

# Setting up your CS144 VM using VirtualBox

This guide will walk you through setting up [Ubuntu Server 18.04](#) on your CS144 VM. This distribution gives a reasonably streamlined installation with few unnecessary background tasks running by default.

**NOTE** If you want a graphical interface, we strongly recommend using the [prepared image](#). Otherwise, if you install an Ubuntu Desktop variant following these instructions, [NetworkManager may interfere with your completing the assignments](#).

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## Prerequisites

1. Install [VirtualBox](#).

If your host OS is linux, your distribution may already package virtualbox:

- On Debian-derived distributions (like Ubuntu), `apt-get install virtualbox`
- On arch, `pacman -S virtualbox virtualbox-host-modules-arch` (or `virtualbox-host-dkms` if you're running a custom kernel)
- CentOS (and probably Fedora) users should consult the [wiki](#)

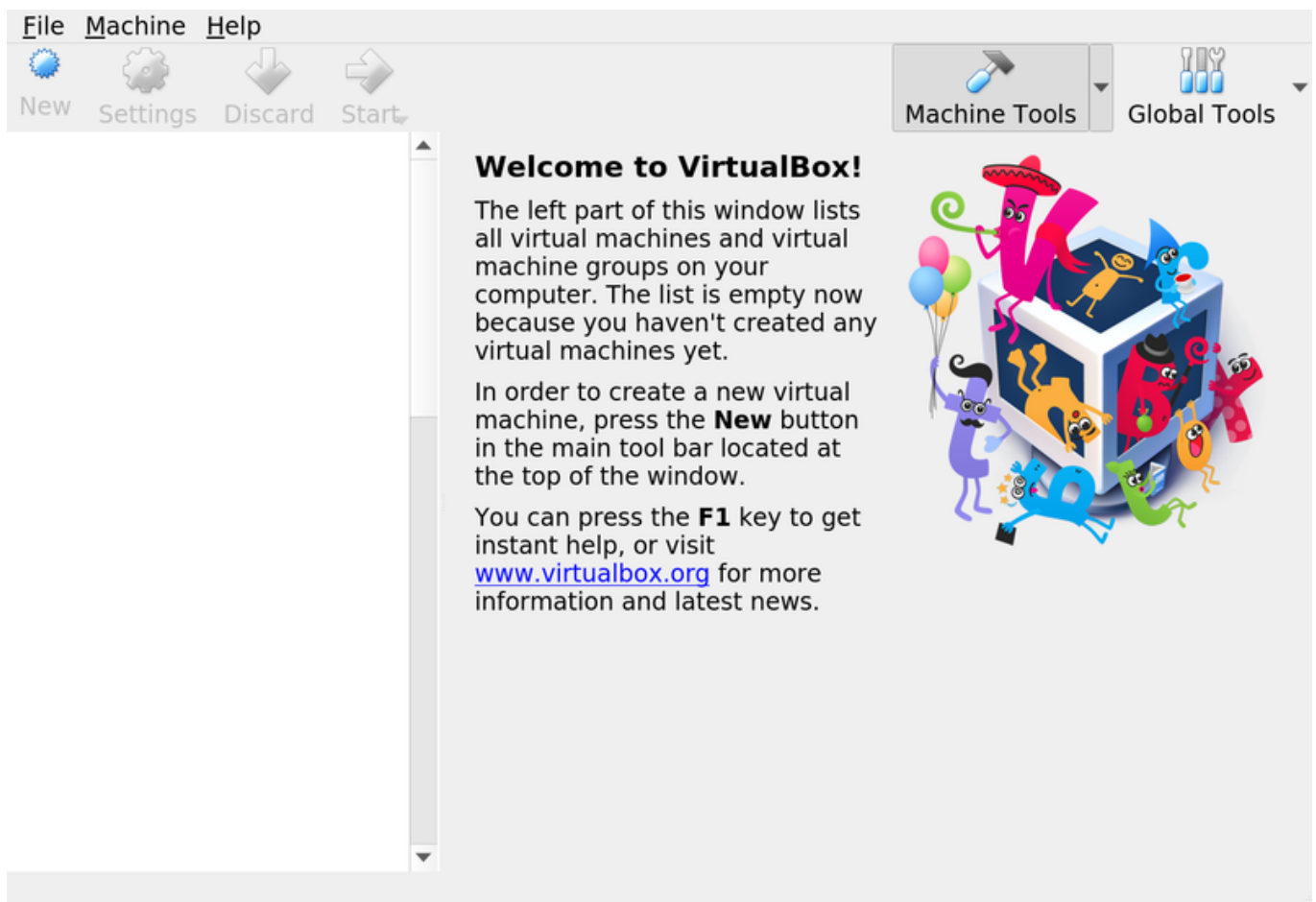
2. Download the installation image. If you're using the recommended Ubuntu Server image, we've made a [local mirror](#) for faster downloading. Otherwise, download and verify your preferred installation medium.

This is a large file, so **use a wired connection or sit close to an access point while downloading!**

**IMPORTANT:** if you are downloading an installation image other than the recommended one, you should cryptographically [verify it](#) before using it. Compromised ISOs are an [increasingly common](#) issue —*never* use an unverified ISO! (We promise our local mirror won't pwn you. But you should [verify it](#) anyway.)

