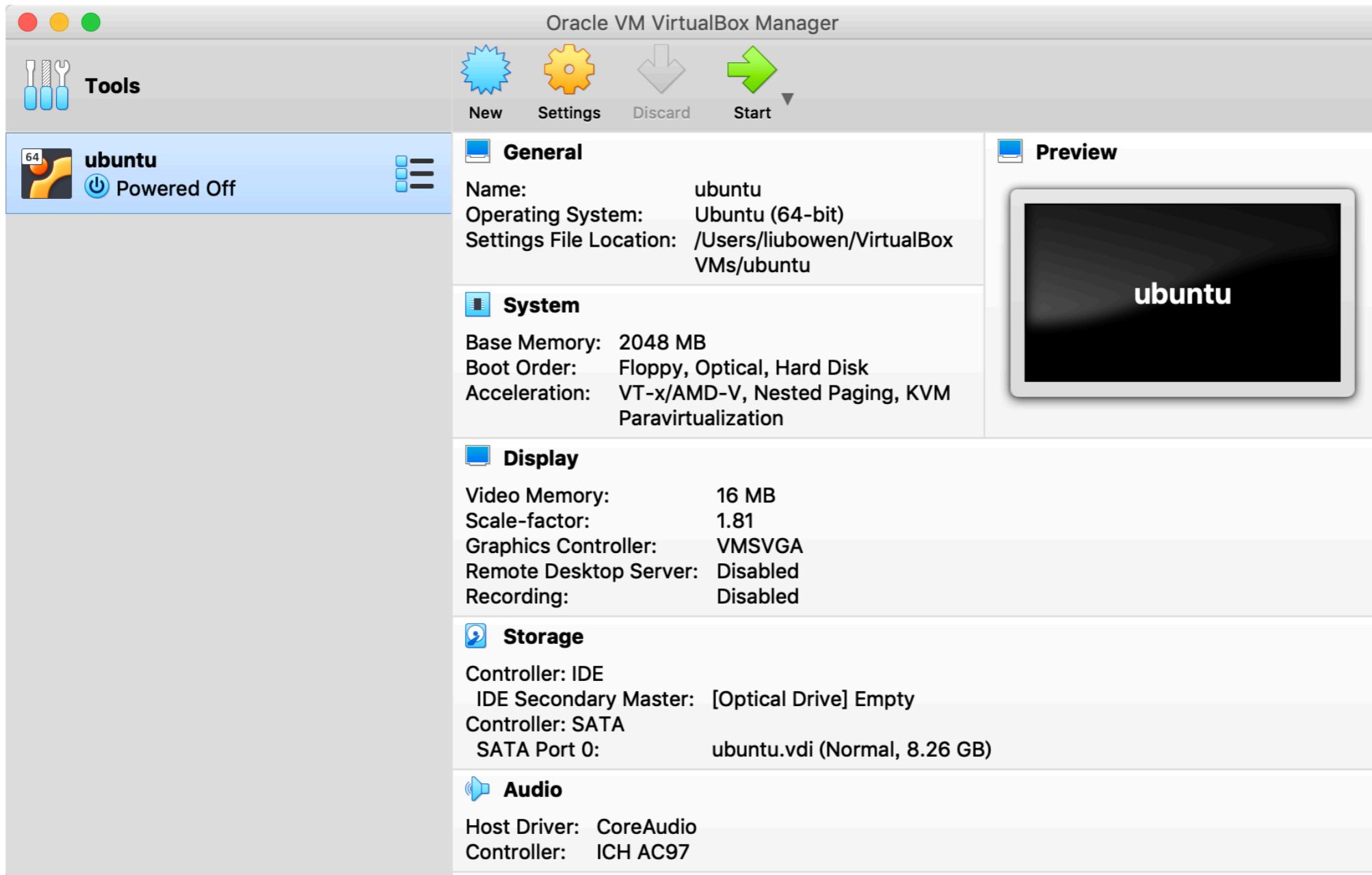


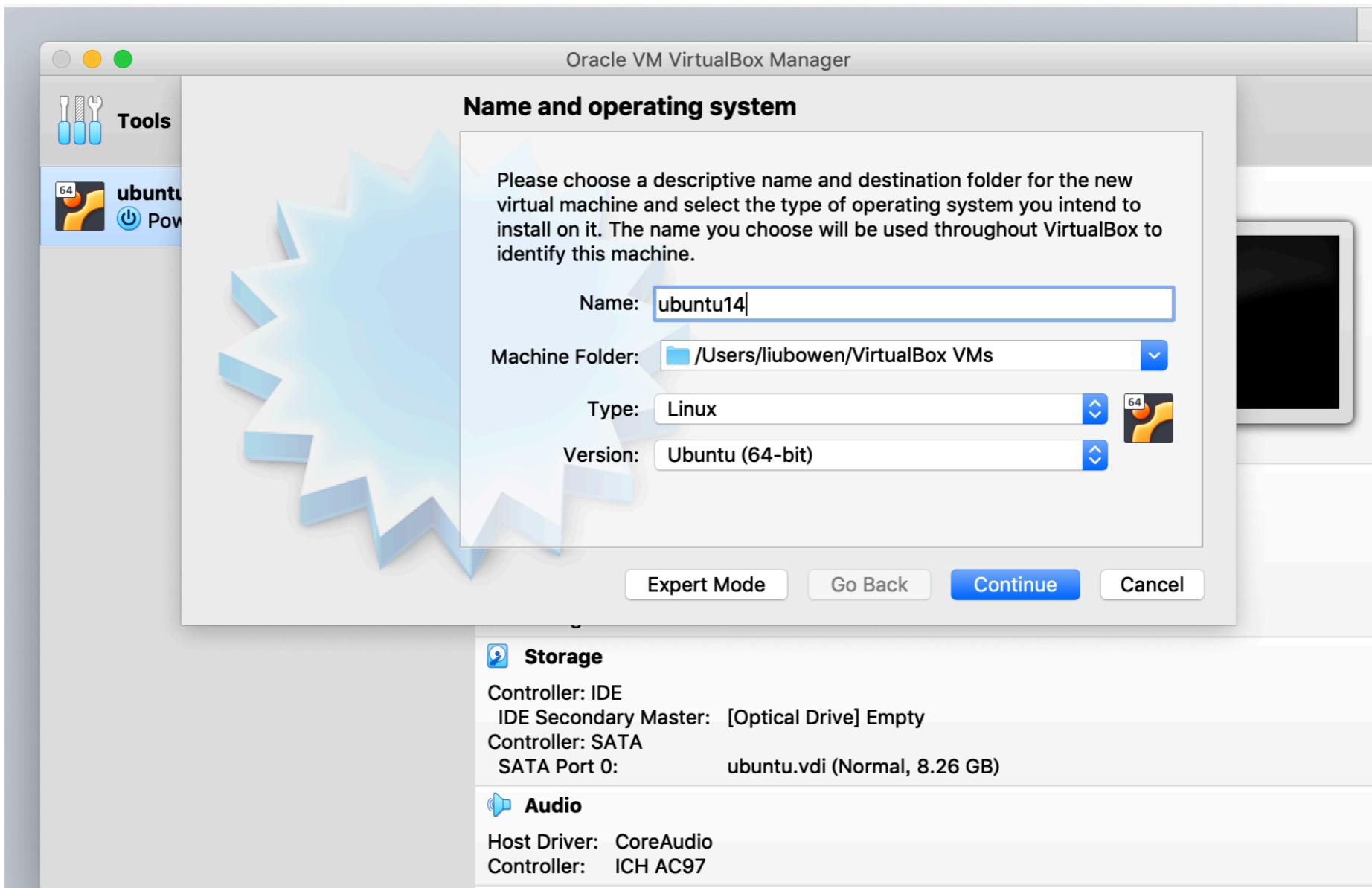
VirtualBox Installation

- VirtualBox Binary Download
 - <https://www.virtualbox.org/wiki/Downloads>



Ubuntu Image

- Ubuntu 14.04 Download
 - <http://releases.ubuntu.com/14.04/>
 - Desktop image (with Xterm) recommend



