# Lab 1 (Week 1)
# Linux OS, Virtual Machine and Mininet

CAN201

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# Outline

- Linux OS
- Virtual Machine
- Mininet
- Hands-on Practice
- Appendix

# Linux Operating System

- Why do we use Linux OS?
  - Windows
  - Macintosh/MacOS
  - Linux
    - ✓ open-source
    - ✓ user friendly, e.g., built-in networking commands
    - ✓ many free apps networking related

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- For this module, we mainly use Ubuntu Linux OS.
  - A standard running and testing environment!

# Virtual Machine

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# Virtual Machine

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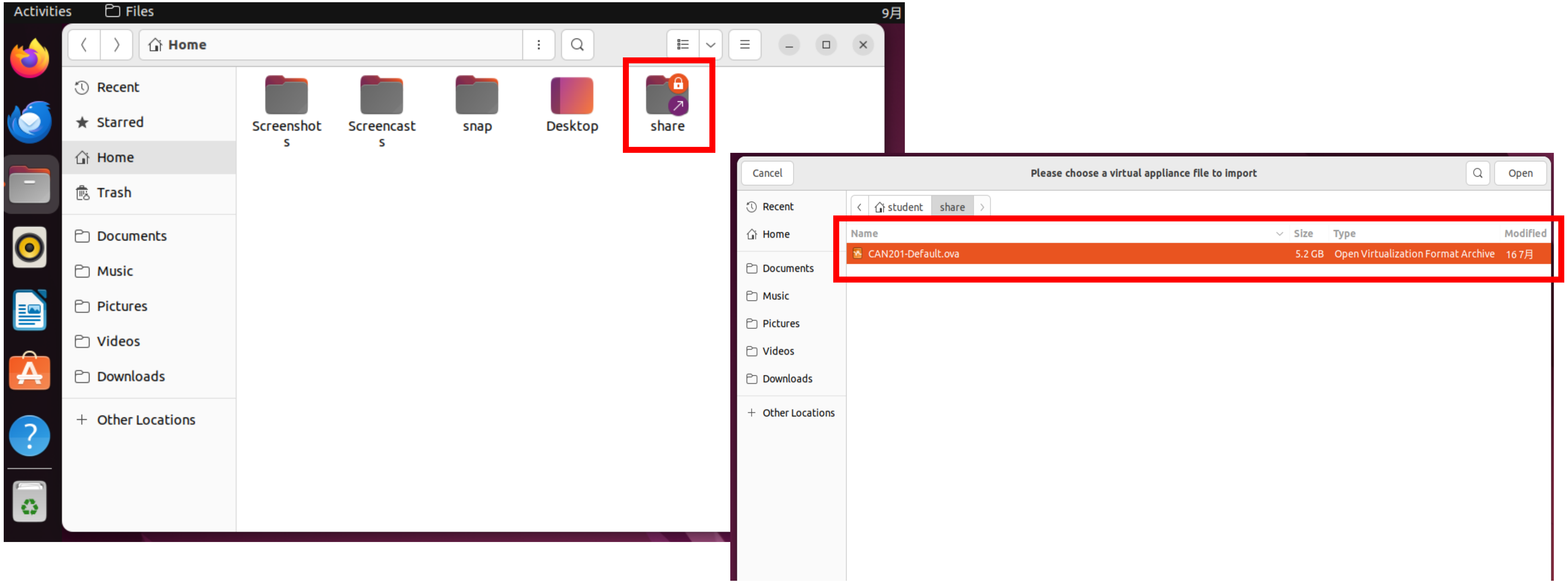
  - A physical machine can “simulate” multiple VMs (guest Oses, hosts)
  - Run Linux guest OS (if your host OS is Windows)
  - Much safer doing network security lab against VM
  - SDN lab-friendly

# Virtual Machine

- Getting VM hypervisor
  - VirtualBox (open-source)
  - ❑ https://www.virtualbox.org/wiki/Downloads
  - VMware (not free)
  - ❑ https://www.vmware.com/products/workstation-player.html
  - Other VM hypervisors: QEMU, KVM, UML, etc.

# Virtual Machine

- A Ready-made Ubuntu (20.04 LTS) OVA file “CAN201-Default.ova” has been created, which is located in the “share” folder.



| Name | Size | Type | Modified |
|---|---|---|---|
| CAN201-Default.ova | 5.2 GB | Open Virtualization Format Archive | 16 7月 |

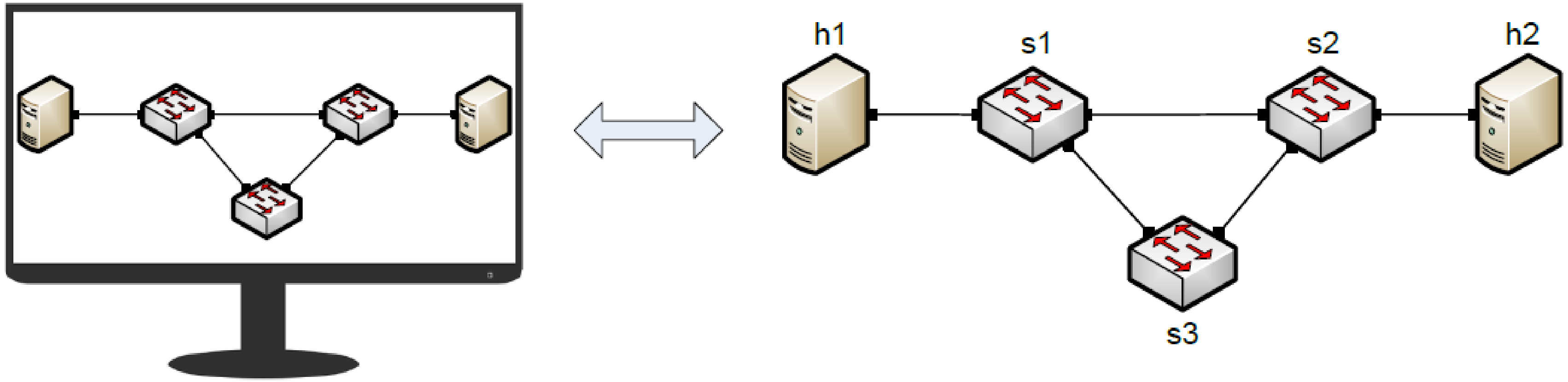
# Virtual Machine

- The ready-made Virtualbox OVA (installing Ubuntu OS) includes the following softwares (which will be used for this module):

| Software Name | License number |
|---|---|
| Wireshark (install on Ubuntu) | Version 3.4.9 or later (open source) https://www.wireshark.org/download.html |
| Mininet (install on Ubuntu) | Version 2.3.0 or later (open source) http://mininet.org/ |
| Ryu SDN framework (install on Ubuntu) | Version 1 or later (open source) https://ryu-sdn.org/ |
| Python (install on Ubuntu) | Version 3.0 or later (open source) https://www.python.org/downloads/ |
| Snort (install on Ubuntu) | Version 3.0 or later (open source) https://www.snort.org/ |
| Nmap (install on Ubuntu) | Version 7.9 or later (open source) https://nmap.org/ |

# Mininet

- Mininet: a virtual testbed used for testing network tools and protocols.



**Mininet Emulated Network**

**Hardware Network**

# Mininet

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  - Fast prototyping for new networking protocols.
  - Simplified testing for complex topologies without the need of buying expensive hardware.
  - Realistic execution as it runs real code on the Unix and Linux kernels.
  - Open-source environment backed by a large community contributing extensive documentation.