## Create a VM image

Start VirtualBox. You should see this:



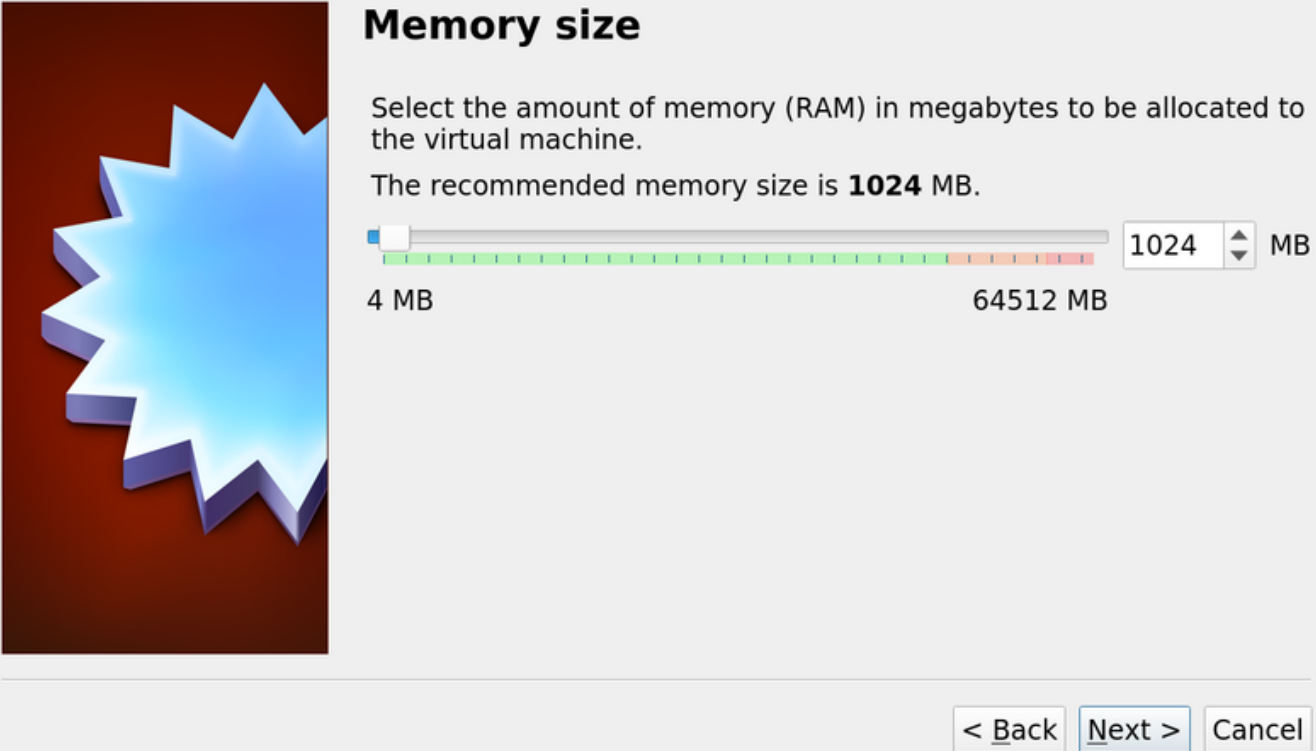
Virtualbox startup screen

Click the New icon or type Ctrl-N to bring up the new VM dialog. As shown below, you'll need to choose a name for your VM, select "Linux" for the Type, and select "Ubuntu (64-bit)" for the Version.

The screenshot shows the 'Name and operating system' dialog box. On the left is a large blue starburst graphic. The main area contains the title 'Name and operating system' and a paragraph explaining that the user must choose a descriptive name and an operating system type. Below this are three input fields: 'Name' with the text 'cs144\_vm', 'Type' with a dropdown menu set to 'Linux', and 'Version' with a dropdown menu set to 'Ubuntu (64-bit)'. To the right of the 'Version' dropdown is a small icon of a 64-bit processor. At the bottom right are four buttons: 'Expert Mode', '< Back', 'Next >', and 'Cancel'.

## New VM dialog

Next, select the amount of RAM to allocate to your VM. You should allocate at least 1 GiB, but more is better, provided that your machine has the RAM to spare.



### Memory size

Select the amount of memory (RAM) in megabytes to be allocated to the virtual machine.

The recommended memory size is **1024 MB**.

4 MB 64512 MB

1024 MB

< Back Next > Cancel

## RAM dialog

Next, choose to *Create a virtual hard disk now*, choose a VDI image, dynamically allocate space, and increase the image size from the default to 32 GiB. (Don't worry: it's dynamically allocated, so it won't actually take up 32 GiB on your hard drive.)



### Hard disk

If you wish you can add a virtual hard disk to the new machine. You can either create a new hard disk file or select one from the list or from another location using the folder icon.

If you need a more complex storage set-up you can skip this step and make the changes to the machine settings once the machine is created.

The recommended size of the hard disk is **10.00 GB**.

☐ Do not add a virtual hard disk

☒ Create a virtual hard disk now

☐ Use an existing virtual hard disk file

Empty

< Back Create Cancel



## Hard disk file type

Please choose the type of file that you would like to use for the new virtual hard disk. If you do not need to use it with other virtualization software you can leave this setting unchanged.

- ☒ VDI (VirtualBox Disk Image)
- ☐ VHD (Virtual Hard Disk)
- ☐ VMDK (Virtual Machine Disk)

Expert Mode

< Back

Next >

Cancel

VDI file type



## Storage on physical hard disk

Please choose whether the new virtual hard disk file should grow as it is used (dynamically allocated) or if it should be created at its maximum size (fixed size).

A **dynamically allocated** hard disk file will only use space on your physical hard disk as it fills up (up to a maximum **fixed size**), although it will not shrink again automatically when space on it is freed.

A **fixed size** hard disk file may take longer to create on some systems but is often faster to use.

