

# Virtualization and VM Provisioning Assignment

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## 1. Exporting and Importing a VM

### **Objective:**

Create a VM, export its configuration and disk, then import it into a new VM and verify it boots successfully.

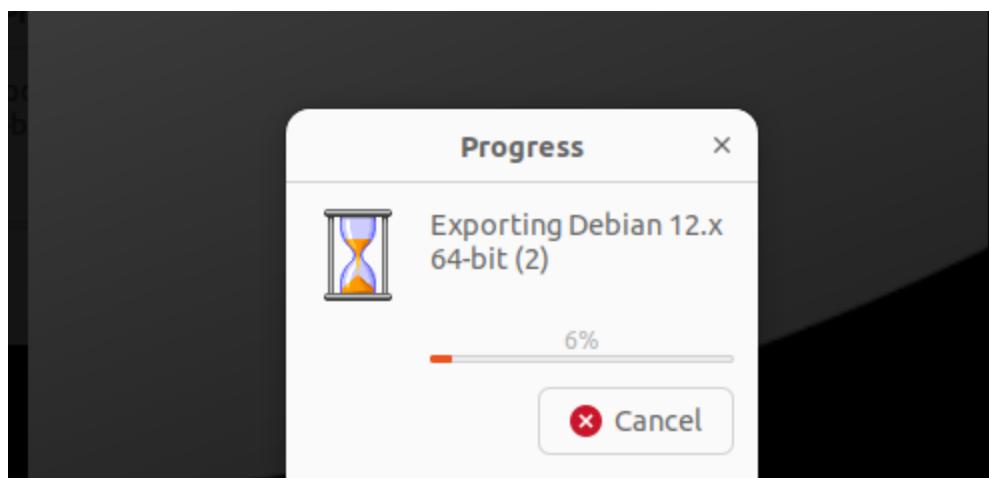
### **Steps Performed:**

#### 1. Created a Virtual Machine

- Resources: CPU [2], RAM [2 GB], Disk [20 GB]
- Installed updates and basic packages.

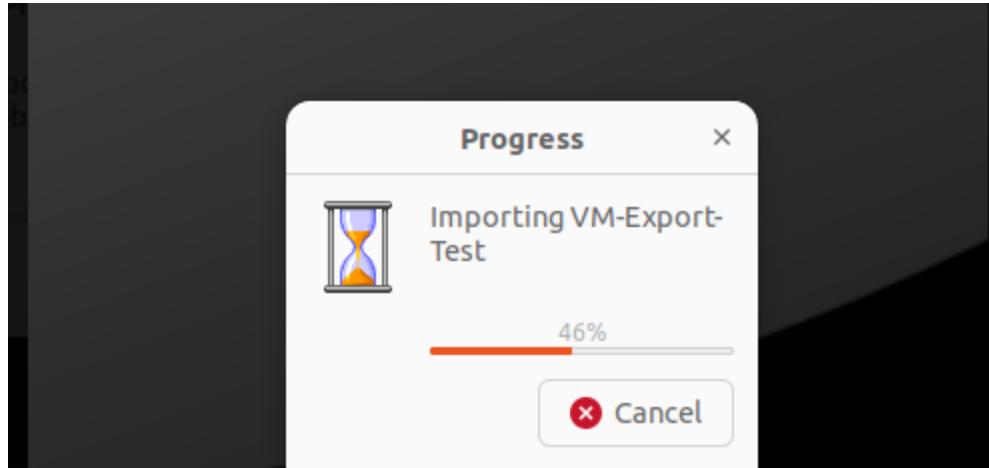
#### 2. Exported the VM

- Format: OVF (Open Virtualization Format)



- Included all disk files and configuration.