# Hands-on Practice

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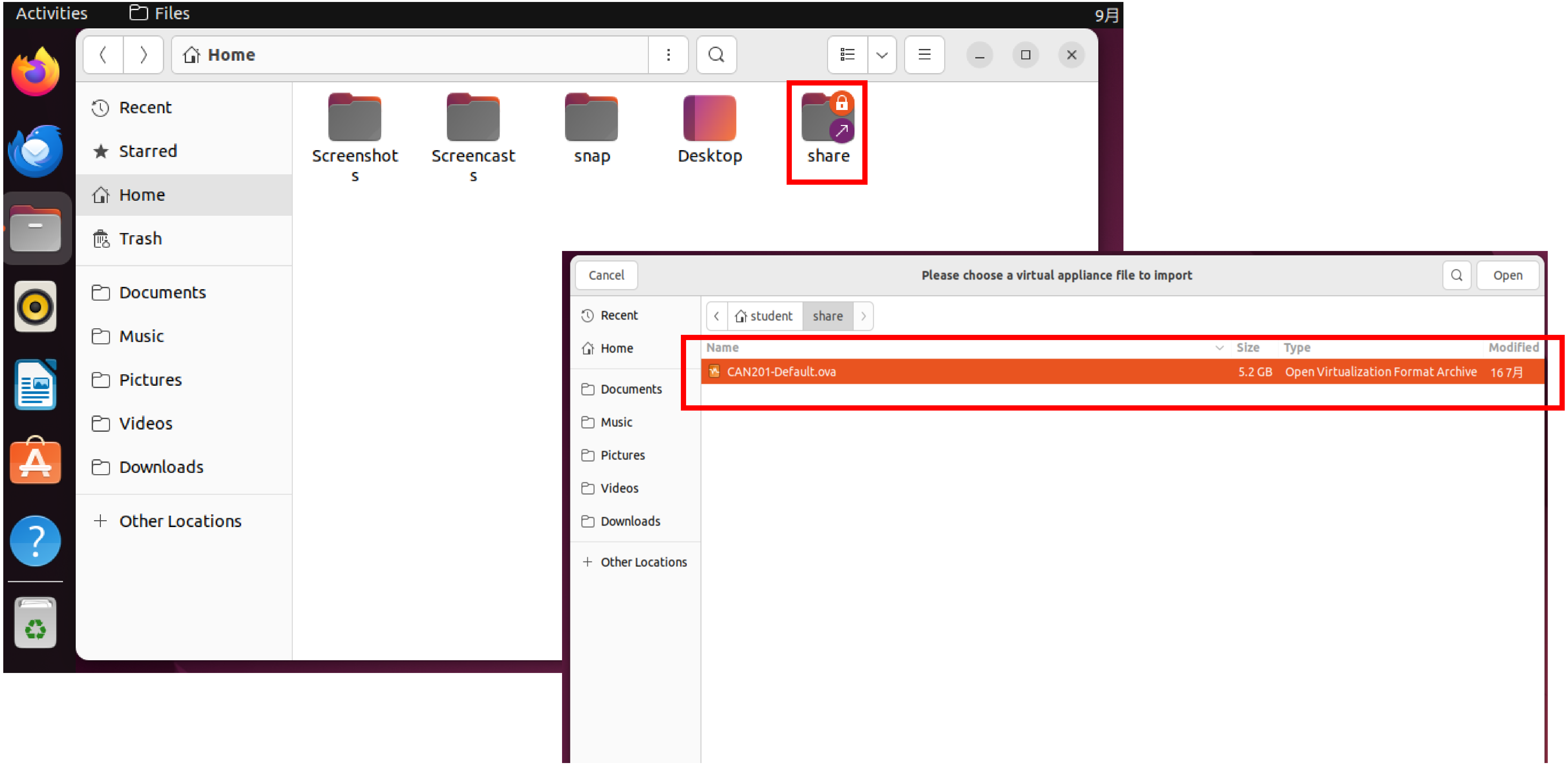
# Appendix

- (Optional) Copy or Download the Ubuntu image VirtualBox OVA file
- Open VirtualBox software
- Create the virtual machine by importing the OVA file
- Set up the virtual network for the virtual machines
- Run the virtual machine

# Copy the Ubuntu OVA file



Please choose a virtual appliance file to import

| Name | Size | Type | Modified |
|---|---|---|---|
| CAN201-Default.ova | 5.2 GB | Open Virtualization Format Archive | 16 7月 |

