

Autonomous Systems Virtual Machine Setup Guide

1 Setup a Virtual Machine from scratch

- Install the VMware Workstation Player from: <https://www.vmware.com/in/products/workstation-player/workstation-player-evaluation.html>
- Download the Ubuntu 20.04 iso file from: <https://releases.ubuntu.com/focal/>
- To run virtual machines in your pc you have to enable that option in the computer's BIOS. To do so, restart your computer and press the key that will open the BIOS menu before the OS startup
- Open VMware
- Click on "Create a New Virtual Machine" (Figure 1)
- Select the iso file of the Ubuntu 20.04 and click next (Figure 2)
- Enter your OS information (Full name, User name and Password) and click next (Figure 3)
- Enter the virtual machine name and the location to store them and click next (Figure 4)
- Select the virtual machine size and click next (Figure 5)
- To better customize the virtual machine press the "Customize Hardware" button (Figure 6)
- To finalize the virtual machine setup click Finish (Figure 6)

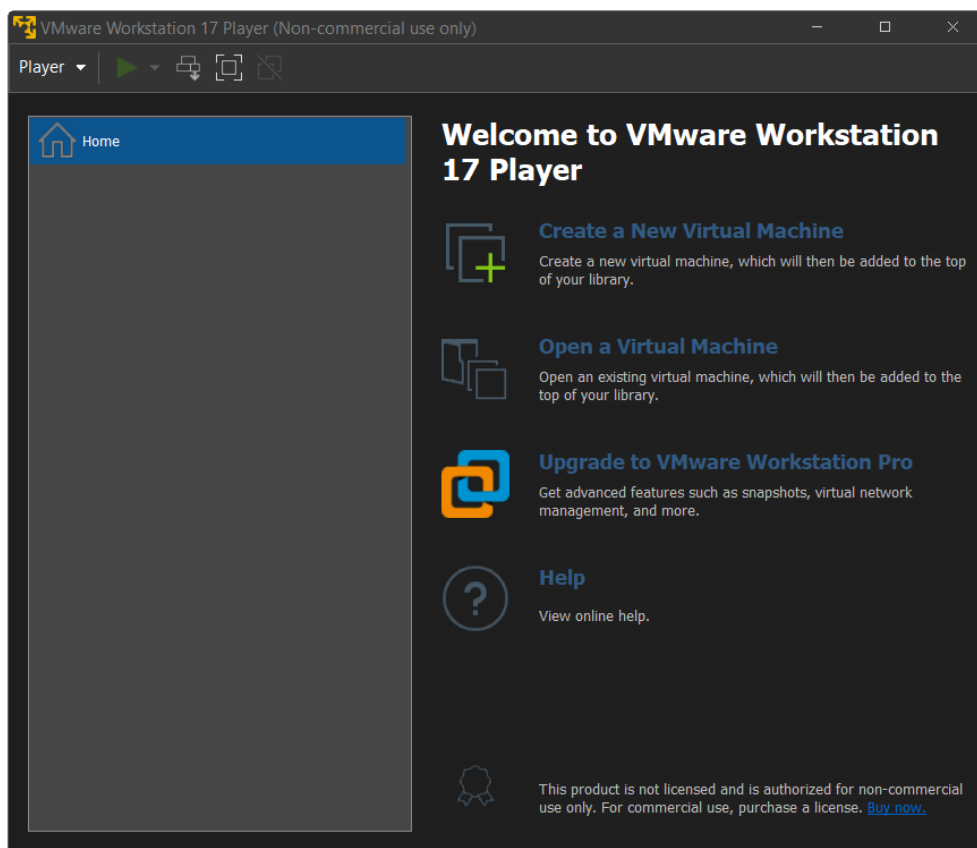


Figure 1: Create Virtual Machine

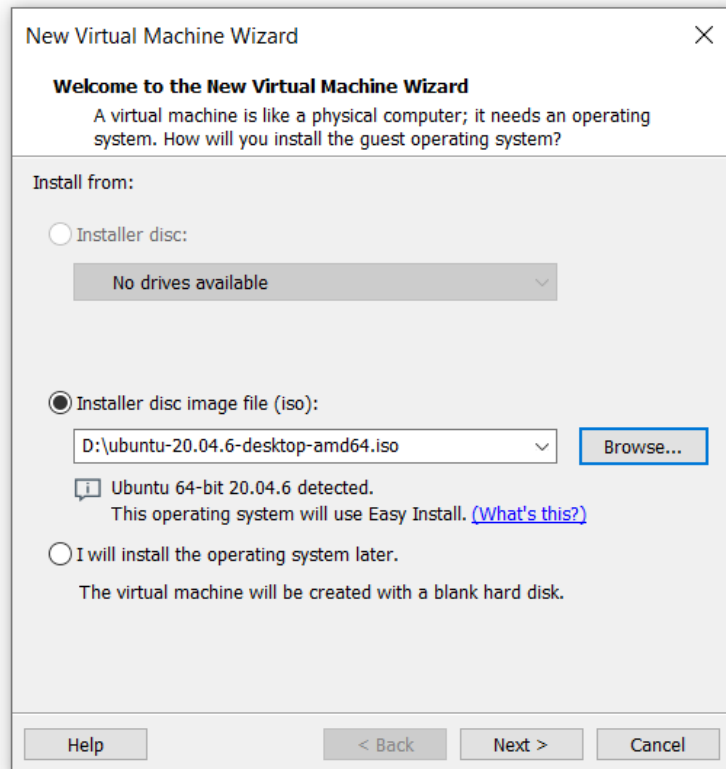


Figure 2: Select Ubuntu iso file

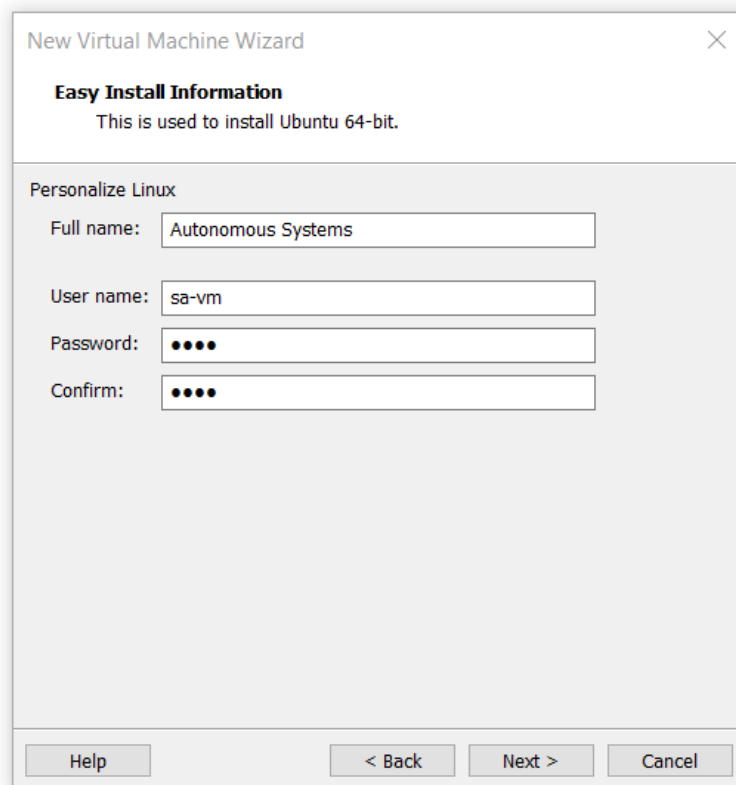
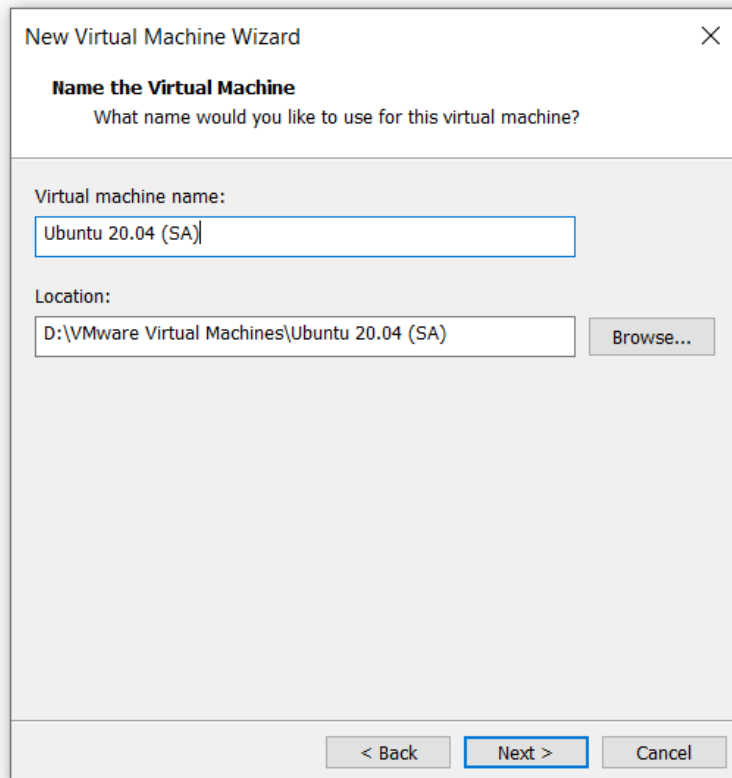