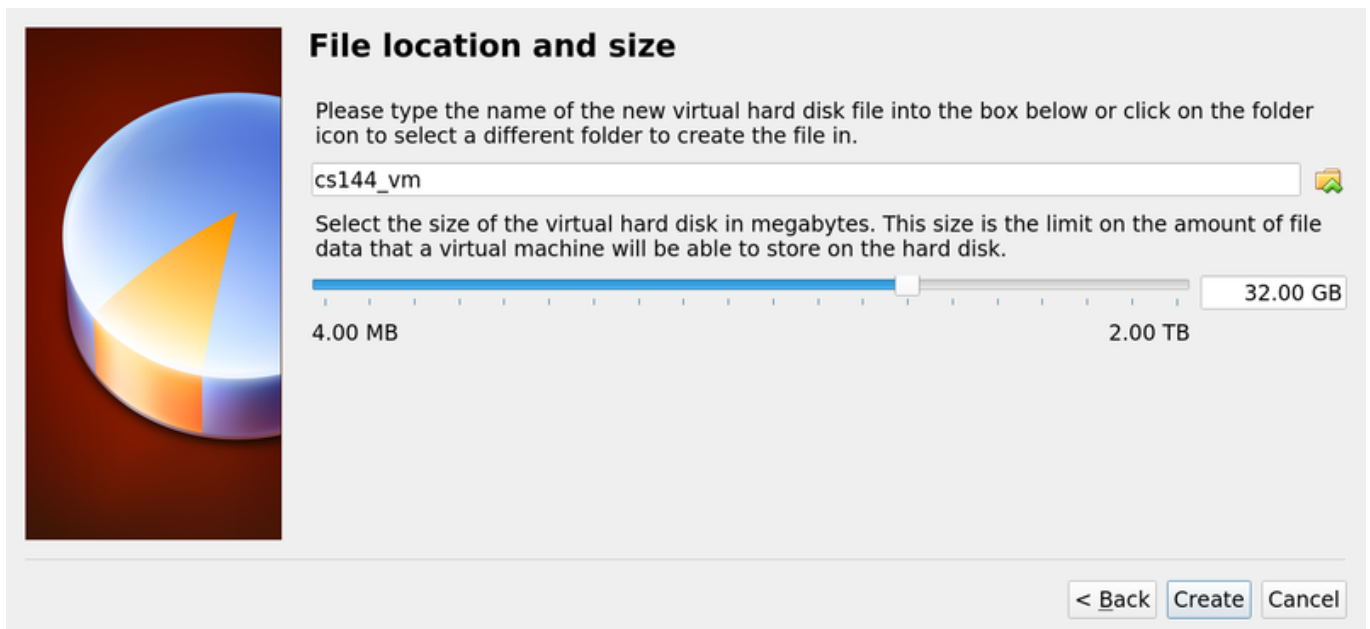
- ☒ Dynamically allocated
- ☐ Fixed size