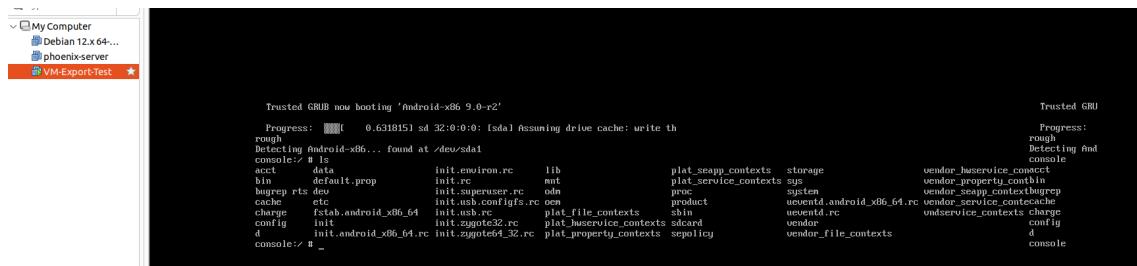
### **3. Imported into a New VM**



- Verified imported VM resources matched original VM.

#### **4. Verification**

- Booted the new VM successfully.
  - Screenshot of VM running:



## 2. VM Provisioning using Vagrant

**Objective:** Automatically provision a VM using Vagrant.

## Vagrantfile Used:

## Vagrantfile

```

Vagrant.configure("2") do |config|
  # Base box
  config.vm.box = "generic/ubuntu2204"

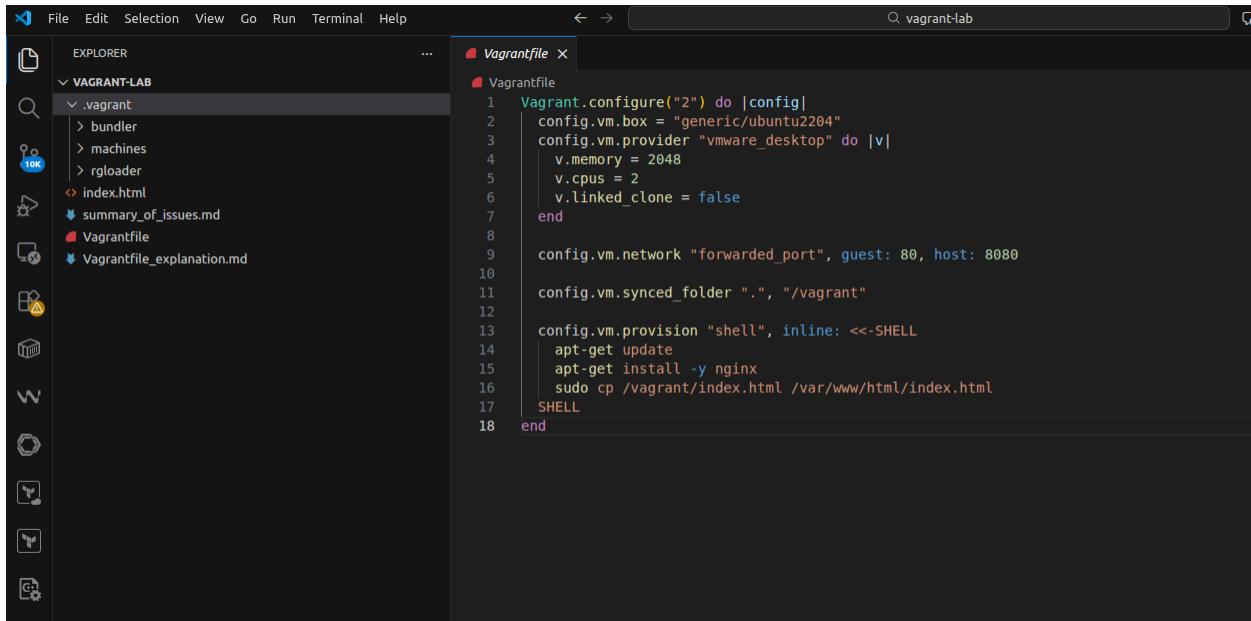
  # VMware provider settings
  config.vm.provider "vmware_desktop" do |v|
    v.memory = 2048    # 2 GB RAM
    v.cpus = 2          # 2 CPU cores
    v.linked_clone = false
  end

  # Forward HTTP port from guest to host
  config.vm.network "forwarded_port", guest: 80, host: 8080

  # Sync current folder to VM
  config.vm.synced_folder ".", "/vagrant"

  # Provision VM with Nginx and copy index.html
  config.vm.provision "shell", inline: <<-SHELL
    apt-get update
    apt-get install -y nginx
    sudo cp /vagrant/index.html /var/www/html/index.html
    sudo systemctl enable nginx
    sudo systemctl start nginx
  SHELL
end

