7M
          CPU: 3.819s
        CGroup: /system.slice/mysqld.service
                  └─37602 /usr/libexec/mysqld --basedir=/usr

Jun 11 19:42:58 localhost.localdomain systemd[1]: Starting MySQL 8.0 database server...
Jun 11 19:42:58 localhost.localdomain mysql-prepare-db-dir[37528]: Initializing MySQL database
Jun 11 19:43:09 localhost.localdomain systemd[1]: Started MySQL 8.0 database server.
```

Run SQL queries.

```
[root@localhost basanta-23473]# mysql -u root
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 9
Server version: 8.0.36 Source distribution

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> SHOW DATABASES;
+-----+
| Database      |
+-----+
| information_schema |
| mysql          |
| performance_schema |
| sys            |
+-----+
4 rows in set (0.00 sec)
```

## Web hosting

## Installing nginx

```
$ yum install epel-release nginx -y
```

```
[root@localhost basanta-23473]# yum install epel-release nginx -y
Last metadata expiration check: 1:06:59 ago on Tue 11 Jun 2024 06:40:07 PM +0545.
Dependencies resolved.
=====
Package           Architecture    Version       Repository      Size
=====
Installing:
epel-release     noarch         9-7.el9      extras-common   19 k
nginx            x86_64         1:1.20.1-16.el9 appstream       37 k
Installing dependencies:
nginx-core       x86_64         1:1.20.1-16.el9 appstream       569 k
nginx-filesystem noarch         1:1.20.1-16.el9 appstream       9.3 k
Installing weak dependencies:
epel-next-release noarch         9-7.el9      extras-common   8.1 k
Transaction Summary
=====
Install 5 Packages

Total download size: 642 k
Installed size: 1.8 M
Downloading Packages:
(1/5): nginx-1.20.1-16.el9.x86_64.rpm          44 kB/s | 37 kB   00:00
(2/5): nginx-filesystem-1.20.1-16.el9.noarch.rpm 6.3 kB/s | 9.3 kB   00:01
```

Enable and start nginx.

```
$ systemctl enable nginx
```

```
$ systemctl start nginx
```

```
$ systemctl status nginx
```

```
[basanta-23473@localhost ~]$ sudo systemctl enable nginx
Created symlink from /etc/systemd/system/multi-user.target.wants/nginx.service to /usr/lib/systemd/system/nginx.service.
[basanta-23473@localhost ~]$ sudo systemctl start nginx
[basanta-23473@localhost ~]$ sudo systemctl status nginx
● nginx.service - The nginx HTTP and reverse proxy server
   Loaded: loaded (/usr/lib/systemd/system/nginx.service; enabled; vendor preset : disabled)
     Active: active (running) since Tue 2024-06-11 13:06:33 EDT; 4s ago
   Process: 1884 ExecStart=/usr/sbin/nginx (code=exited, status=0/SUCCESS)
   Process: 1880 ExecStartPre=/usr/sbin/nginx -t (code=exited, status=0/SUCCESS)
   Process: 1879 ExecStartPre=/usr/bin/rm -f /run/nginx.pid (code=exited, status=0/SUCCESS)
 Main PID: 1886 (nginx)
    CGroup: /system.slice/nginx.service
            ├─1886 nginx: master process /usr/sbin/nginx
            ├─1887 nginx: worker process
            └─1888 nginx: worker process

Jun 11 13:06:33 localhost.localdomain systemd[1]: Starting The nginx HTTP and...
Jun 11 13:06:33 localhost.localdomain nginx[1880]: nginx: the configuration f...
Jun 11 13:06:33 localhost.localdomain nginx[1880]: nginx: configuration file ...
Jun 11 13:06:33 localhost.localdomain systemd[1]: Started The nginx HTTP and...
```

Create a simple html page inside `/var/www/html/` directory.

