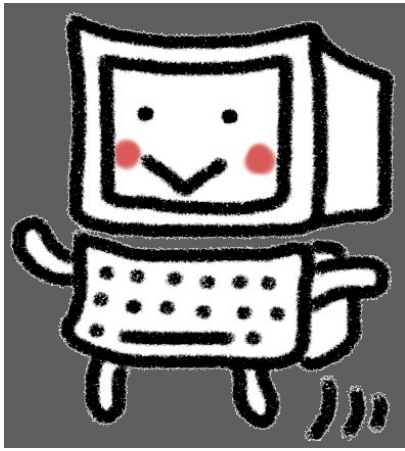

SDN Environment Setup

Install ONOS in VM

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Outline

- Objective
- Experiment Environment
- Installation
  - VirtualBox 6.1.2
  - Add VM
  - Ubuntu 16.04
  - ONOS 2.2.0

Objective

- Prepare a operational environment
  - VirtualBox: Open-source cross-platform virtualization application
    - Run virtual machines
  - Ubuntu: Open-source operating system
    - A most popular OS for software development
  - ONOS: Open Network Operating System in SDN
    - Offer a graphic interface for observing network topology
  - Mininet: Network Emulator
    - Make network environment setup easily

Outline

- Objective
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  - VirtualBox 6.1.2
  - Add VM
  - Ubuntu 16.04
  - ONOS 2.2.0

Experiment Environment

- Ubuntu Desktop 16.04
- **Minimum** Hardware Requirements:
  - 2 Cores (CPUs)
  - 8GB RAM
  - 20GB HDD

Outline

- Objective
- Experiment Environment
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  - VirtualBox 6.1.2
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  - Ubuntu 16.04
  - ONOS 2.2.0

VirtualBox Installation (1/6)

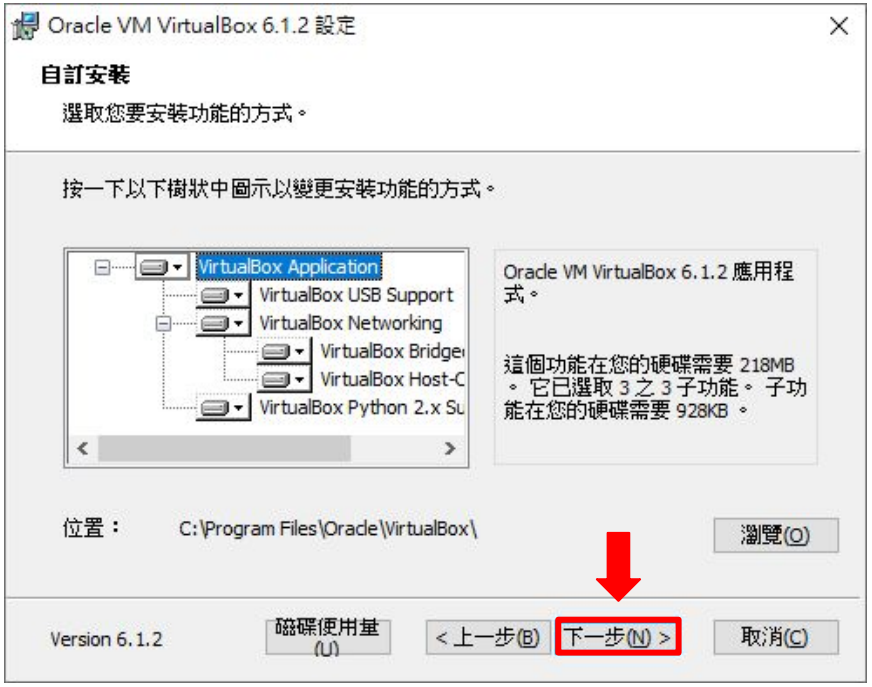
- Go to official website:

  https://www.virtualbox.org/wiki/Downloads

- Download the “platform packages” for the corresponding host’s

VirtualBox Installation (2/6)

- Execute "*VirtualBox-6.1.2-135663-Win.exe*"

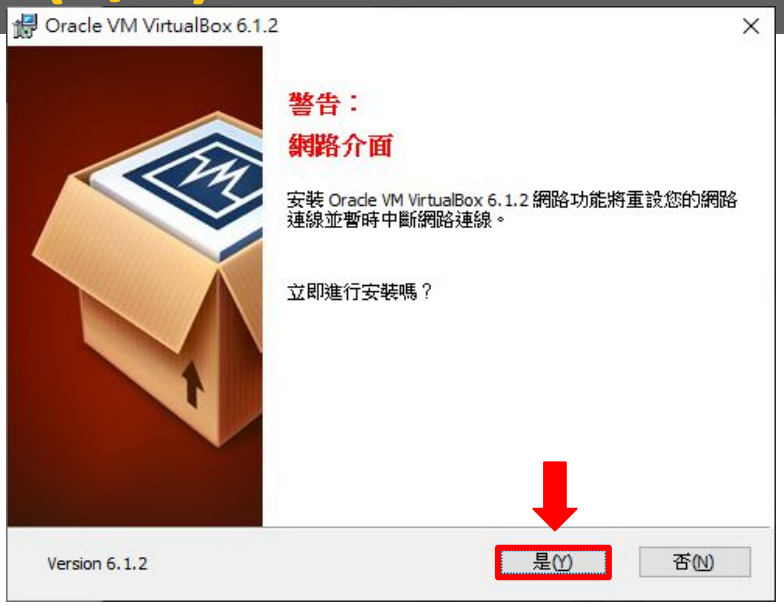


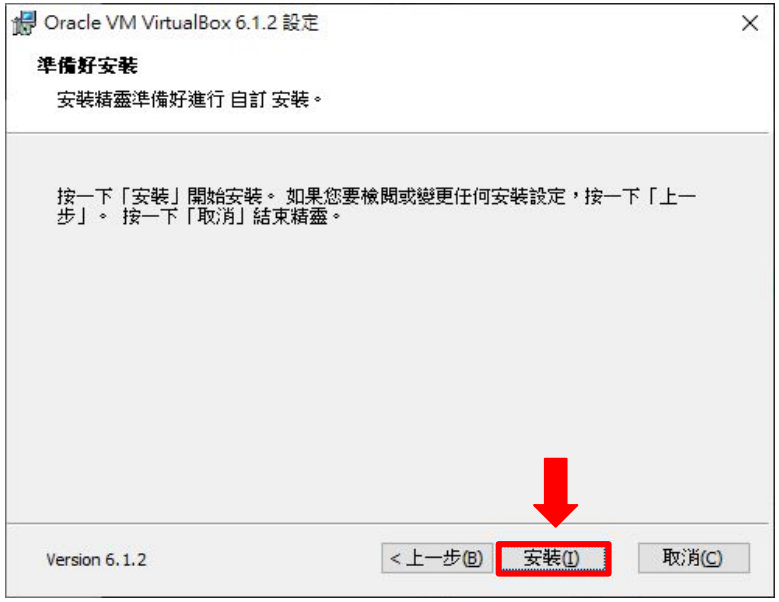
VirtualBox Installation (3/6)

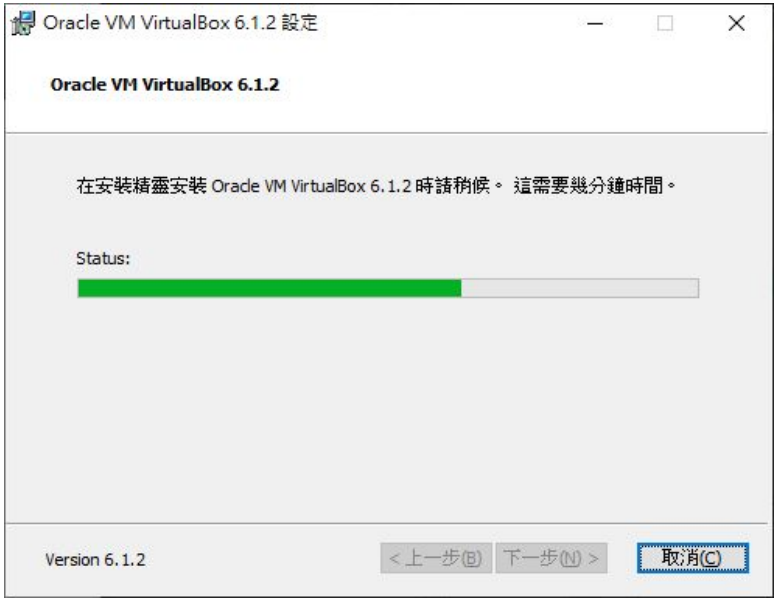
- Choose how you want to install

VirtualBox Installation (4/6)

1. Click “Yes”
2. Click “Install”
3. Wait for installing

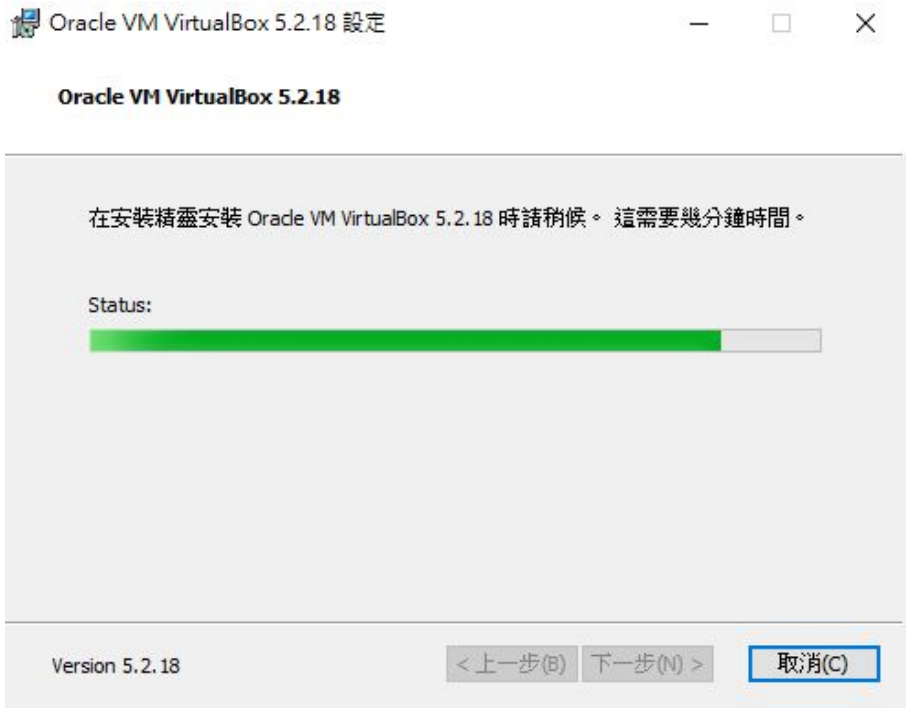






VirtualBox Installation (5/6)

- Click “Always trust software from ‘Oracle Corporation’”
- Waiting



VirtualBox Installation (6/6)

- Click “Finish”

Outline

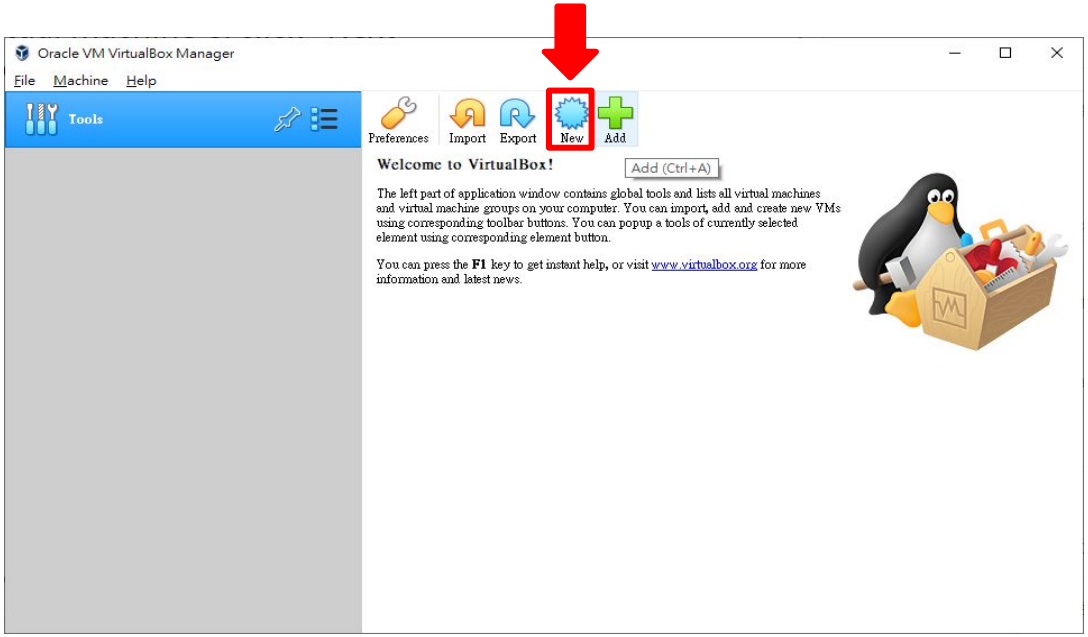
- Experiment Environment
- Installation
  - VirtualBox 6.1.2
  - Add VM
    - Download image file
    - Virtual machine setting
  - Ubuntu 16.04
  - ONOS 2.2.0

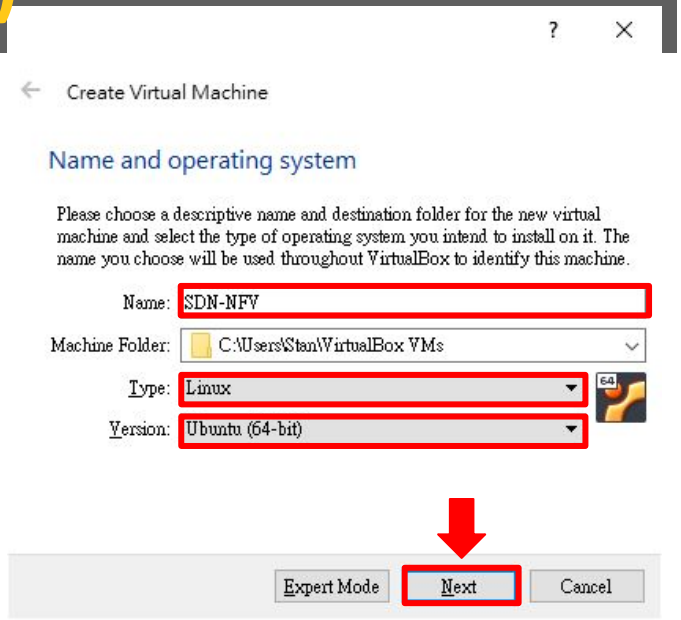
Download image file (1/10)