Figure 3: Configure Operation System credentials



The screenshot shows the 'New Virtual Machine Wizard' window, specifically the 'Name the Virtual Machine' step. The window title is 'New Virtual Machine Wizard' with a close button (X) in the top right corner. Below the title bar, the section header is 'Name the Virtual Machine' followed by the question 'What name would you like to use for this virtual machine?'. There are two input fields: 'Virtual machine name:' with the text 'Ubuntu 20.04 (SA)' and 'Location:' with the text 'D:\VMware Virtual Machines\Ubuntu 20.04 (SA)'. A 'Browse...' button is located to the right of the location field. At the bottom, there are three buttons: '< Back', 'Next >', and 'Cancel'. The 'Next >' button is highlighted with a blue border.

New Virtual Machine Wizard

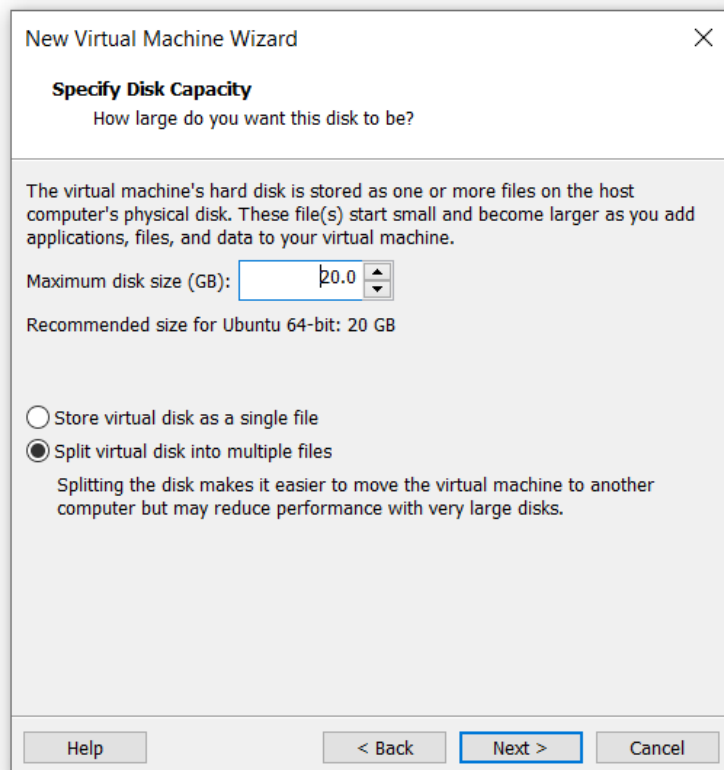
Name the Virtual Machine
What name would you like to use for this virtual machine?

Virtual machine name:
Ubuntu 20.04 (SA)

Location:
D:\VMware Virtual Machines\Ubuntu 20.04 (SA) Browse...

< Back Next > Cancel

Figure 4: Select Virtual Machine name and location



The screenshot shows the 'New Virtual Machine Wizard' window, specifically the 'Specify Disk Capacity' step. The window title is 'New Virtual Machine Wizard' with a close button (X) in the top right corner. Below the title bar, the section header is 'Specify Disk Capacity' followed by the question 'How large do you want this disk to be?'. A paragraph of text explains: 'The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.' Below this, there is a 'Maximum disk size (GB):' label followed by a numeric input field containing '20.0' and a spinner control. Below the input field, it says 'Recommended size for Ubuntu 64-bit: 20 GB'. There are two radio button options: 'Store virtual disk as a single file' (unselected) and 'Split virtual disk into multiple files' (selected). Below the selected option, a note states: 'Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.' At the bottom, there are four buttons: 'Help', '< Back', 'Next >', and 'Cancel'. The 'Next >' button is highlighted with a blue border.

New Virtual Machine Wizard

Specify Disk Capacity
How large do you want this disk to be?

The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.

Maximum disk size (GB): 20.0

Recommended size for Ubuntu 64-bit: 20 GB

☐ Store virtual disk as a single file
☒ Split virtual disk into multiple files

Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.