Memory size setting

Memory size

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

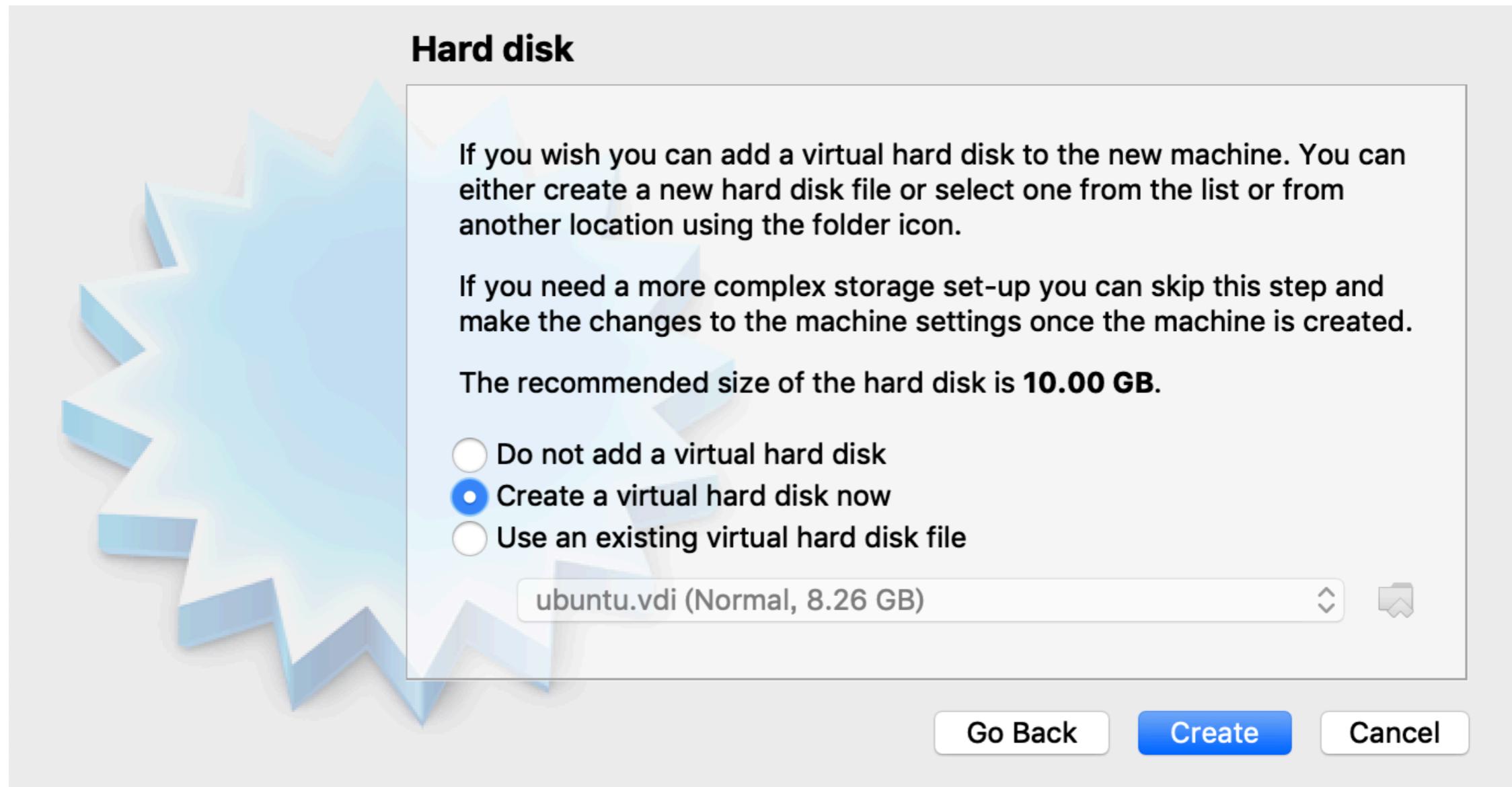
The recommended memory size is **1024 MB**.

2048 MB

4 MB 8192 MB

Go Back Continue Cancel

Disk space setting



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

ubuntu.vdi (Normal, 8.26 GB) ▼ 

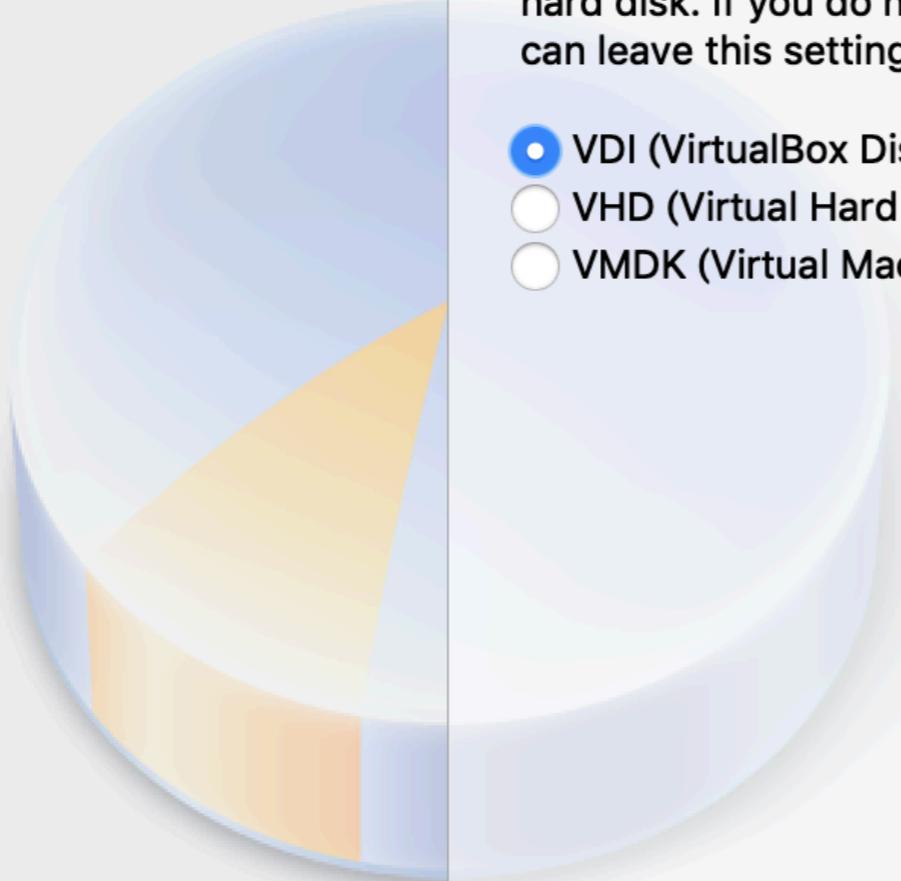
[Go Back](#) [Create](#) [Cancel](#)

Disk file type setting

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](#) [Go Back](#) [Continue](#) [Cancel](#)