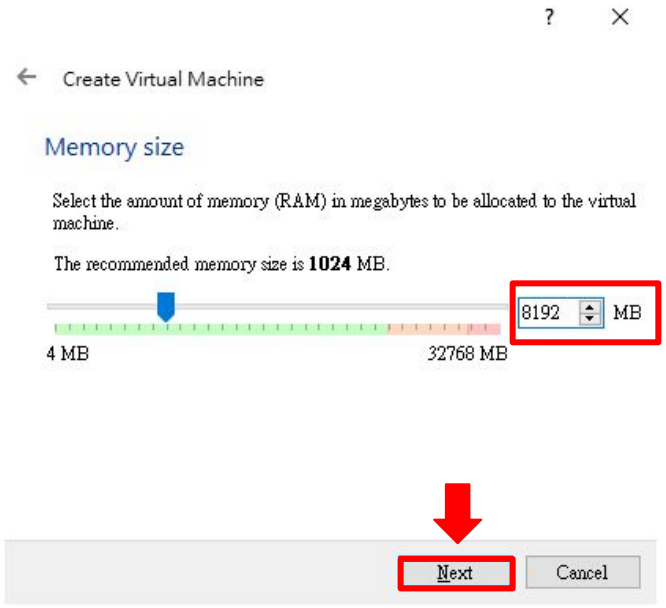
- Download image file (.iso) first
  - https://www.ubuntu-tw.org/modules/tinyd0/
  - Ubuntu Desktop 16.04

Virtual machine setting (2/10)

1. Start VirtualBox & Click “New”
2. Name the virtual machine (SDN-NFV), then click “Next”
3. Adjust the memory size to 8192MB, then click “Next”

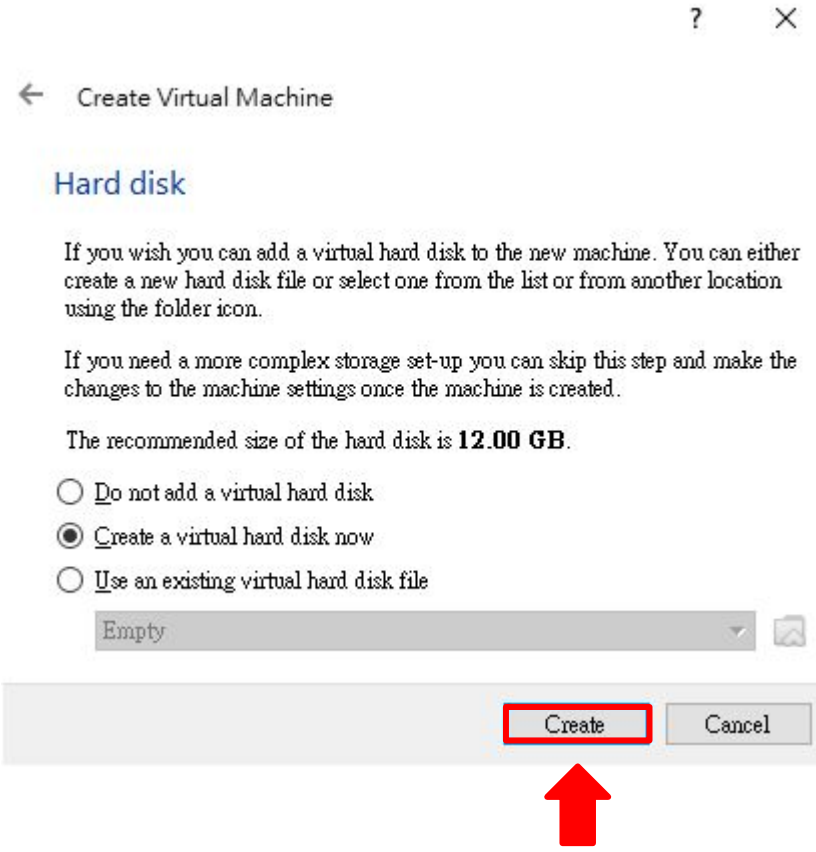


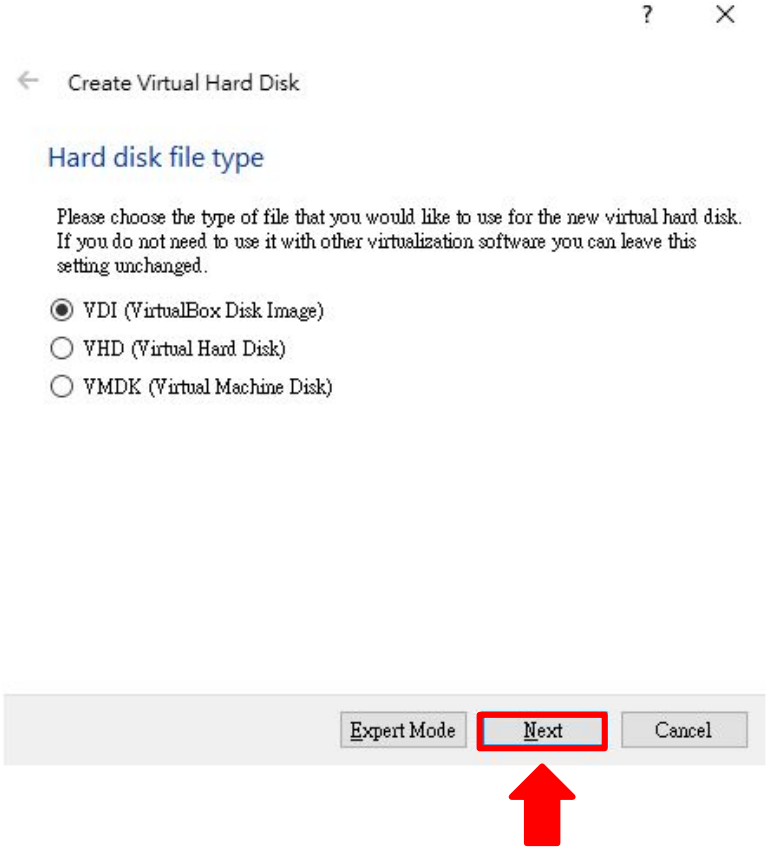




Virtual machine setting (3/10)

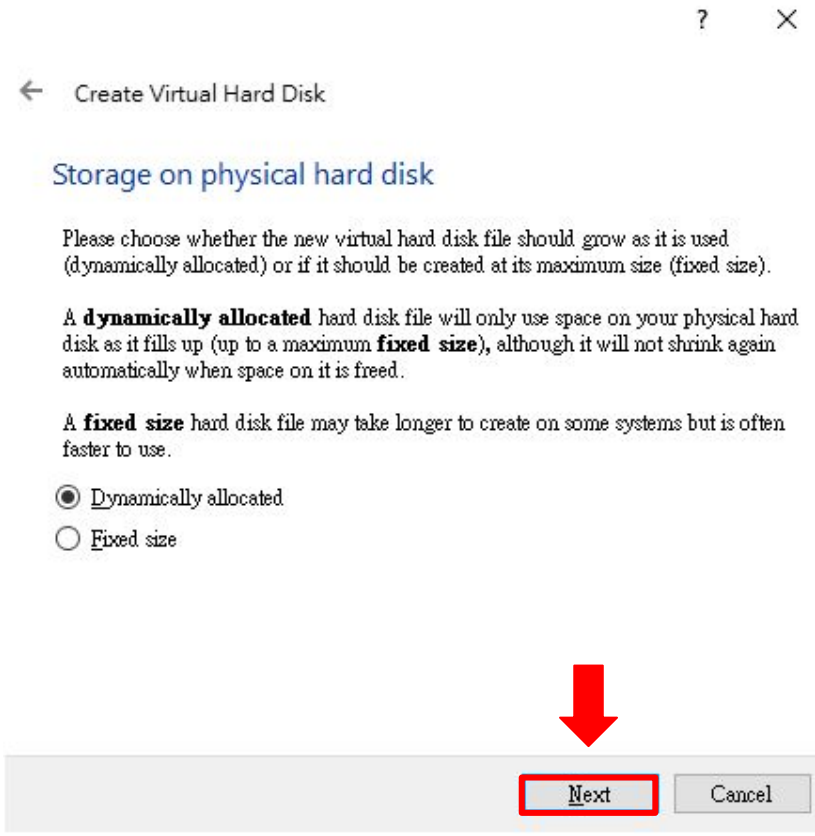
1. Click “Create”
2. Click “Next”

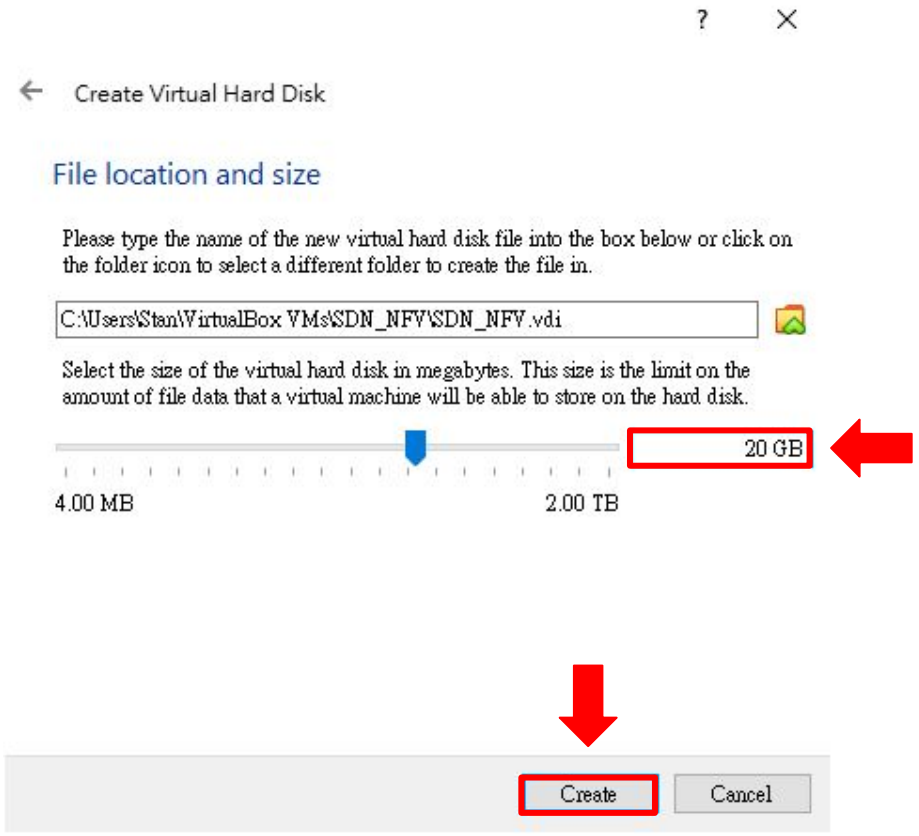




Virtual machine setting (4/10)

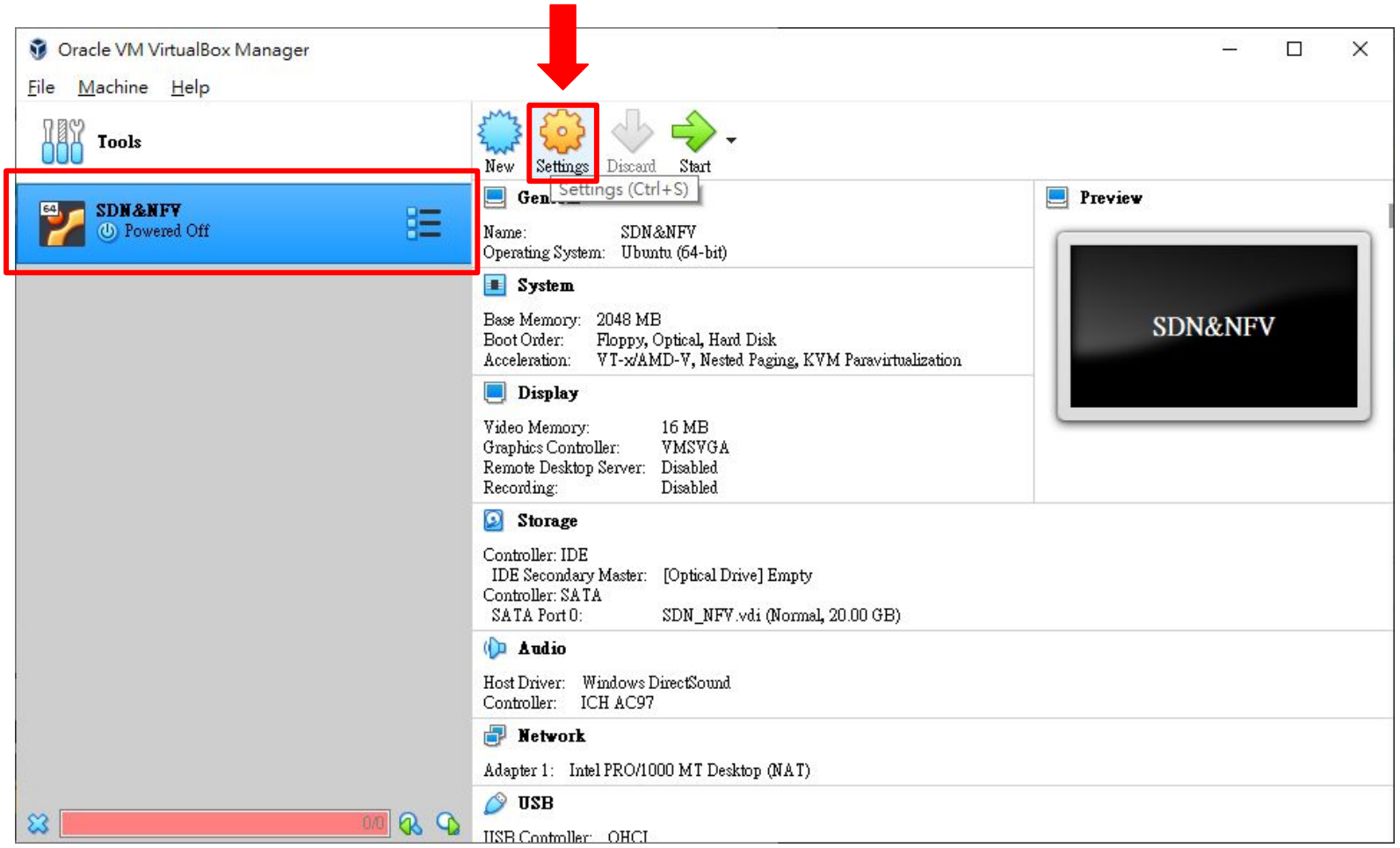
1. Click “Next”
2. Adjust the size of virtual HD to 20GB, then click “Create”