< Back

Next >

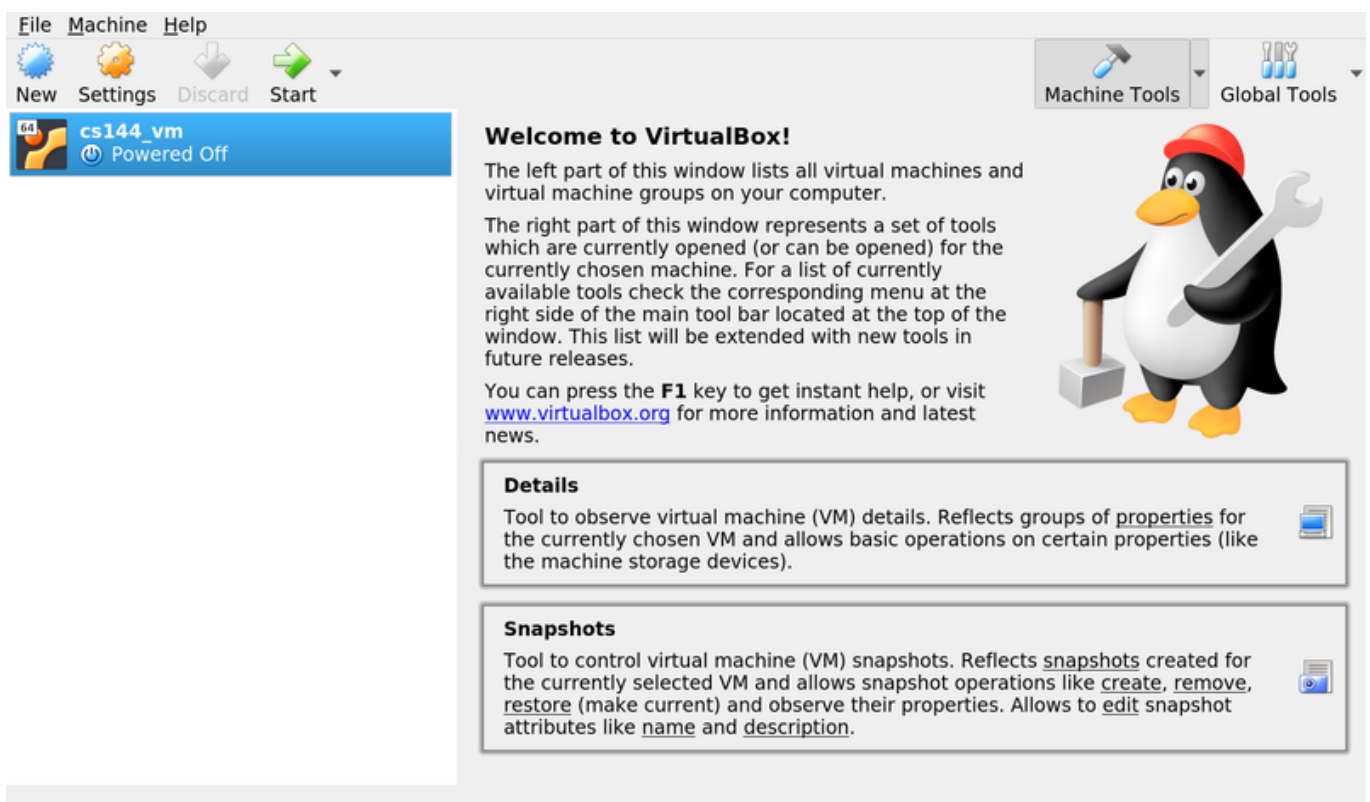
Cancel

Dynamically allocated



Allocate 32 GiB

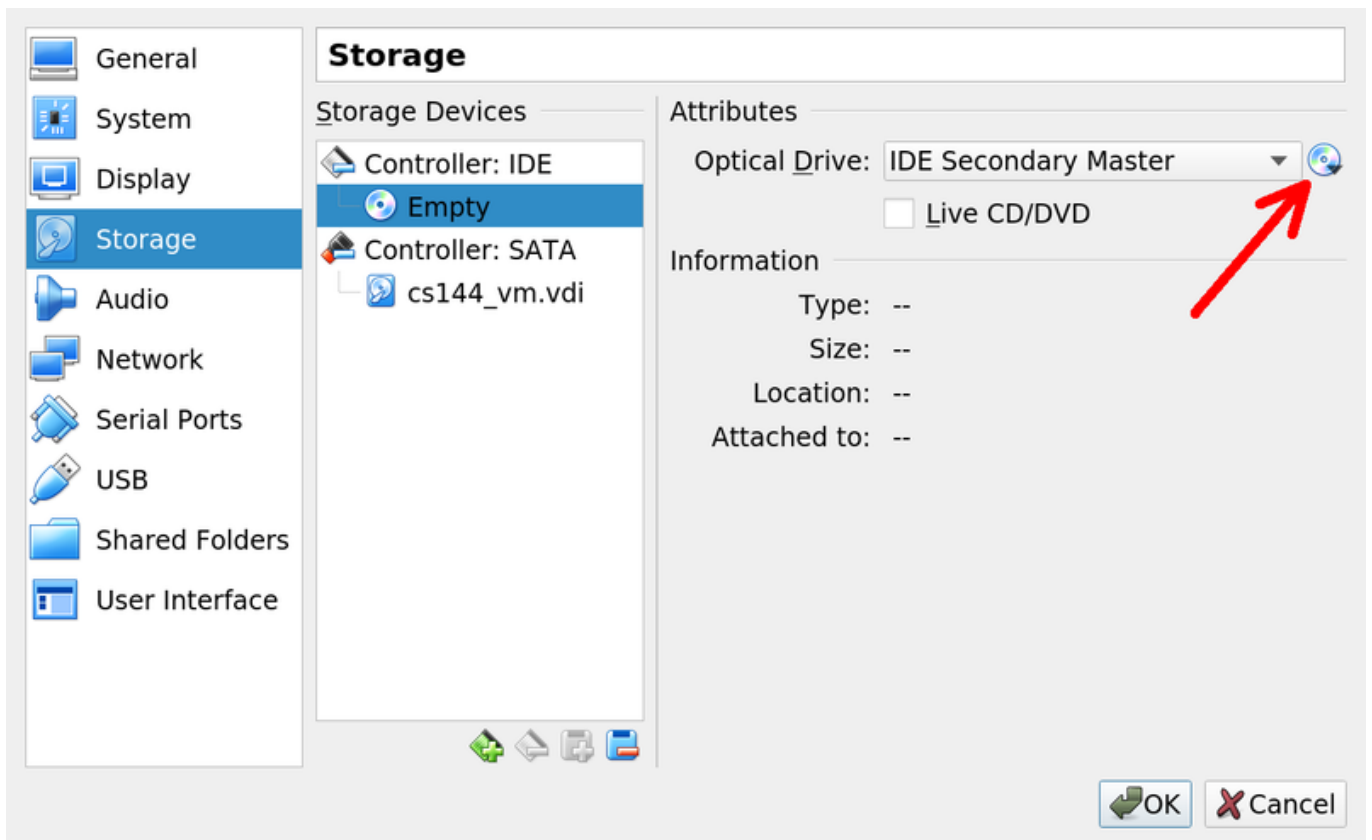
You should now be back at the VirtualBox home screen:



VirtualBox home screen with newly created VM image

Click the Settings icon or type Ctrl-S to bring up the Settings dialog:

1. choose “Storage” from the left column
2. click on the “Empty” CD-ROM drive
3. click the CD icon on the far right (highlighted below)
4. click “Choose Virtual Optical Disk File...”
5. use the file picker to choose the ISO you downloaded in [Prerequisites](#)
6. click OK



Machine settings dialog

You've set up the VM. Now it's time to install Ubuntu.

## Install Ubuntu

From the VirtualBox home screen, click the Start icon. Your VM will boot, and in about two minutes you'll arrive at the following screen. Accepting the defaults for the next few screens:

Willkommen! Bienvenue! Welcome! Добро пожаловать! Welkom!

Please choose your preferred language.

- [ English ▶ ]
- [ Asturianu ▶ ]
- [ Català ▶ ]
- [ Hrvatski ▶ ]
- [ Nederlands ▶ ]
- [ Suomi ▶ ]
- [ Français ▶ ]
- [ Deutsch ▶ ]
- [ Ελληνικά ▶ ]
- [ Magyar ▶ ]
- [ Latviešu ▶ ]
- [ Norsk bokmål ▶ ]
- [ Polski ▶ ]
- [ Русский ▶ ]
- [ Español ▶ ]
- [ Українська ▶ ]

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Use UP, DOWN and ENTER keys to select your language.



Ubuntu install start screen

Keyboard configuration

Please select your keyboard layout below, or select "Identify keyboard" to detect your layout automatically.

Layout: [ English (US) ▼ ]

Variant: [ English (US) ▼ ]

[ Identify keyboard ]

[ Done ]  
[ Back ]

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Use UP, DOWN and ENTER keys to select your keyboard.



Right Ctrl

Ubuntu keyboard setup screen



Ubuntu 18.04

Welcome to Ubuntu! The world's favourite platform for clouds, clusters, and amazing internet things. This is the installer for Ubuntu on servers and internet devices.