Storage setting

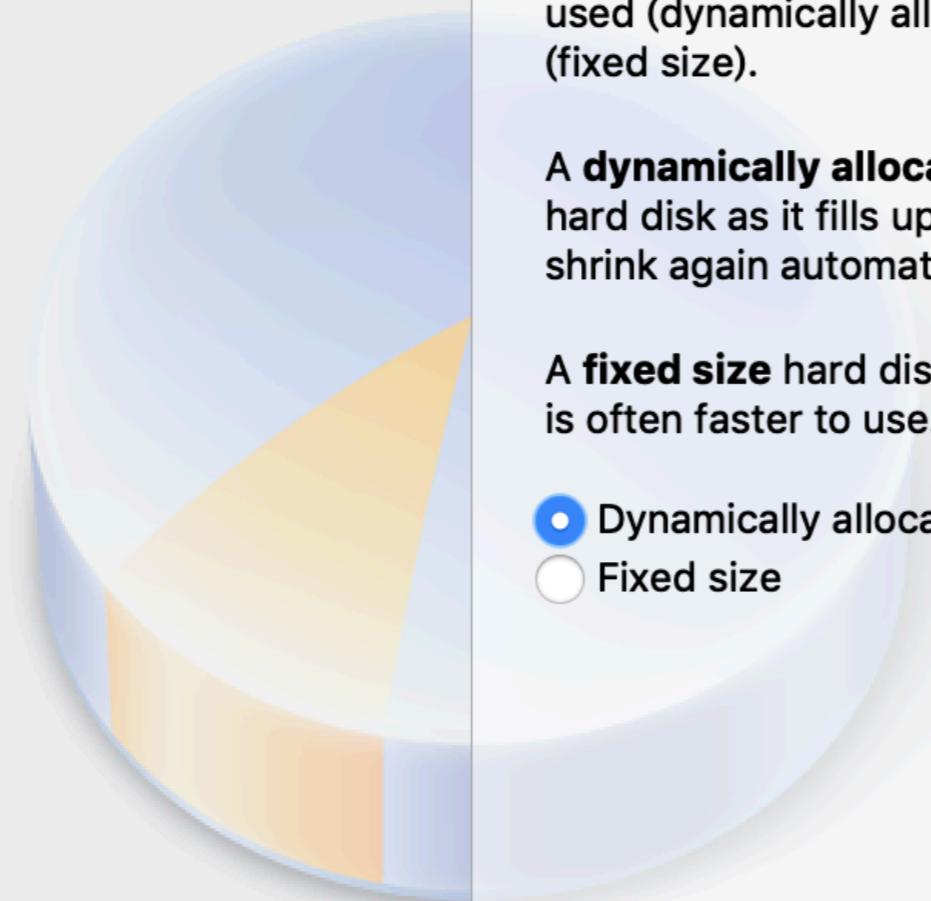
Storage on physical hard disk

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

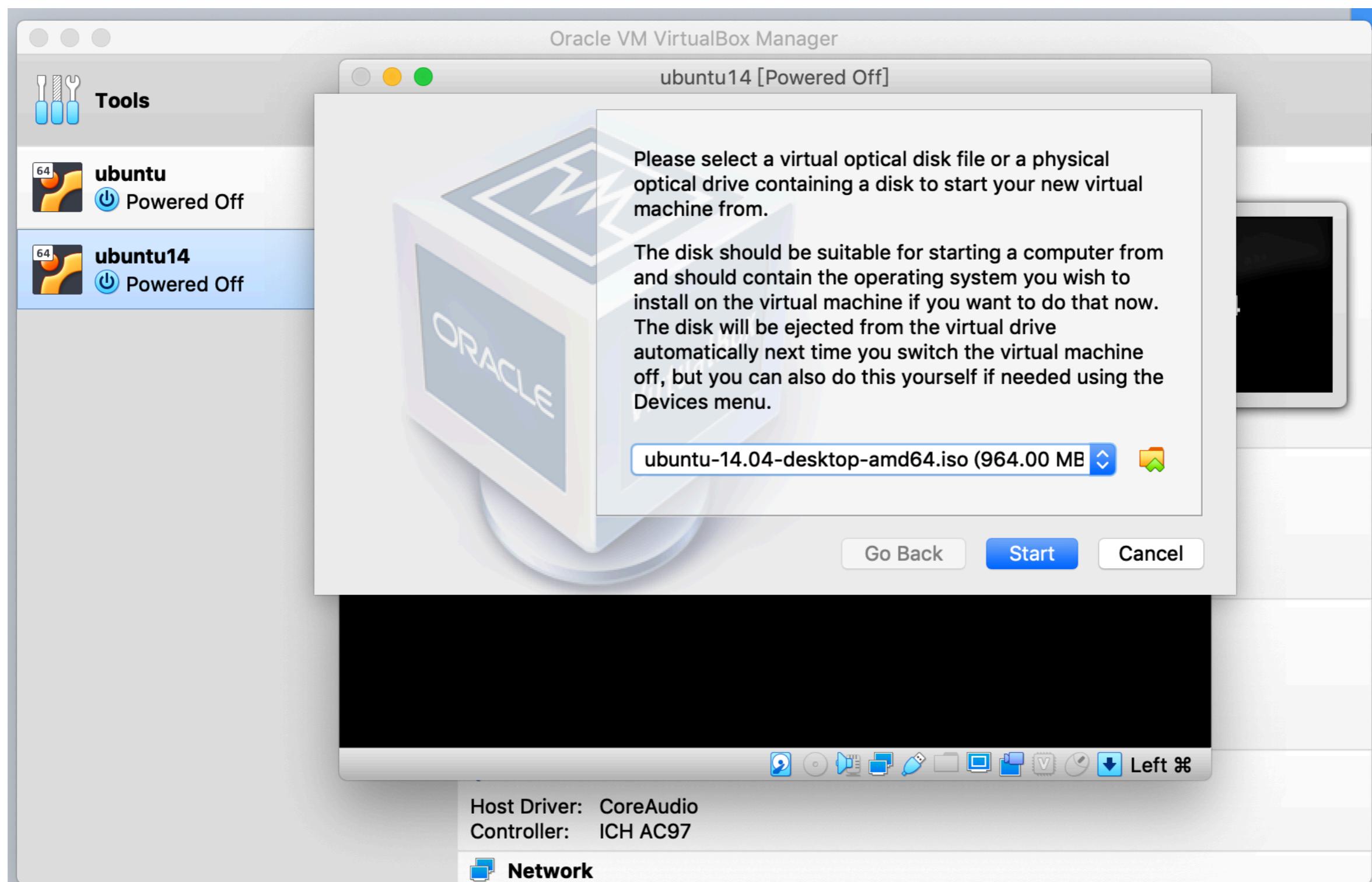


Go Back