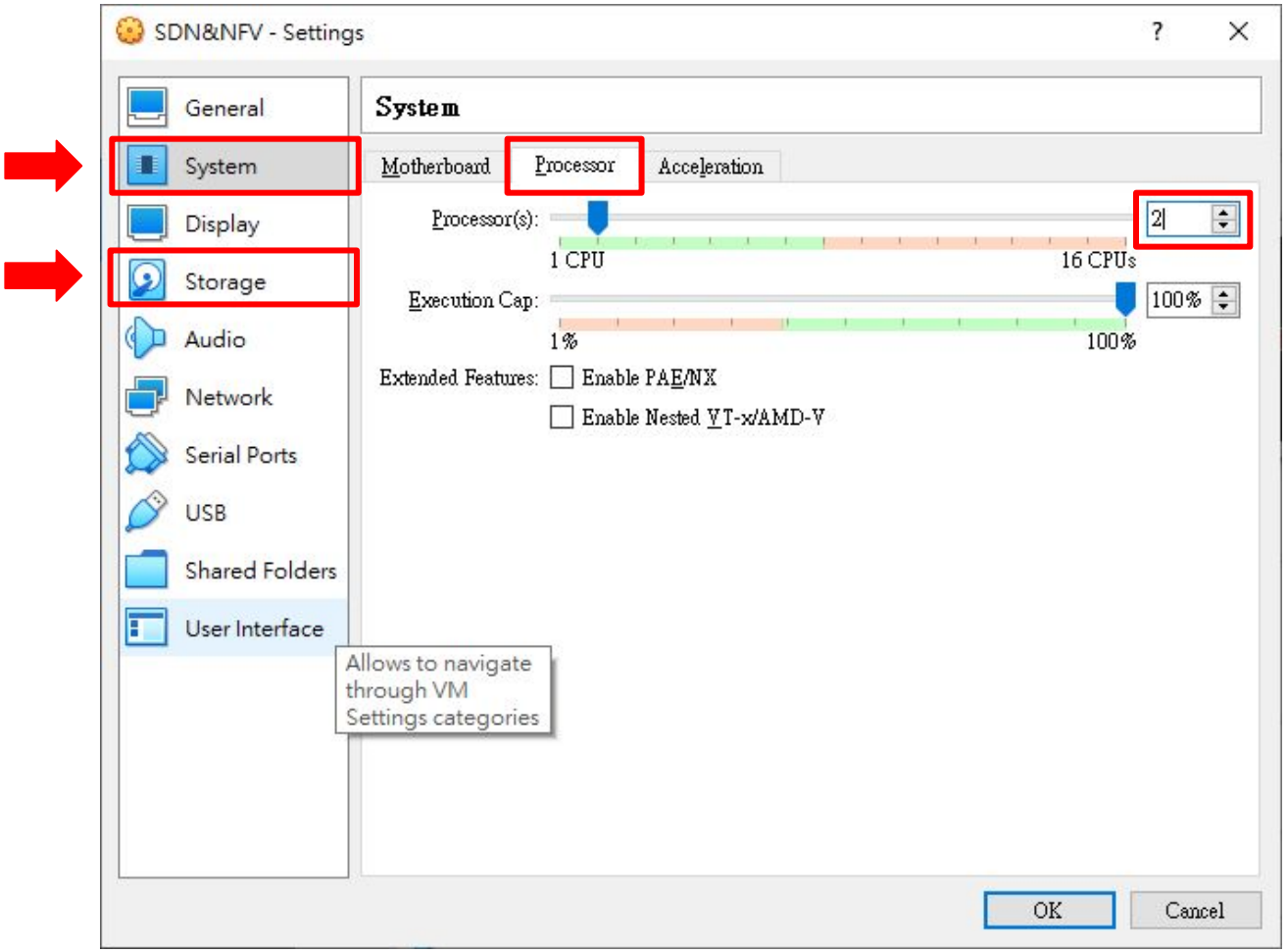
Virtual machine setting (5/10)

- Click “Settings”



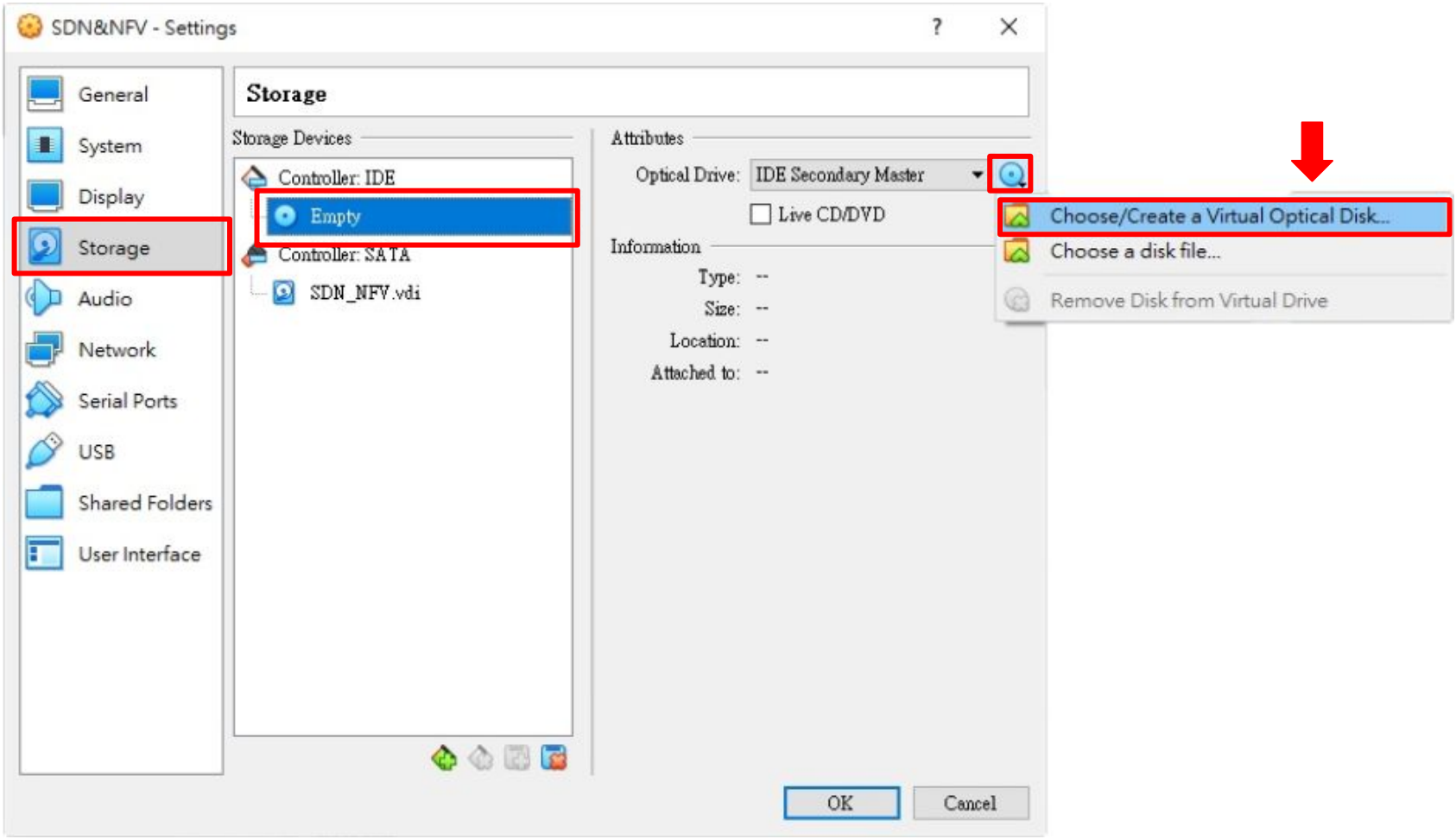
Virtual machine setting (6/10)

- System > Processor
  - Set 2 CPUs, then click “Storage”



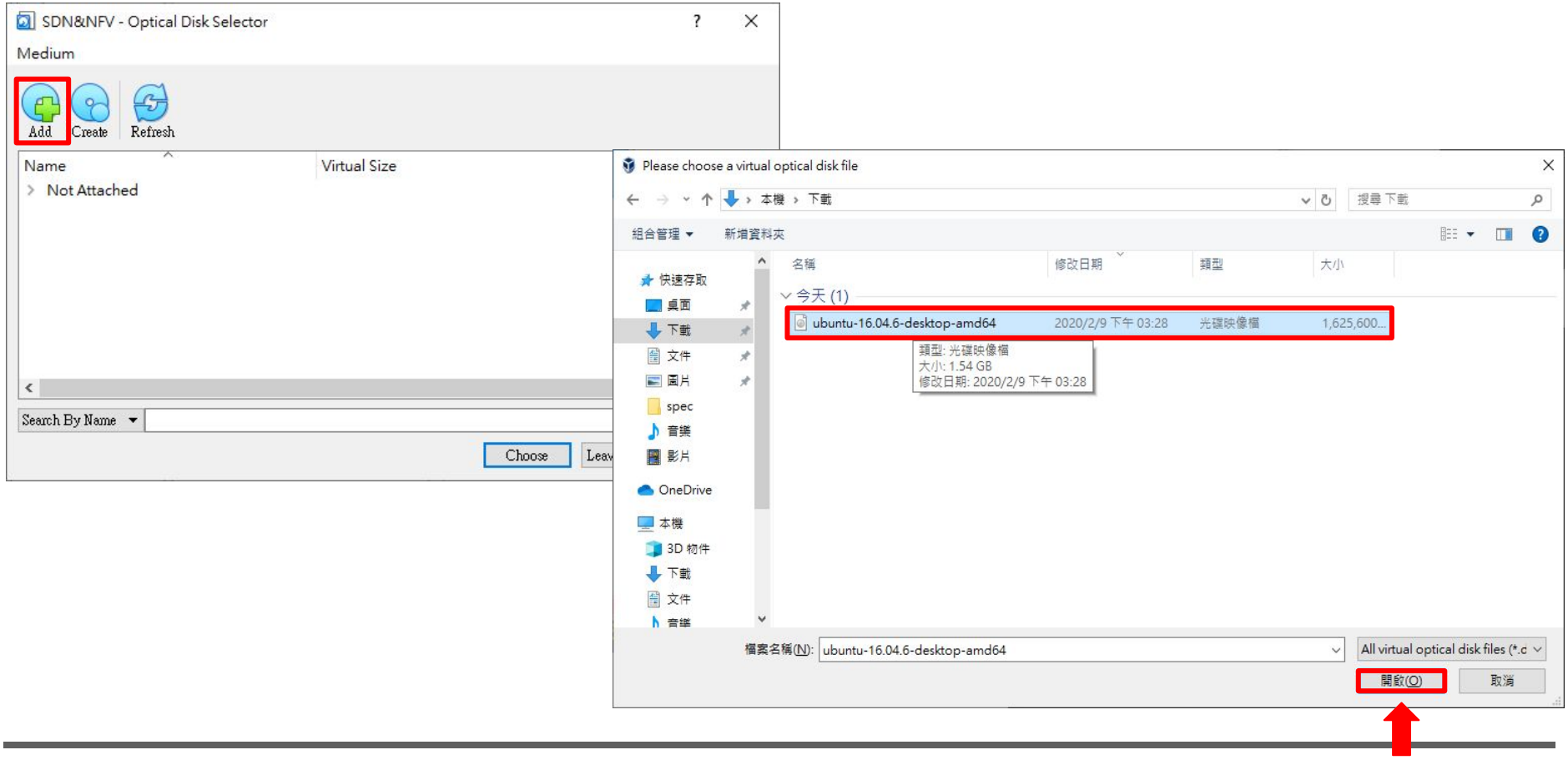
Virtual machine setting (7/10)

- Storage > Controller: IDE



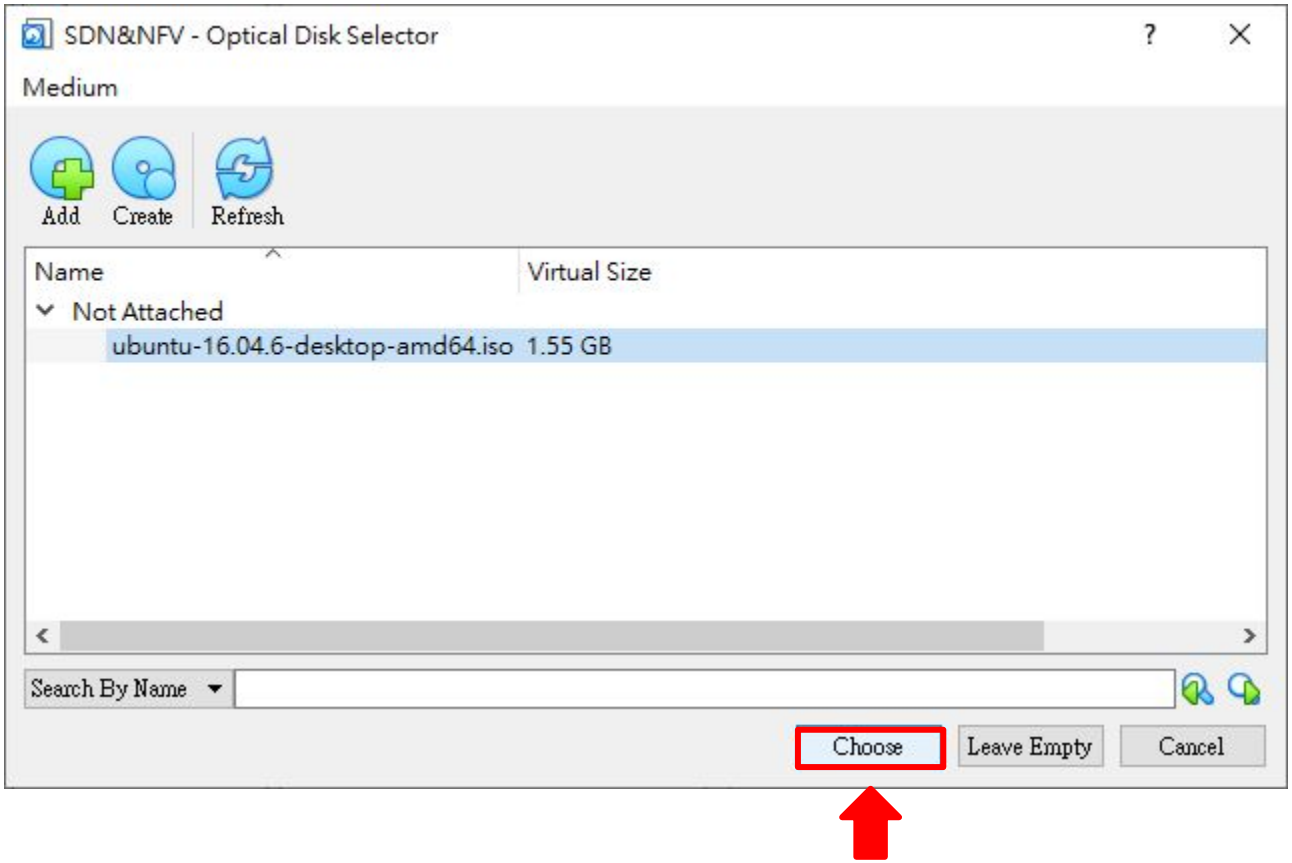
Virtual machine setting (8/10)

