

# Virtual machine setup

OPERATING SYSTEM BASED ON PBL

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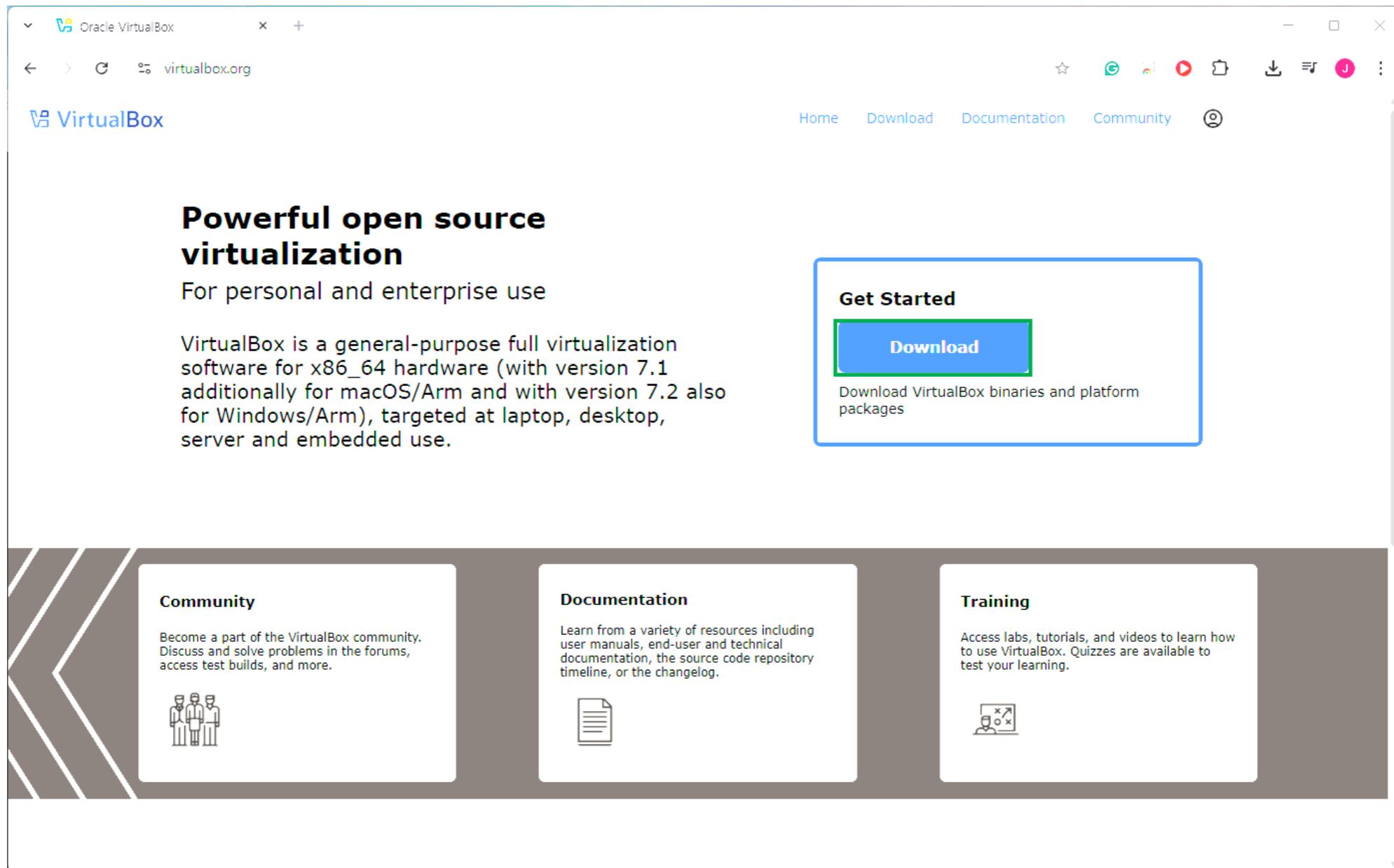
# Download Linux Image

- Visit Ubuntu Desktop homepage
  - ▶ <https://ubuntu.com/download/desktop>
- Press Download 24.04.3

The screenshot shows a web browser displaying the Ubuntu Desktop download page at <https://ubuntu.com/download/desktop>. The page features a dark header with navigation links like 'Canonical Ubuntu', 'Products', 'Use cases', 'Support', 'Community', 'Download Ubuntu', and 'Downloads' (which is highlighted). Below the header, there's a large title 'Download Ubuntu Desktop' and a brief description: 'The open source desktop operating system that powers millions of PCs and laptops around the world. Find out more about Ubuntu's features and how we support developers and organisations below.' Two buttons are visible: 'Discover Ubuntu Desktop' and 'Check out the blog'. The main content area is for 'Ubuntu 24.04.3 LTS', which is described as 'The latest LTS version of Ubuntu, for desktop PCs and laptops. LTS stands for long-term support — which means five years of free security and maintenance updates, extended up to 12 years with Ubuntu Pro.' A large green 'Download' button is available for 'Intel or AMD 64-bit architecture' files, which are 5.9GB in size. Below the download section, there's a note about alternative downloads and links to 'What's new', 'System requirements', and 'How to install'. A sidebar on the left shows the Ubuntu logo.

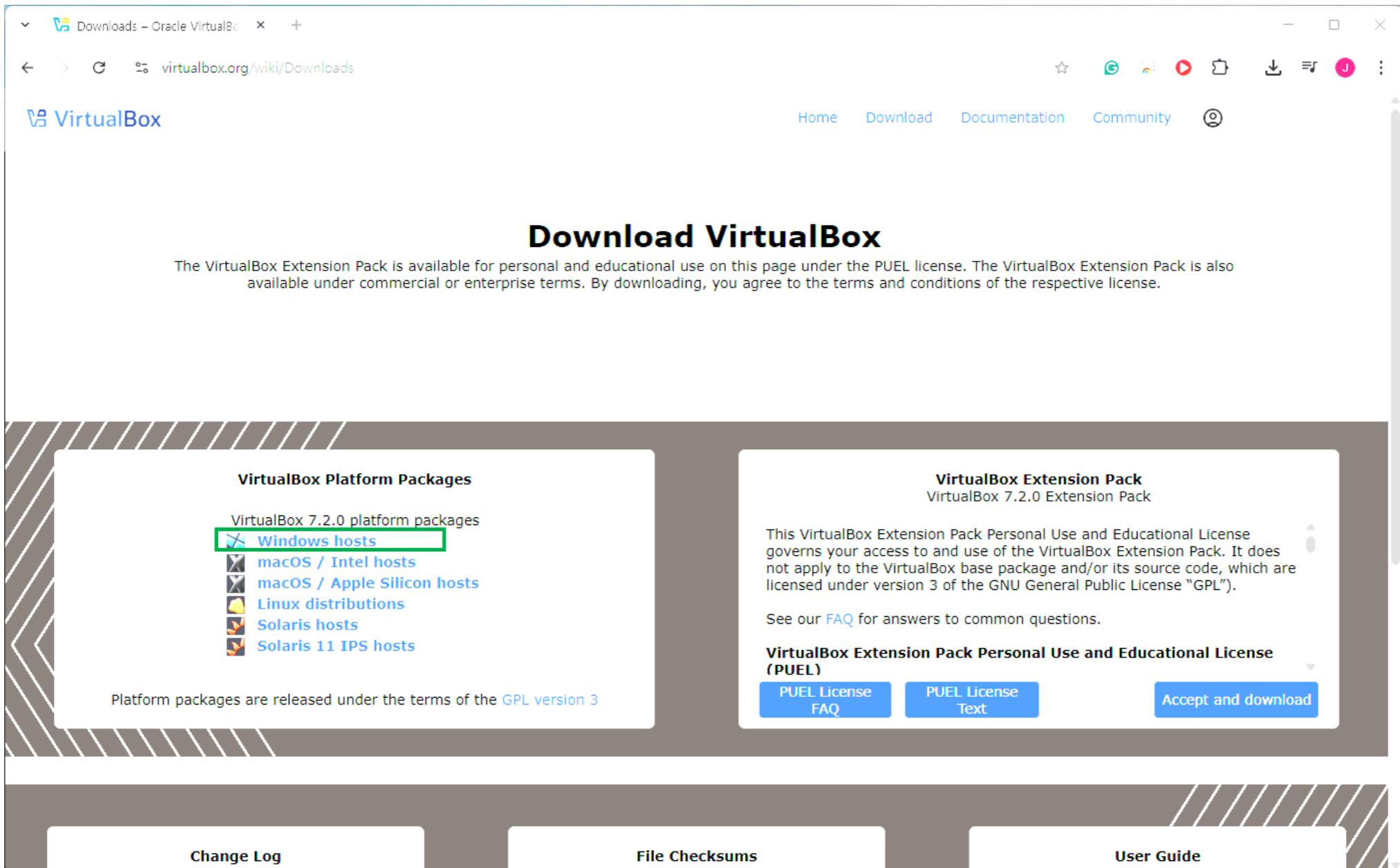
# Install VirtualBox

- Visit VirtualBox homepage
  - ▶ <https://www.virtualbox.org/>
  - ▶ Click Download