# Download the Ubuntu OVA file

**1. OVA file is available:**

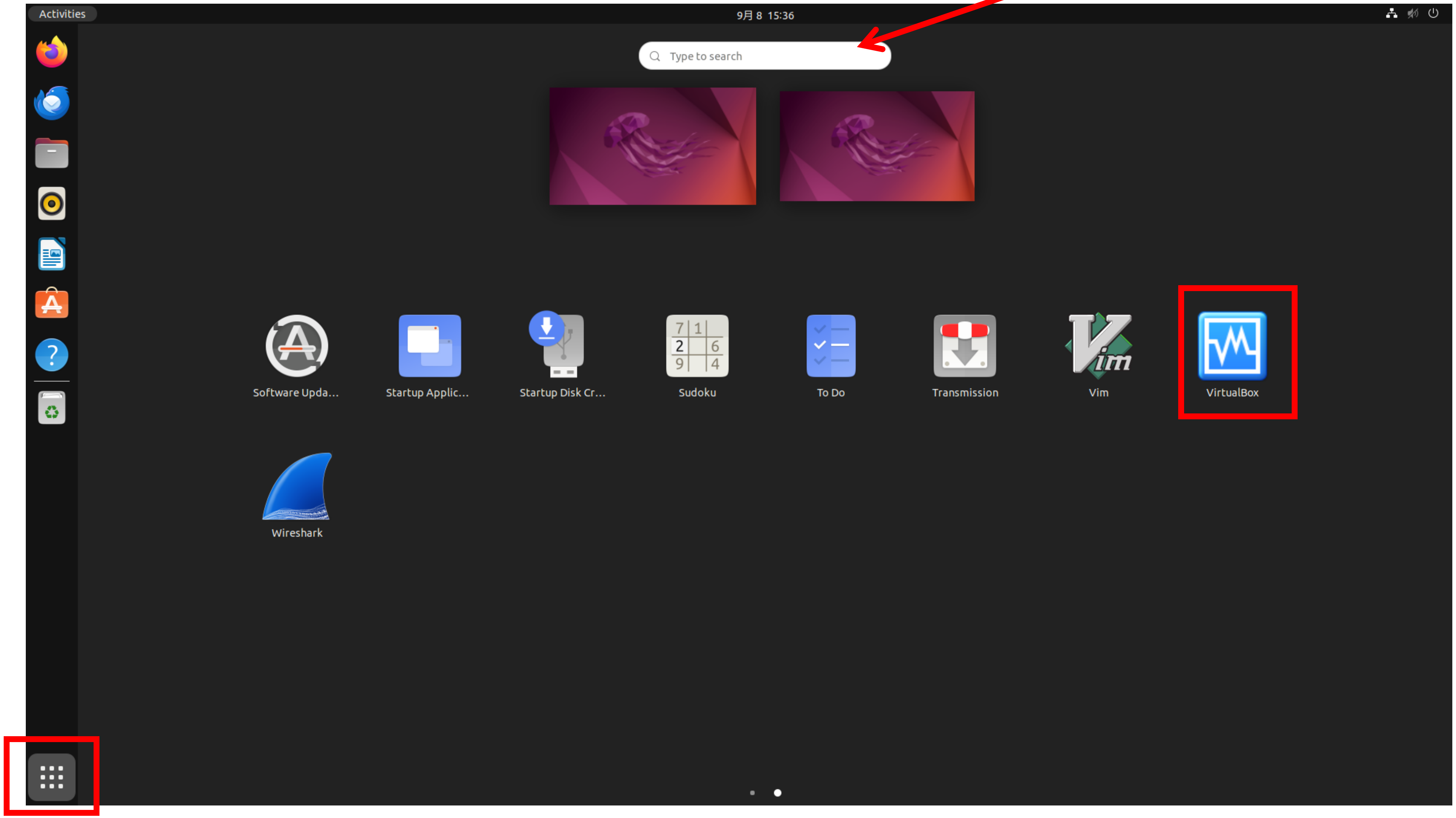
**Baidu Pan (extracting code: c201):**

https://pan.baidu.com/s/17l3PSXkNA_4aVwS6ZwED0g?pwd=c201

**2. Or copy from the ubuntu computer in the lab SC464.**

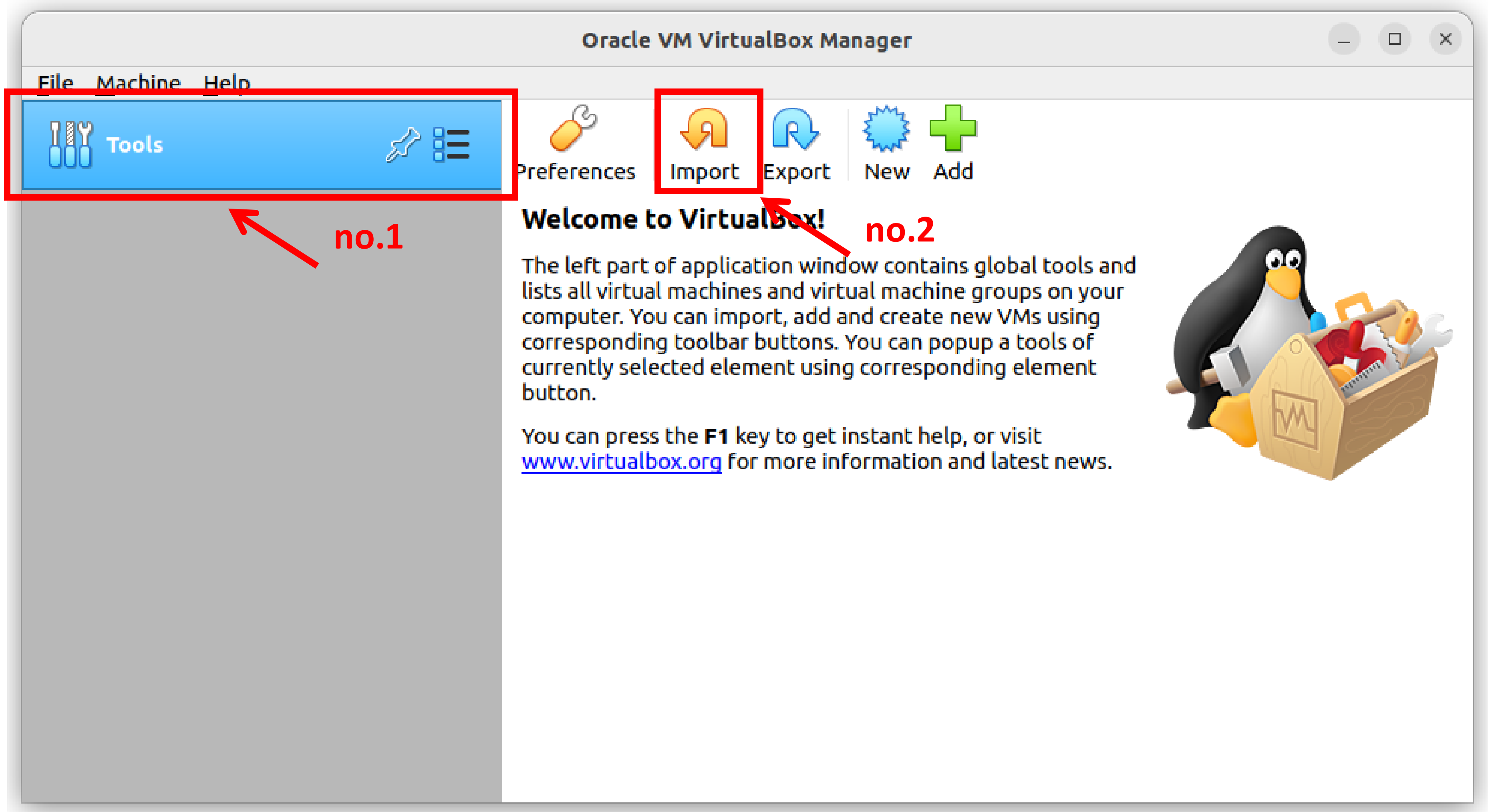
# Open VirtualBox software

Type “Virtualbox” to search



# Import the Ubuntu OVA file

## 1. Choose Tools and click Import in VirtualBox



Oracle VM VirtualBox Manager

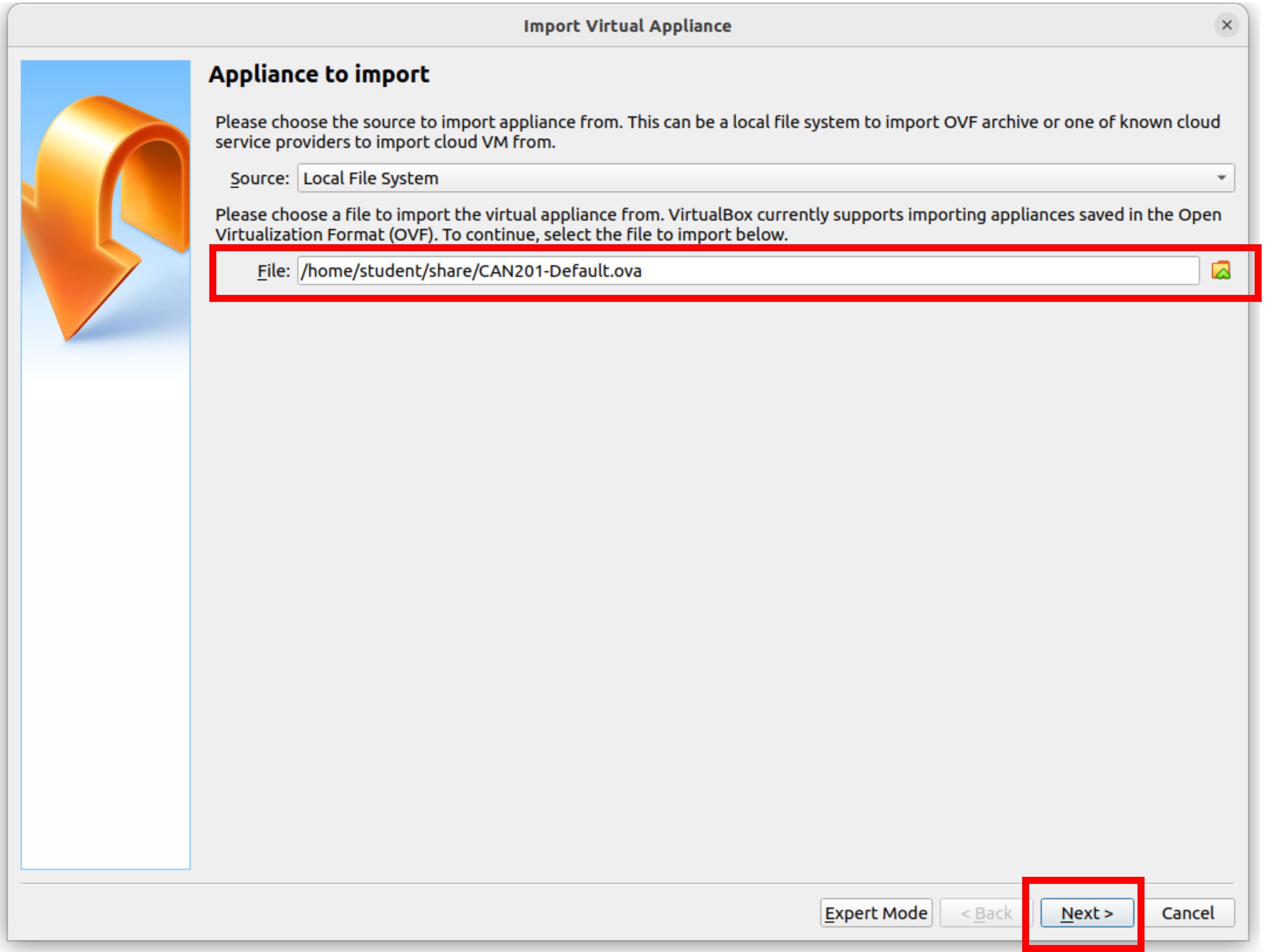
**Welcome to VirtualBox!**

The left part of application window contains global tools and lists all virtual machines and virtual machine groups on your computer. You can import, add and create new VMs using corresponding toolbar buttons. You can popup a tools of currently selected element using corresponding element button.

You can press the **F1** key to get instant help, or visit www.virtualbox.org for more information and latest news.

# Import the Ubuntu Image

## 2. Select the OVA file and click Next.



Import Virtual Appliance

Appliance to import

Please choose the source to import appliance from. This can be a local file system to import OVF archive or one of known cloud service providers to import cloud VM from.

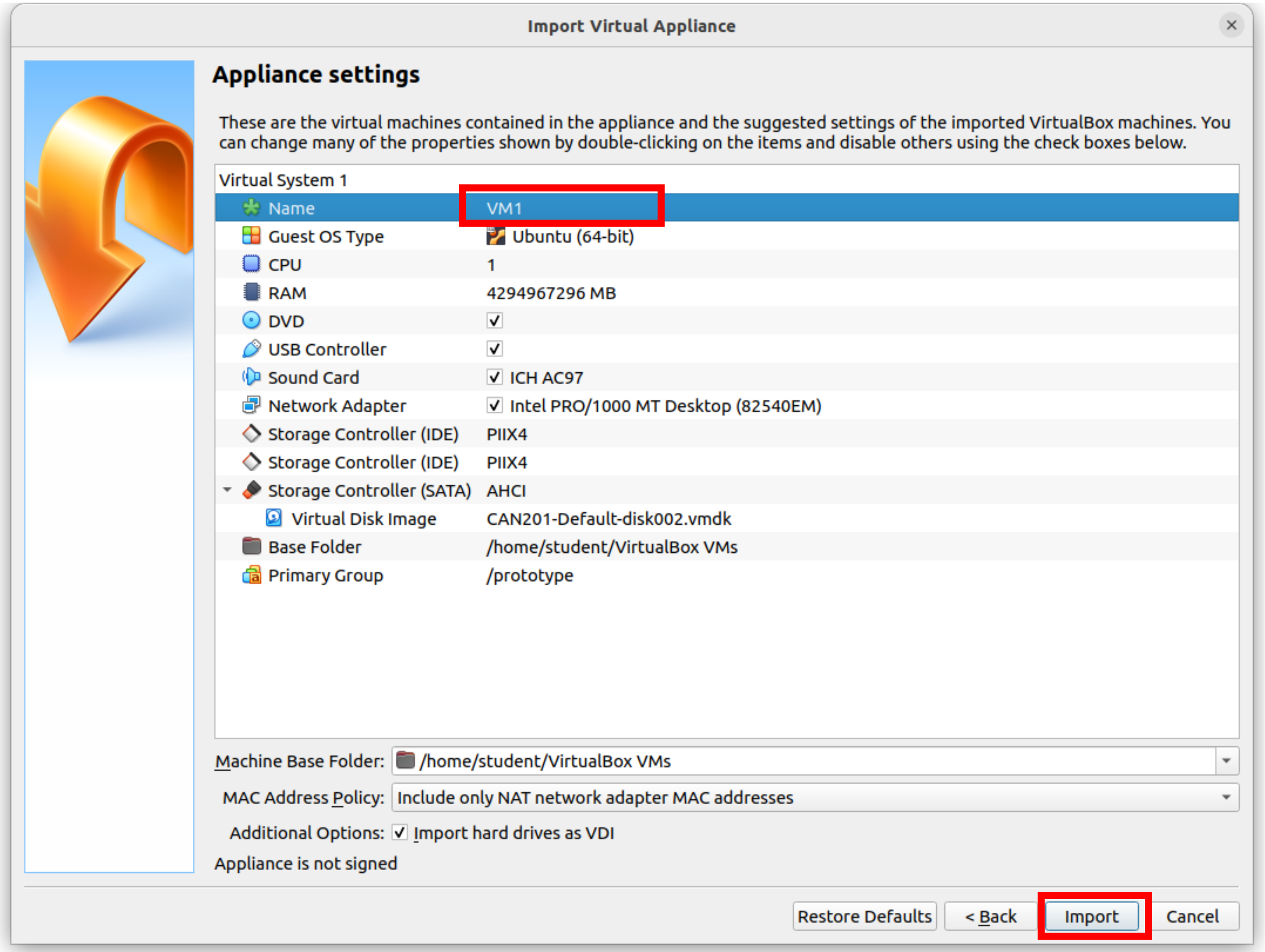
Source: Local File System

Please choose a file to import the virtual appliance from. VirtualBox currently supports importing appliances saved in the Open Virtualization Format (OVF). To continue, select the file to import below.