- [ Install Ubuntu ▶ ]
- [ Install MAAS bare-metal cloud (region) ▶ ]
- [ Install MAAS bare-metal cloud (rack) ▶ ]

[ Back ]

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Use UP, DOWN arrow keys, and ENTER, to navigate options



Install Ubuntu

## Network connections

Configure at least one interface this server can use to talk to other machines, and which preferably provides sufficient access for updates.

```
NAME      TYPE  NOTES / ADDRESSES
[ enp0s3  eth   10.0.2.15/24 (from dhcp) ► ]
08:00:27:c0:50:87 / Intel Corporation / 82540EM Gigabit Ethernet Controller (PRO/1000
MT Desktop Adapter)

[ Create bond ► ]
```

```
[ Done      ]
[ Back     ]
```

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Select an interface to configure it or select Done to continue



Right Ctrl

Default network settings are fine

Configure proxy

If this system requires a proxy to connect to the internet, enter its details here.

Proxy address:

If you need to use a HTTP proxy to access the outside world, enter the proxy information here. Otherwise, leave this blank.

The proxy information should be given in the standard form of "http://[[user] [:pass]@]host[:port]/".

[ Done ]  
[ Back ]

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No proxy is necessary

On the next screen, you can accept the default or, for slightly faster download, you can change the Ubuntu mirror to <http://mirrors.ocf.berkeley.edu/ubuntu>:

Configure Ubuntu archive mirror

If you use an alternative mirror for Ubuntu, enter its details here.

Mirror address:   
You may provide an archive mirror that will be used instead of  
the default 'http://archive.ubuntu.com/ubuntu'

[ Done ]  
[ Back ]

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Berkeley has a fast Ubuntu mirror

Filesystem setup

The installer can guide you through partitioning an entire disk either directly or using LVM, or, if you prefer, you can do it manually.

If you choose to partition an entire disk you will still have a chance to review and modify the results.

```
[ Use An Entire Disk ]
[ Use An Entire Disk And Set Up LVM ]
[ Manual ]
[ Back ]
```

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Choose guided or manual partitioning



Use an entire disk

## Filesystem setup

The selected guided partitioning scheme creates the required bootloader partition on the chosen disk and then creates a single partition covering the rest of the disk, formatted as ext4 and mounted at '/'.  
Choose the disk to install to:

[ VBOX\_HARDDISK\_VBe685c7a2-4697eb99 32.000G ▶ ]

[ Cancel ]

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Choose the installation target



Choose the only disk available

If you're worried that the default partitioning scheme doesn't have swap, don't worry! Ubuntu will create a swapfile for you.

## Filesystem setup

## FILE SYSTEM SUMMARY

MOUNT POINT	SIZE	TYPE	DEVICE TYPE
[ /	31.997G	ext4	partition of local disk ▶ ]

## AVAILABLE DEVICES

No available devices

[ Create software RAID (md) ▶ ]  
[ Create volume group (LVM) ▶ ]

## USED DEVICES

DEVICE	SIZE	TYPE
[ VBOX_HARDDISK_VBe685c7a2-4697eb99	32.000G	local disk ▶ ]
[ partition 1	1.000M (0%)	▶ ]
bios_grub		
[ partition 2	31.997G (99%)	▶ ]
formatted as ext4, mounted at /		

[ Done ]  
[ Reset ]  
[ Back ]

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Select available disks to format and mount



Right Ctrl

Accept the default partitioning scheme

## Filesystem setup

## FILE SYSTEM SUMMARY

MOUNT POINT	SIZE	TYPE	DEVICE TYPE
[ /	31.997G	ext4	partition of local disk ▶ ]

## AVAILABLE

No available

[ Create  
[ Create

## USED DEVICES

DEVICE  
[ VBOX  
[ pa  
  
[ pa

## Confirm destructive action

Selecting Continue below will begin the installation process and result in the loss of data on the disks selected to be formatted.

You will not be able to return to this or a previous screen once the installation has started.

Are you sure you want to continue?

[ No ]

[ Continue ]

[ Done ]  
[ Reset ]  
[ Back ]

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Select available disks to format and mount



Right Ctrl

Confirm that you're ready to install

Choose a username, machine name, and **strong password**.



## Profile setup

Enter the username and password (or ssh identity) you will use to log in to the system.

Your name:

Your server's name:   
The name it uses when it talks to other computers.

Pick a username:

Choose a password:

Confirm your password:

Import SSH identity: [ No ▼ ]  
You can import your SSH keys from Github or Launchpad.

Import Username:

[ Done ]

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Install in progress: acquiring and extracting image from  
cp:///media/filesystem



Right Ctrl

Choose a good password!!!

## Featured Server Snaps

These are popular snaps in server environments. Select or deselect with SPACE, press ENTER to see more details of the package, publisher and versions available.

microk8s	Kubernetes for workstations and appliances
nextcloud	Nextcloud Server - A safe home for all your data
wekan	Open-Source kanban
kata-containers	Lightweight virtual machines that seamlessly plug into
docker	The docker app deployment mechanism
google-cloud-sdk	Command-line interface for Google Cloud Platform produc
canonical-livepatch	Canonical Livepatch Client
rocketchat-server	Group chat server for 100s, installed in seconds.
lxd	System container manager and API
mosquitto	Eclipse Mosquitto MQTT broker
etcd	Resilient key-value store by CoreOS
powershell	PowerShell for every system!
stress-ng	A tool to load, stress test and benchmark a computer sy
sabnzbd	SABnzbd
wormhole	get things from one computer to another, safely
aws-cli	Universal Command Line Interface for Amazon Web Service
doctl	Digital Ocean command line tool
conjure-up	Package runtime for conjure-up spells
minidlna-escoand	server software with the aim of being fully compliant w
postgresql10	PostgreSQL is a powerful, open source object-relational
heroku	CLI client for Heroku
keepalived	High availability VRRP and load-balancing for Linux