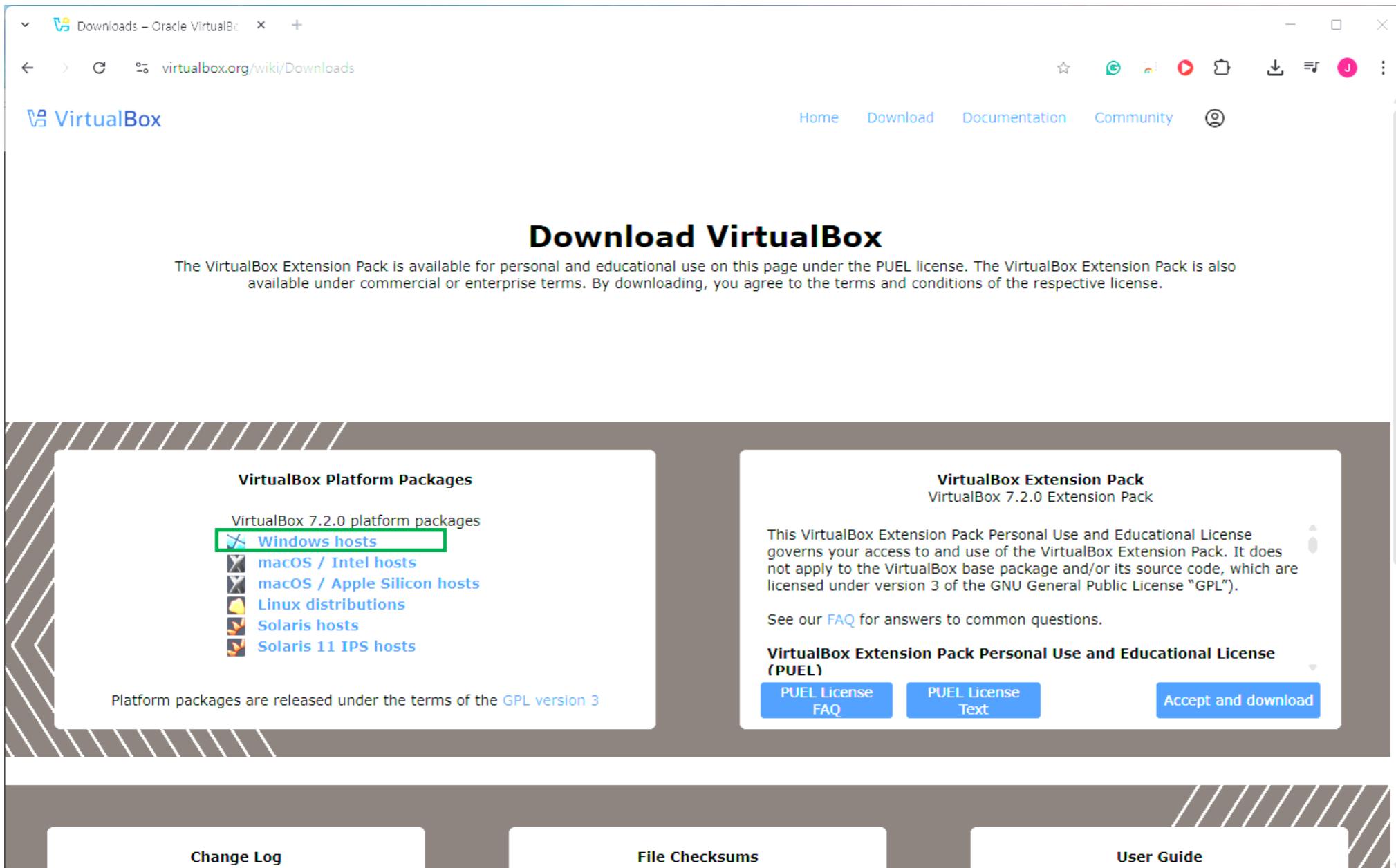
# Install VirtualBox

- ▶ Download a VirtualBox Platform Packages
  - Windows hosts



# Install VirtualBox

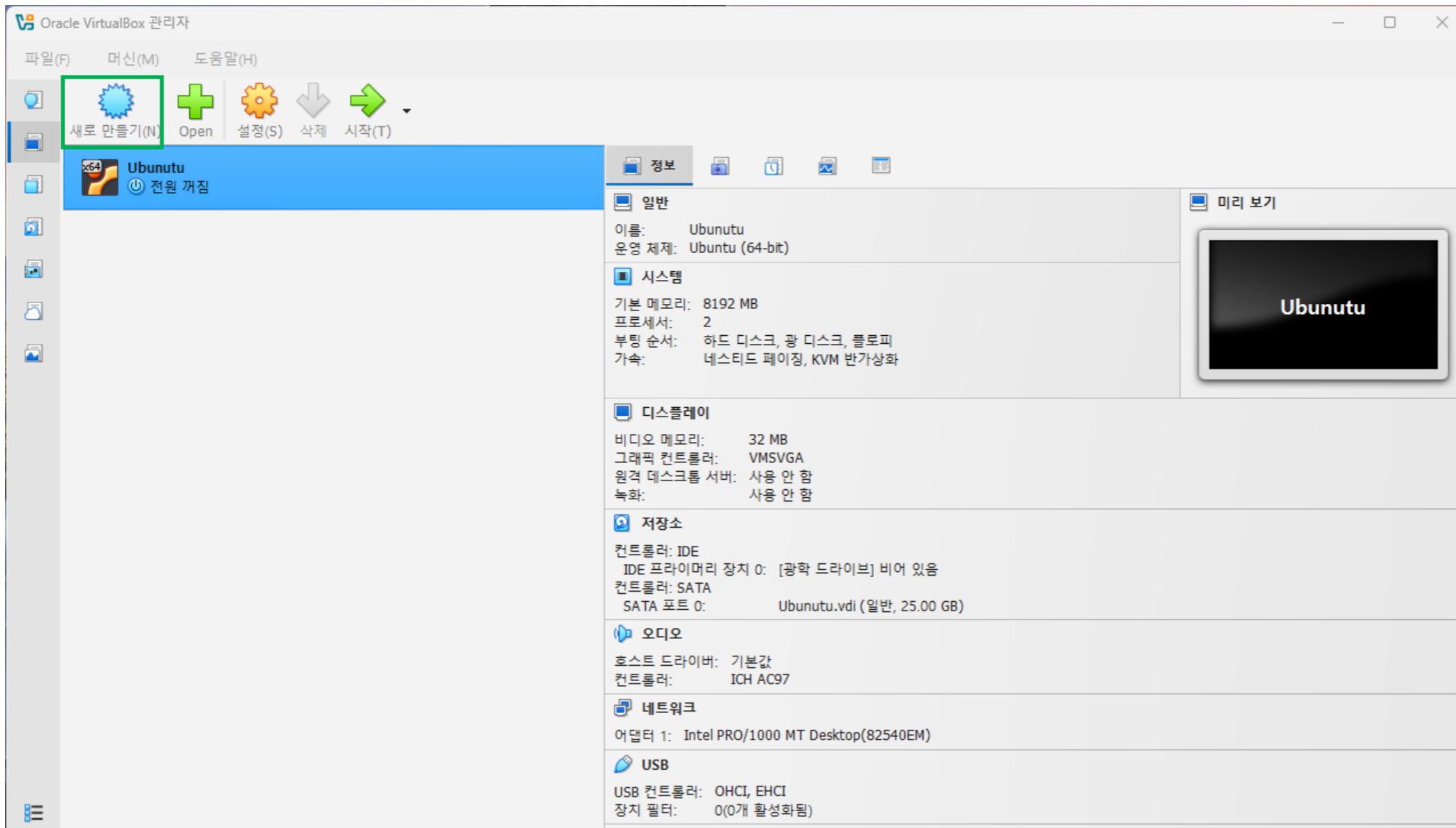
- ▶ Download a VirtualBox Platform Packages
  - Windows hosts