File: /home/student/share/CAN201-Default.ova

# Import the Ubuntu Image

**2. Change the VM name from “CAN201-Default” to “VM1”.**



Import Virtual Appliance

## Appliance settings

These are the virtual machines contained in the appliance and the suggested settings of the imported VirtualBox machines. You can change many of the properties shown by double-clicking on the items and disable others using the check boxes below.

| Virtual System 1 | |
|---|---|
| Name | VM1 |
| Guest OS Type | Ubuntu (64-bit) |
| CPU | 1 |
| RAM | 4294967296 MB |
| DVD | ☑ |
| USB Controller | ☑ |
| Sound Card | ☑ ICH AC97 |
| Network Adapter | ☑ Intel PRO/1000 MT Desktop (82540EM) |
| Storage Controller (IDE) | PIIX4 |
| Storage Controller (IDE) | PIIX4 |
| Storage Controller (SATA) | AHCI |
| Virtual Disk Image | CAN201-Default-disk002.vmdk |
| Base Folder | /home/student/VirtualBox VMs |
| Primary Group | /prototype |

Machine Base Folder: /home/student/VirtualBox VMs

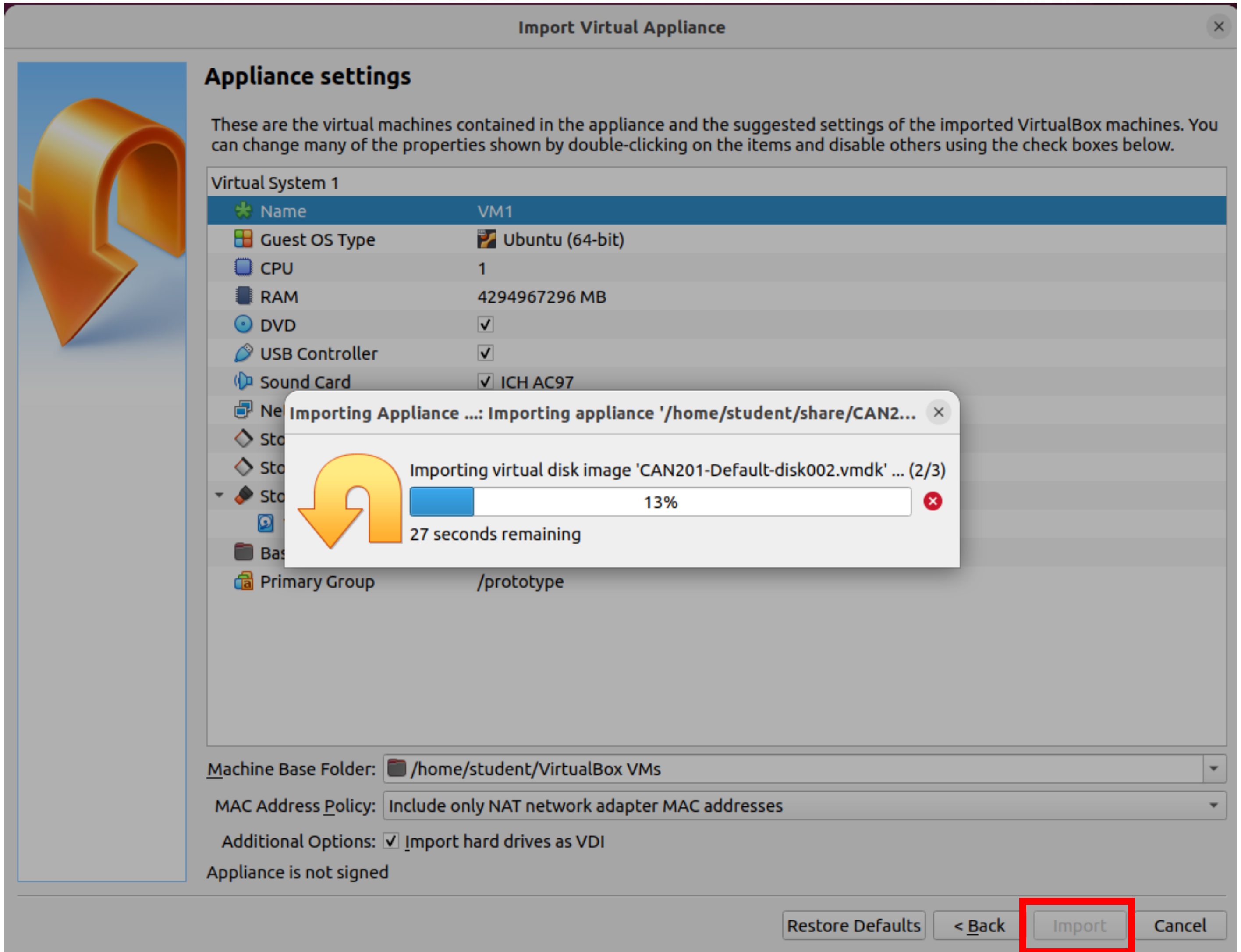
MAC Address Policy: Include only NAT network adapter MAC addresses

Additional Options: ☑ Import hard drives as VDI

Appliance is not signed

# Import the Ubuntu Image

**3. Click Import.**



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| Ne | |
| Sto | |
| Sto | |
| Sto | |
| Bas | |
| Primary Group | /prototype |

Importing Appliance ...: Importing appliance '/home/student/share/CAN2...

Importing virtual disk image 'CAN201-Default-disk002.vmdk' ... (2/3)

13%

27 seconds remaining

Machine Base Folder: /home/student/VirtualBox VMs

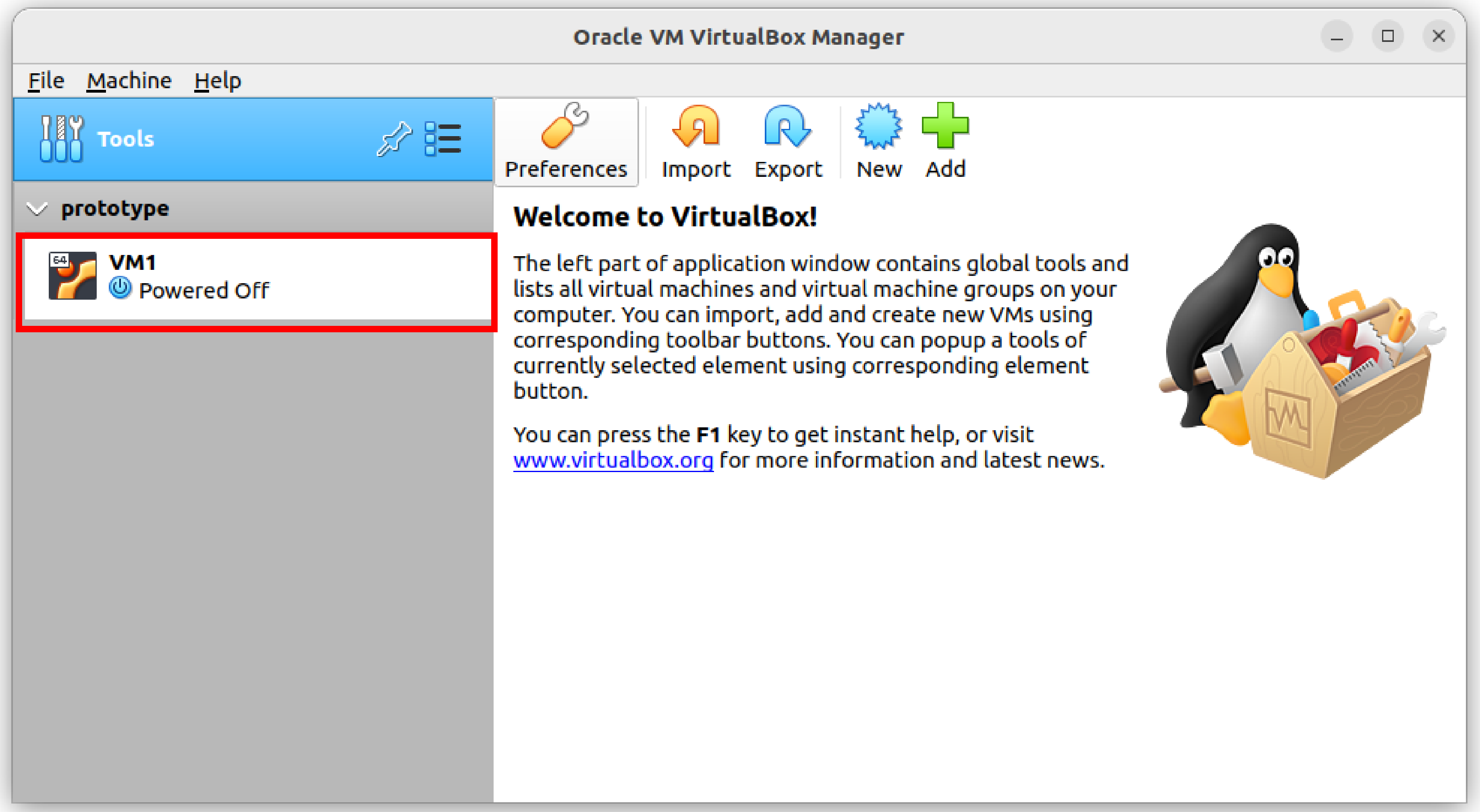
MAC Address Policy: Include only NAT network adapter MAC addresses

Additional Options: ☑ Import hard drives as VDI

Appliance is not signed

# Import the Ubuntu Image

After a while, a new virtual machine option (should be named VM1 rather than CAN201-Default) will appear in the list of VirtualBox.