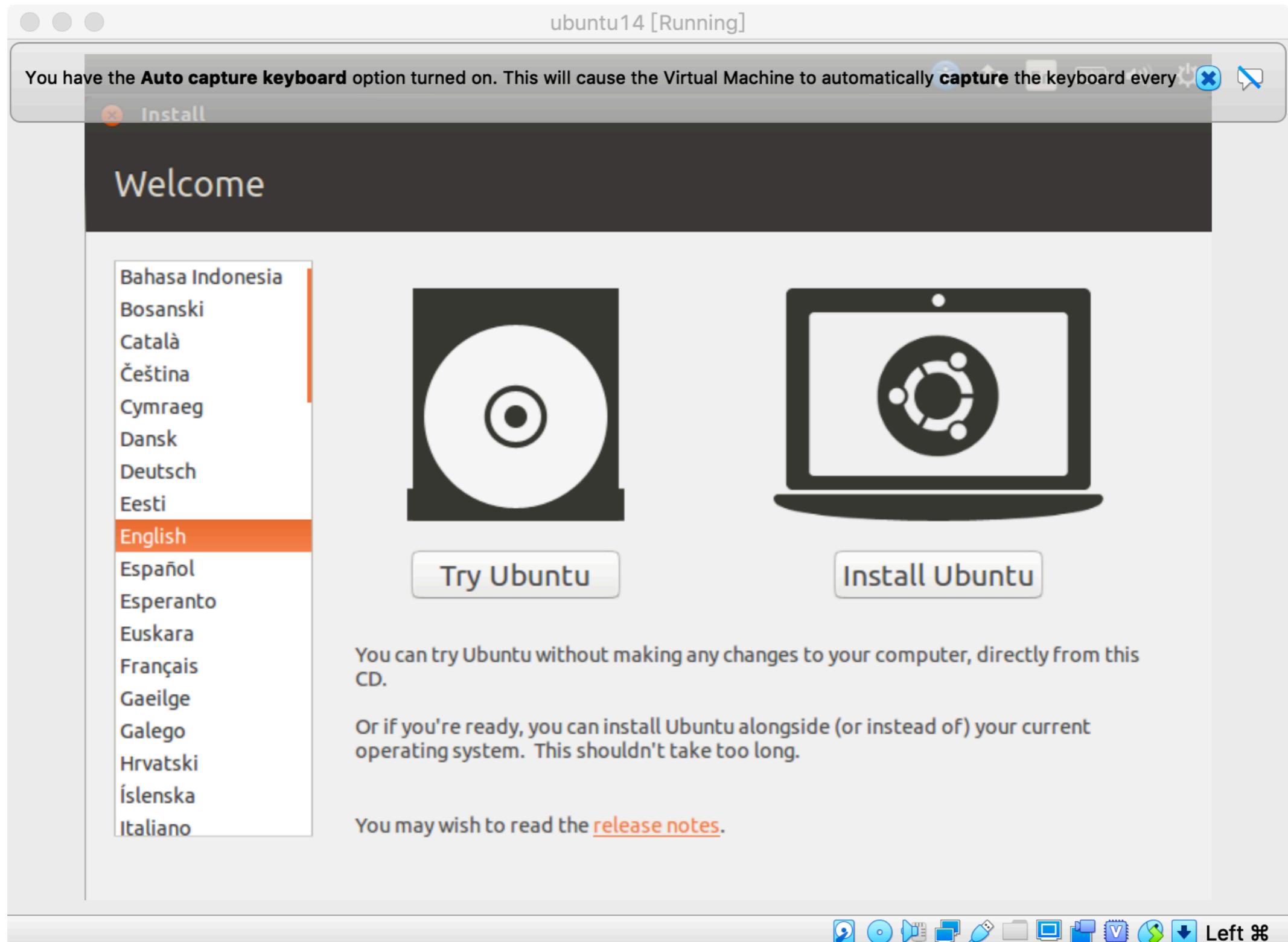
Continue

Cancel

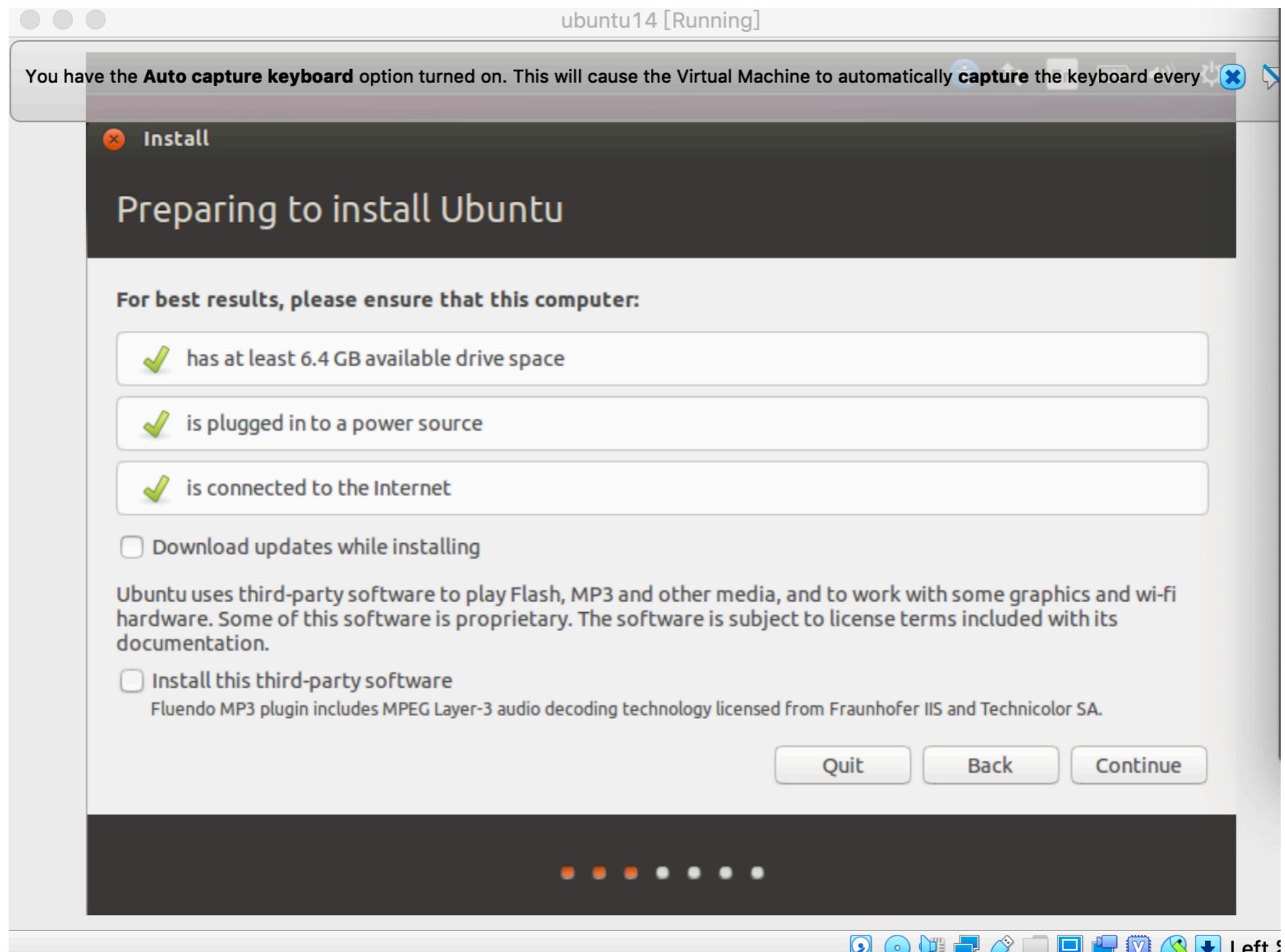
Insert ubuntu image



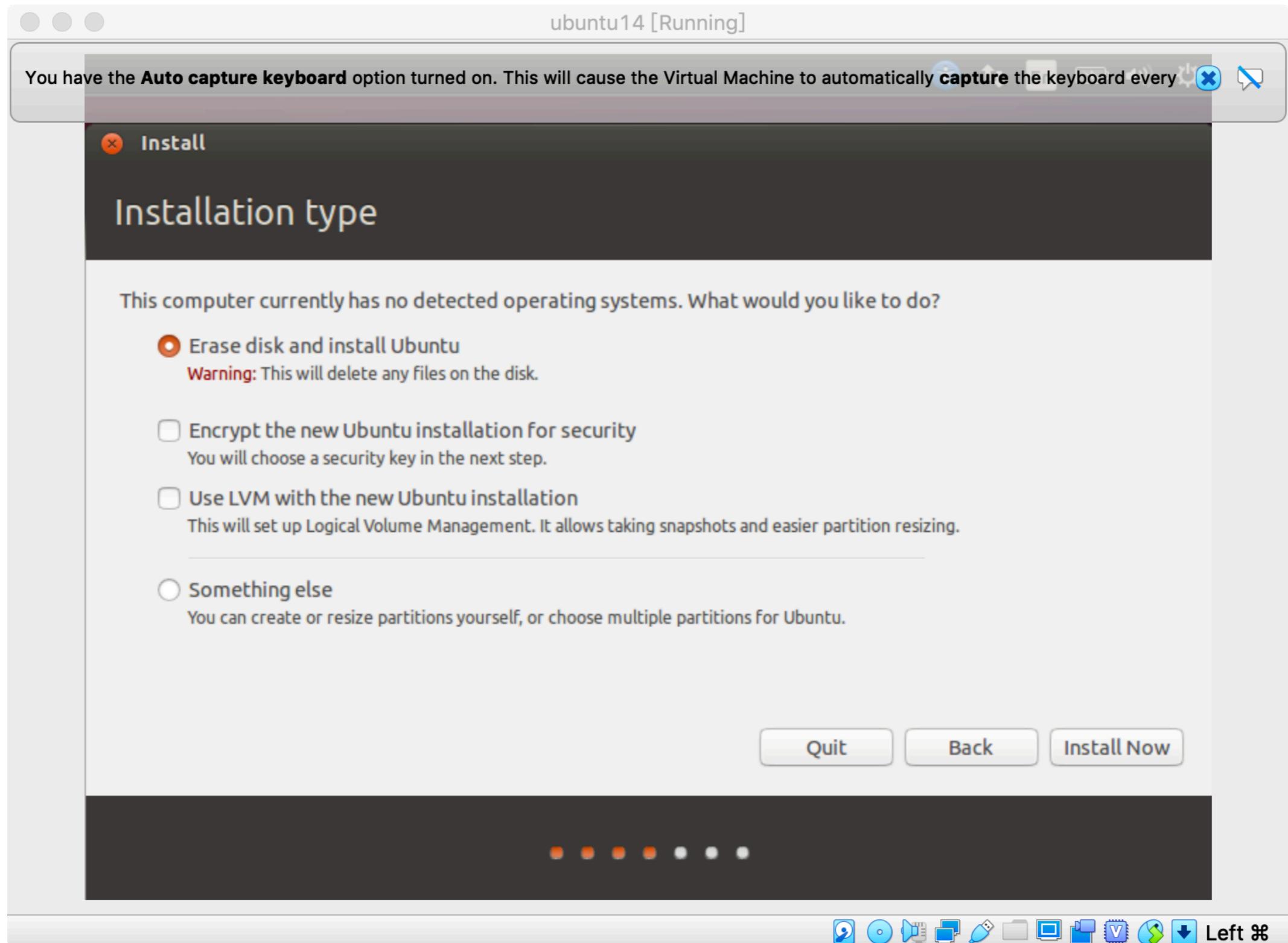
Click “Install ubuntu”