1. Click “Add”
2. Choose the previously downloaded image file (.iso)
3. Click “Open”



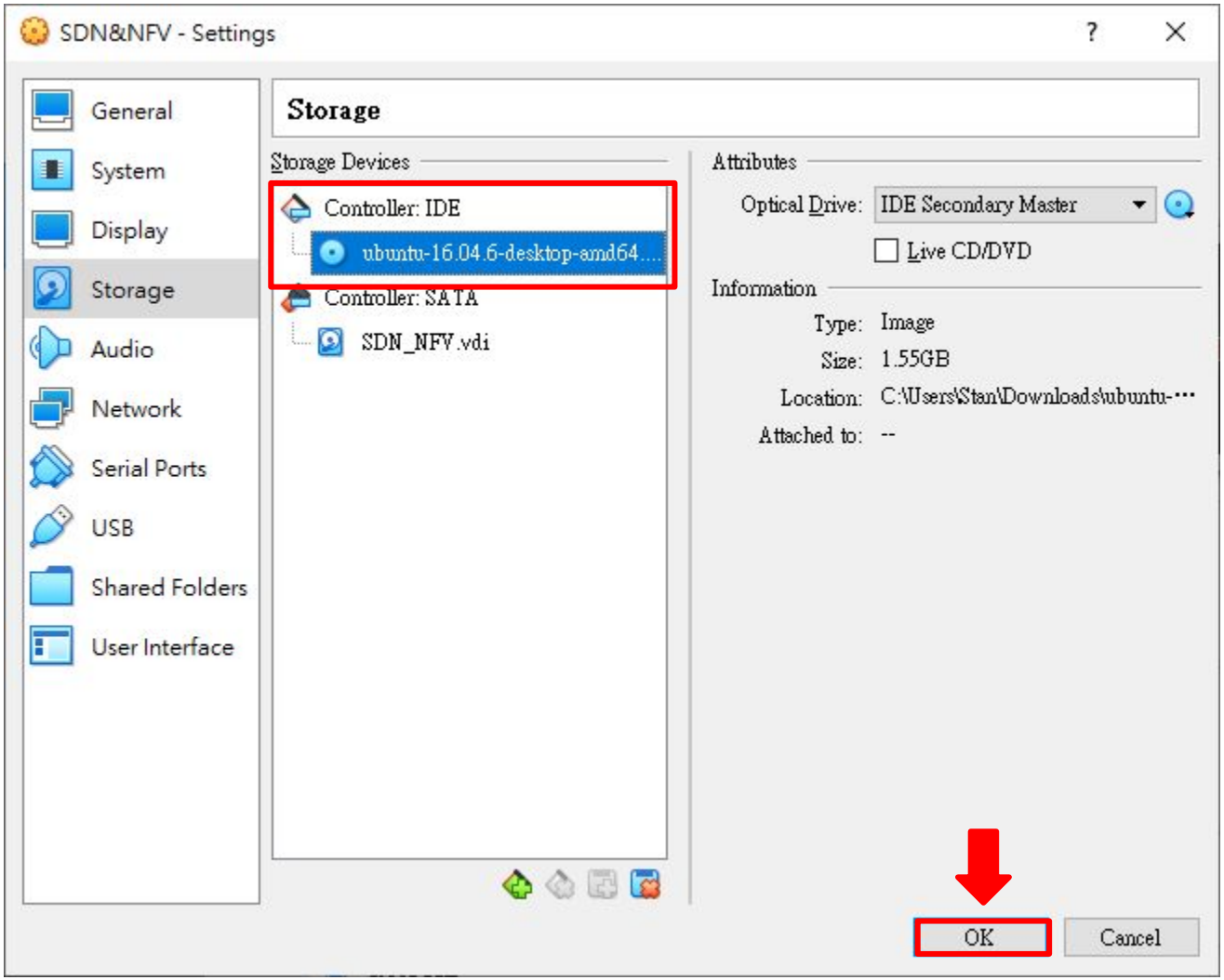
Virtual machine setting (9/10)

- Click “Choose”



Virtual machine setting (10/10)

- Make sure all settings are right, then click “OK”

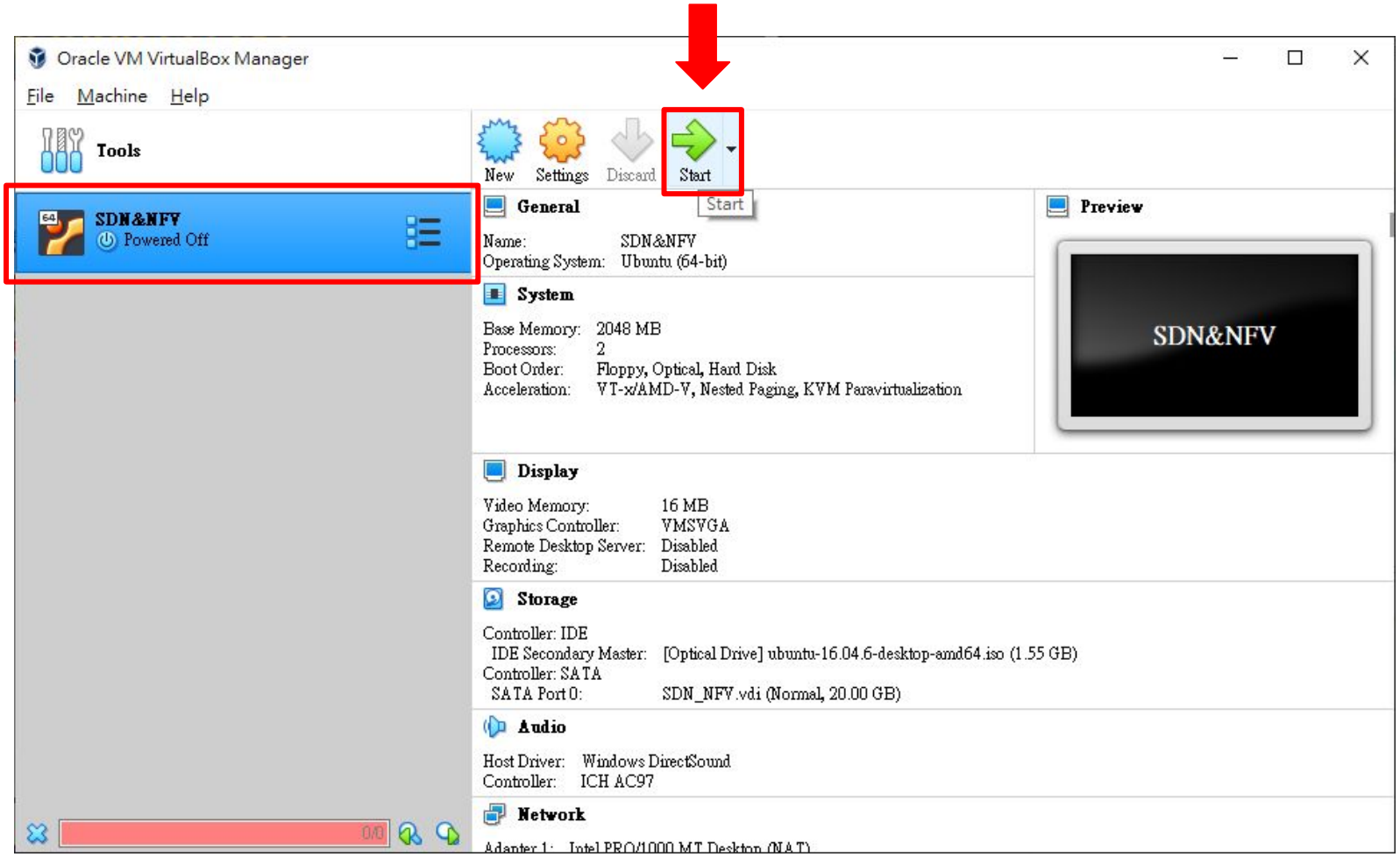


Outline

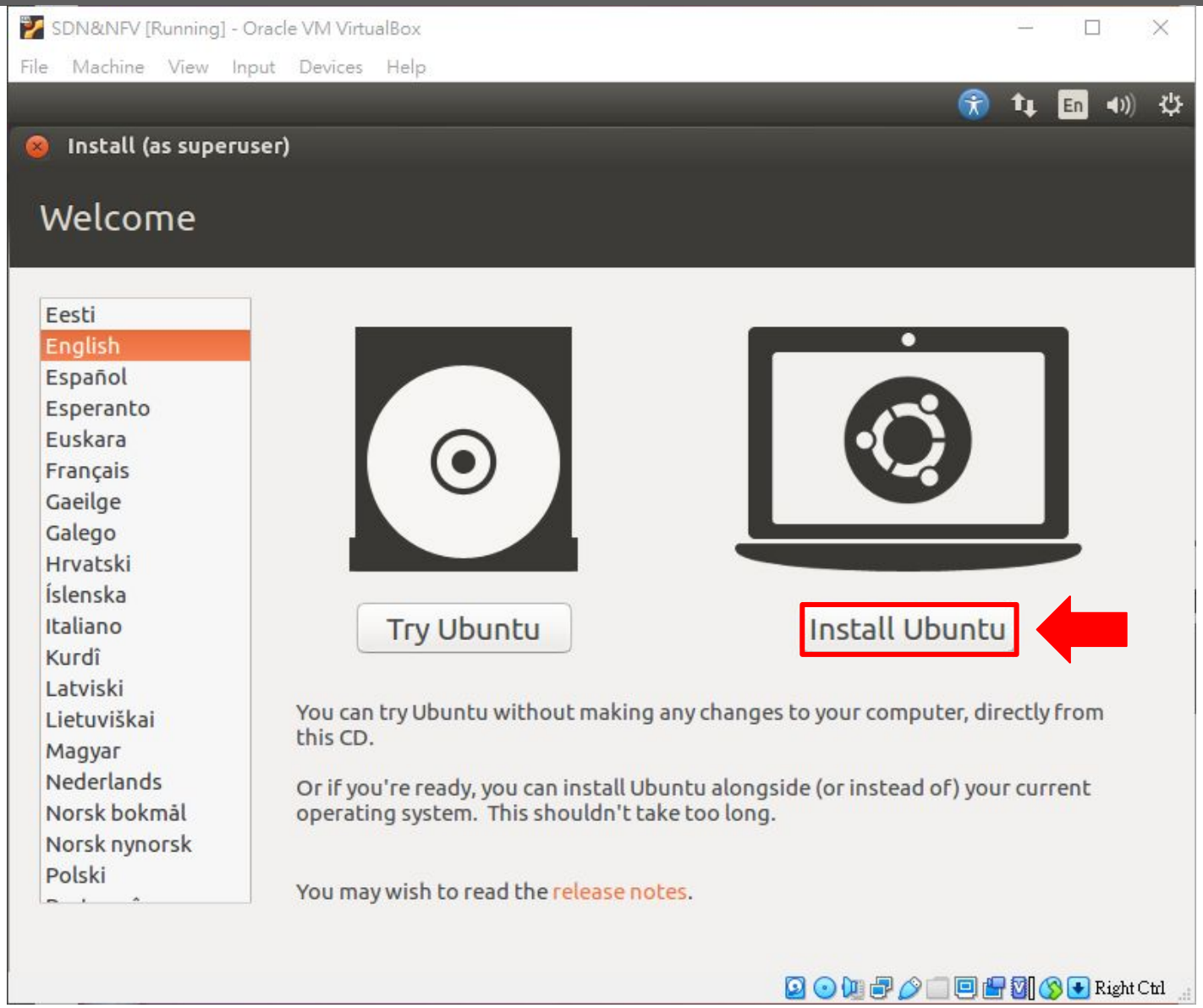
- Experiment Environment
- Installation
  - VirtualBox 6.1.2
  - Add VM
  - Ubuntu 16.04
  - ONOS 2.2.0

Ubuntu Installation (1/12)

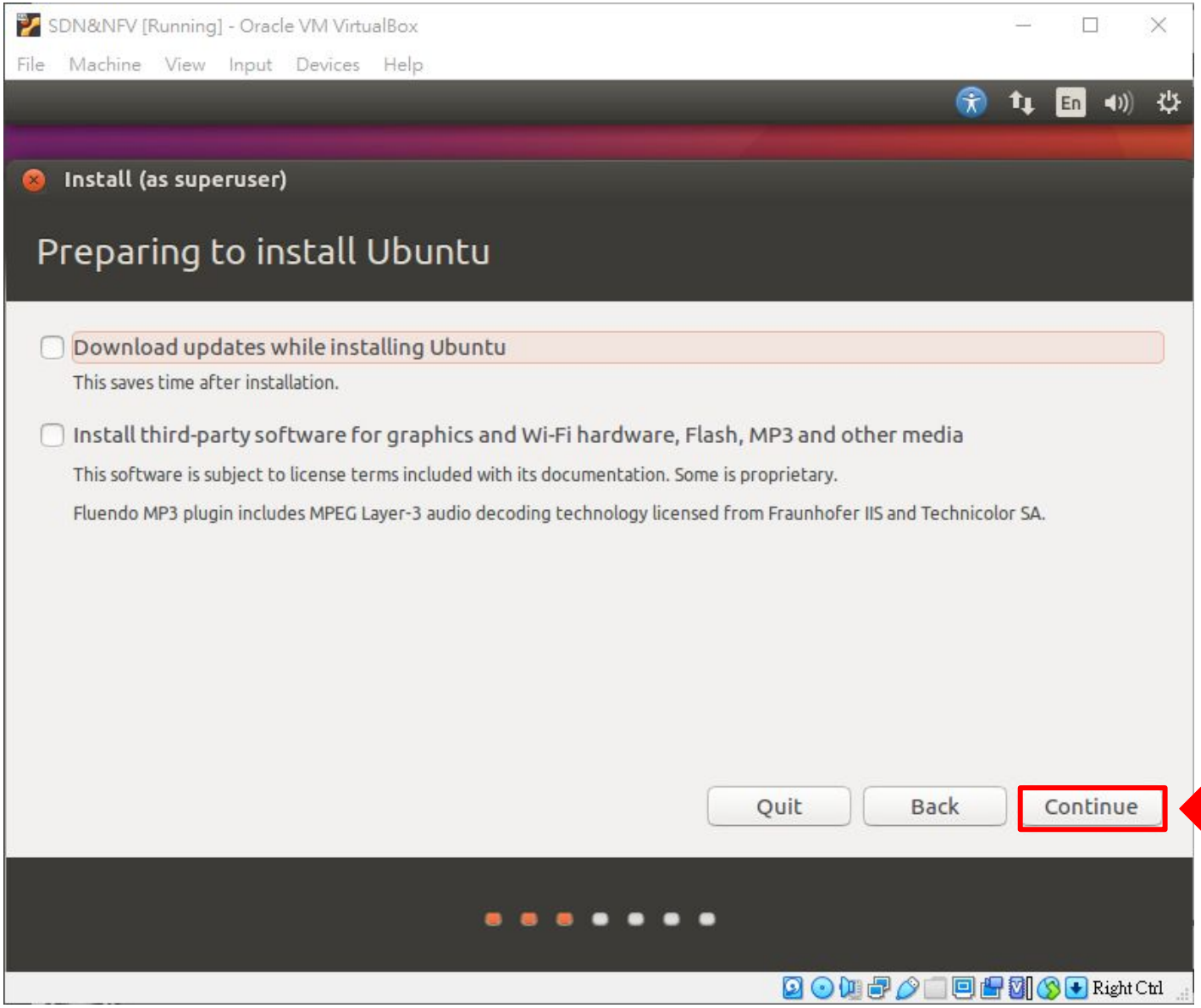
- Click “Start”