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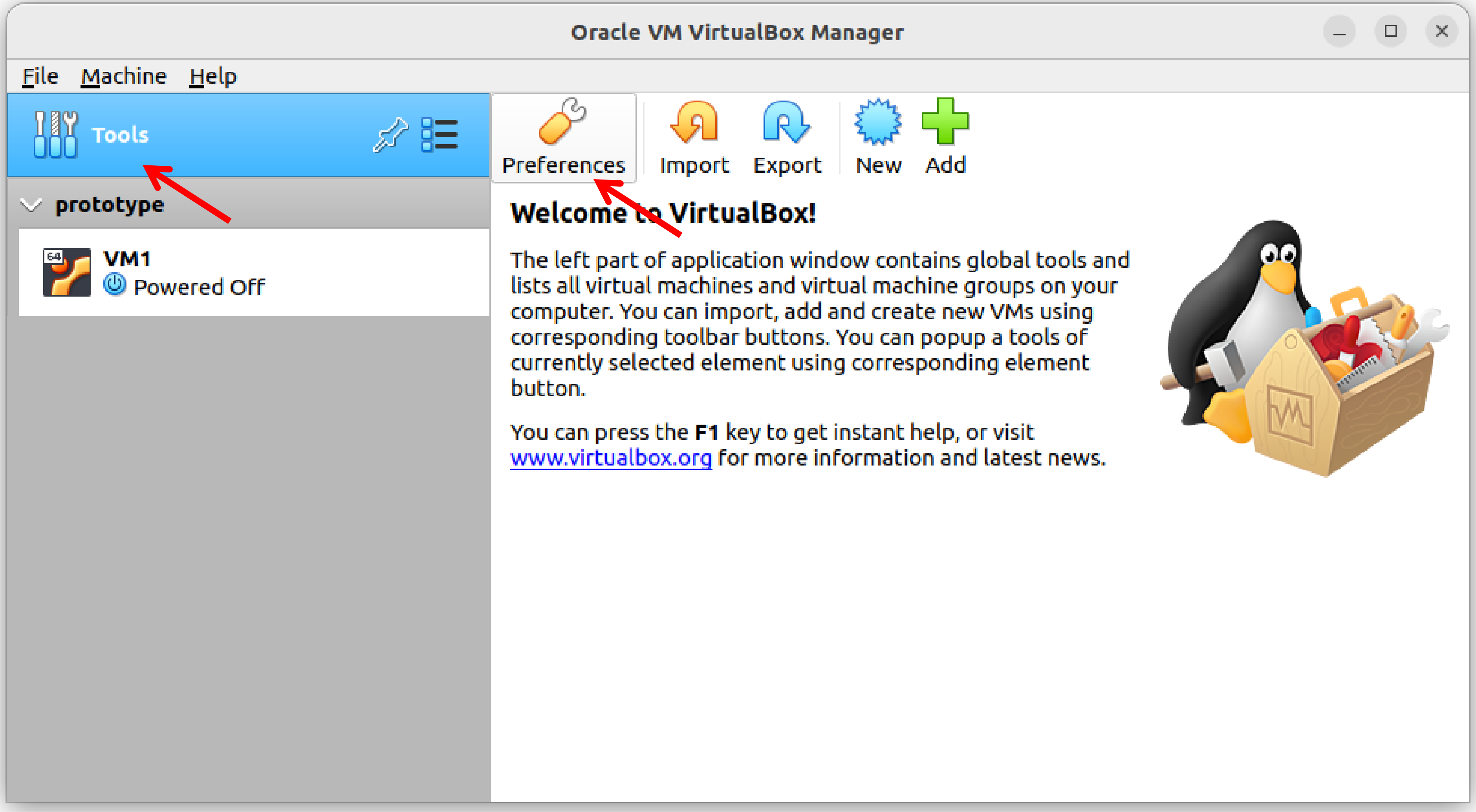
# Set up the virtual network

**1. Click Tools and click Preferences.**



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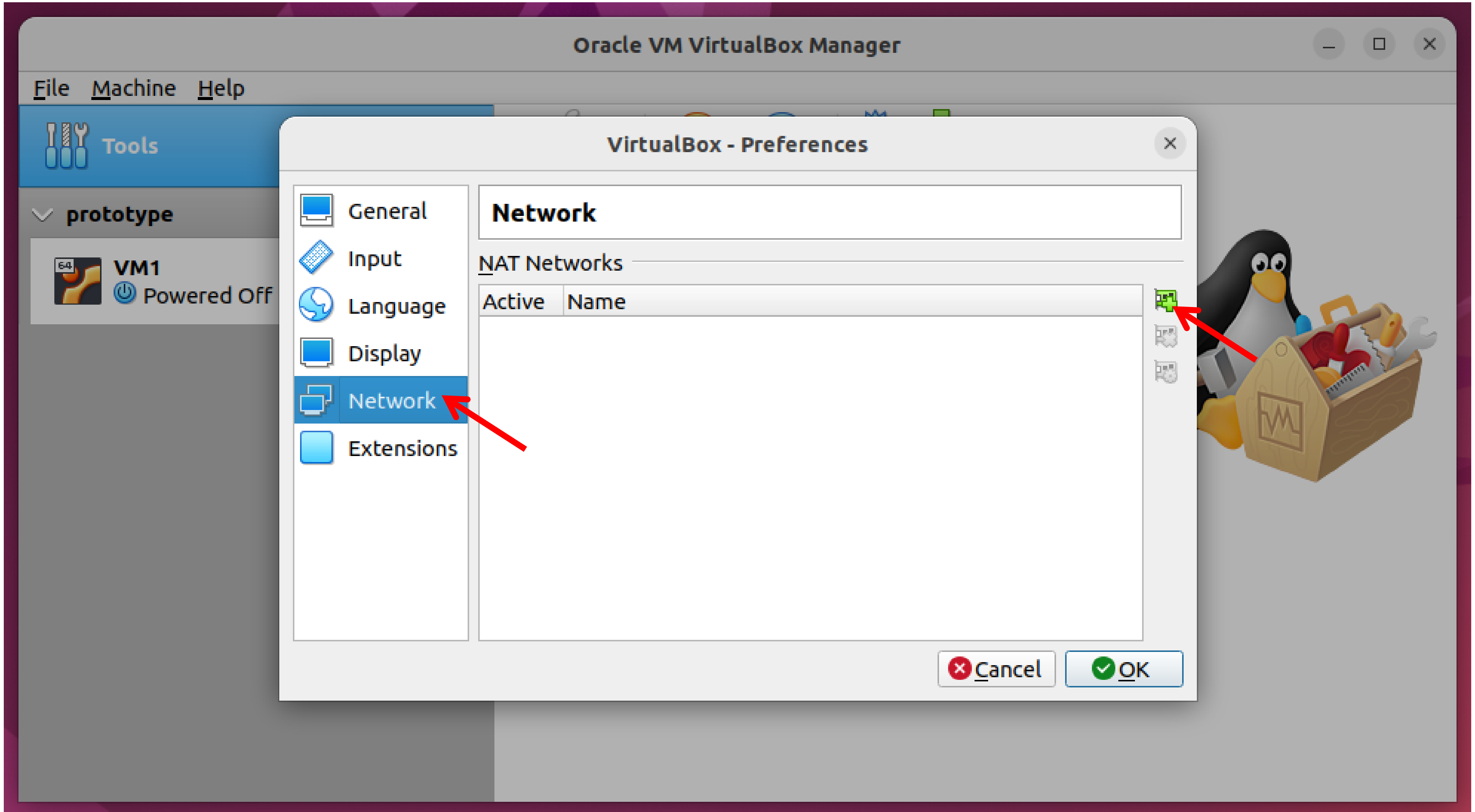
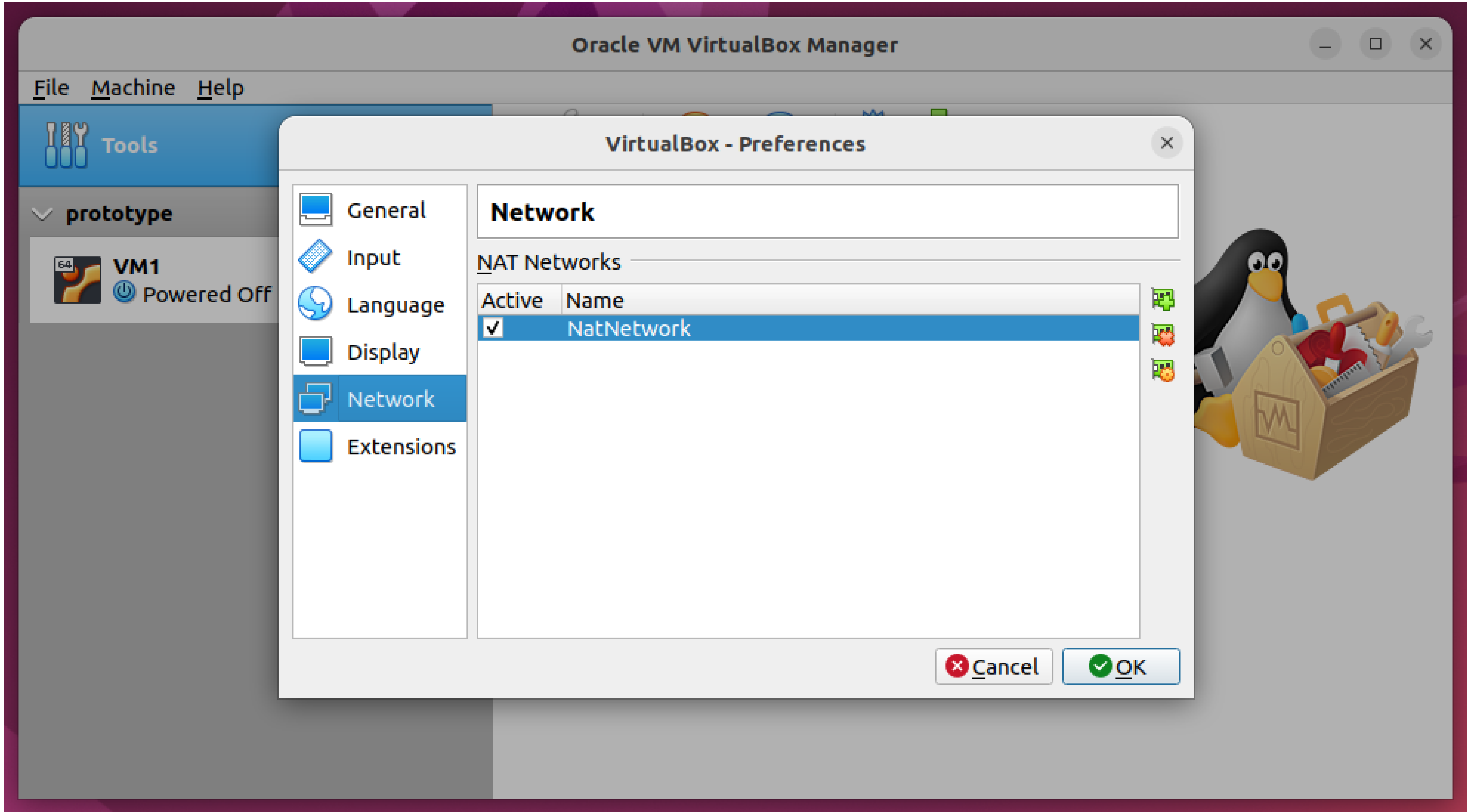
# Set up the virtual network