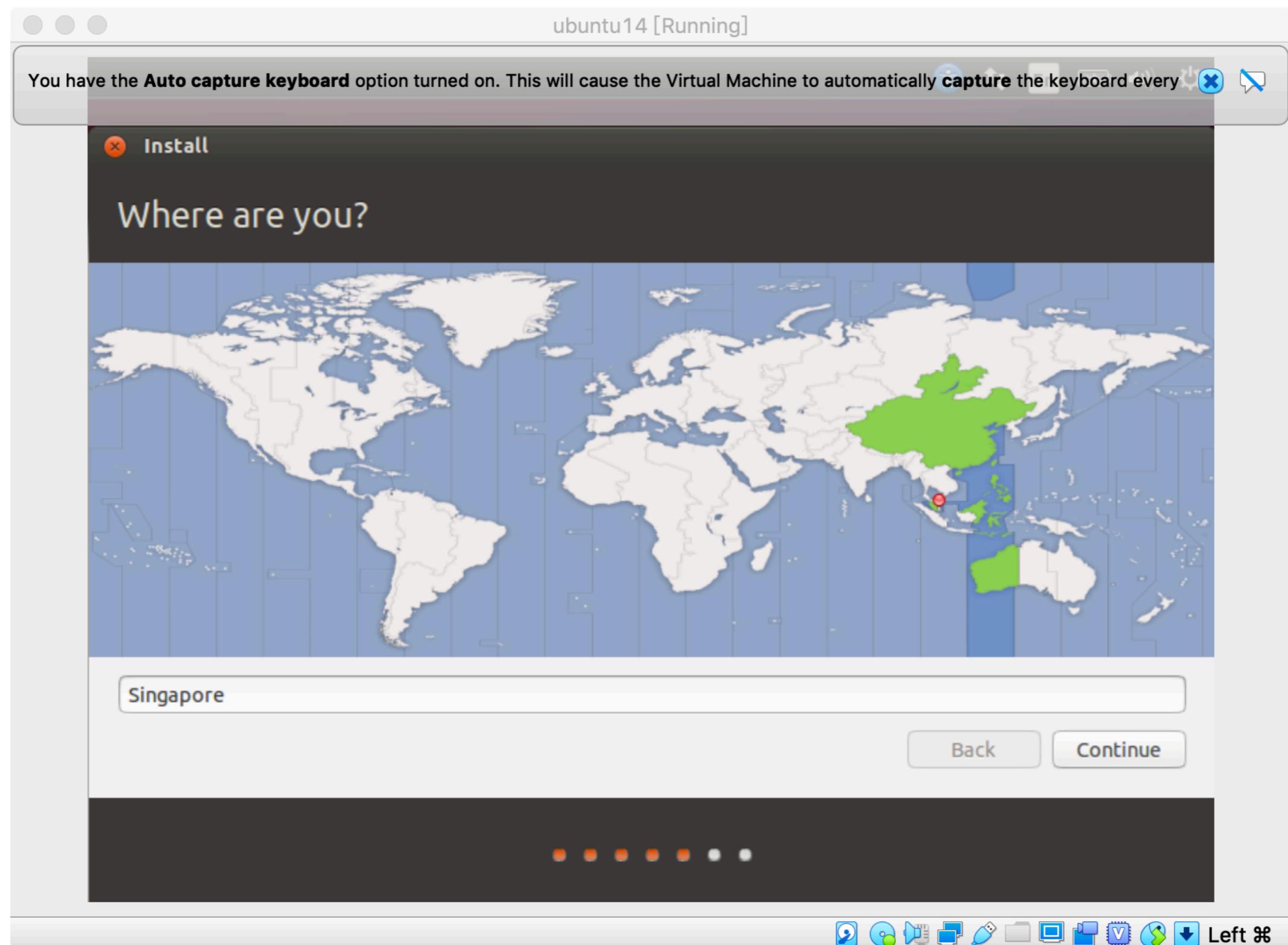
Click “Continue”



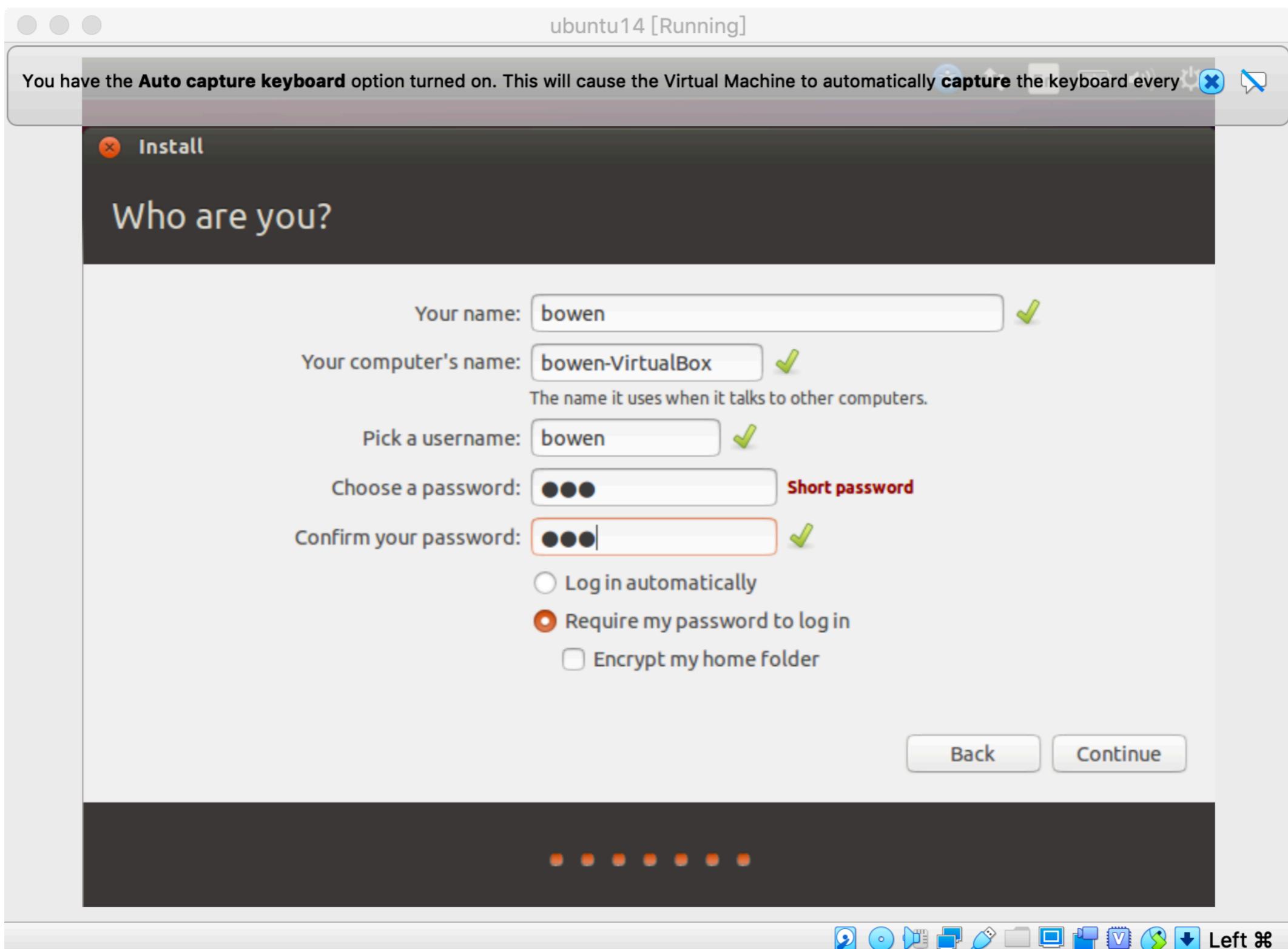
Click “Erase disk & install”