```
[basanta-23473@localhost cloud-computing]$ sudo vi index.html
[basanta-23473@localhost cloud-computing]$ pwd
/var/www/html/cloud-computing
[basanta-23473@localhost cloud-computing]$ cat index.html
<html>
    <head>
        <title>NginX Server</title>
    </head>
    <body>
        <h1>Introduction to Cloud Computing</h1>
        <p>This is <b>NginX</b> server.</p>
    </body>
</html>
[basanta-23473@localhost cloud-computing]$
```

Create a config file for nginx server.

```
[basanta-23473@localhost cloud-computing]$ sudo vi /etc/nginx/conf.d/cloud-computing.conf
[basanta-23473@localhost cloud-computing]$ cat /etc/nginx/conf.d/cloud-computing.conf
server {
    listen 69;
    listen [::]:69;
    server_name 192.168.18.69;

    root /var/www/html/cloud-computing;
    index index;

    location / {
        try_files $uri $uri/ =404;
    }

    error_page 404 /404.html;
    location = /404.html {
        internal;
    }
}
```

## User and permission creation

Create a user and set up its password.

```
$ sudo useradd <user_name>
```

```
$ sudo passwd <user_name>
```

```
[basanta-23473@localhost ~]$ sudo useradd osin_t
[sudo] password for basanta-23473:
[basanta-23473@localhost ~]$ sudo passwd osin_t
Changing password for user osin_t.
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: all authentication tokens updated successfully.
[basanta-23473@localhost ~]$ █
```

Add user to the sudo group

```
$ sudo usermod -aG <group_name> <user_name>
```

```
[root@localhost basanta-23473]# sudo usermod -aG wheel osin_t
[root@localhost basanta-23473]# █
```

Set permissions to a directory.

```
[root@localhost html]# ls -lah
total 0
drwxr-xr-x. 3 root root 20 Jun 11 20:05 .
drwxr-xr-x. 4 root root 33 Jun 11 19:34 ..
drwxr-xr-x. 2 root root 6 Jun 11 20:05 osin_t
[root@localhost html]# chwon -R osin_t:osin_t osin_t/
bash: chwon: command not found...
Similar command is: 'chown'
[root@localhost html]# chown -R osin_t:osin_t osin_t/
[root@localhost html]# ls -lah
total 0
drwxr-xr-x. 3 root root 20 Jun 11 20:05 .
drwxr-xr-x. 4 root root 33 Jun 11 19:34 ..
drwxr-xr-x. 2 osin_t osin_t 6 Jun 11 20:05 osin_t
[root@localhost html]# █
```

View permissions.

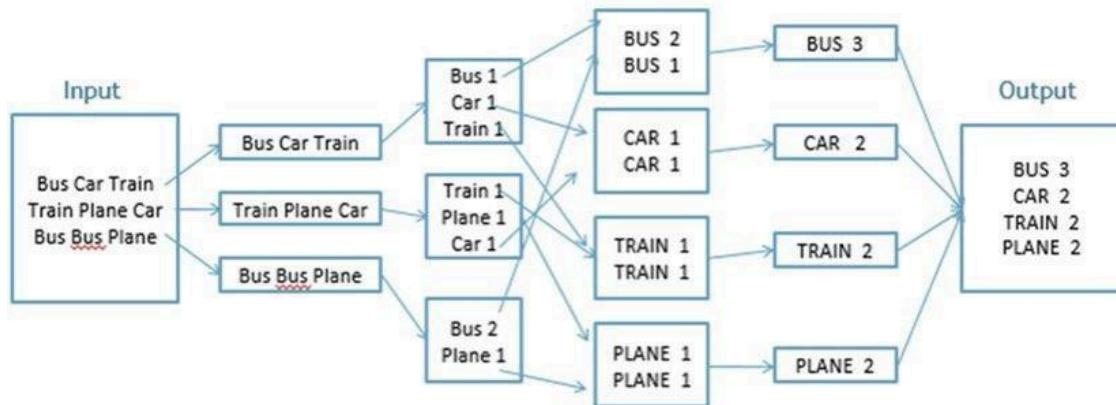
```
[root@localhost osin_t]# ls -lah
total 0
drwxr-xr-x. 2 osin_t osin_t 22 Jun 11 20:26 .
drwxr-xr-x. 3 root    root    20 Jun 11 20:05 ..
-rw-r--r--. 1 root    root    0 Jun 11 20:26 hello.sh
[root@localhost osin_t]# sudo su osin_t
[osin_t@localhost osin_t]$ echo " echo 'Hello'" >> hello.sh
bash: hello.sh: Permission denied
[osin_t@localhost osin_t]$ exit
exit
```

Add permissions.

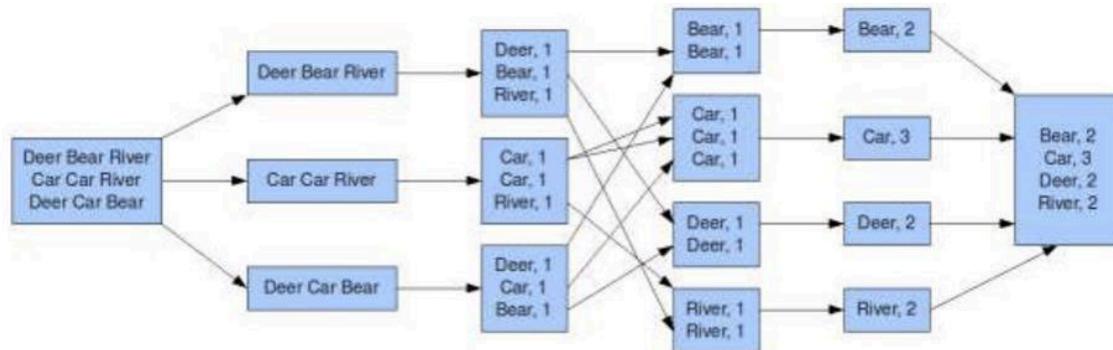
```
[root@localhost osin_t]# touch hello.sh
[root@localhost osin_t]# chmod -R 777 hello.sh
[root@localhost osin_t]# sudo su
[root@localhost osin_t]# su osin_T
su: user osin_T does not exist or the user entry does not contain all the required fields
[root@localhost osin_t]# su osin_
su: user osin_ does not exist or the user entry does not contain all the required fields
[root@localhost osin_t]# su osin_t
[osin_t@localhost osin_t]$ echo "echo 'hello'" >> hello.sh
[osin_t@localhost osin_t]$ cat hello.sh
echo 'hello'
[osin_t@localhost osin_t]$ ./hello.sh
hello
[osin_t@localhost osin_t]$
```

# MapReduce Program

a.



b.



**Source code:**