[ Done ]

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Install in progress: acquiring and extracting image from  
cp:///media/filesystem



Right Ctrl

Don't need any of this garbage

Installation complete!

```
----- Finished install! -----
    configuring mount: mount-0
configuring network
    running 'curtin net-meta auto'
    curtin command net-meta
writing install sources to disk
    running 'curtin extract'
    curtin command extract
    acquiring and extracting image from cp:///media/filesystem
configuring installed system
    running 'curtin curthooks'
    curtin command curthooks
    configuring apt configuring apt
    installing missing packages
    installing kernel
    setting up swap
    apply networking config
    writing etc/fstab
    configuring multipath
    updating packages on target system
    configuring pollinate user-agent on target system
finalizing installation
    running 'curtin hook'
    curtin command hook
executing late commands
```

[ View full log ]

[ Reboot Now ]

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Thank you for using Ubuntu!



Right Ctrl

All done! Reboot.

When it asks you to remove the installation medium, just hit enter.

```
File Machine View Input Devices Help
[FAILED] Failed unmounting Mount unit for subiquity, revision 620.
[FAILED] Failed unmounting Mount unit for core, revision 4917.
[ OK ] Stopped Network Time Synchronization.
[ OK ] Stopped Update UTMP about System Boot/Shutdown.
[ OK ] Stopped Create Volatile Files and Directories.
[ OK ] Stopped target Local File Systems.
      Unmounting /run/user/999...
      Unmounting /tmp...
      Unmounting /rofs...
      Unmounting /target...
[ OK ] Unmounted /tmp.
[ OK ] Unmounted /run/user/999.
[ OK ] Unmounted /rofs.
[ OK ] Stopped target Swap.
[ OK ] Stopped Load/Save Random Seed.
[ OK ] Unmounted /target.
[ OK ] Reached target Unmount All Filesystems.
[ OK ] Stopped target Local File Systems (Pre).
      Stopping Monitoring of LVM2 mirrors, snapshots etc. using dmeventd or progress polling...
[ OK ] Stopped Remount Root and Kernel File Systems.
[ OK ] Stopped Create Static Device Nodes in /dev.
[ OK ] Reached target Shutdown.
      Starting Shuts down the "live" preinstalled system cleanly...
[ OK ] Stopped Monitoring of LVM2 mirrors, snapshots etc. using dmeventd or progress polling.
      Stopping LVM2 metadata daemon...
[ OK ] Stopped LVM2 metadata daemon.
Please remove the installation medium, then press ENTER:
_

[Disk, CD, Speaker, Monitor, USB, Folder, Mail, Calendar, CPU, Refresh, Download] Right Ctrl
```

Just hit enter

Your VM will reboot into your freshly-installed server environment.

## Install the required packages

We've created [a script](#) that will install the required packages, enable [folder sharing](#) with the host OS, etc. To download it, in your VM type:

```
wget https://web.stanford.edu/class/cs144/vm_howto/setup_dev_env.sh
```

**STOP** and read the script! Don't just execute some crap you downloaded from the internet. Once you're satisfied that you understand what's going on:

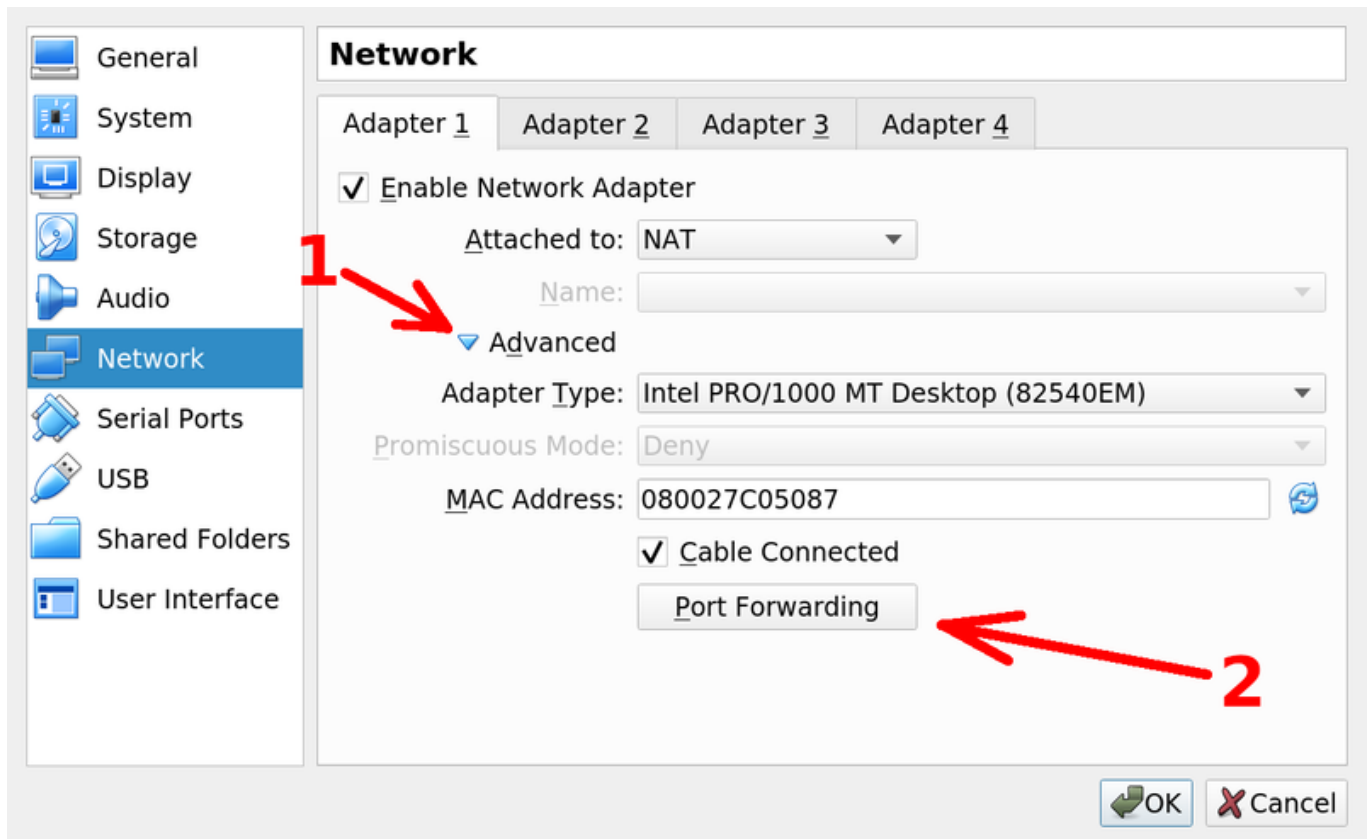
```
bash ./setup_dev_env.sh
```

Once the script has finished, you can shut down your machine for now:

```
sudo shutdown -h now
```

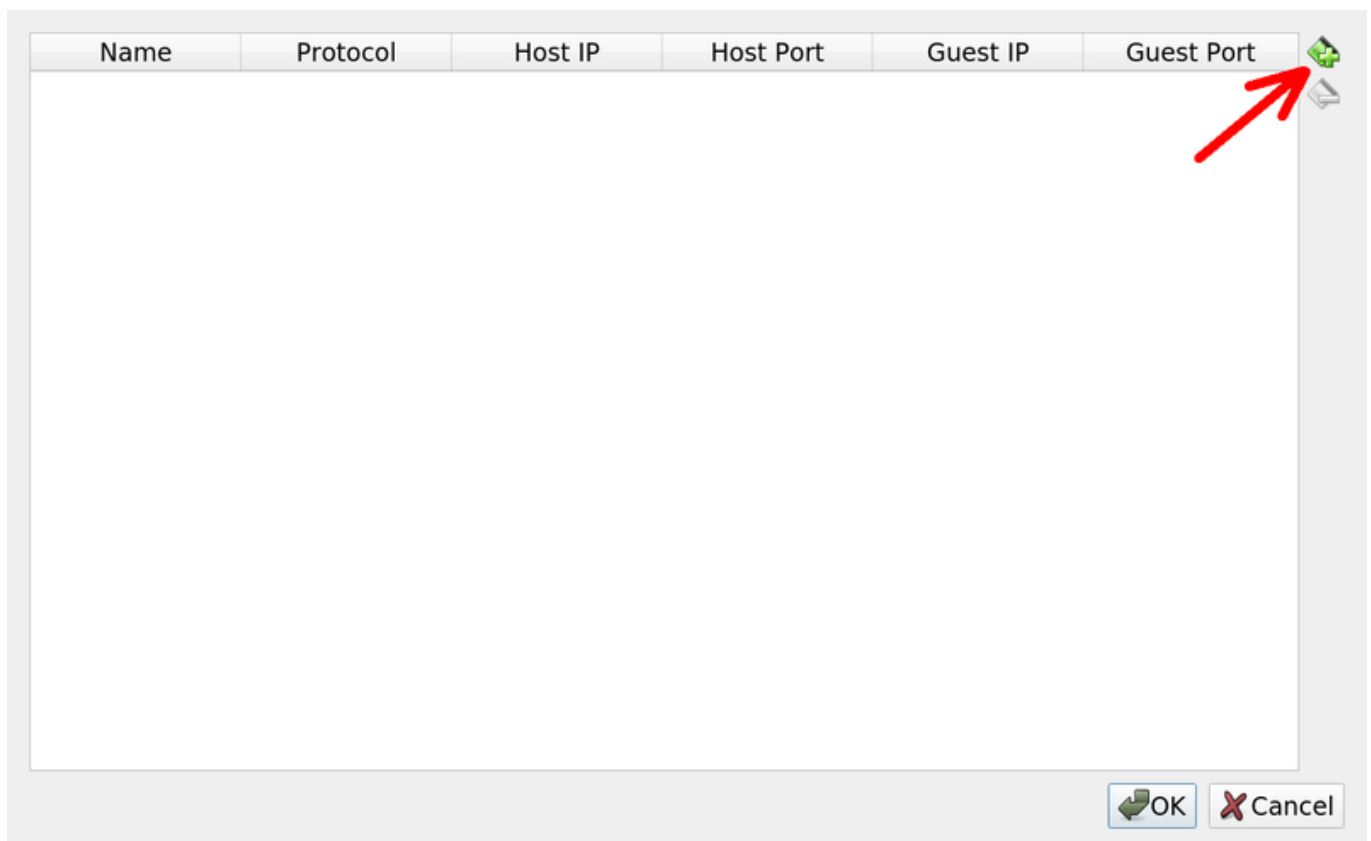
## Set up SSH port forwarding to your VM

From the VirtualBox home screen, click Settings or type Ctrl-S, then select Network, click the “Advanced” button, and click “Port Forwarding”.



Network settings -> advanced

This will bring up the port forwarding dialog. Click in the top-right corner to add a new rule.



Add a port forwarding rule

Give it a name, and use the following settings:

- protocol: TCP
- Host IP: 127.0.0.1
- Host Port: 2222
- Guest IP: *(leave blank)*
- Guest Port: 22

Name	Protocol	Host IP	Host Port	Guest IP	Guest Port
ssh_host_forwarding_rule	TCP	127.0.0.1	2222		22

OK Cancel

Port forwarding rule added

Click OK a few times to get back to the VirtualBox home screen.