Choose time zone

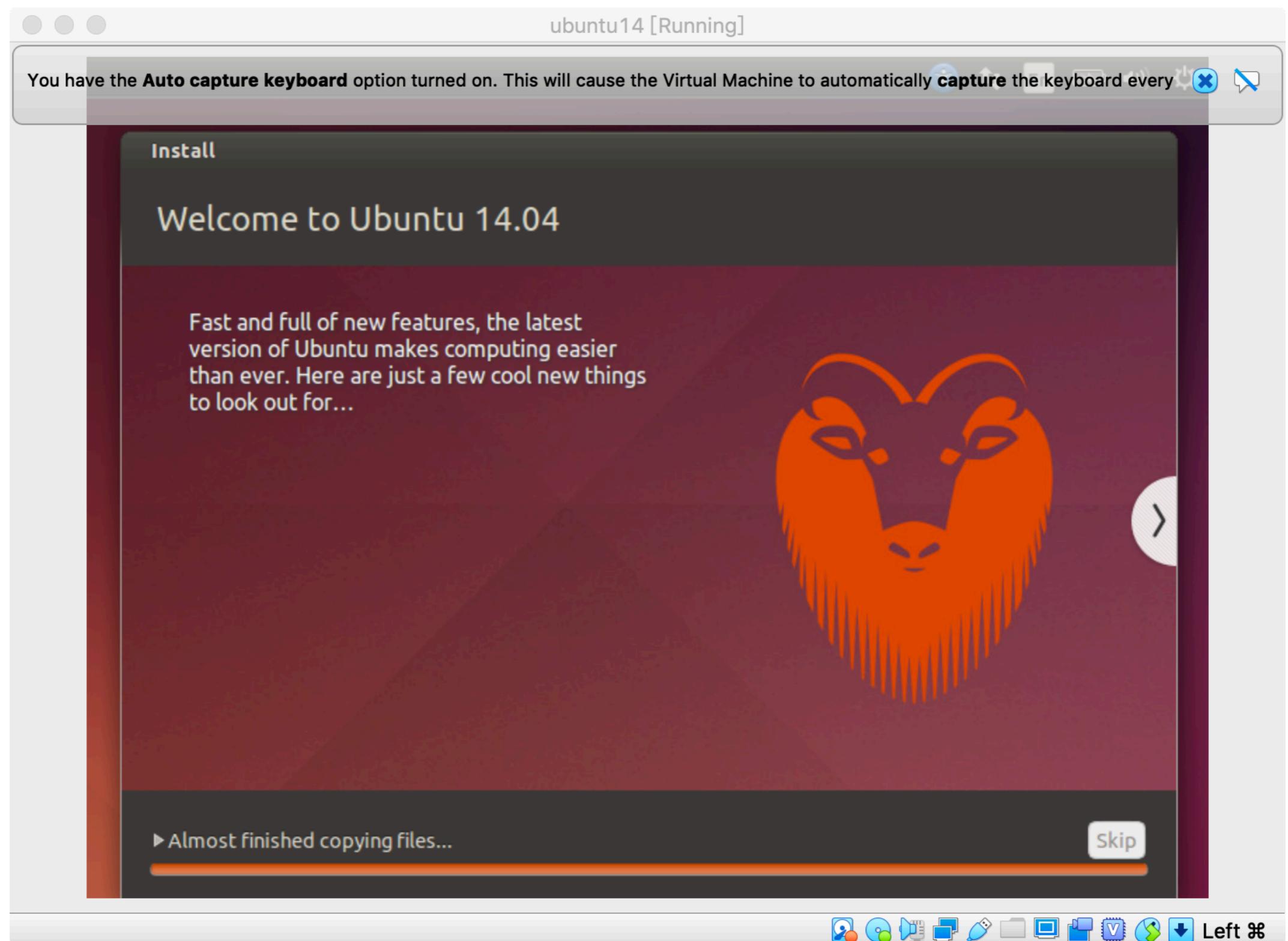


Customize Username & Password

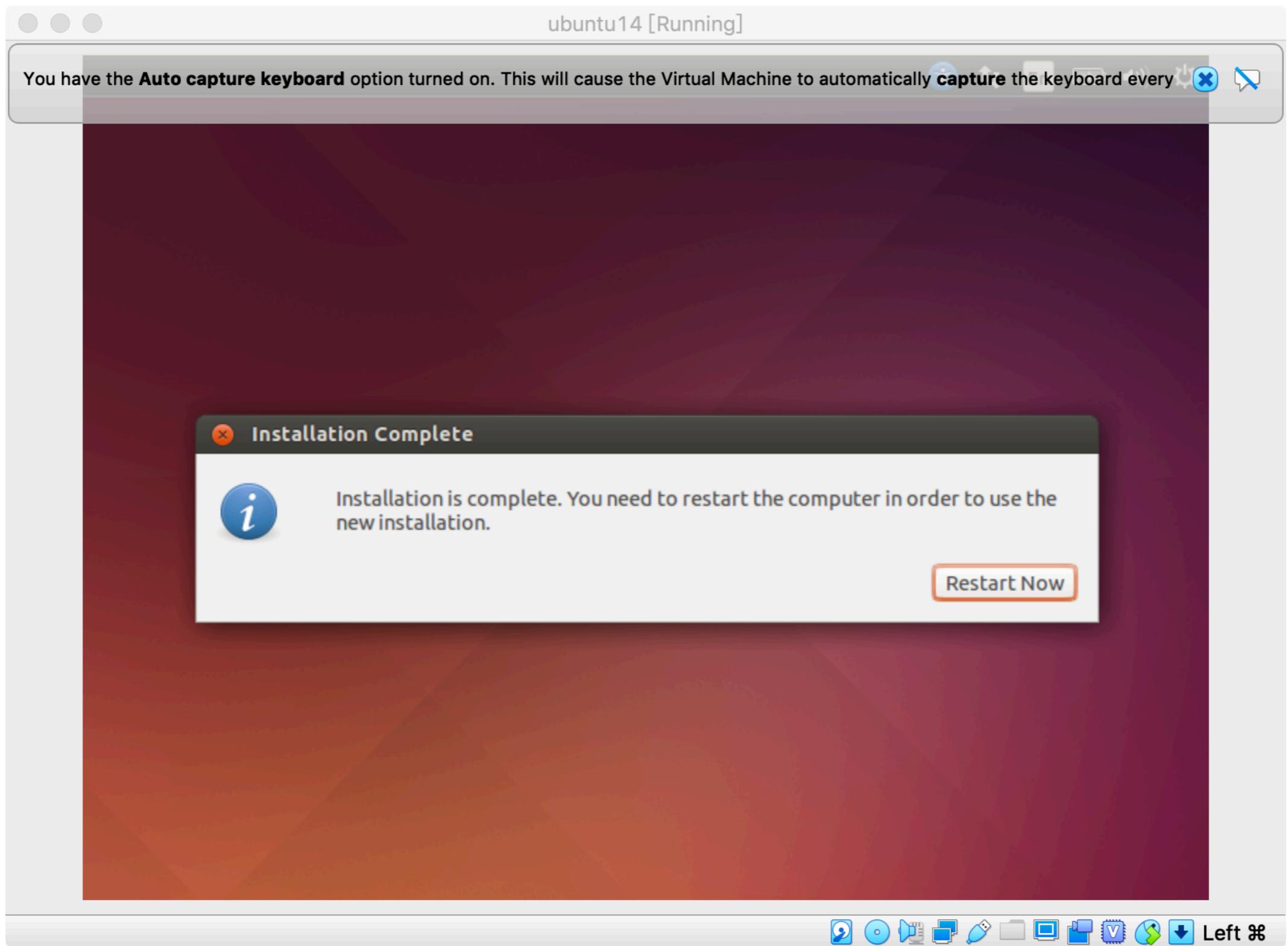


Installing...