```



The screenshot shows a code editor interface with a dark theme. On the left is an Explorer sidebar showing a project structure under 'VAGRANT-LAB'. The main area displays the 'Vagrantfile' content:

```
Vagrant.configure("2") do |config|
  config.vm.box = "generic/ubuntu2204"
  config.vm.provider "vmware_desktop" do |v|
    v.memory = 2048
    v.cpus = 2
    v.linked_clone = false
  end

  config.vm.network "forwarded_port", guest: 80, host: 8080
  config.vm.synced_folder ".", "/vagrant"

  config.vm.provision "shell", inline: <<-SHELL
    apt-get update
    apt-get install -y nginx
    sudo cp /vagrant/index.html /var/www/html/index.html
  SHELL
end
```

## Steps Performed:

1. Initialized Vagrant environment:

```
vagrant init
```

2. Started and provisioned VM:

```
vagrant up
```

3. Verified Apache service is running on VM.

**Result:** VM was automatically configured and Apache web server is running.

Screenshot of service status:

```

Vagrantfile
1 Vagrant.configure("2") do |config|
2   config.vm.box = "generic/ubuntu2204"
3   config.vm.provider "vmware_desktop" do |v|
4     v.memory = 2048
5     v.cpus = 2

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS SONARQUBE

> <-- TERMINAL
  • [~](-vagrant-lab) [16:25:34 on master +]→ curl localhost:8080
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
  body {
    width: 35em;
    margin: 0 auto;
    font-family: Tahoma, Verdana, Arial, sans-serif;
  }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and working. Further configuration is required.</p>
<p><em>Thank you for using nginx.</em></p>
</body>
</html>

[~](-vagrant-lab) [16:25:58 on master +]→ vagrant ssh -c "sudo systemctl status nginx"
● nginx.service - A high performance web server and a reverse proxy server
  Loaded: loaded (/lib/systemd/system/nginx.service; enabled; vendor preset: enabled)
  Active: active (running) since Mon 2026-02-09 15:04:18 UTC; 22min ago
    Docs: man:nginx(8)
   Main PID: 3098 (nginx)
      Tasks: 3 (limit: 2220)
     Memory: 4.6M
        CPU: 50ms
       CGroup: /system.slice/nginx.service
           ├─3098 "nginx: master process /usr/sbin/nginx -g daemon on; master_process on;"
           ├─3101 "nginx: worker process" " "
           ├─3102 "nginx: worker process" " "

Feb 09 15:04:18 ubuntu2204.localdomain systemd[1]: Starting A high performance web server and a reverse proxy server...
Feb 09 15:04:18 ubuntu2204.localdomain systemd[1]: Started A high performance web server and a reverse proxy server.

[~](-vagrant-lab) [16:26:20 on master +]→

```

## 3. VM Configuration using Cloud-Init

### Objective:

Configure a VM on first boot using cloud-init, automating user creation, package installation, and service setup.