Help < Back Next > Cancel

Figure 5: Select Virtual Machine maximum disk size

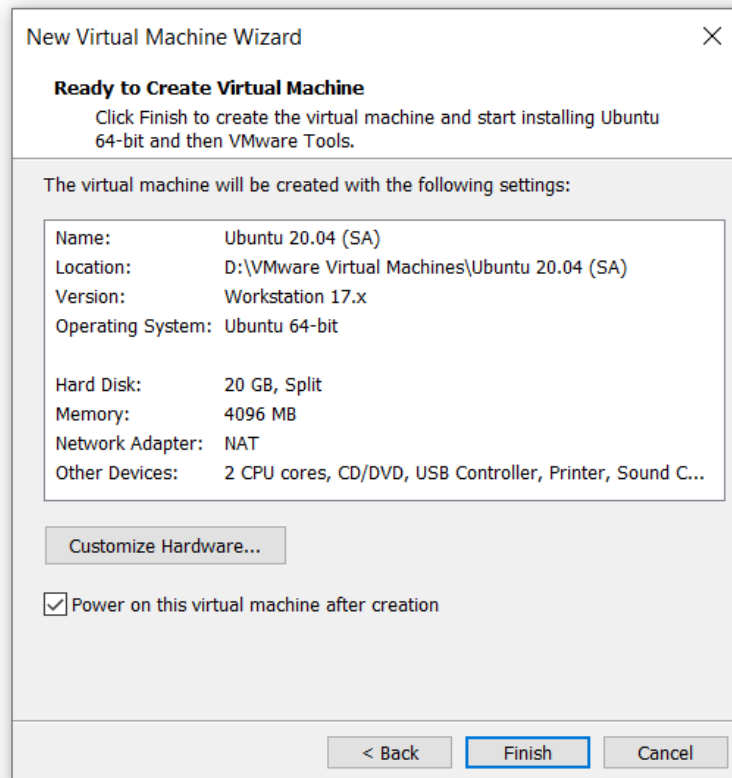


Figure 6: Customize Virtual Machine Hardware

2 Setup Additional Software

2.1 Setup ROS Noetic

- Open the terminal (Ctrl + Alt + T)

```
$ sudo apt update && sudo apt upgrade
$ sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release
↪ -sc) main" > /etc/apt/sources.list.d/ros-latest.list'
$ sudo apt install curl
$ curl -s https://raw.githubusercontent.com/ros/rosdistro/master/ros.asc
↪ | sudo apt-key add -
$ sudo apt update
$ sudo apt install ros-noetic-desktop
$ sudo apt install build-essential
$ echo "source /opt/ros/noetic/setup.bash" >> ~/.bashrc
$ source ~/.bashrc
```

2.2 Create a ROS Workspace

- Open the terminal (Ctrl + Alt + T)

```
$ mkdir -p ~/catkin_ws/src
$ cd ~/catkin_ws/
$ catkin_make
$ echo "source ~/catkin_ws/devel/setup.bash" >> ~/.bashrc
$ source ~/.bashrc
```

2.3 Install VS Code

- Open the terminal (Ctrl + Alt + T)

```
$ sudo snap install --classic code
```

- Recommended extensions (C/C++ and Cmake)

2.4 Install Terminator

- Open the terminal (Ctrl + Alt + T)

```
$ sudo apt install terminator
```

- Use-full Commands:

- Ctrl + Shift + O (Split terminals horizontally)
- Ctrl + Shift + E (Split terminals vertically)
- Ctrl + Shift + T (Open new tab)

3 Import preconfigured virtual machine

- Install the VMware Workstation Player from: <https://www.vmware.com/in/products/workstation-player/workstation-player-evaluation.html>
- Download the preconfigured virtual machine form: <https://drive.google.com/drive/u/1/folders/18ewjFRvg06VWfVcNuUg1e03WfC-KZfky>
- To run virtual machines in your pc you have to enable that option in the computer's BIOS. To do so, restart your computer and press the key that will open the BIOS menu before the OS startup
- Open VMware
- Click on "Open a Virtual Machine" (Figure 1)
- Select the "Ubuntu 20.04 (SA).ova" file that was downloaded earlier (Figure 7)
- Select the name and the location for the virtual machine and press import (Figure 8)
- Wait until the virtual machine is ready (Figure 9)
- Run the virtual machine with the Ubuntu password "12345"