**2. Click Network and click ) create a new NAT network .**



# Set up the virtual network

**3. Click** OK **.**



Oracle VM VirtualBox Manager

VirtualBox - Preferences

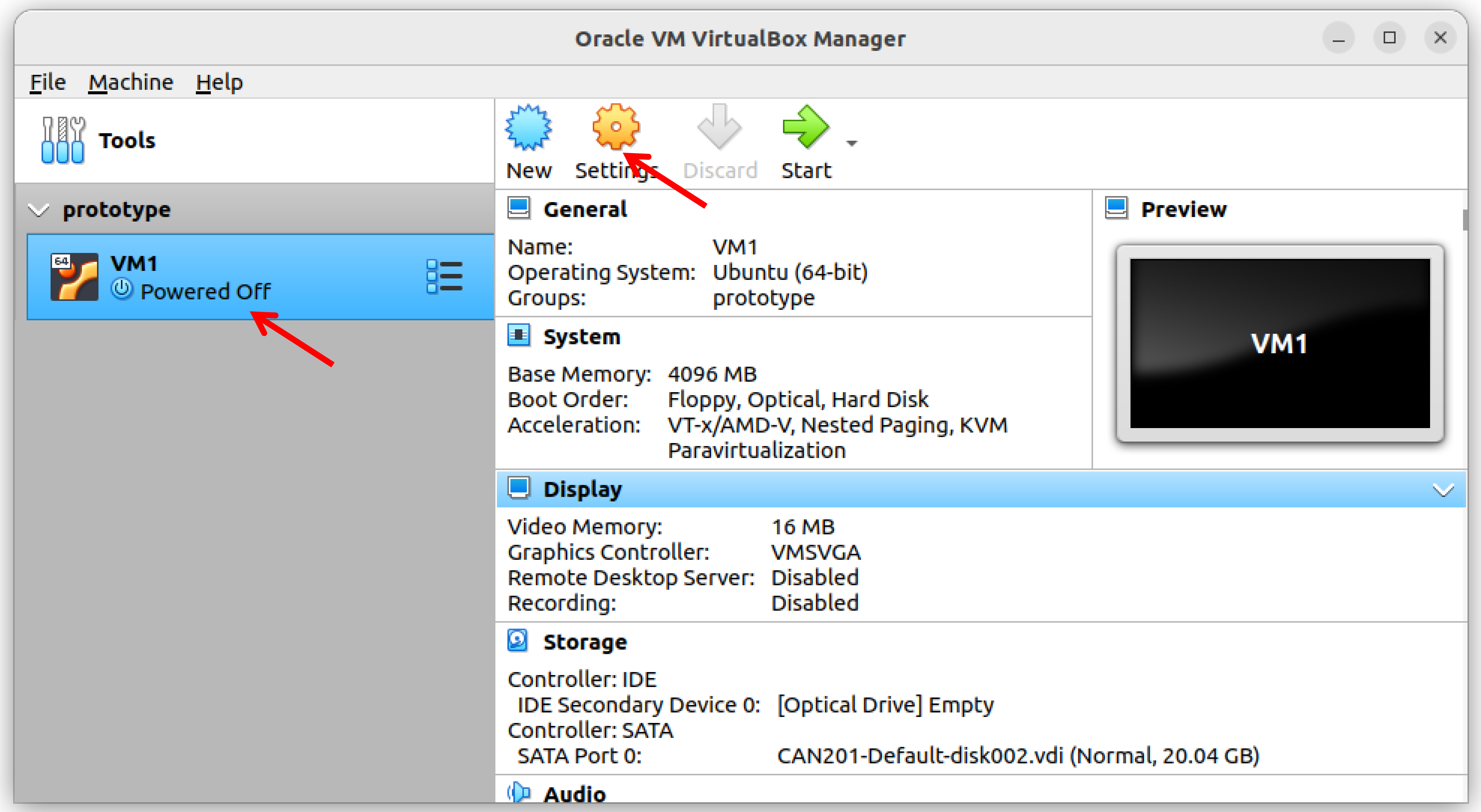
Network

NAT Networks

| Active | Name |
|---|---|
| ☑ | NatNetwork |

# Set up the virtual network

## 4. Click VM1 and click Settings.



General

Name: VM1
Operating System: Ubuntu (64-bit)
Groups: prototype

System

Base Memory: 4096 MB
Boot Order: Floppy, Optical, Hard Disk
Acceleration: VT-x/AMD-V, Nested Paging, KVM Paravirtualization

Display

Video Memory: 16 MB
Graphics Controller: VMSVGA
Remote Desktop Server: Disabled
Recording: Disabled