- Run 'VirtualBox-7.2.0-170228-Win.exe'

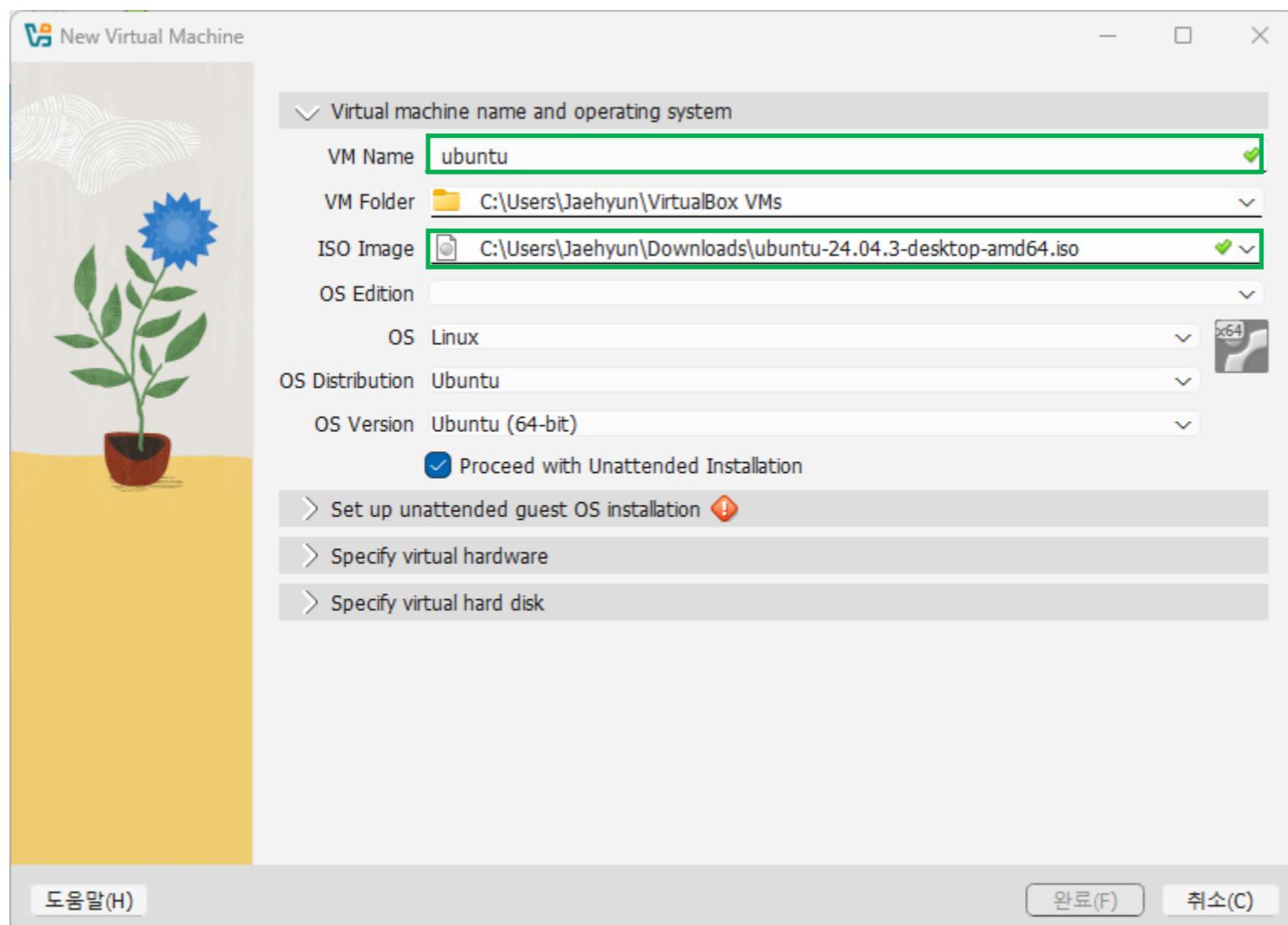
# Create Virtual Machine

- Run VirtualBox
  - ▶ Create a virtual machine



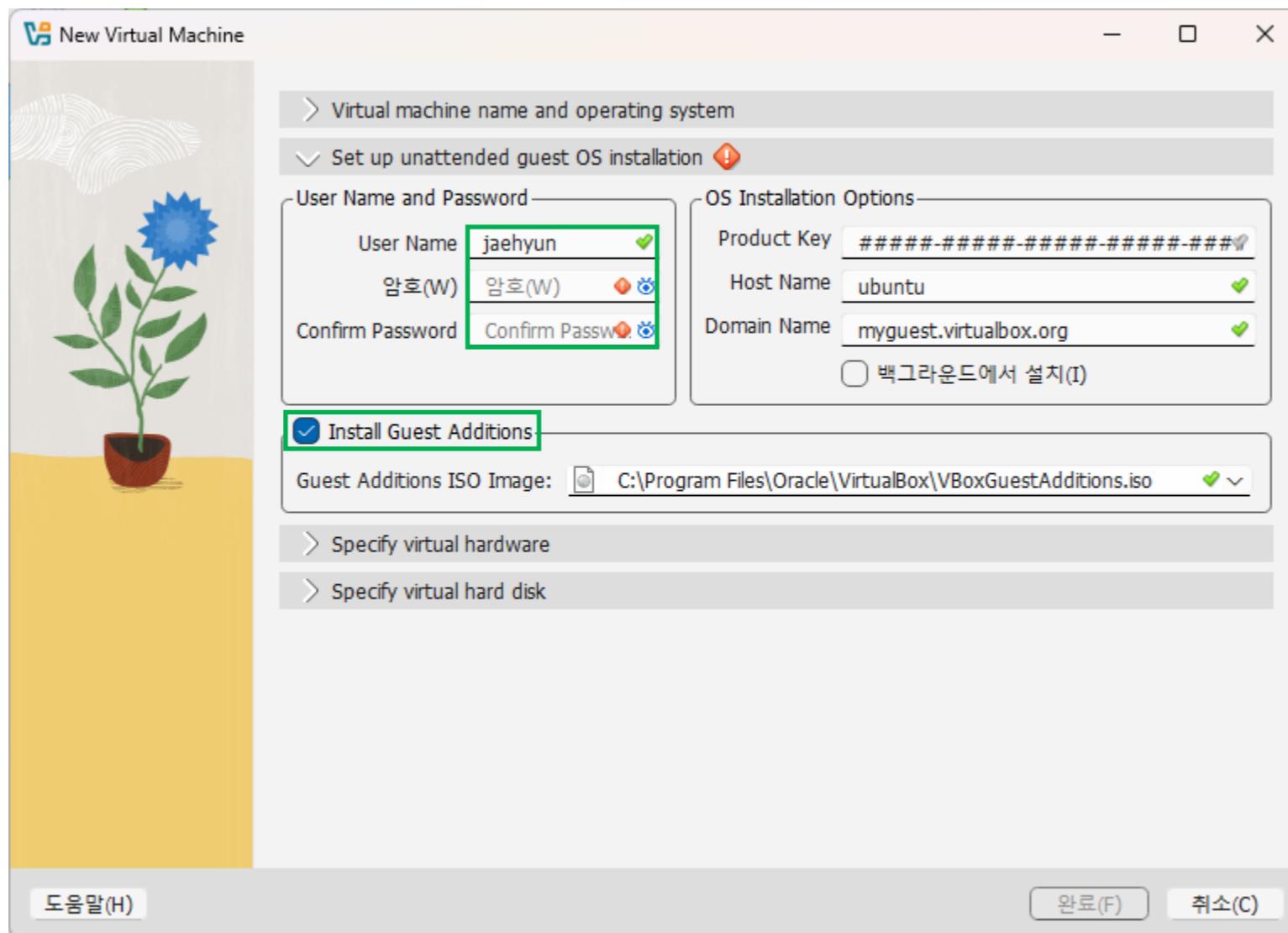
# Create Virtual Machine

- Open Virtual machine name and operating system
  - ▶ Enter VM Name and search iso file of ubuntu 24.04.3