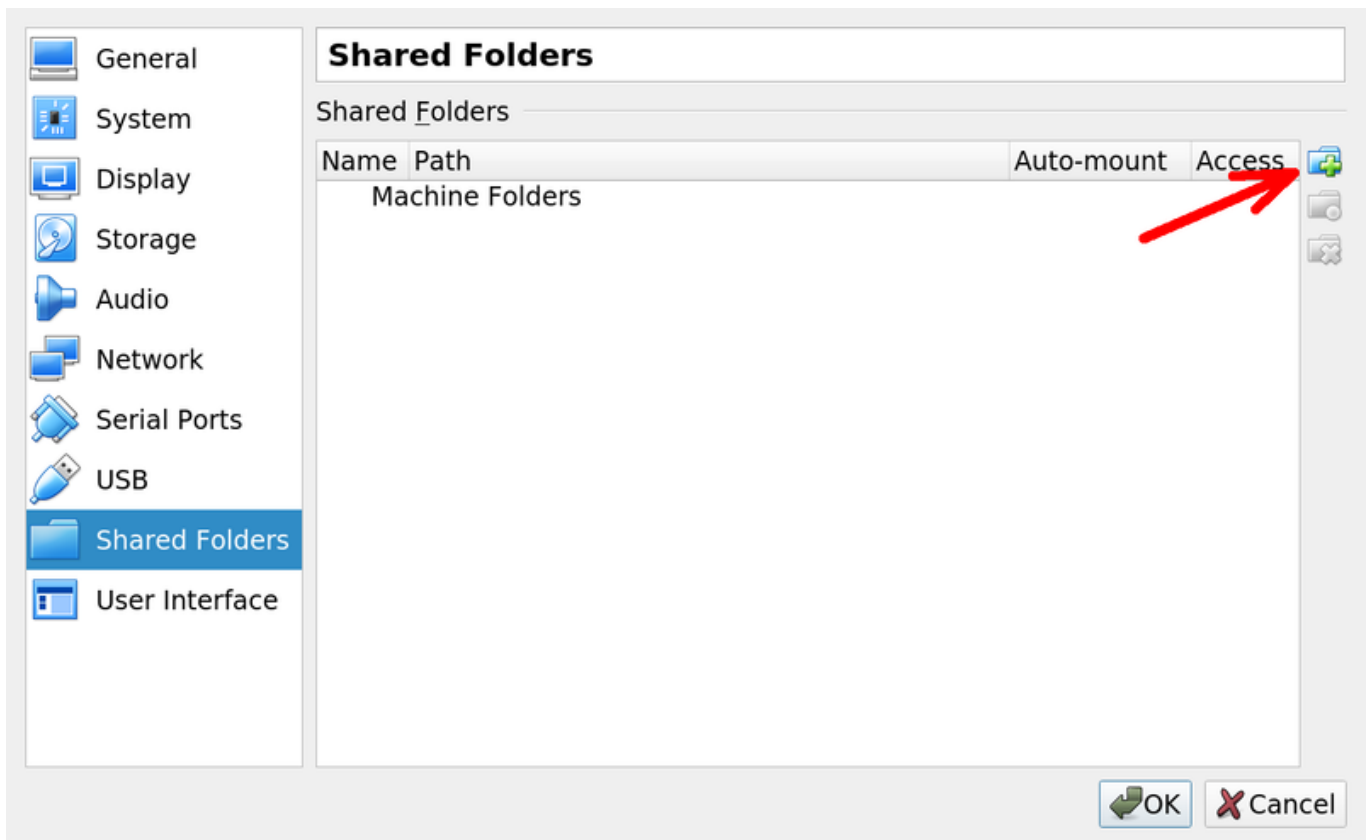
This will forward port 2222 of the host machine to port 22 (ssh) for the guest machine. You will be able to SSH into your VM using

```
ssh -p 2222 myname@localhost
```

where myname is the username you chose when setting up your VM.

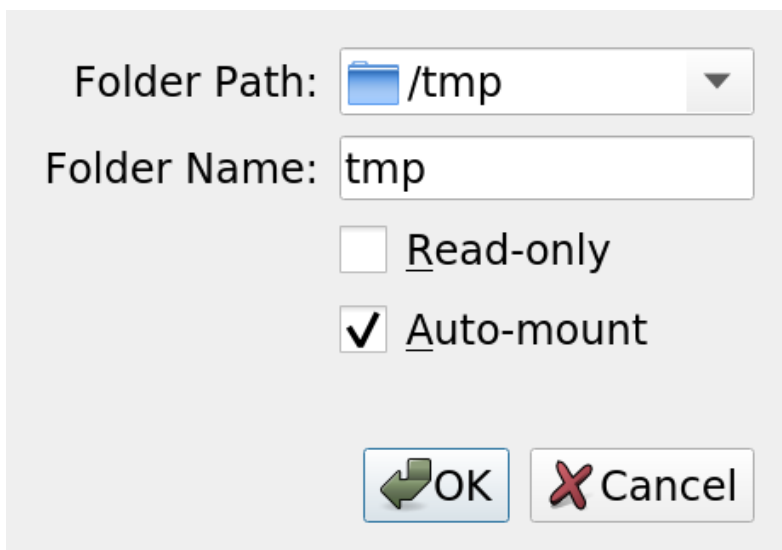
## (optional) Set up a shared folder

From the VirtualBox home screen, click Settings or type Ctrl-S, select “Shared Folders” in the column on the left, then click the “Add” button in the top-right corner.



Add a shared folder

Select a folder from the host machine to add. We recommend ticking “Auto-mount” to have it mounted automatically when your VM boots.



For example, to share /tmp

Auto-mounted folders will be available at `/media/sf_<FolderName>`, where `<FolderName>` is the name you used in the Shared Folder dialog immediately above (in this example, `<FolderName>` would be `tmp`).

If you didn’t tick Auto-mount, you can still mount shared folders manually in your VM with:

```
sudo mkdir -p /media/sf_<FolderName>
sudo mount -t vboxsf -o rw,gid=vboxsf <FolderName> /media/sf_<FolderName>
```