### Cloud-Init Configuration File ( `cloud-init.yaml` ):

```

#cloud-config

# Create a user with sudo privileges
users:
  - name: student
    sudo: ['ALL=(ALL) NOPASSWD:ALL']
    shell: /bin/bash

```

```

# Install packages automatically on first boot
packages:
    - nginx                      # Web server
    - git                        # Version control
    - vim                        # Text editor
    - htop                        # System monitor
    - curl                        # Command-line HTTP client
    - wget                        # Download tool
    - build-essential            # Compiler and development tools
    - python3                     # Python runtime
    - python3-pip                 # Python package manager
    - unzip                       # Extract zip files
    - net-tools                   # Network tools (ifconfig, netstat)
    - tree                         # Directory structure visualization

# Run commands at first boot
runcmd:
    # Set up a welcome page for Nginx
    - echo "<h1>Welcome to Multipass Nginx Lab!</h1>" > /home/student/index.html
    - sudo mv /home/student/index.html /var/www/html/index.html

    # Enable and start Nginx
    - sudo systemctl enable nginx
    - sudo systemctl start nginx

    # Create directories for practice
    - mkdir -p /home/student/projects
    - mkdir -p /home/student/scripts

    # Update pip and install a Python package
    - python3 -m pip install --upgrade pip
    - python3 -m pip install requests

    # Log system info in a welcome file

```

```
- echo "Multipass VM initialized successfully on $(date)" >
> /home/student/welcome.log
- uname -a >> /home/student/welcome.log
- lsb_release -a >> /home/student/welcome.log
```

### Steps Performed:

1. Created the file `cloud-init.yaml` in the local directory.
2. Launched the Multipass VM with cloud-init applied:

```
multipass launch --name cloudinit --memory 1G --disk 5G --
cpus 1 --cloud-init cloud-init.yaml
```

3. Connected to the VM to verify:

```
multipass shell cloudinit
```

4. Verified:

- User `student` exists with sudo privileges.
- Nginx service is running (`systemctl status nginx`).
- Packages like `git`, `vim`, `htop`, `python3`, `pip` are installed.
- Welcome webpage is accessible via the VM IP.
- `projects` and `scripts` directories created.
- `welcome.log` file contains system info.

### Result:

The VM is fully configured automatically on first boot, ready for development, testing, and learning exercises.

### Screenshot

```
[~] (16:35:56 on master ★)→ nano cloud-init.yaml
[~] (16:36:43 on master ★)→ multipass launch --name cloudinit --memory 1G --disk 2G --cpus 1 --cloud-init cloud-init.yaml
Retrieving image: 41%
```

```
[~] (16:42:17 on master ★)→ multipass launch --name cloudinit --memory 1G --disk 5G --cpus 1 --cloud-init cloud-init.yaml
Launched: cloudinit
[~] (16:45:04 on master ★)→ multipass list
Name           State      IPv4          Image
cloudinit      Running   10.47.116.239 Ubuntu 24.04 LTS
fineract-vm    Running   10.47.116.96  Ubuntu 24.04 LTS
                  192.168.49.1
                  172.17.0.1
school         Running   10.47.116.21  Ubuntu 24.04 LTS
```

```
ubuntu@cloudinit:~$ nginx -v
nginx version: nginx/1.24.0 (Ubuntu)
ubuntu@cloudinit:~$ git --version
git version 2.43.0
ubuntu@cloudinit:~$ htop --version
htop 3.3.0
ubuntu@cloudinit:~$ python3 --version
Python 3.12.3
ubuntu@cloudinit:~$
```

```
student@cloudinit:~$ ls
projects scripts welcome.log
student@cloudinit:~$ cat welcome.log
Multipass VM initialized successfully on Mon Feb  9 16:45:03 WAT 2026
Linux cloudinit 6.8.0-90-generic #91-Ubuntu SMP PREEMPT_DYNAMIC Tue Nov 18 14:14:30 UTC 2025 x86_64 x86_64 x86_64 GNU/Linux
Distributor ID: Ubuntu
Description:    Ubuntu 24.04.3 LTS
Release:        24.04
Codename:       noble
student@cloudinit:~$
```