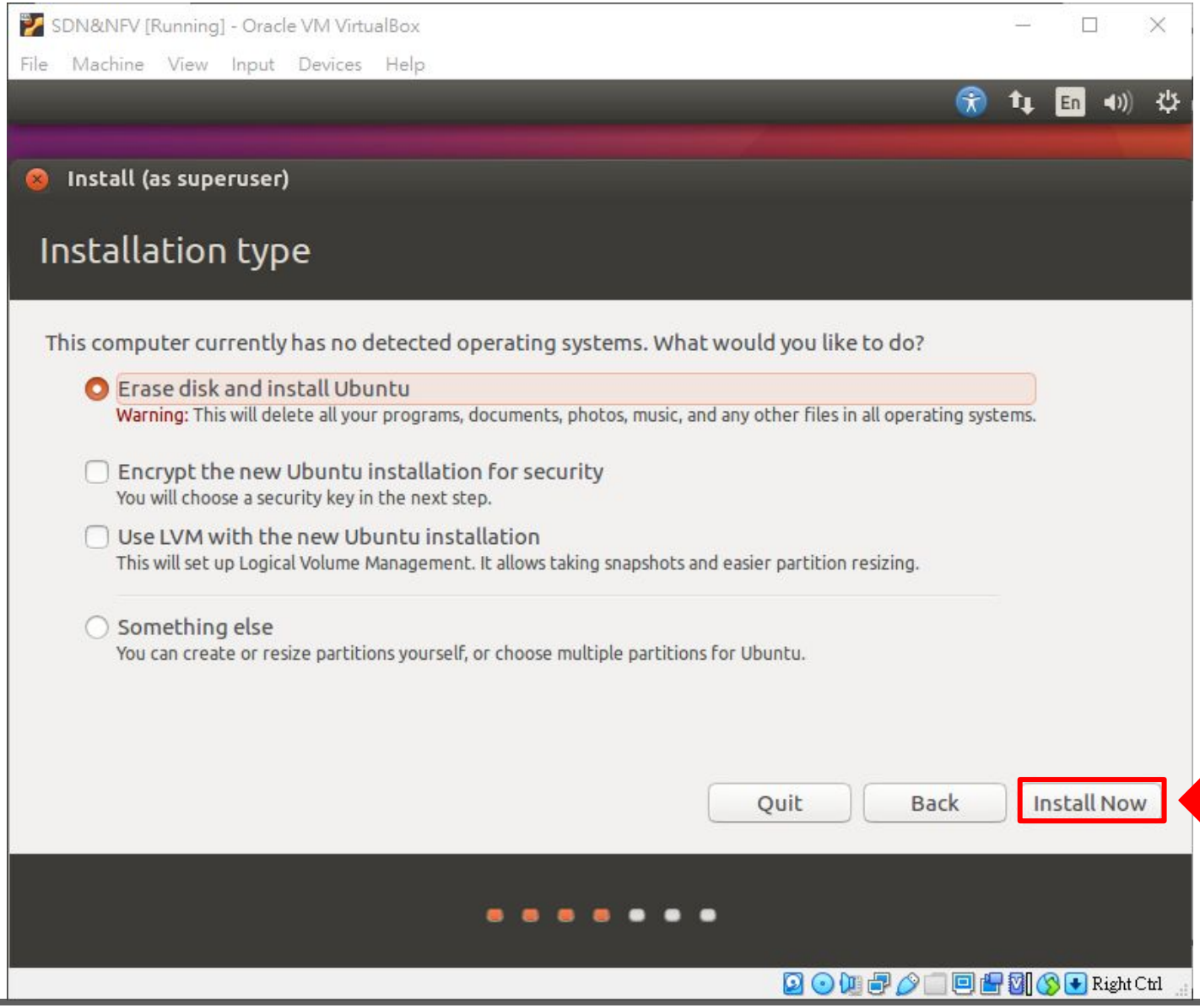
Ubuntu Installation (2/12)



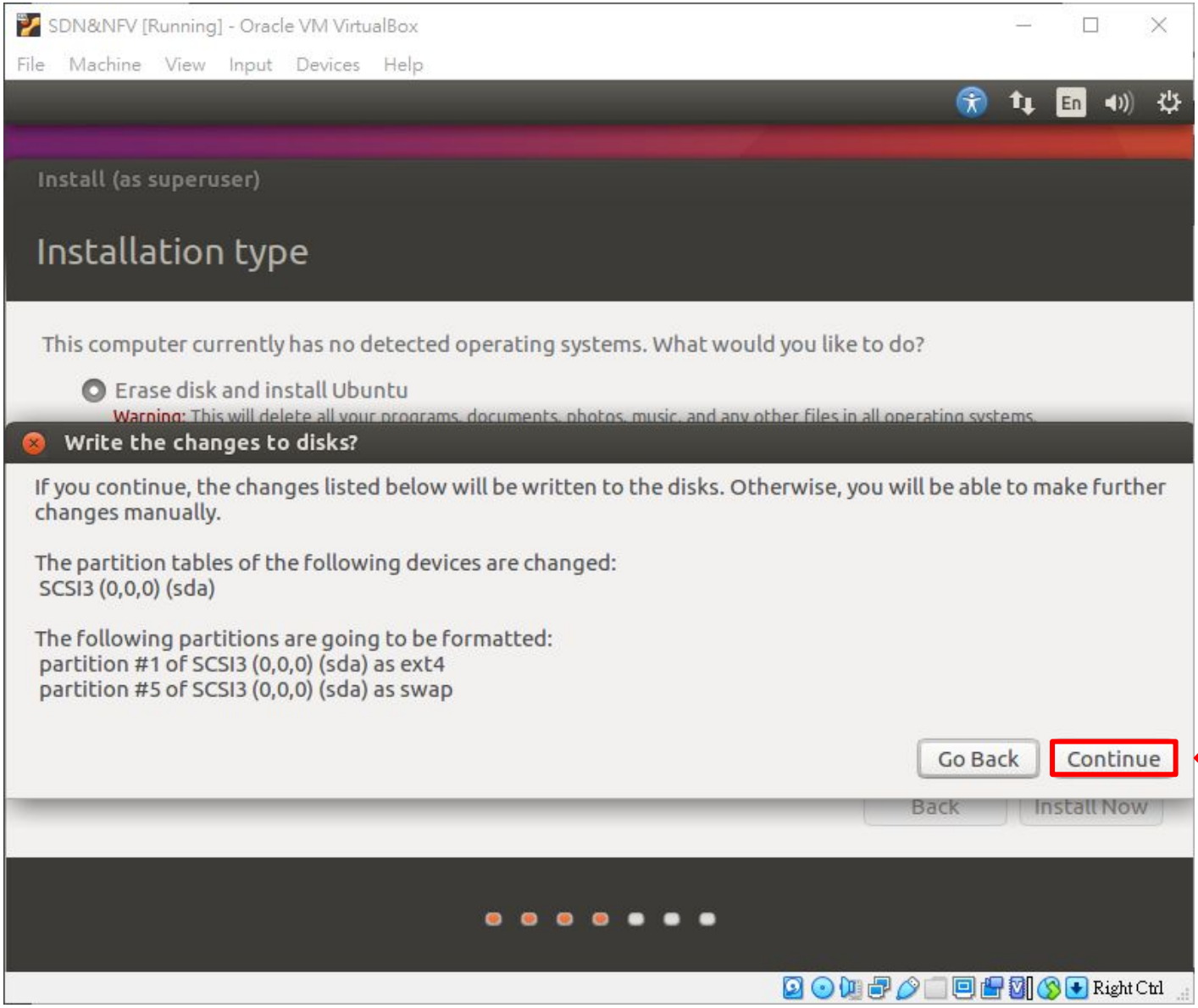
Ubuntu Installation (3/12)



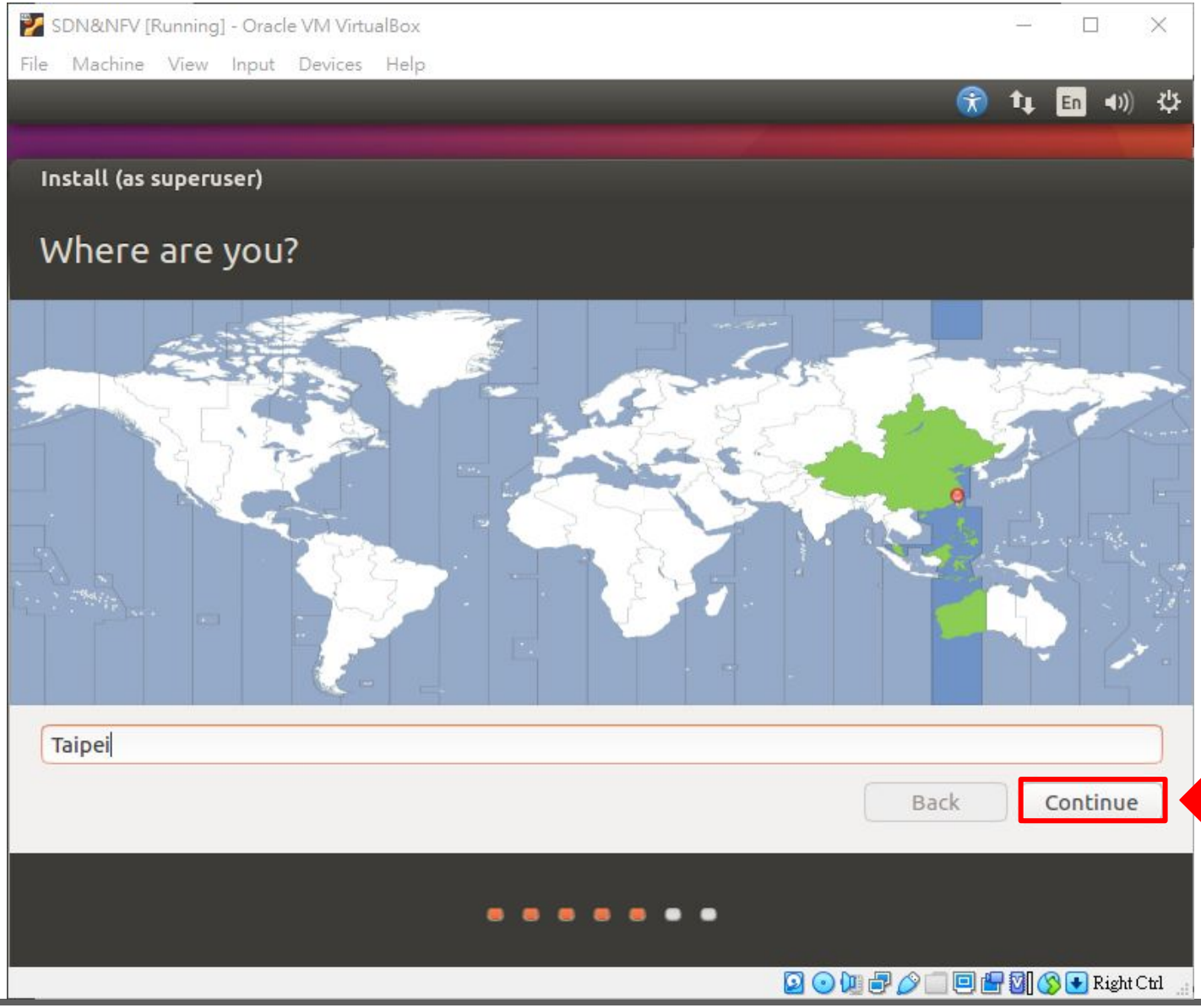
Ubuntu Installation (4/12)



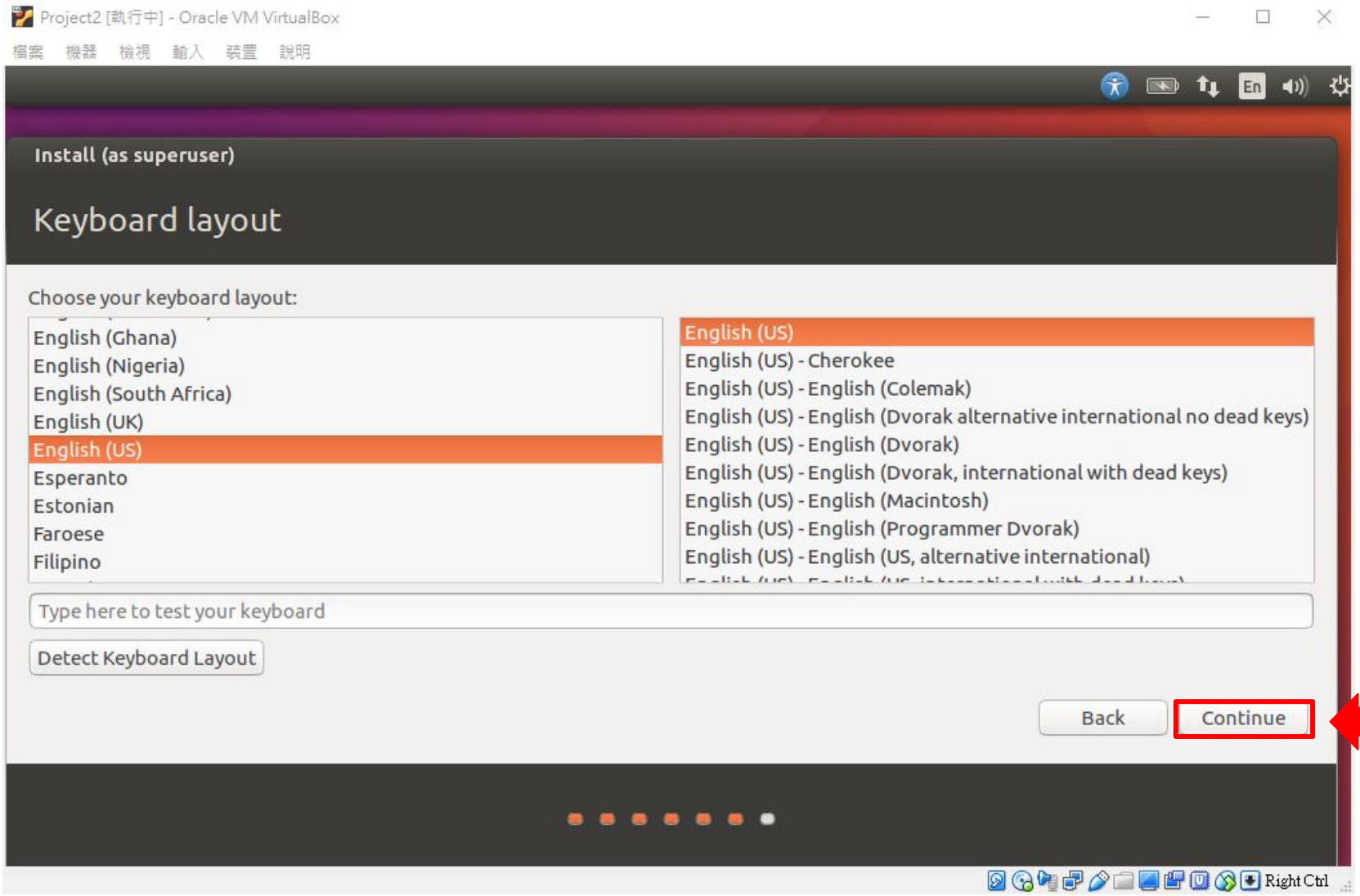
Ubuntu Installation (5/12)