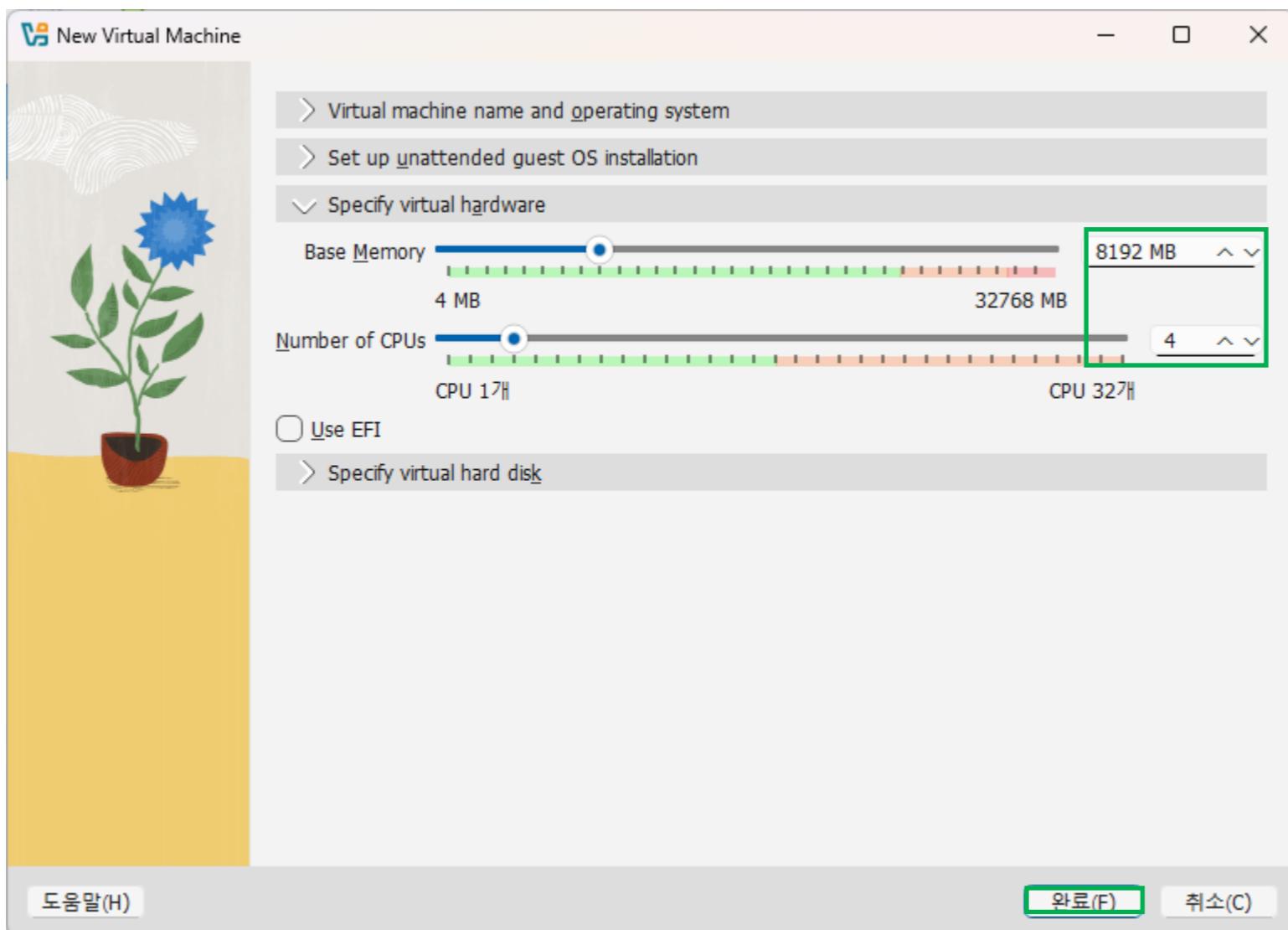
# Create Virtual Machine

- Open Set up unattended guest OS installation
  - ▶ Set User Name as your first name and set password
  - ▶ Check Install Guest Additions



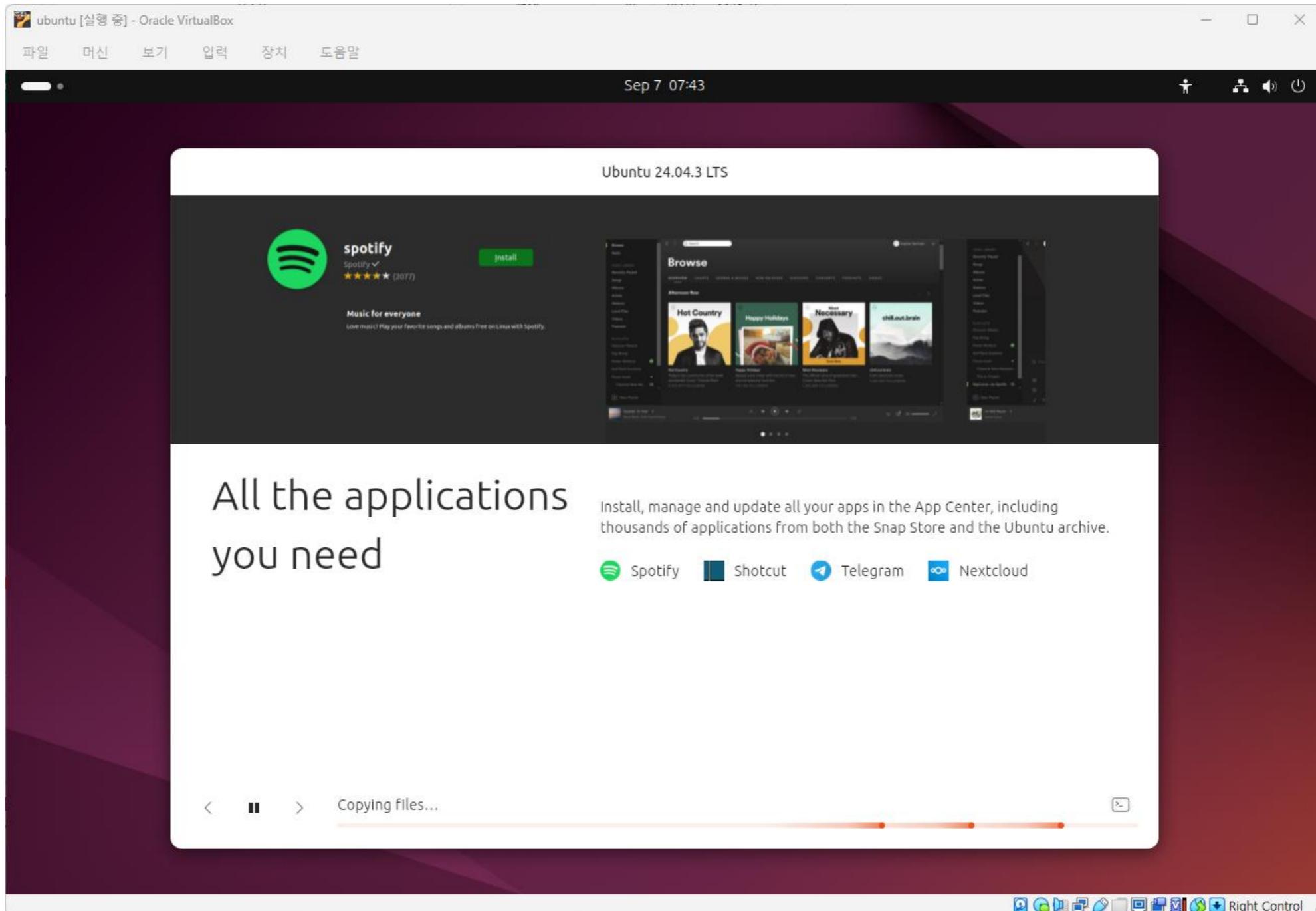
# Create Virtual Machine

- Open Specify virtual hardware
  - ▶ Set Base Memory more than 8192 MB
  - ▶ Set Number of CPUs more than 2
- Click Finish button