Installing

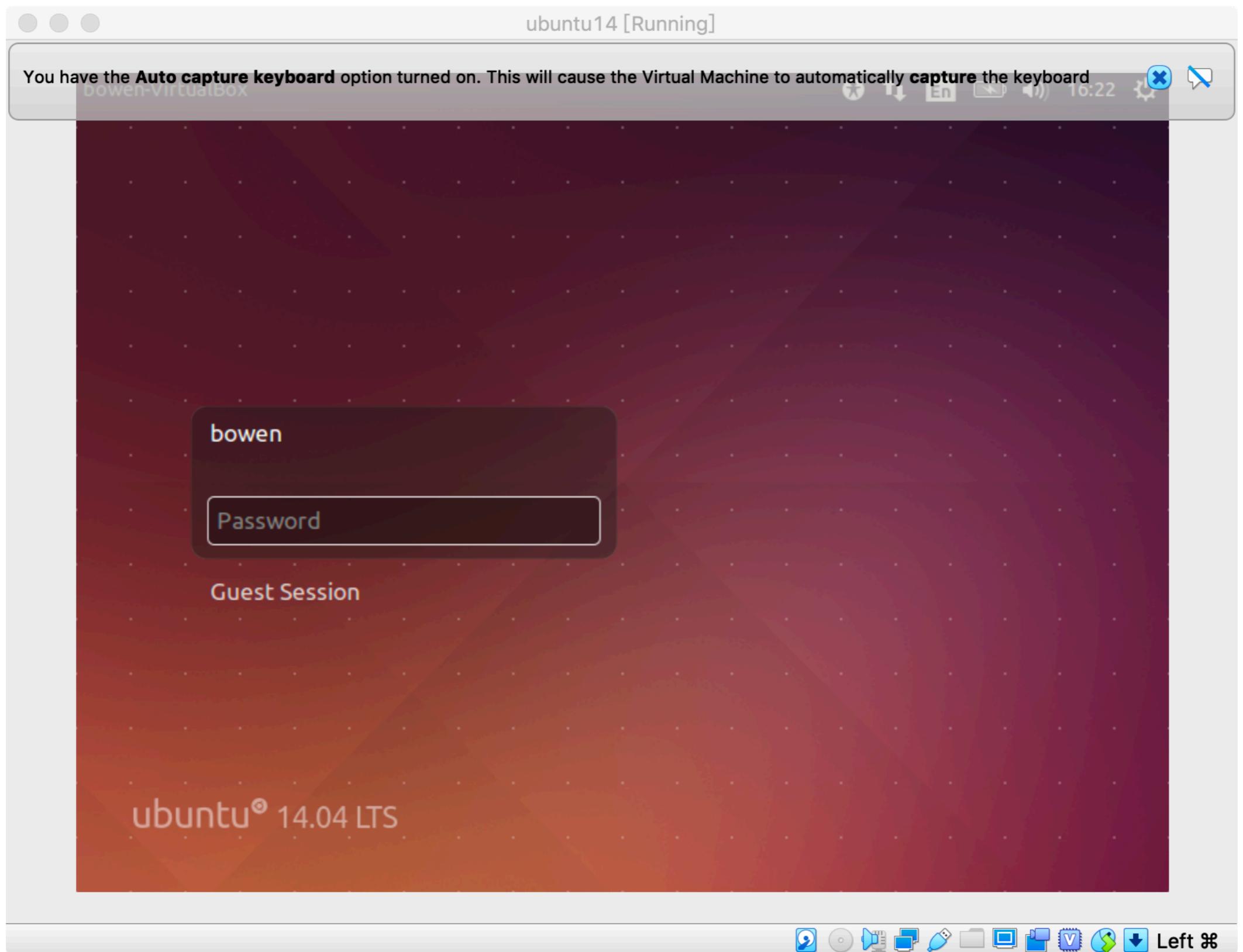


Restart

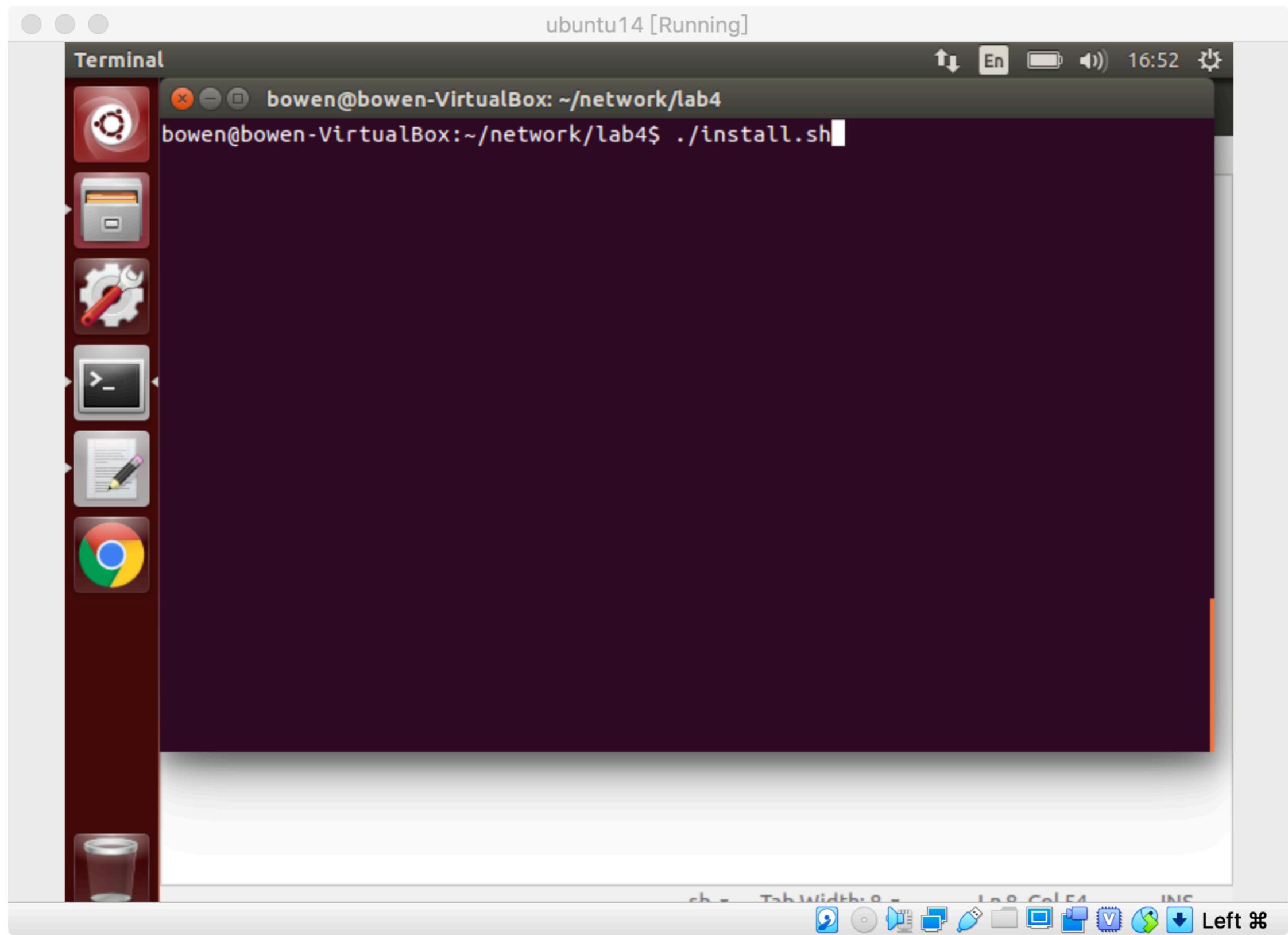


Restart...