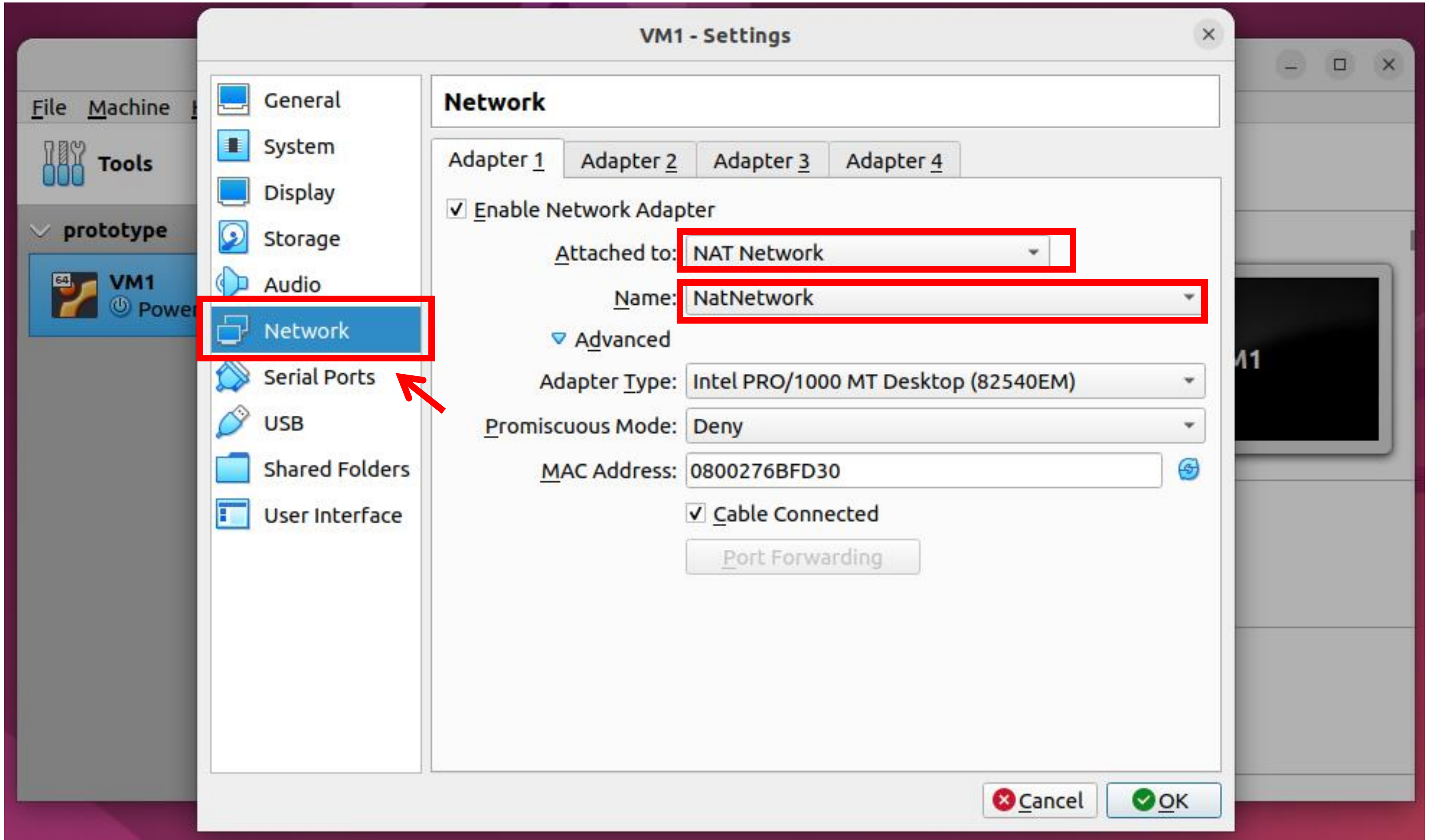
Storage

Controller: IDE
IDE Secondary Device 0: [Optical Drive] Empty
Controller: SATA
SATA Port 0: CAN201-Default-disk002.vdi (Normal, 20.04 GB)

Audio

# Set up the virtual network

**5. Click Network and set Attached to: NAT Network ; Name: NatNetwork.**



VM1 - Settings

Network

Adapter 1 | Adapter 2 | Adapter 3 | Adapter 4

☑ Enable Network Adapter

Attached to: NAT Network

Name: NatNetwork

Advanced

Adapter Type: Intel PRO/1000 MT Desktop (82540EM)

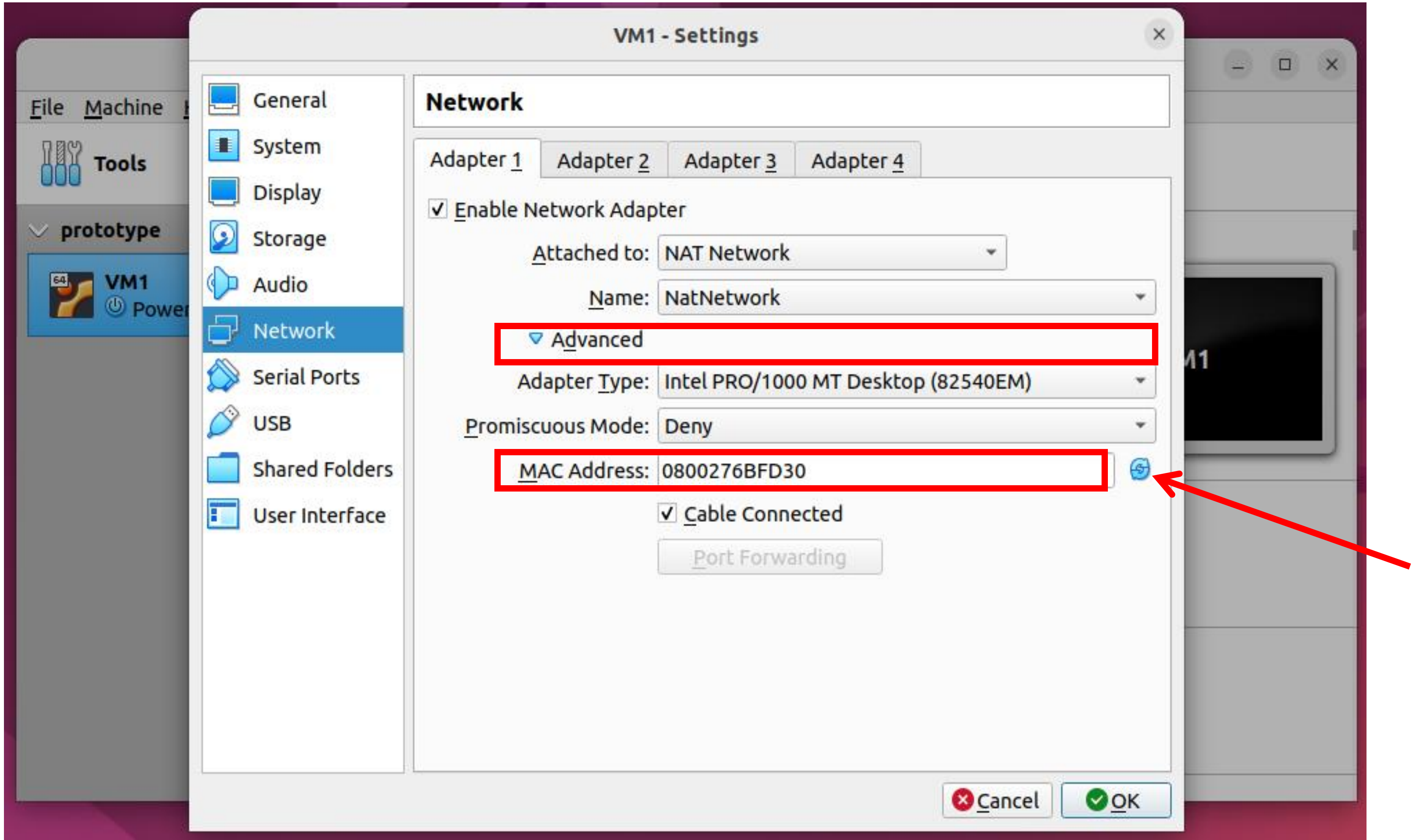
Promiscuous Mode: Deny

MAC Address: 0800276BFD30

☑ Cable Connected

# Set up the virtual network

## 6. Click Advanced and set MAC Address you want. Finally , click OK.



VM1 - Settings

Network

Adapter 1 | Adapter 2 | Adapter 3 | Adapter 4

☑ Enable Network Adapter

Attached to: NAT Network

Name: NatNetwork

▽ Advanced

Adapter Type: Intel PRO/1000 MT Desktop (82540EM)