```

function mapper(text) {
  const keyValuePairs = [];
  const words = text.split(/\s+/);
  for (const word of words) {
    keyValuePairs.push([word, 1]);
  }
  return keyValuePairs;
}

function reducer(keyValuePairs) {
  const word = keyValuePairs[0];
  const counts = keyValuePairs[1];
  const total = counts.reduce((sum, count) => sum + count, 0);
  return [word, total];
}
  
```

```

}

function mapreduce(textData) {
  const keyValuePairs = {};
  const lines = textData.split('\n');
  for (const line of lines) {
    const mappedPairs = mapper(line);
    for (const [word, count] of mappedPairs) {
      if (!keyValuePairs[word]) {
        keyValuePairs[word] = [];
      }
      keyValuePairs[word].push(count);
    }
  }
  const results = [];
  for (const [word, counts] of Object.entries(keyValuePairs)) {
    results.push(reducer([word, counts]));
  }
  return results;
}

const da = prompt();

```

```

const results = mapreduce(textData);
for (const [word, count] of results) {
  console.log(`Word: ${word}, Count: ${count}`);
}

```

**a. Output:**

|                       |
|-----------------------|
| Word: Bus, Count: 3   |
| Word: Car, Count: 2   |
| Word: Train, Count: 2 |
| Word: Plane, Count: 2 |

**b. Output:**

|                       |
|-----------------------|
| Word: Deer, Count: 2  |
| Word: Bear, Count: 2  |
| Word: River, Count: 2 |
| Word: Car, Count: 3   |

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