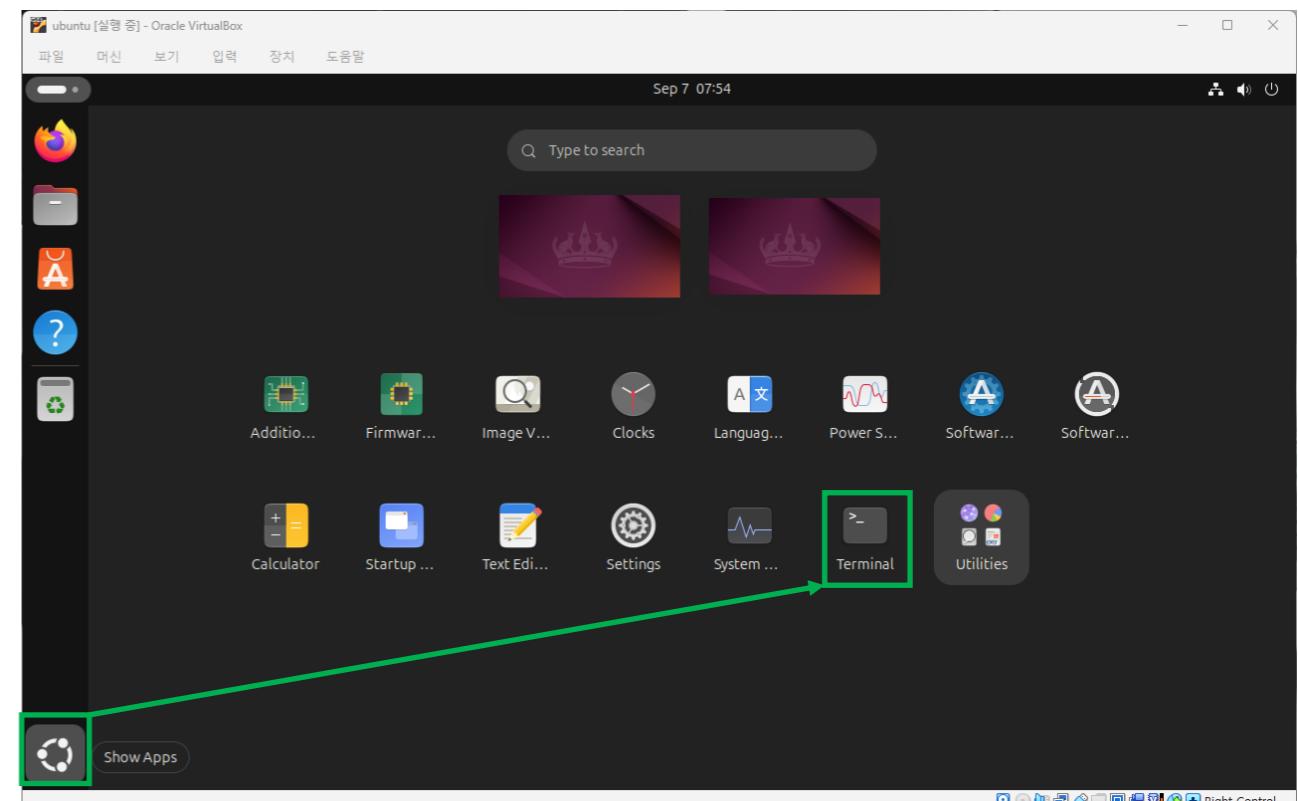
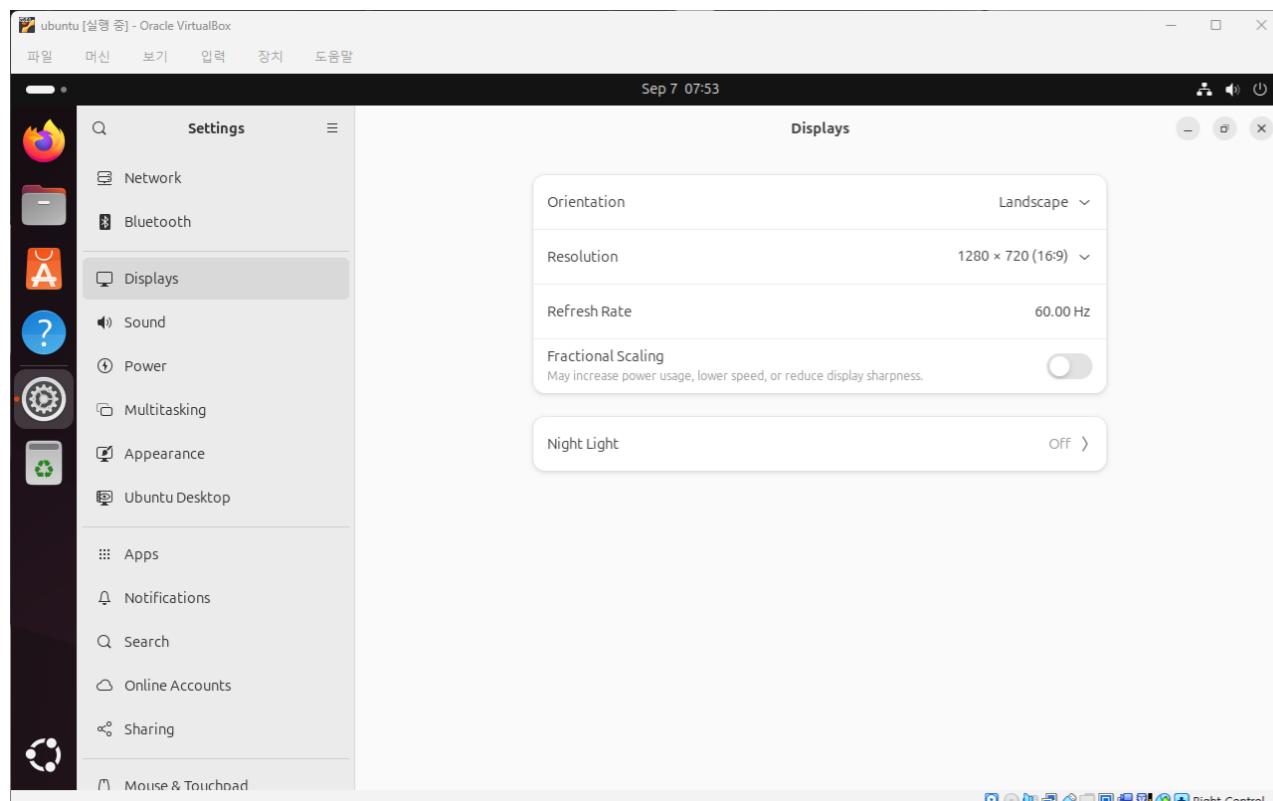
# Create Virtual Machine

- Install Ubuntu
  - ▶ Reboot after install Ubuntu



# Setup Ubuntu

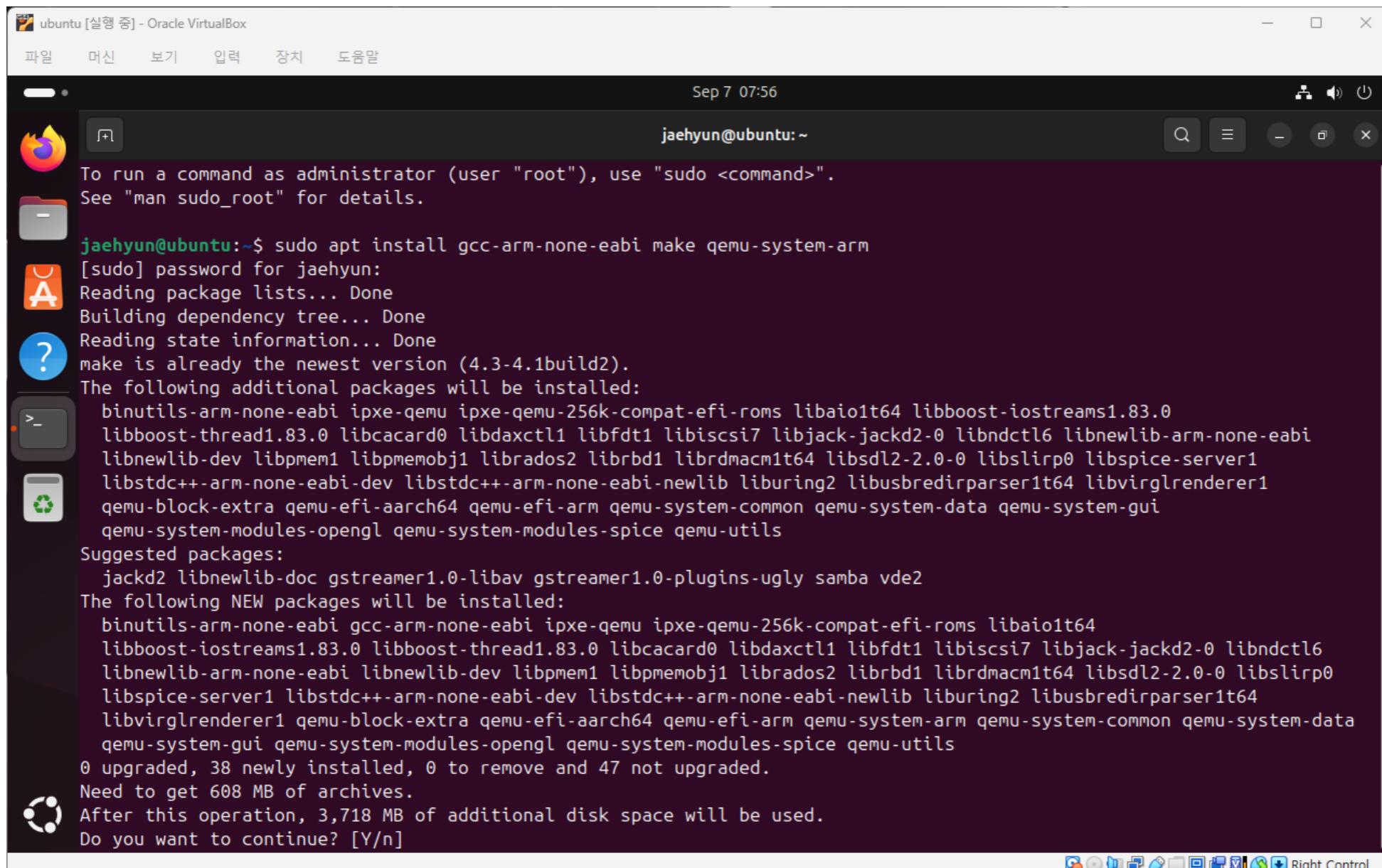
- After installation, it will show Ubuntu Desktop virtual machine
  - ▶ Don't need Ubuntu Pro
- Open Settings and set Displays Resolution
- Open Terminal