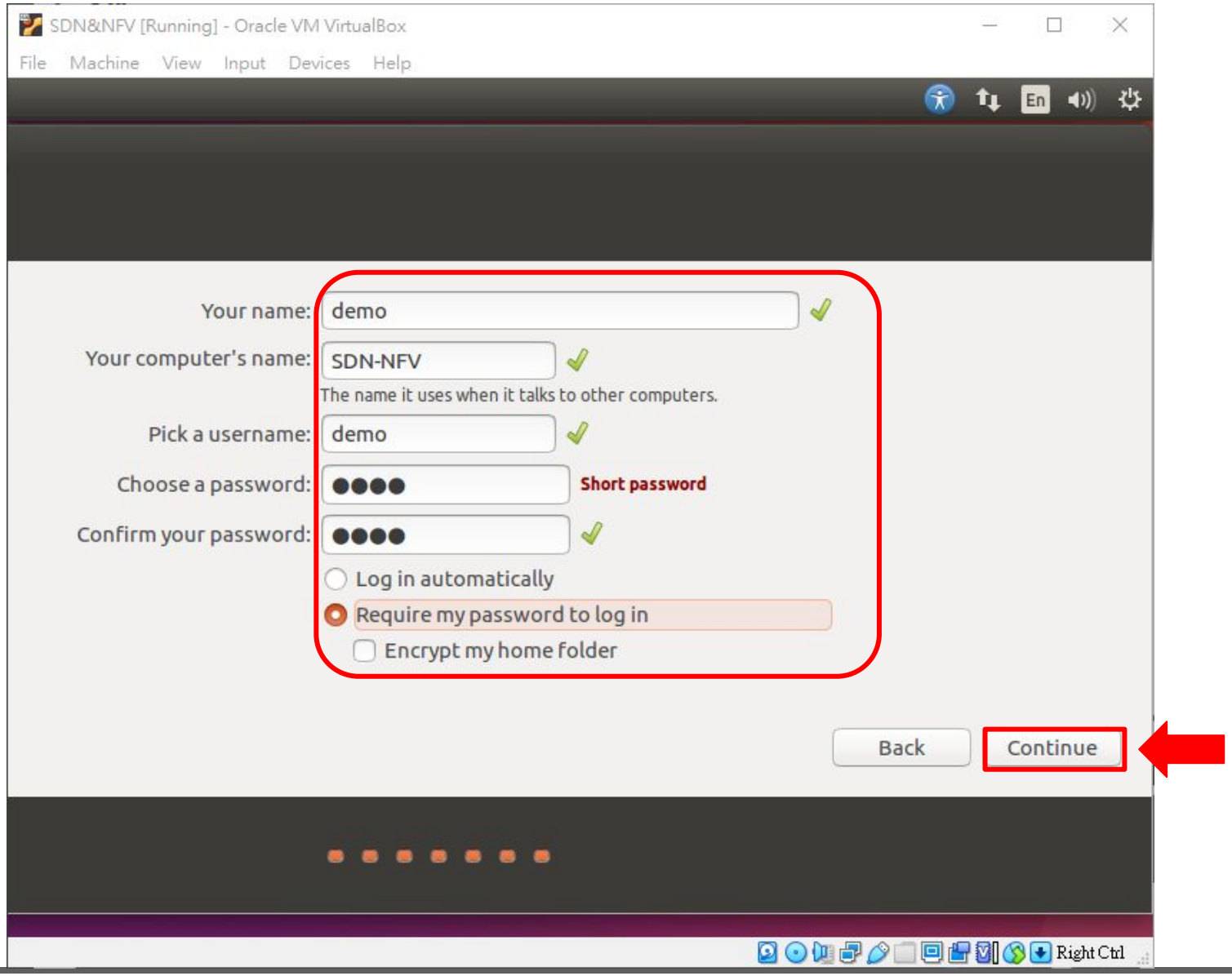
Ubuntu Installation (6/12)



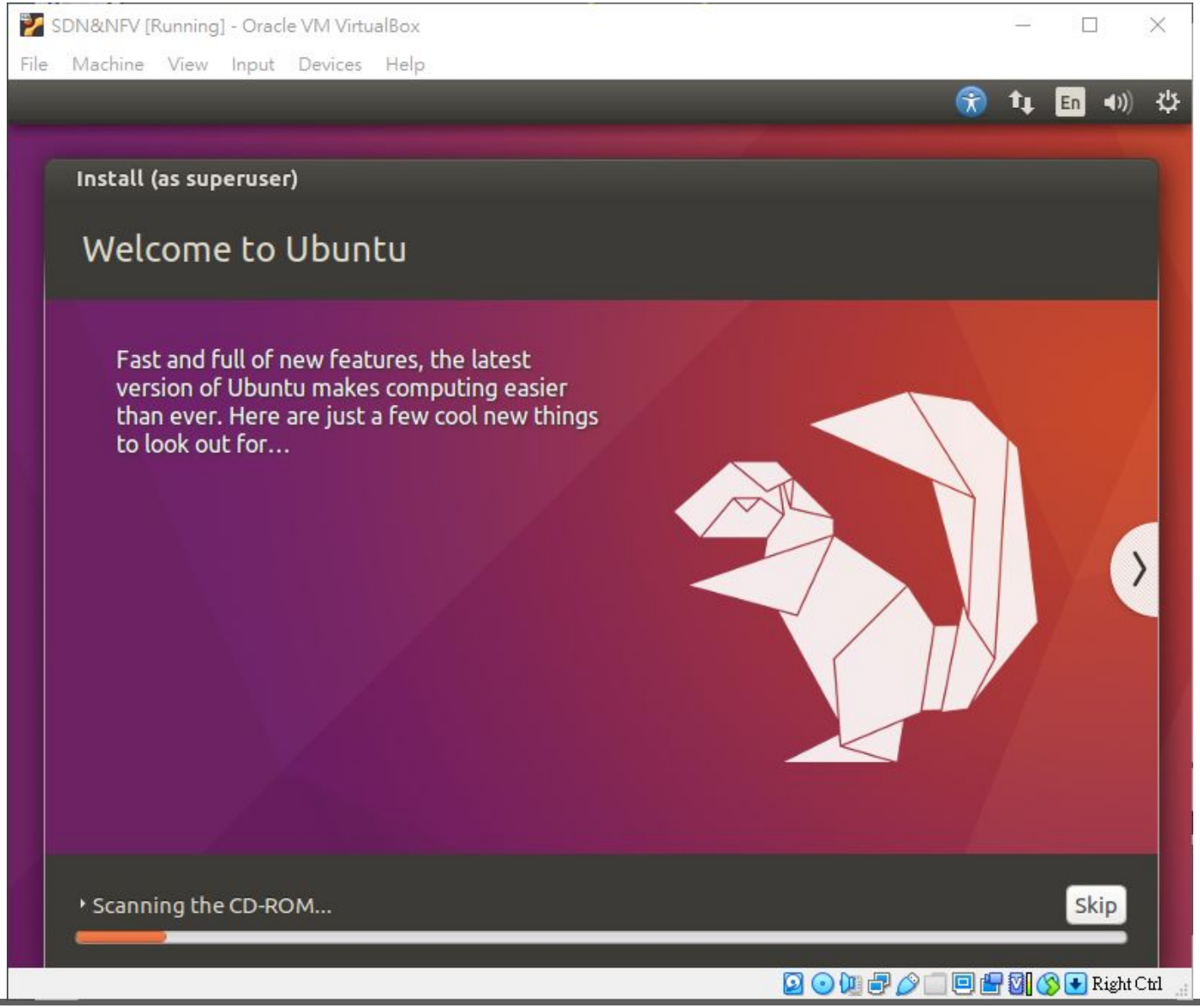
Ubuntu Installation (7/12)



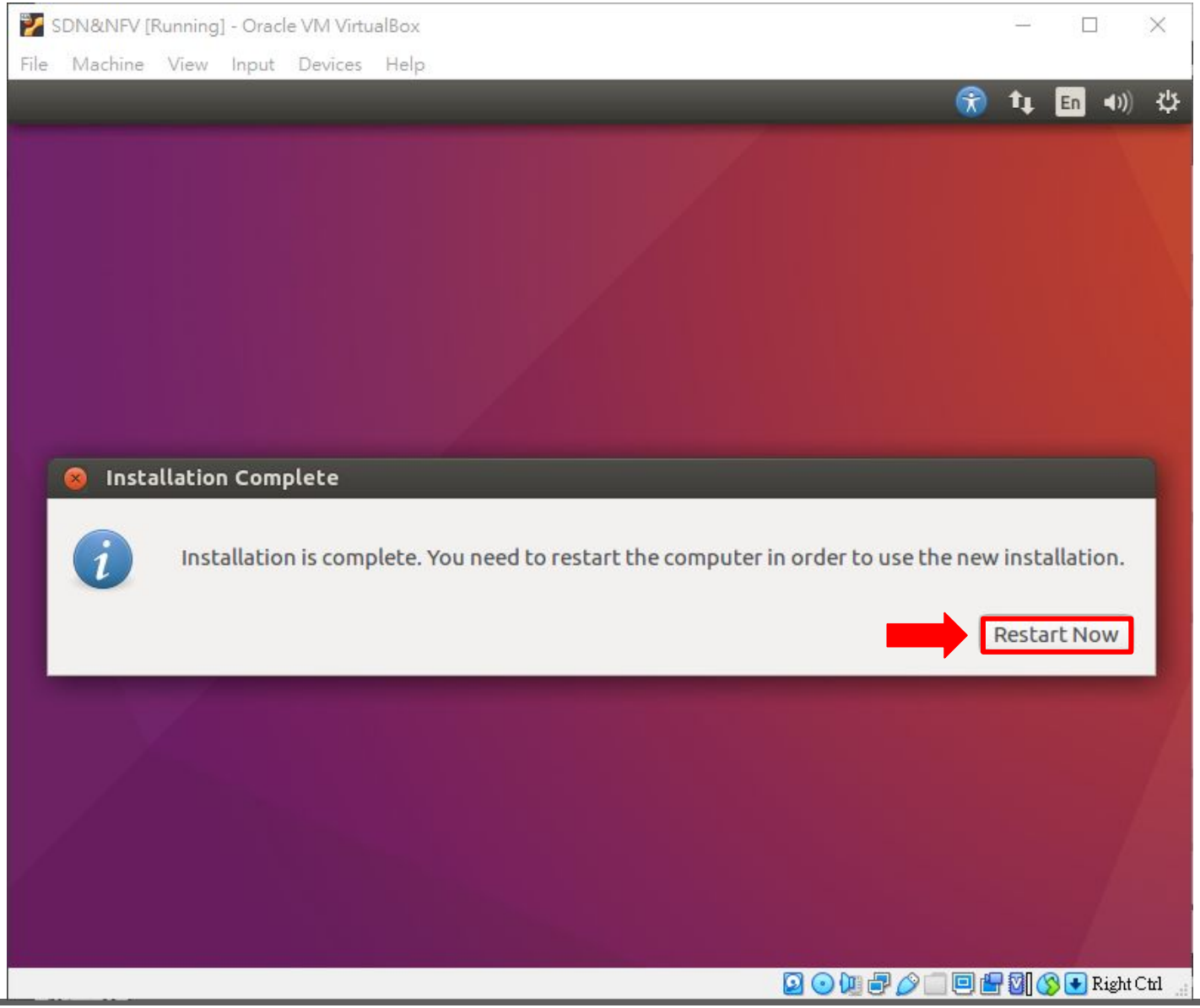
Ubuntu Installation (8/12)



Ubuntu Installation (9/12)

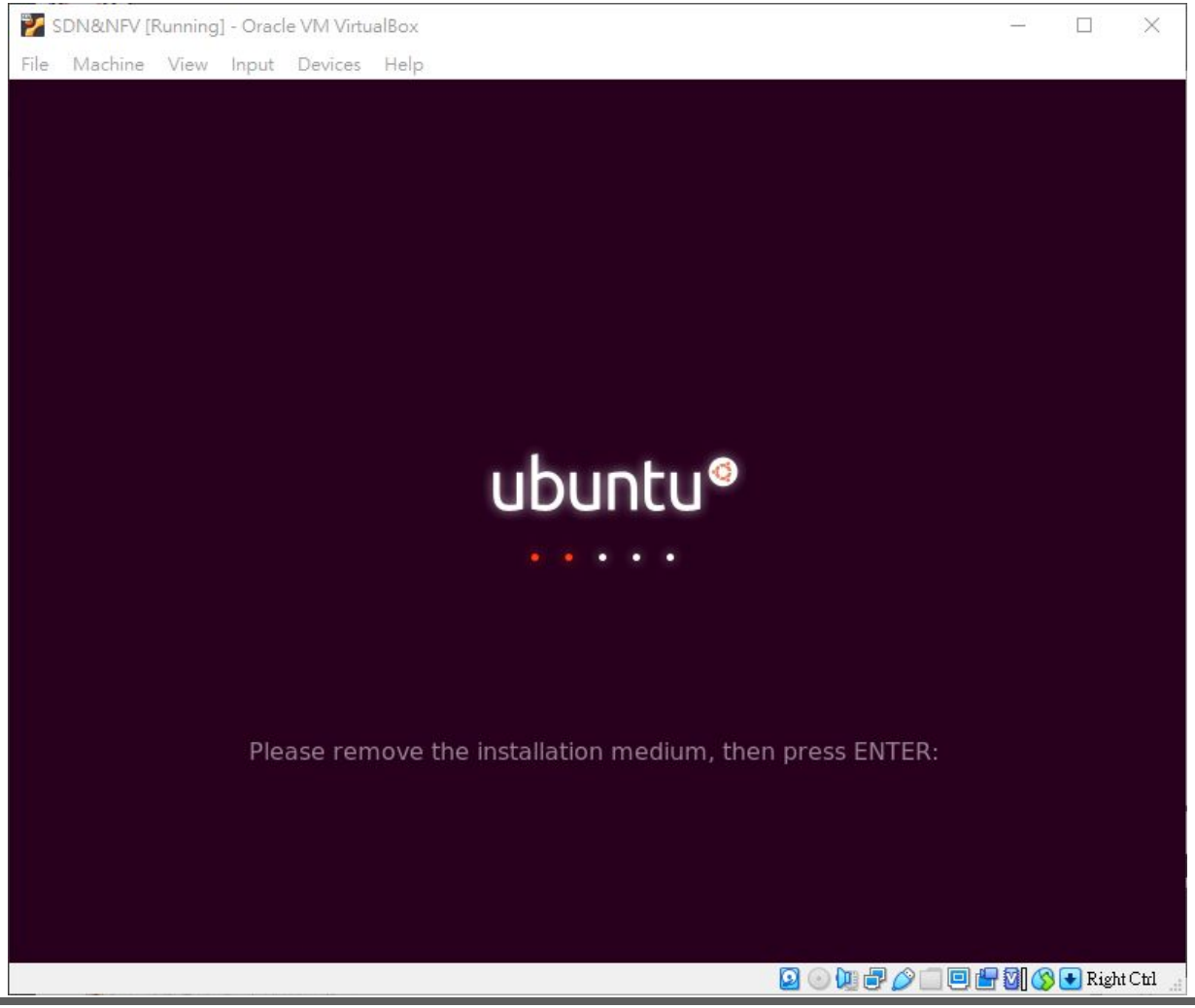


Ubuntu Installation (10/12)