Promiscuous Mode: Deny

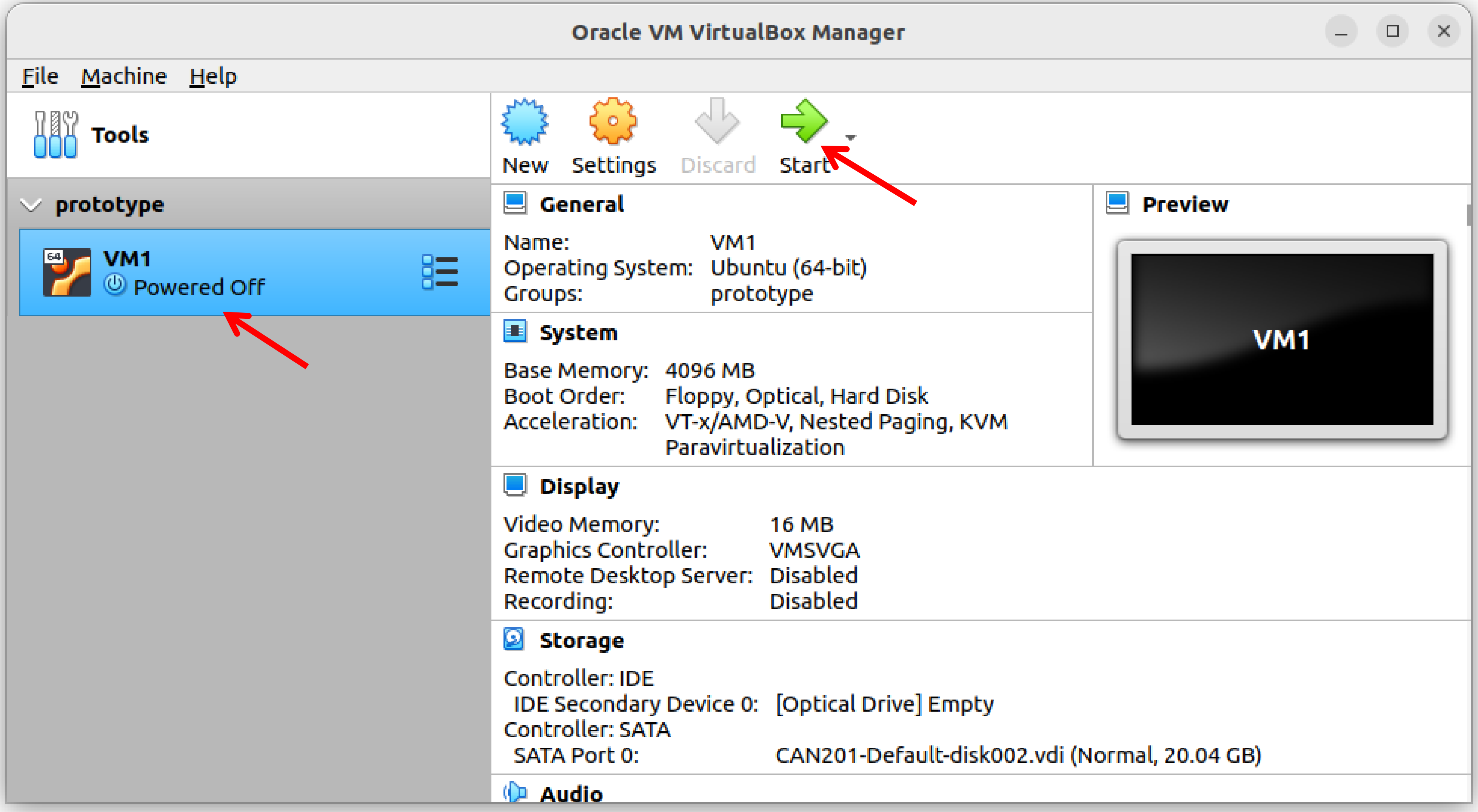
MAC Address: 0800276BFD30

☑ Cable Connected

Modify the MAC address

# Run the virtual machine

**1. Choose VM1 and click the Start.**



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 IDE Secondary Device 0: [Optical Drive] Empty
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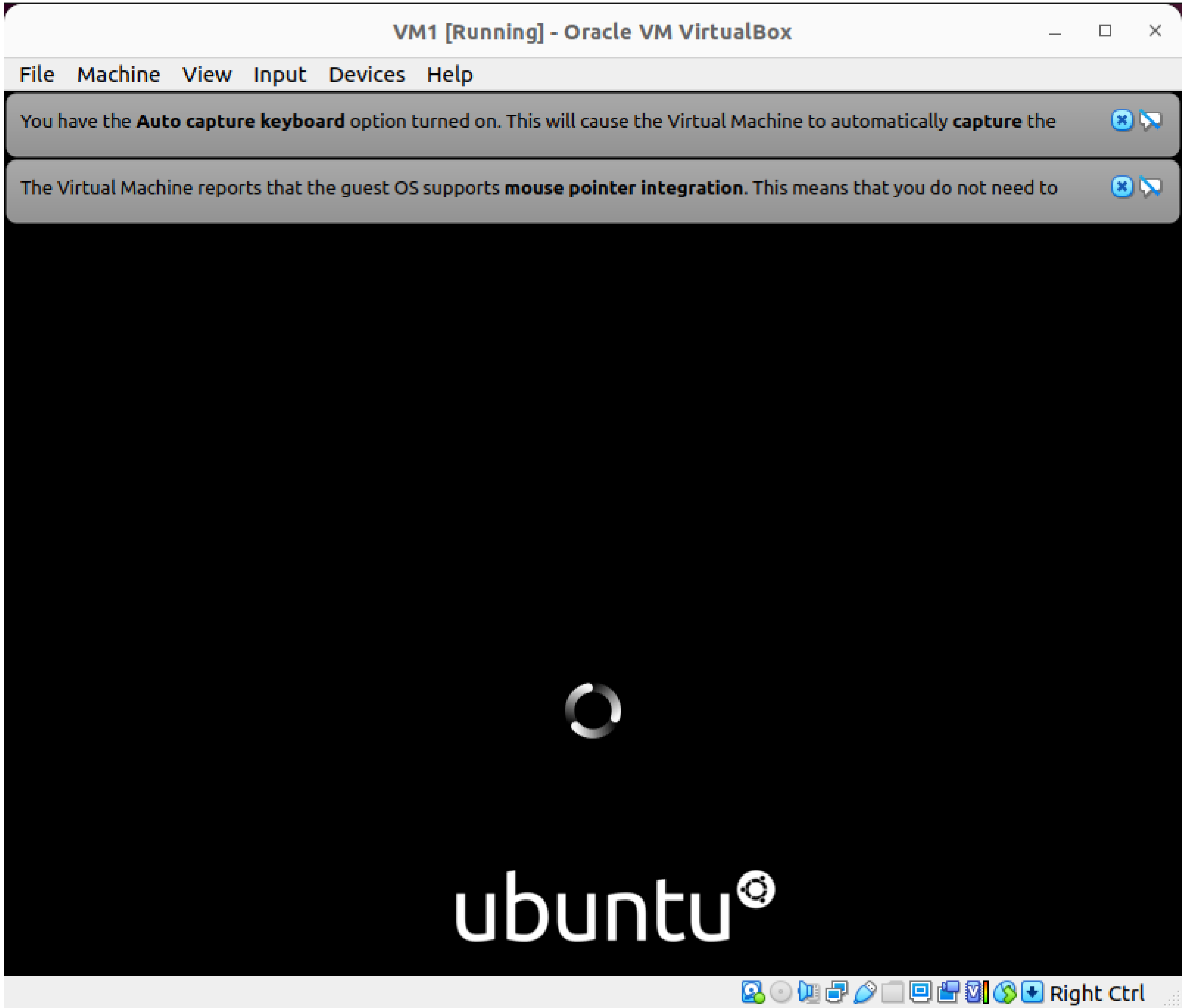
 SATA Port 0: CAN201-Default-disk002.vdi (Normal, 20.04 GB)

**Audio**

# Run the virtual machine

**2. Wait a few seconds.**

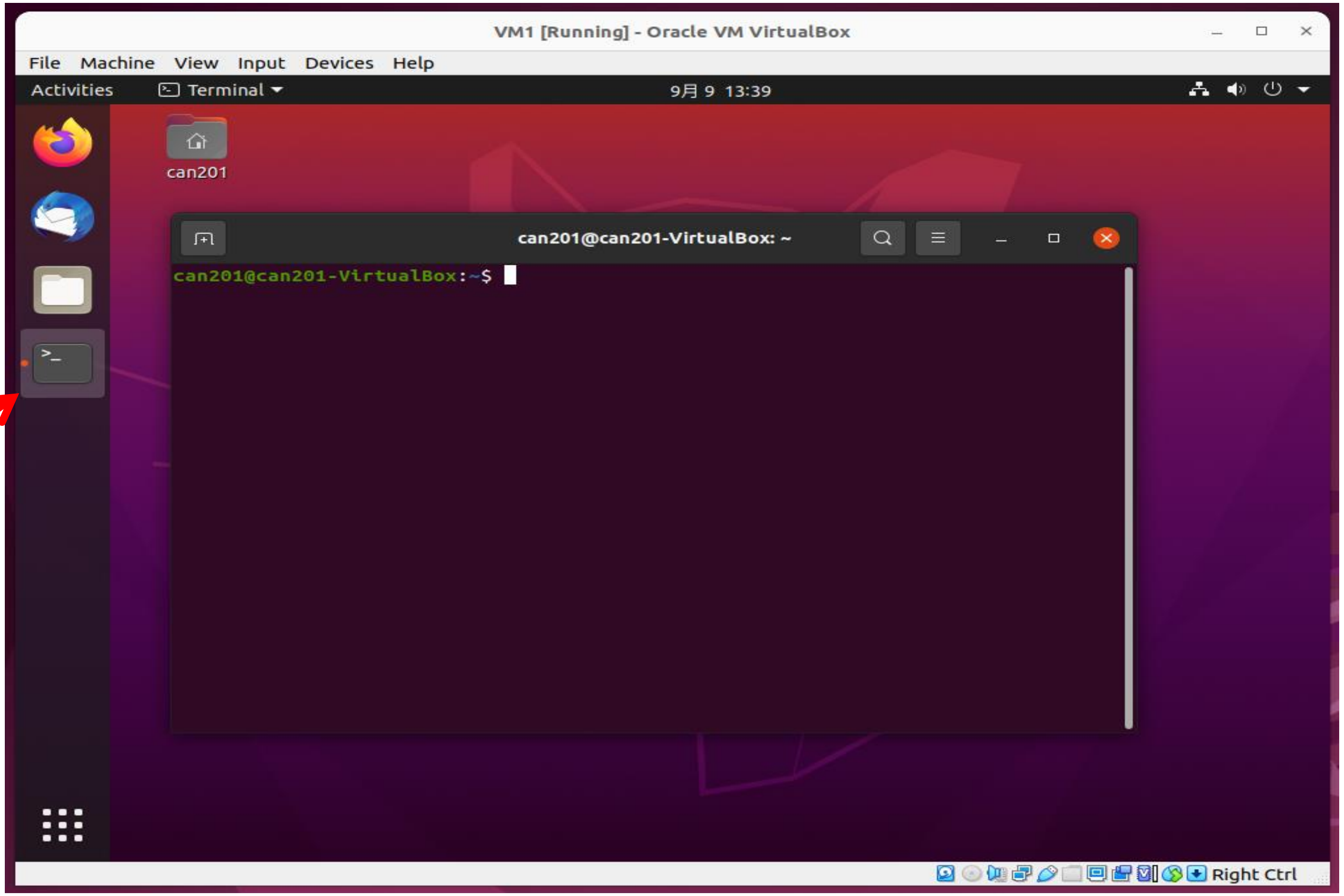


You have the **Auto capture keyboard** option turned on. This will cause the Virtual Machine to automatically **capture** the

The Virtual Machine reports that the guest OS supports **mouse pointer integration**. This means that you do not need to

# Run the virtual machine

## Ubuntu graphic interface/window shows up.



```
can201@can201-VirtualBox:~$
```

**Open a terminal**

Entering ubuntu does not require a password, but remember that the administrator password is **password**.