# Setup Ubuntu

- Install ARM cross compiler, Make tool, and QEMU
  - ▶ \$ sudo apt install gcc-arm-none-eabi make qemu-system-arm

Targeting ARM      No operating system      Embedded ABI

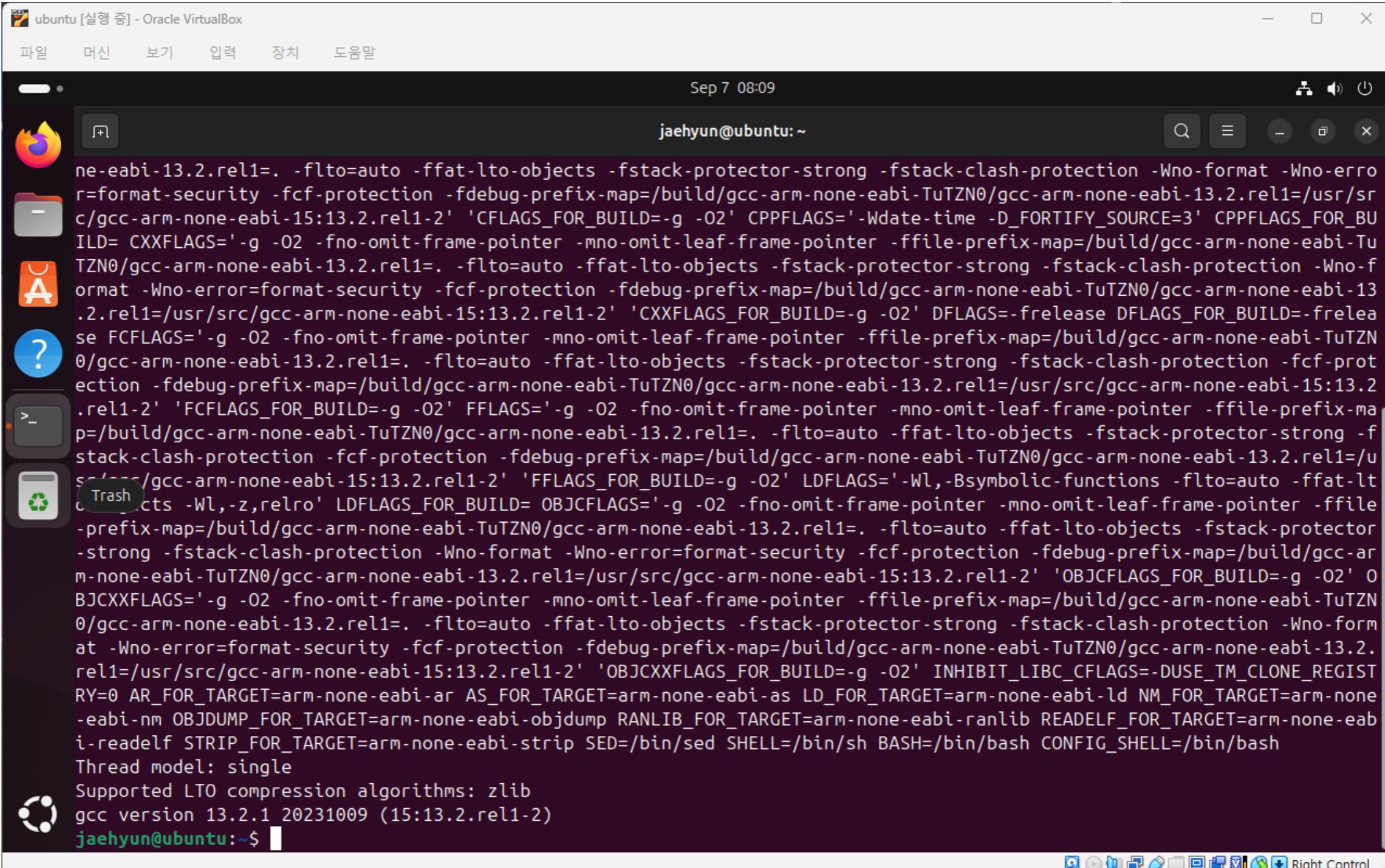


```
ubuntu [실행 중] - Oracle VirtualBox
파일 머신 보기 입력 장치 도움말
Sep 7 07:56
jaehyun@ubuntu:~ To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

jaehyun@ubuntu:~$ sudo apt install gcc-arm-none-eabi make qemu-system-arm
[sudo] password for jaehyun:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
make is already the newest version (4.3-4.1build2).
The following additional packages will be installed:
  binutils-arm-none-eabi ipxe-qemu ipxe-qemu-256k-compat-efi-roms libbaio1t64 libboost-iostreams1.83.0
  libboost-thread1.83.0 libcacard0 libdaxctl1 libfdt1 libiscsi7 libjack-jackd2-0 libndctl6 libnewlib-arm-none-eabi
  libnewlib-dev libpmem1 libpmemobj1 librados2 librbd1 librdmacm1t64 libSDL2-2.0-0 libslirp0 libspice-server1
  libstdc++-arm-none-eabi-dev libstdc++-arm-none-eabi-newlib liburing2 libusbredirparser1t64 libvirglrenderer1
  qemu-block-extra qemu-efi-aarch64 qemu-efi-arm qemu-system-common qemu-system-data qemu-system-gui
  qemu-system-modules-opengl qemu-system-modules-spice qemu-utils
Suggested packages:
  jackd2 libnewlib-doc gstreamer1.0-libav gstreamer1.0-plugins-ugly samba vde2
The following NEW packages will be installed:
  binutils-arm-none-eabi gcc-arm-none-eabi ipxe-qemu ipxe-qemu-256k-compat-efi-roms libbaio1t64
  libboost-iostreams1.83.0 libboost-thread1.83.0 libcacard0 libdaxctl1 libfdt1 libiscsi7 libjack-jackd2-0 libndctl6
  libnewlib-arm-none-eabi libnewlib-dev libpmem1 libpmemobj1 librados2 librbd1 librdmacm1t64 libSDL2-2.0-0 libslirp0
  libspice-server1 libstdc++-arm-none-eabi-dev libstdc++-arm-none-eabi-newlib liburing2 libusbredirparser1t64
  libvirglrenderer1 qemu-block-extra qemu-efi-aarch64 qemu-efi-arm qemu-system-arm qemu-system-common qemu-system-data
  qemu-system-gui qemu-system-modules-opengl qemu-system-modules-spice qemu-utils
0 upgraded, 38 newly installed, 0 to remove and 47 not upgraded.
Need to get 608 MB of archives.
After this operation, 3,718 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

# Setup Ubuntu

- Check ARM cross compiler
  - ▶ \$ arm-none-eabi-gcc -v