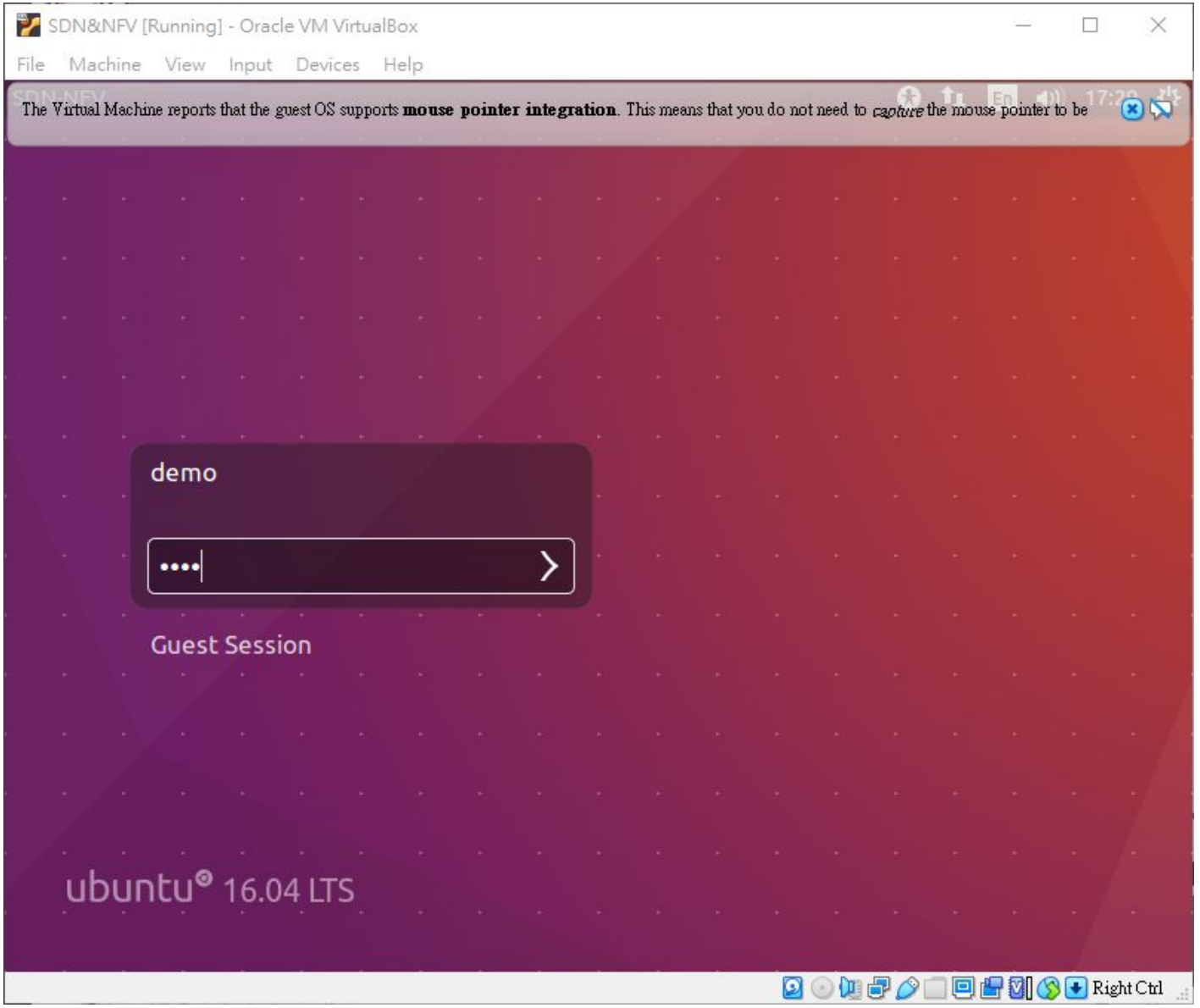


Ubuntu Installation (11/12)

- Press “Enter”, then VM will restart



Ubuntu Installation (12/12)



Outline

- Experiment Environment
- Installation
  - VirtualBox 6.1.2
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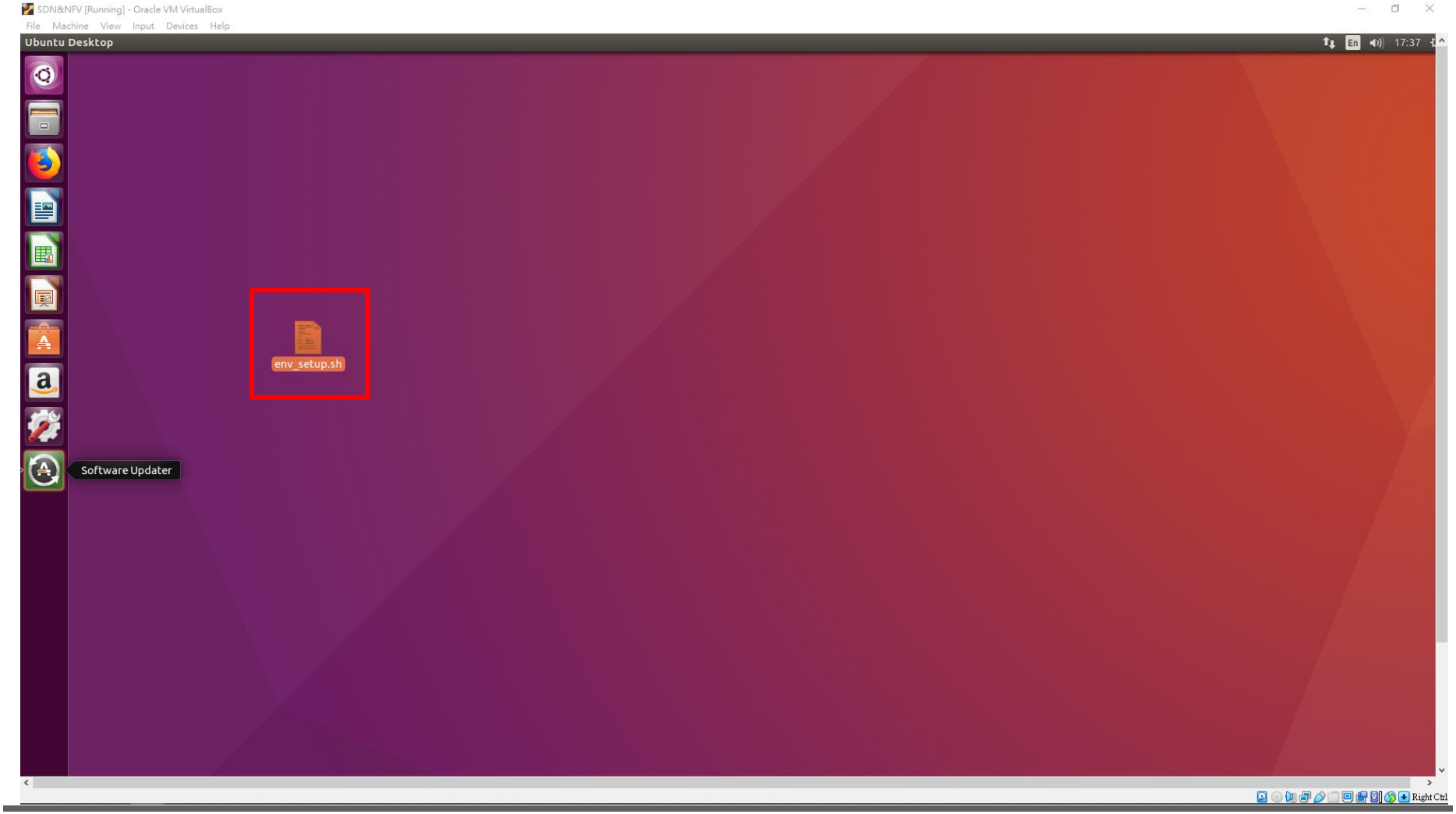
  - ONOS 2.2.0

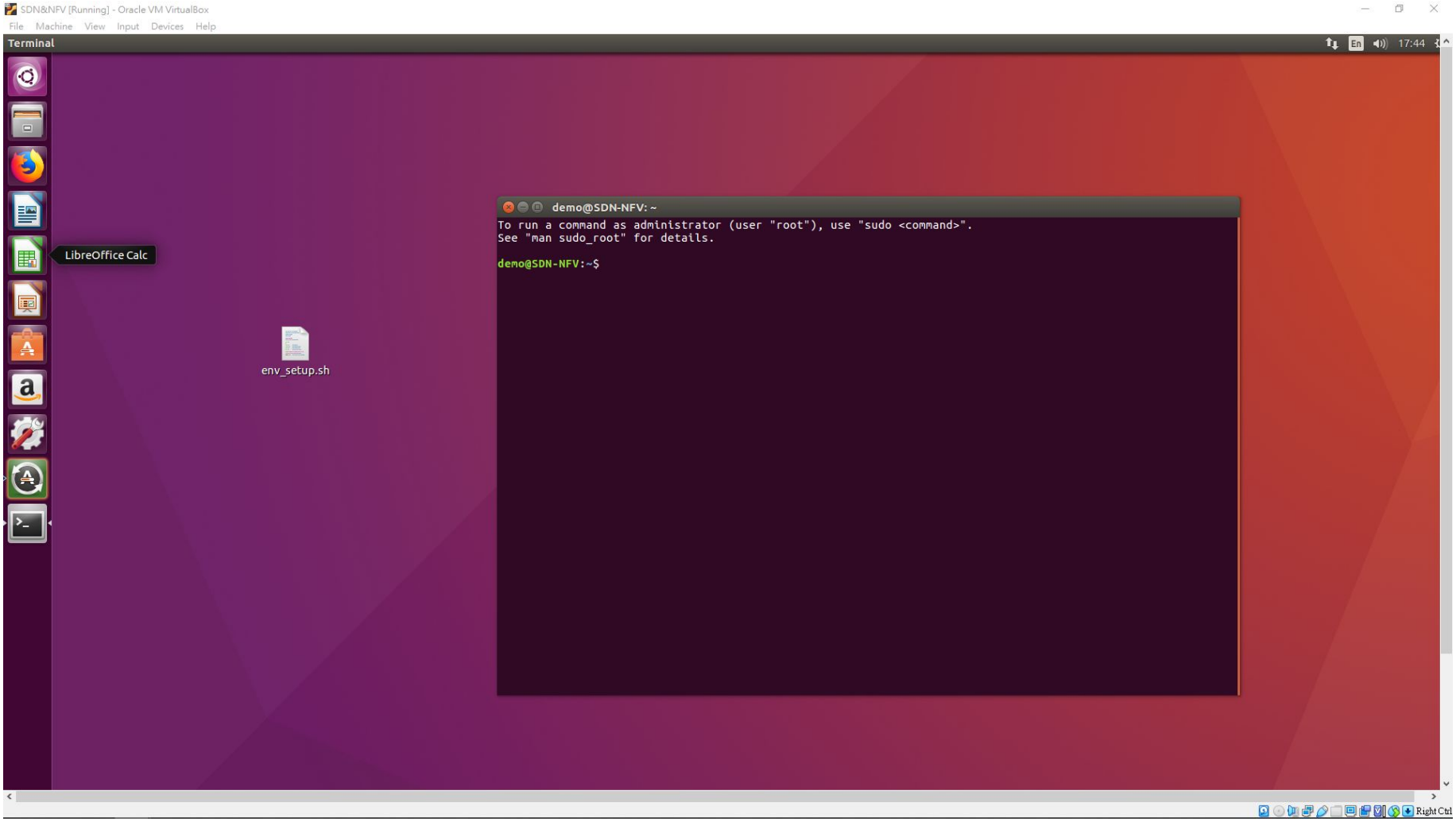
ONOS Installation (1/7)

- Download “*env_setup.sh*” from e3



ONOS Installation (2/7)

- Open terminal



ONOS Installation (3/7)

- Go to directory where the “env_setup.sh” is

  `$ cd ~/Desktop`

- Change file permission to execute

  `$ chmod +x env_setup.sh`

- Execute the shell script

  `$ ./env_setup.sh`

```
demo@SDN-NFV:~$ cd ~/Desktop/
demo@SDN-NFV:~/Desktop$ chmod +x env_setup.sh
demo@SDN-NFV:~/Desktop$ ./env_setup.sh
[sudo] password for demo:
```

ONOS Installation (4/7)

- Shell script will automatically install:
  - Bazel 0.27.0
  - ONOS 2.2.0
  - Mininet
  - OvS 2.11.0

```
demo@SDN-NFV:~/Downloads$ ./env_setup.sh
[sudo] password for demo:
Hit:1 http://tw.archive.ubuntu.com/ubuntu xenial InRelease
Hit:2 http://tw.archive.ubuntu.com/ubuntu xenial-updates InRelease
Hit:3 http://tw.archive.ubuntu.com/ubuntu xenial-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu xenial-security InRelease
Reading package lists... Done
Building dependency tree
Reading state information... Done
317 packages can be upgraded. Run 'apt list --upgradable' to see them.
[*] Begin to install Bazel...
Reading package lists... Done
Building dependency tree
Reading state information... Done
g++ is already the newest version (4:5.3.1-1ubuntu1).
pkg-config is already the newest version (0.29.1-0ubuntu1).
python3 is already the newest version (3.5.1-3).
unzip is already the newest version (6.0-20ubuntu1).
zip is already the newest version (3.0-11).
The following additional packages will be installed:
  zlib1g
The following NEW packages will be installed:
  zlib1g-dev
The following packages will be upgraded:
  zlib1g
1 upgraded, 1 newly installed, 0 to remove and 316 not upgraded.
Need to get 218 kB of archives.
After this operation, 424 kB of additional disk space will be used.
Get:1 http://tw.archive.ubuntu.com/ubuntu xenial-updates/main amd64 zlib1g amd64 1:1.2.8.dfsg-2ubuntu4.3 [51.2 kB]
Get:2 http://tw.archive.ubuntu.com/ubuntu xenial-updates/main amd64 zlib1g-dev amd64 1:1.2.8.dfsg-2ubuntu4.3 [167 kB]
Fetched 218 kB in 0s (3860 kB/s)
(Reading database ... 177098 files and directories currently installed.)
Preparing to unpack .../zlib1g_1%3a1.2.8.dfsg-2ubuntu4.3_amd64.deb ...
Unpacking zlib1g:amd64 (1:1.2.8.dfsg-2ubuntu4.3) over (1:1.2.8.dfsg-2ubuntu4.1) ...
Processing triggers for libc-bin (2.23-0ubuntu11) ...
Setting up zlib1g:amd64 (1:1.2.8.dfsg-2ubuntu4.3) ...
Processing triggers for libc-bin (2.23-0ubuntu11) ...
Selecting previously unselected package zlib1g-dev:amd64.
(Reading database ... 177098 files and directories currently installed.)
Preparing to unpack .../zlib1g-dev_1%3a1.2.8.dfsg-2ubuntu4.3_amd64.deb ...
Unpacking zlib1g-dev:amd64 (1:1.2.8.dfsg-2ubuntu4.3) ...
Processing triggers for man-db (2.7.5-1) ...
Setting up zlib1g-dev:amd64 (1:1.2.8.dfsg-2ubuntu4.3) ...
```