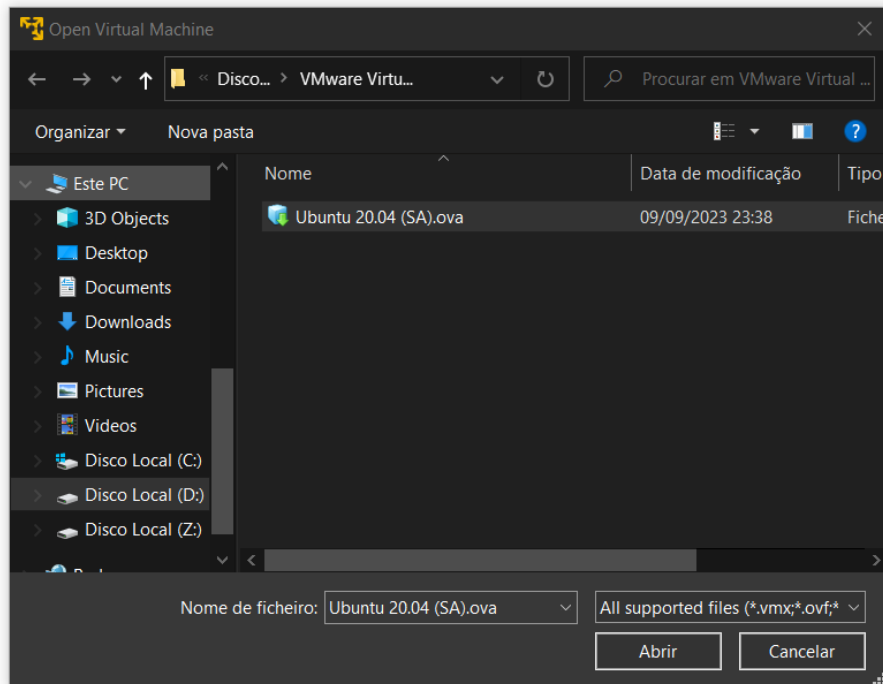


Figure 7: Select the preconfigured Virtual Machine .ova file

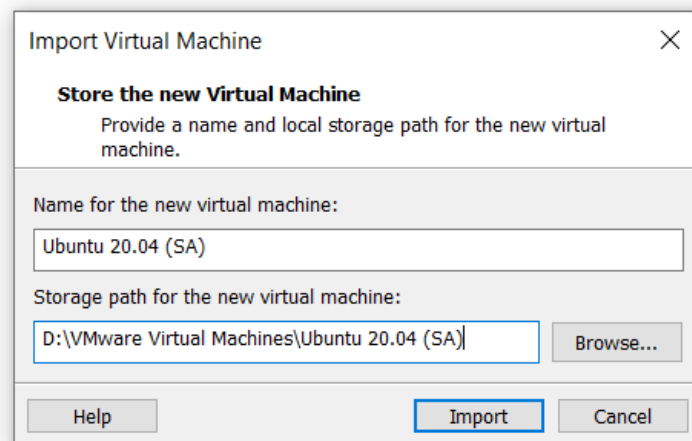


Figure 8: Select the Virtual Machine name and location



Figure 9: Wait until the virtual machine is ready

4 Install and run the Autonomous Systems ROS package

- Copy and paste the "autonomous_systems" folder inside the "carkin_ws/src" directory
- To compile the code go the "catkin_ws" directory and run the command "catkin_make":

```
$ cd ~/catkin_ws
$ catkin_make
```

- To run the ROS nodes execute the following command:

```
$ roslaunch sa_robot_ros_nav_conf wake_up_simulated_robot.launch
```

- To stop the ROS nodes press Ctrl + C in the terminal
- To edit the code open the navigation controller package:

```
$ cd ~/catkin_ws/src/autonomous_systems/sa_ros_nav_controller/
```

- Open the VScode in that directory with:

```
$ code .
```

- Edit the file SARosNavController.cpp in the folder "src/sa_ros_nav_controller"
- Don't forget to compile the code before running it
- To execute the control functions (GoToXY, FollowLine and FollowCircle), the ROS nodes must first be running in a terminal window. Then, in another window, execute one of the following instructions:
 - GoToXY: rosservice call /unnamed_robot/gotoxy_srv - xf(m) yf(m) thetalf(deg)


```
$ rosservice call /unnamed_robot/gotoxy_srv -- 0.5 0.5 90
```
 - FollowLine: rosservice call /unnamed_robot/followline_srv - xi(m) yi(m) xf(m) yf(m) thetalf(deg)


```
$ rosservice call /unnamed_robot/followline_srv -- 0 0 1.5 0 180
```
 - FollowCircle: rosservice call /unnamed_robot/followcircle_srv - xc(m) yc(m) r(m) anglef(deg) thetalf(deg)


```
$ rosservice call /unnamed_robot/followcircle_srv -- 1 1 1 -90 40 0
```