```
ubuntu [실행 중] - Oracle VirtualBox
파일 머신 보기 입력 장치 도움말
Sep 7 08:09
jaehyun@ubuntu:~ Q E - o x
ne-eabi-13.2.rel1=. -fno-fat-lto-objects -fstack-protector-strong -fstack-clash-protection -Wno-format -Wno-erro
r=format-security -fcf-protection -fdebug-prefix-map=/build/gcc-arm-none-eabi-TuTZN0/gcc-arm-none-eabi-13.2.rel1=/usr/sr
c/gcc-arm-none-eabi-15:13.2.rel1-2' 'CFLAGS_FOR_BUILD=-g -O2' CPPFLAGS=' -Wdate-time -D_FORTIFY_SOURCE=3' CPPFLAGS_FOR_BU
ILD=CXXFLAGS='-g -O2 -fno-omit-frame-pointer -mno-omit-leaf-frame-pointer -ffile-prefix-map=/build/gcc-arm-none-eabi-Tu
TZN0/gcc-arm-none-eabi-13.2.rel1=. -fno-fat-lto-objects -fstack-protector-strong -fstack-clash-protection -Wno-f
ormat -Wno-error=format-security -fcf-protection -fdebug-prefix-map=/build/gcc-arm-none-eabi-TuTZN0/gcc-arm-none-eabi-13
.2.rel1=/usr/src/gcc-arm-none-eabi-15:13.2.rel1-2' 'CXXFLAGS_FOR_BUILD=-g -O2' DFLAGS=-frelease DFLAGS_FOR_BUILD=-frelea
se FCFLAGS='-g -O2 -fno-omit-frame-pointer -mno-omit-leaf-frame-pointer -ffile-prefix-map=/build/gcc-arm-none-eabi-TuTZN
0/gcc-arm-none-eabi-13.2.rel1=. -fno-fat-lto-objects -fstack-protector-strong -fstack-clash-protection -fcf-prot
ection -fdebug-prefix-map=/build/gcc-arm-none-eabi-TuTZN0/gcc-arm-none-eabi-13.2.rel1=/usr/src/gcc-arm-none-eabi-15:13.2
.rel1-2' 'FCFLAGS_FOR_BUILD=-g -O2' FFLAGS='-g -O2 -fno-omit-frame-pointer -mno-omit-leaf-frame-pointer -ffile-prefix-ma
p=/build/gcc-arm-none-eabi-TuTZN0/gcc-arm-none-eabi-13.2.rel1=. -fno-fat-lto-objects -fstack-protector-strong -f
stack-clash-protection -fcf-protection -fdebug-prefix-map=/build/gcc-arm-none-eabi-TuTZN0/gcc-arm-none-eabi-13.2.rel1=/
usr/src/gcc-arm-none-eabi-15:13.2.rel1-2' 'FFLAGS_FOR_BUILD=-g -O2' LDFLAGS='-Wl,-Bsymbolic-functions -fno-fat-lt
o-objects -Wl,-z,relro' LDFLAGS_FOR_BUILD= OBJCFLAGS='-g -O2 -fno-omit-frame-pointer -mno-omit-leaf-frame-pointer -ffile
-prefix-map=/build/gcc-arm-none-eabi-TuTZN0/gcc-arm-none-eabi-13.2.rel1=. -fno-fat-lto-objects -fstack-protector
-strong -fstack-clash-protection -Wno-format -Wno-error=format-security -fcf-protection -fdebug-prefix-map=/build/gcc-ar
m-none-eabi-TuTZN0/gcc-arm-none-eabi-13.2.rel1=/usr/src/gcc-arm-none-eabi-15:13.2.rel1-2' 'OBJCFLAGS_FOR_BUILD=-g -O2'
OBJCXXFLAGS='-g -O2 -fno-omit-frame-pointer -mno-omit-leaf-frame-pointer -ffile-prefix-map=/build/gcc-arm-none-eabi-TuTZN
0/gcc-arm-none-eabi-13.2.rel1=. -fno-fat-lto-objects -fstack-protector-strong -fstack-clash-protection -Wno-form
at -Wno-error=format-security -fcf-protection -fdebug-prefix-map=/build/gcc-arm-none-eabi-TuTZN0/gcc-arm-none-eabi-13.2.
rel1=/usr/src/gcc-arm-none-eabi-15:13.2.rel1-2' 'OBJCXXFLAGS_FOR_BUILD=-g -O2' INHIBIT_LIBC_CFLAGS=-DUSE_TM_CLONE_REGIST
RY=0 AR_FOR_TARGET=arm-none-eabi-ar AS_FOR_TARGET=arm-none-eabi-as LD_FOR_TARGET=arm-none-eabi-ld NM_FOR_TARGET=arm-none
-eabi-nm OBJDUMP_FOR_TARGET=arm-none-eabi-objdump RANLIB_FOR_TARGET=arm-none-eabi-ranlib READELF_FOR_TARGET=arm-none-eab
i-readelf STRIP_FOR_TARGET=arm-none-eabi-strip SED=/bin/sed SHELL=/bin/sh BASH=/bin/bash CONFIG_SHELL=/bin/bash
Thread model: single
Supported LTO compression algorithms: zlib
gcc version 13.2.1 20231009 (15:13.2.rel1-2)
jaehyun@ubuntu:~$
```

# Setup Ubuntu

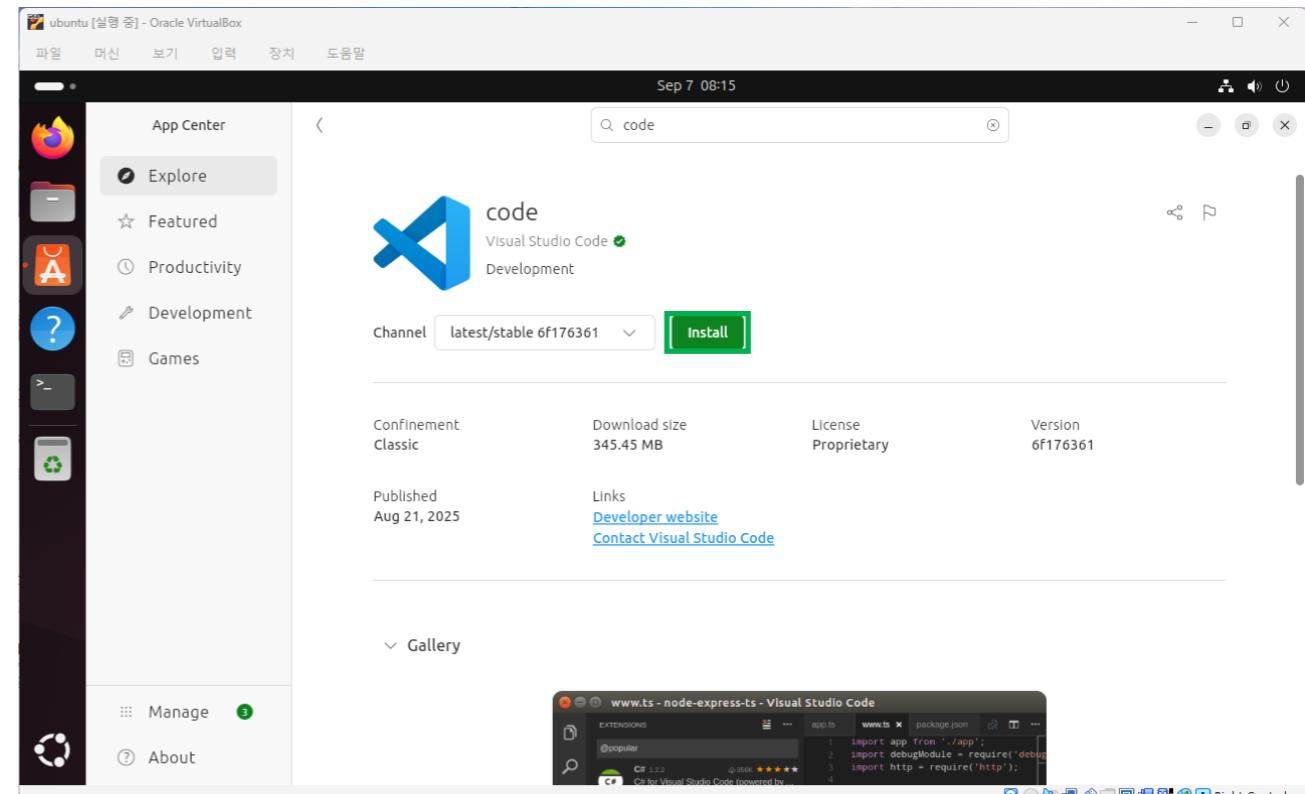
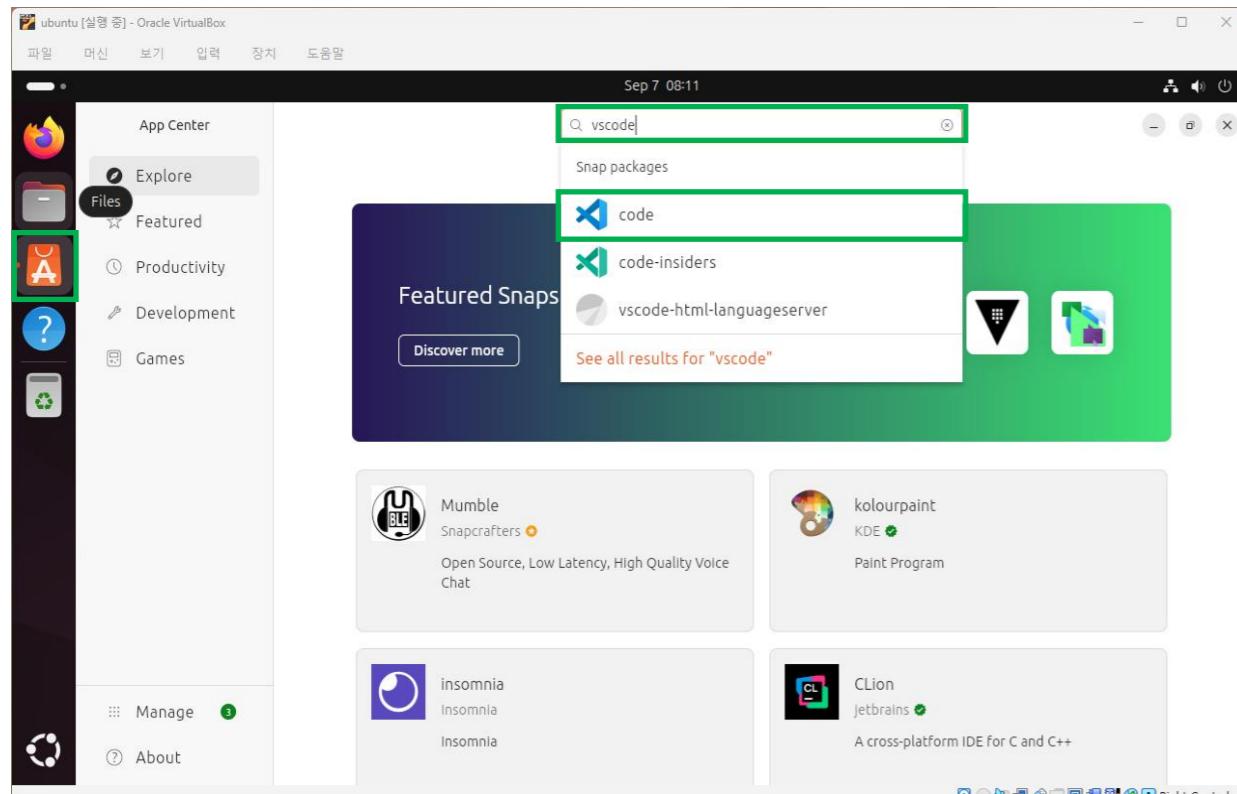
- Check QEMU installation and supported machine list
  - ▶ \$ qemu-system-arm --version
  - ▶ \$ qemu-system-arm -M ?
    - We will use realview-pb-a8 processor