ONOS Installation (5/7)

- Ignore those Error messages

```
Setting up curl (7.47.0-1ubuntu2.14) ...
Setting up liberror-perl (0.17-1.2) ...
Setting up git-man (1:2.7.4-0ubuntu1.7) ...
Setting up git (1:2.7.4-0ubuntu1.7) ...
Processing triggers for libc-bin (2.23-0ubuntu11) ...
Cloning into 'onos'...
remote: Counting objects: 177, done
remote: Finding sources: 100% (580274/580274)
remote: Total 580274 (delta 232665), reused 580229 (delta 232665)
Receiving objects: 100% (580274/580274), 174.82 MiB | 6.40 MiB/s, done.
Resolving deltas: 100% (232665/232665), done.
Checking connectivity... done.
Note: checking out '2.2.0'.

You are in 'detached HEAD' state. You can look around, make experimental
changes and commit them, and you can discard any commits you make in this
state without impacting any branches by performing another checkout.

If you want to create a new branch to retain commits you create, you may
do so (now or later) by using -b with the checkout command again. Example:

  git checkout -b <new-branch-name>

HEAD is now at dc713f4... Tagging 2.2.0
Starting local Bazel server and connecting to it...
INFO: Call stack for the definition of repository 'com_google_android_annotations' which is a jvm_import_external (rule definition at /home/demo/.cache
/bazel/_bazel_demo/f44ec76501ebb182b3e91b698a15afc2/external/bazel_tools/tools/build_defs/repo/jvm.bzl:203:23):
 - /home/demo/.cache/bazel/_bazel_demo/f44ec76501ebb182b3e91b698a15afc2/external/bazel_tools/tools/build_defs/repo/jvm.bzl:263:5
 - /home/demo/.cache/bazel/_bazel_demo/f44ec76501ebb182b3e91b698a15afc2/external/io_grpc_grpc_java/repositories.bzl:146:5
 - /home/demo/.cache/bazel/_bazel_demo/f44ec76501ebb182b3e91b698a15afc2/external/io_grpc_grpc_java/repositories.bzl:48:9
 - /home/demo/onos/WORKSPACE:47:1
ERROR: An error occurred during the fetch of repository 'com_google_android_annotations':
   java.io.IOException: Error downloading [http://central.maven.org/maven2/com/google/android/annotations/4.1.1.4/annotations-4.1.1.4.jar] to /home/dem
o/.cache/bazel/_bazel_demo/f44ec76501ebb182b3e91b698a15afc2/external/com_google_android_annotations/annotations-4.1.1.4.jar: Unknown host: central.maven
n.org
ERROR: /home/demo/.cache/bazel/_bazel_demo/f44ec76501ebb182b3e91b698a15afc2/external/io_grpc_grpc_java/core/BUILD.bazel:28:1: no such package '@com_goo
gle_android_annotations//jar': java.io.IOException: Error downloading [http://central.maven.org/maven2/com/google/android/annotations/4.1.1.4/annotatio
ns-4.1.1.4.jar] to /home/demo/.cache/bazel/_bazel_demo/f44ec76501ebb182b3e91b698a15afc2/external/com_google_android_annotations/annotations-4.1.1.4.jar
: Unknown host: central.maven.org and referenced by '@io_grpc_grpc_java//core:internal'
ERROR: Analysis of target '//:onos' failed; build aborted: no such package '@com_google_android_annotations//jar': java.io.IOException: Error downloadi
ng [http://central.maven.org/maven2/com/google/android/annotations/4.1.1.4/annotations-4.1.1.4.jar] to /home/demo/.cache/bazel/_bazel_demo/f44ec76501eb
b182b3e91b698a15afc2/external/com_google_android_annotations/annotations-4.1.1.4.jar: Unknown host: central.maven.org
INFO: Elapsed time: 57.220s
INFO: 0 processes.
FAILED: Build did NOT complete successfully (582 packages loaded, 4454 targets configured)
INFO: Analyzed target //:onos (202 packages loaded, 9183 targets configured).
INFO: Found 1 target...
[0 / 1] [Prepa] BazelWorkspaceStatusAction stable-status.txt
```

ONOS Installation (6/7)

- Retype password

```
  bazel-bin/models/microsemi/onos-models-microsemi-oar.oar
  bazel-bin/models/polatis/onos-models-polatis-oar.oar
  bazel-bin/models/ciena/waveserverai/onos-models-ciena-waveserverai-oar.oar
  bazel-bin/pipelines/basic/onos-pipelines-basic-oar.oar
  bazel-bin/pipelines/fabric/onos-pipelines-fabric-oar.oar
  bazel-bin/protocols/grpc/onos-protocols-grpc-oar.oar
  bazel-bin/protocols/p4runtime/onos-protocols-p4runtime-oar.oar
  bazel-bin/protocols/gnmi/onos-protocols-gnmi-oar.oar
  bazel-bin/protocols/gnoi/onos-protocols-gnoi-oar.oar
  bazel-bin/protocols/xmpp/core/onos-protocols-xmpp-core-oar.oar
  bazel-bin/protocols/xmpp/pubsub/onos-protocols-xmpp-pubsub-oar.oar
  bazel-bin/apps/cpman/api/libonos-apps-cpman-api.jar
  bazel-bin/apps/routing-api/libonos-apps-routing-api.jar
  bazel-bin/apps/dhcp/api/libonos-apps-dhcp-api.jar
  bazel-bin/apps/dhcp/app/libonos-apps-dhcp-app.jar
  bazel-bin/apps/imr/api/libonos-apps-imr-api.jar
  bazel-bin/apps/imr/app/libonos-apps-imr-app.jar
  bazel-bin/apps/dhcprelay/app/libonos-apps-dhcprelay-app.jar
  bazel-bin/apps/dhcprelay/web/libonos-apps-dhcprelay-web.jar
  bazel-bin/apps/fwd/libonos-apps-fwd.jar
  bazel-bin/apps/iptopology-api/libonos-apps-iptopology-api.jar
  bazel-bin/apps/routing/common/libonos-apps-routing-common.jar
  bazel-bin/apps/vtn/vtnrsc/libonos-apps-vtn-vtnrsc.jar
  bazel-bin/apps/vtn/sfcmgr/libonos-apps-vtn-sfcmgr.jar
  bazel-bin/apps/vtn/vtnmgr/libonos-apps-vtn-vtnmgr.jar
  bazel-bin/apps/vtn/vtnweb/libonos-apps-vtn-vtnweb.jar
  bazel-bin/apps/kafka-integration/api/libonos-apps-kafka-integration-api.jar
  bazel-bin/apps/kafka-integration/app/libonos-apps-kafka-integration-app.jar
  bazel-bin/tools/build/conf/libonos-build-conf.jar
  bazel-bin/onos-admin.tar.gz
  bazel-bin/onos-test.tar.gz
  bazel-bin/onos.tar.gz
INFO: Elapsed time: 866.616s, Critical Path: 202.81s
INFO: 2444 processes: 2116 linux-sandbox, 1 local, 327 worker.
INFO: Build completed successfully, 2472 total actions
[*] Begin to install mininet...
Cloning into 'mininet'...
remote: Enumerating objects: 9, done.
remote: Counting objects: 100% (9/9), done.
remote: Compressing objects: 100% (9/9), done.
remote: Total 9705 (delta 3), reused 3 (delta 0), pack-reused 9696
Receiving objects: 100% (9705/9705), 3.01 MiB | 1.01 MiB/s, done.
Resolving deltas: 100% (6439/6439), done.
Checking connectivity... done.
Detected Linux distribution: Ubuntu 16.04 xenial amd64
sys.version_info(major=2, minor=7, micro=12, releaselevel='final', serial=0)
Detected Python (python) version 2
Installing Mininet dependencies
[sudo] password for demo:
```

ONOS Installation (7/7)

- If the installation complete, you'll see finish message

```
 /usr/bin/install -c -m 644  python/ovstest/__init__.py python/ovstest/args.py python/ovstest/rpcserver.py python/ovstest/tcp.py python/ovstest/tests.p
y python/ovstest/udp.py python/ovstest/util.py python/ovstest/vswitch.py '/usr/local/share/openvswitch/python/ovstest'
 /bin/mkdir -p '/usr/local/share/openvswitch/python/ovs'
 /usr/bin/install -c -m 644  python/ovs/__init__.py python/ovs/daemon.py python/ovs/fcntl_win.py python/ovs/fatal_signal.py python/ovs/json.py python/o
vs/jsonrpc.py python/ovs/ovsuuid.py python/ovs/poller.py python/ovs/process.py python/ovs/reconnect.py python/ovs/socket_util.py python/ovs/stream.py p
ython/ovs/timeval.py python/ovs/util.py python/ovs/version.py python/ovs/vlog.py python/ovs/winutils.py '/usr/local/share/openvswitch/python/ovs'
 /bin/mkdir -p '/usr/local/include/openflow'
 /usr/bin/install -c -m 644 include/openflow/intel-ext.h include/openflow/netronome-ext.h include/openflow/nicira-ext.h include/openflow/openflow-1.0.h
 include/openflow/openflow-1.1.h include/openflow/openflow-1.2.h include/openflow/openflow-1.3.h include/openflow/openflow-1.4.h include/openflow/openf
low-1.5.h include/openflow/openflow-1.6.h include/openflow/openflow-common.h include/openflow/openflow.h '/usr/local/include/openflow'
 /bin/mkdir -p '/usr/local/include/openvswitch'
 /usr/bin/install -c -m 644 include/openvswitch/compiler.h include/openvswitch/dynamic-string.h include/openvswitch/hmap.h include/openvswitch/flow.h i
nclude/openvswitch/geneve.h include/openvswitch/json.h include/openvswitch/list.h include/openvswitch/netdev.h include/openvswitch/match.h include/open
vswitch/meta-flow.h include/openvswitch/namemap.h include/openvswitch/ofpbuf.h include/openvswitch/ofp-actions.h include/openvswitch/ofp-bundle.h inclu
de/openvswitch/ofp-connection.h include/openvswitch/ofp-ed-props.h include/openvswitch/ofp-errors.h include/openvswitch/ofp-flow.h include/openvswitch/
ofp-group.h include/openvswitch/ofp-ipfix.h include/openvswitch/ofp-match.h include/openvswitch/ofp-meter.h include/openvswitch/ofp-monitor.h include/o
penvswitch/ofp-msgs.h include/openvswitch/ofp-packet.h include/openvswitch/ofp-parse.h include/openvswitch/ofp-port.h include/openvswitch/ofp-print.h i
nclude/openvswitch/ofp-prop.h include/openvswitch/ofp-protocol.h include/openvswitch/ofp-queue.h include/openvswitch/ofp-switch.h include/openvswitch/o
fp-table.h include/openvswitch/ofp-util.h include/openvswitch/packets.h include/openvswitch/poll-loop.h include/openvswitch/rconn.h include/openvswitch
/shash.h include/openvswitch/thread.h include/openvswitch/token-bucket.h '/usr/local/include/openvswitch'
 /usr/bin/install -c -m 644 include/openvswitch/tun-metadata.h include/openvswitch/type-props.h include/openvswitch/types.h include/openvswitch/util.h
include/openvswitch/uuid.h include/openvswitch/version.h include/openvswitch/vconn.h include/openvswitch/vlog.h include/openvswitch/nsh.h '/usr/local/i
nclude/openvswitch'
 /bin/mkdir -p '/usr/local/include/ovn'
 /usr/bin/install -c -m 644 include/ovn/actions.h include/ovn/expr.h include/ovn/lex.h '/usr/local/include/ovn'
 /bin/mkdir -p '/usr/local/lib/pkgconfig'
 /usr/bin/install -c -m 644 lib/libopenvswitch.pc lib/libsflow.pc ofproto/libofproto.pc ovsdb/libovsdb.pc '/usr/local/lib/pkgconfig'
 /bin/mkdir -p '/usr/local/share/openvswitch'
 /usr/bin/install -c -m 644 vswitchd/vswitch.ovsschema vtep/vtep.ovsschema ovn/ovn-sb.ovsschema ovn/ovn-nb.ovsschema '/usr/local/share/openvswitch'
 /bin/mkdir -p '/usr/local/share/openvswitch/scripts'
 /usr/bin/install -c -m 644 utilities/ovs-lib '/usr/local/share/openvswitch/scripts'
 /bin/mkdir -p '/usr/local/share/openvswitch/scripts'
 /usr/bin/install -c utilities/ovs-check-dead-ifs utilities/ovs-ctl utilities/ovs-kmod-ctl utilities/ovs-save utilities/bugtool/ovs-bugtool-fdb-show ut
ilities/bugtool/ovs-bugtool-tc-class-show utilities/bugtool/ovs-bugtool-daemons-ver utilities/bugtool/ovs-bugtool-ovs-ofctl-loop-over-bridges utilities
/bugtool/ovs-bugtool-ovs-appctl-dpif utilities/bugtool/ovs-bugtool-ovs-bridge-datapath-type utilities/bugtool/ovs-bugtool-ovs-vswitchd-threads-affinity
 utilities/bugtool/ovs-bugtool-qos-configs utilities/bugtool/ovs-bugtool-get-dpdk-nic-numa ovn/utilities/bugtool/ovn-bugtool-nbctl-show ovn/utilities/b
ugtool/ovn-bugtool-sbctl-show ovn/utilities/bugtool/ovn-bugtool-sbctl-lflow-list ipsec/ovs-monitor-ipsec vtep/ovs-vtep ovn/utilities/ovn-ctl ovn/utilit
ies/ovndb-servers.ocf '/usr/local/share/openvswitch/scripts'
make[3]: Leaving directory '/home/demo/onos/openvswitch-2.11.0'
make[2]: Leaving directory '/home/demo/onos/openvswitch-2.11.0'
make[1]: Leaving directory '/home/demo/onos/openvswitch-2.11.0'
 * Starting ovsdb-server
 * system ID not configured, please use --system-id
 * Configuring Open vSwitch system IDs
 * Inserting openvswitch module
 * Starting ovs-vswitchd
 * Enabling remote OVSDB managers
*** Installation Finished! ***
demo@SDN-NFV:~/Downloads$
```