Type Password and login



Execute install.sh



What install.sh dose ?

```
1 # 50.012
2 # install mininet and supporting libraries
3 sudo apt -y install mininet
4 # install curl package for pip3.4 installation
5 sudo apt-get install curl
6 # install pip3.4
7 curl https://bootstrap.pypa.io/get-pip.py -o get-pip.py
8 sudo python3.4 get-pip.py
9 # install matplotlib package for lab4 plotting figures
10 # if occur 'cannot uninstall six', try adding the flags --ignore-installed six
11 # sudo pip3.4 install matplotlib --ignore-installed six
12 sudo pip3.4 install matplotlib
```

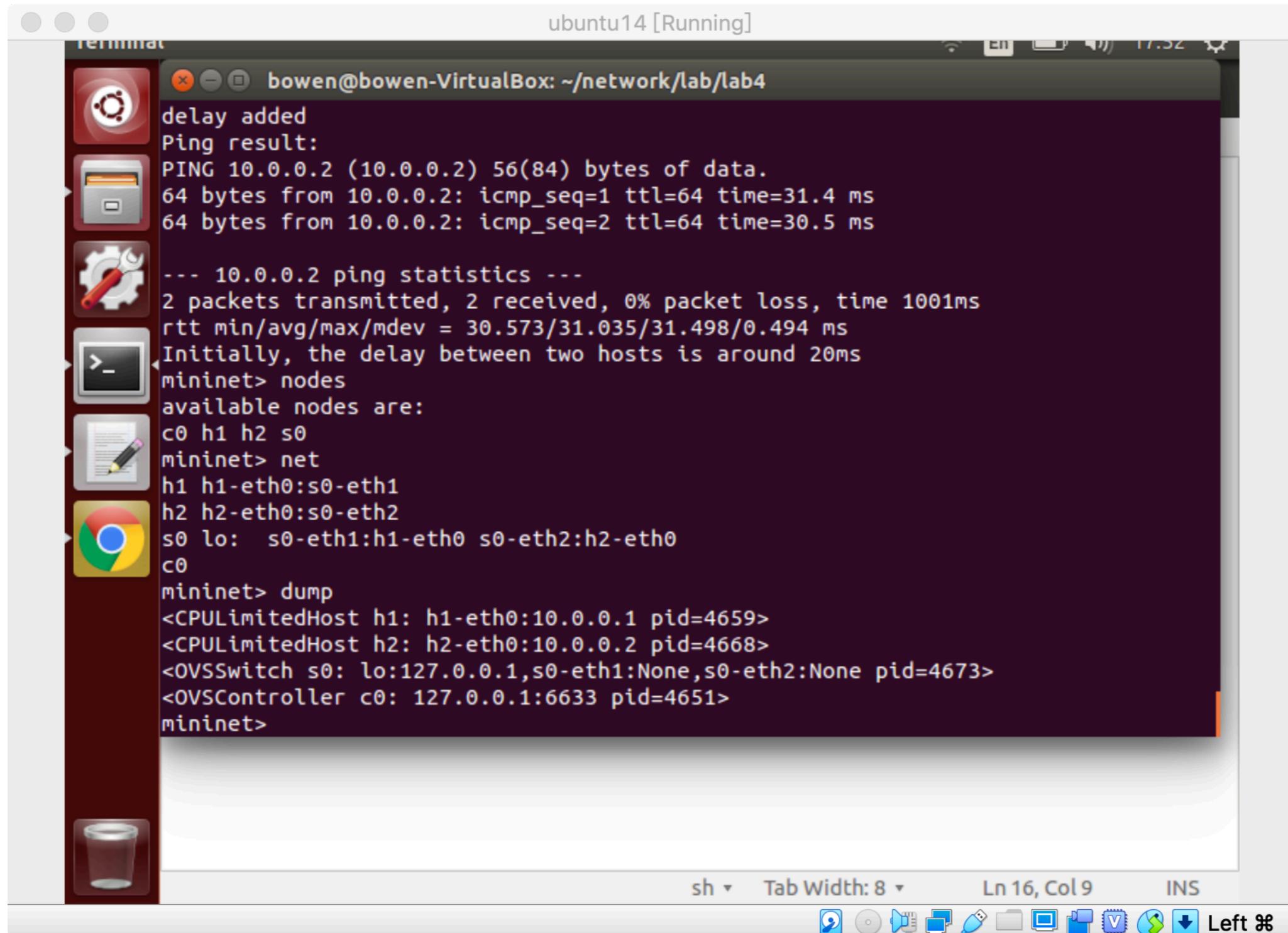
mininet Introduction

- **mininet**
 - A *network emulator*
 - Creates a network of virtual hosts, switches, controllers, and links.
- **Useful links**
 - Overview: <http://mininet.org/overview/>
 - Documents: <https://github.com/mininet/mininet/wiki/Documentation>
 - Walkthrough: <http://mininet.org/walkthrough/>

After installed & *sudo mn* to start mininet

Example 1: commands

- nodes, net, dump...



The image shows a screenshot of a Linux desktop environment, specifically Ubuntu 14.04 LTS, running in a VirtualBox. A terminal window titled "ubuntu14 [Running]" is open, displaying the output of several Mininet commands. The terminal window has a dark background and light-colored text. The desktop interface includes a dock with icons for the Dash, Home, File Explorer, Terminal, and a web browser.

```
delay added
Ping result:
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=31.4 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=30.5 ms

--- 10.0.0.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 30.573/31.035/31.498/0.494 ms
Initially, the delay between two hosts is around 20ms
mininet> nodes
available nodes are:
c0 h1 h2 s0
mininet> net
h1 h1-eth0:s0-eth1
h2 h2-eth0:s0-eth2
s0 lo: s0-eth1:h1-eth0 s0-eth2:h2-eth0
c0
mininet> dump
<CPULimitedHost h1: h1-eth0:10.0.0.1 pid=4659>
<CPULimitedHost h2: h2-eth0:10.0.0.2 pid=4668>
<OVSSwitch s0: lo:127.0.0.1,s0-eth1:None,s0-eth2:None pid=4673>
<OVSCController c0: 127.0.0.1:6633 pid=4651>
mininet>
```

Example 2: Testing h1 & h2

```
ubuntu14 [Running]
terminal  bowen@bowen-VirtualBox: ~/network/lab/lab4
mininet> nodes
available nodes are:
c0 h1 h2 s0
mininet> net
h1 h1-eth0:s0-eth1
h2 h2-eth0:s0-eth2
s0 lo:  s0-eth1:h1-eth0 s0-eth2:h2-eth0
c0
mininet> dump
<CPULimitedHost h1: h1-eth0:10.0.0.1 pid=4659>
<CPULimitedHost h2: h2-eth0:10.0.0.2 pid=4668>
<OVSSwitch s0: lo:127.0.0.1,s0-eth1:None,s0-eth2:None pid=4673>
<OVSServer c0: 127.0.0.1:6633 pid=4651>
mininet> h1 ping h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=34.6 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=31.9 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=31.8 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=30.7 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=31.2 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=31.7 ms
64 bytes from 10.0.0.2: icmp_seq=7 ttl=64 time=32.5 ms
64 bytes from 10.0.0.2: icmp_seq=8 ttl=64 time=31.5 ms
```

The terminal window is titled "ubuntu14 [Running]" and shows a standard Linux desktop interface with icons for various applications like the Dash, Home, and Control Center. The terminal itself has a dark background and displays the output of the mininet command-line interface. It lists the available nodes (c0, h1, h2, s0), shows the network topology (h1 connected to s0-eth1, h2 connected to s0-eth2, s0 connected to both), and performs a ping between h1 and h2, showing round-trip times for each packet sent.

- Thanks