```
ubuntu [실행 중] - Oracle VirtualBox
파일 머신 보기 입력 장치 도움말
Sep 7 08:10 jaehyun@ubuntu: ~
jaehyun@ubuntu:~$ qemu-system-arm --version
QEMU emulator version 8.2.2 (Debian 1:8.2.2+ds-0ubuntu1.9)
Copyright (c) 2003-2023 Fabrice Bellard and the QEMU Project developers
jaehyun@ubuntu:~$ qemu-system-arm -M ?
Supported machines are:
akita           Sharp SL-C1000 (Akita) PDA (PXA270)
ast1030-evb    Aspeed AST1030 MiniBMC (Cortex-M4)
ast2500-evb    Aspeed AST2500 EVB (ARM1176)
ast2600-evb    Aspeed AST2600 EVB (Cortex-A7)
bletchley-bmc Facebook Bletchley BMC (Cortex-A7)
borzoi          Sharp SL-C3100 (Borzoi) PDA (PXA270)
bpim2u          Bananapi M2U (Cortex-A7)
canon-a1100    Canon PowerShot A1100 IS (ARM946)
cheetah          Palm Tungsten|E aka. Cheetah PDA (OMAP310)
collie           Sharp SL-5500 (Collie) PDA (SA-1110)
connex           Gumstix Connex (PXA255)
cubieboard      cubitech cubieboard (Cortex-A8)
emcraft-sf     SmartFusion2 SOM kit from Emcraft (M2S010)
fbby35-bmc     Facebook fby35 BMC (Cortex-A7)
fbby35          Meta Platforms fby35
fp5280g2-bmc   Inspur FP5280G2 BMC (ARM1176)
fuji-bmc        Facebook Fuji BMC (Cortex-A7)
g220a-bmc      Bytedance G220A BMC (ARM1176)
highbank         Calxeda Highbank (ECX-1000)
imx25-pdk      ARM i.MX25 PDK board (ARM926)
integratorcp   ARM Integrator/CP (ARM926EJ-S)
kudo-bmc       Kudo BMC (Cortex-A9)
kzm             ARM KZM Emulation Baseboard (ARM1136)
lm3s6965evb   Stellaris LM3S6965EVB (Cortex-M3)
```

```
ubuntu [실행 중] - Oracle VirtualBox
파일 머신 보기 입력 장치 도움말
Sep 7 08:10 jaehyun@ubuntu: ~
jaehyun@ubuntu:~$ qemu-system-arm -M ?
qcom-dc-scm-v1-bmc  Qualcomm DC-SCM V1 BMC (Cortex A7)
qcom-firework-bmc  Qualcomm DC-SCM V1/Firework BMC (Cortex A7)
quanta-gbs-bmc    Quanta GBS (Cortex-A9)
quanta-gsj         Quanta GSJ (Cortex-A9)
quanta-q71l-bmc   Quanta-Q71l BMC (ARM926EJ-S)
rainier-bmc        IBM Rainier BMC (Cortex-A7)
raspi0             Raspberry Pi Zero (revision 1.2)
raspi1ap           Raspberry Pi A+ (revision 1.1)
raspi2b             Raspberry Pi 2B (revision 1.1)
realview-eb        ARM RealView Emulation Baseboard (ARM926EJ-S)
realview-pb-mcpc   ARM RealView Emulation Baseboard (ARM11MDCore)
realview-pb-a8    ARM RealView Platform Baseboard for Cortex-A8
realview-pb-a9    ARM RealView Platform Baseboard Explore for Cortex-A9
romulus-bmc       OpenPOWER Romulus BMC (ARM1176)
trash_lite         Freescale i.MX6 Quad SABRE Lite Board (Cortex-A9)
smdkc210          Samsung SMDKC210 board (Exynos4210)
sonorapass-bmc   OCP SonoraPass BMC (ARM1176)
spitz              Sharp SL-C3000 (Spitz) PDA (PXA270)
stm32vldiscovery ST STM32VLDiscovery (Cortex-M3)
supermicro-x11spi-bmc Supermicro X11 SPI BMC (ARM1176)
supermicrox11-bmc Supermicro X11 BMC (ARM926EJ-S)
sx1                Siemens SX1 (OMAP310) V2
sx1-v1            Siemens SX1 (OMAP310) V1
tacoma-bmc        OpenPOWER Tacoma BMC (Cortex-A7)
terrier            Sharp SL-C3200 (Terrier) PDA (PXA270)
tiogapass-bmc   Facebook Tiogapass BMC (ARM1176)
tosa               Sharp SL-6000 (Tosa) PDA (PXA255)
verdex             Gunstix Verdex Pro XL6P COMs (PXA270)
versatileab       ARM Versatile/AB (ARM926EJ-S)
```

# Setup Ubuntu

- Open App Center
  - ▶ Search vscode
  - ▶ Click Install



# Setup Ubuntu

- Create a project directory and move to the project directory
  - ▶ ~\$ mkdir RTOS
  - ▶ ~\$ cd RTOS
- Run Visual Studio Code
  - ▶ ~/RTOS\$ code .
    - Trust the authors of the files in the folder

A screenshot of a terminal window on an Ubuntu desktop environment. The terminal shows the following command history:  
jaehyun@ubuntu:~\$ mkdir RTOS  
jaehyun@ubuntu:~\$ cd RTOS  
jaehyun@ubuntu:~/RTOS\$ code .

