

Operating Systems, Virtual Machine and Cloud computing

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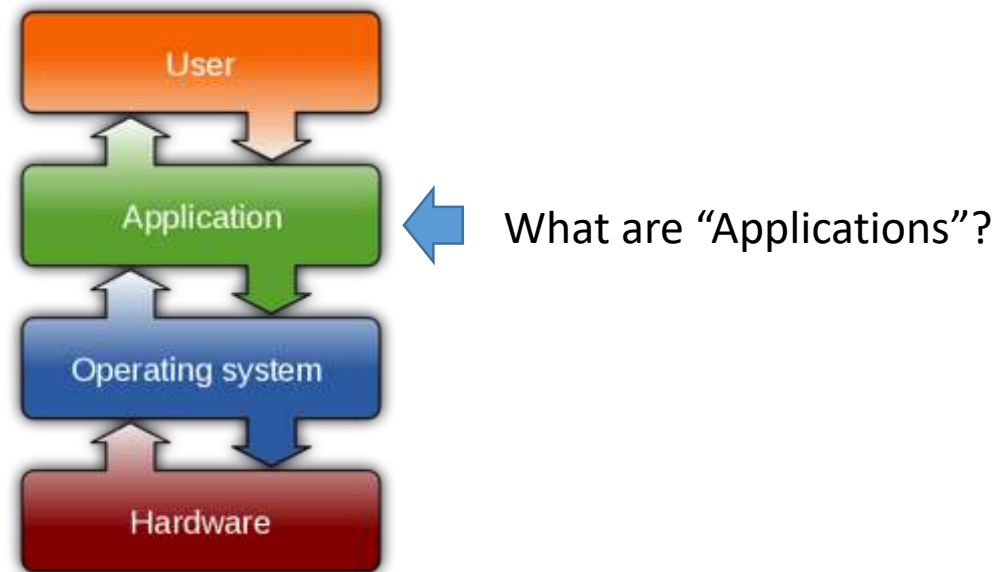
SIRE507: FUNDAMENTAL COMPUTER SCIENCE FOR BIOLOGIST

Operating system (OS)

- What is it?
- Why is it important?

Operating system (OS)

- What is it?
 - The basic software that manages a computer
- Why is it important?



Operating system (OS)

- What is it?
 - The basic software that manages a computer
- Why is it important?



[Golftheman](#)



What are “Applications”?

Self-contained programs that perform a specific function



Operating system (OS)

- Do you know any OS?

Operating system (OS)

- Do you know any OS?



macOS High Sierra

ubuntu 

The Ubuntu logo, which is an orange circle containing a white stylized gear or flower-like shape.

Operating system (OS)

- Do you know any OS?



macOS High Sierra

ubuntu 

The Ubuntu logo, which is a red circle containing a white gear-like shape with eight dots arranged in a circle.

Mobile OS

iOS



Operating system (OS)

- Do you know any OS?

Microsoft Windows family



Other

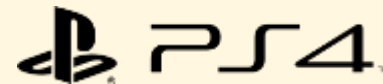


Unix/Unix-like family



FreeBSD

ORACLE
SOLARIS



Macintosh/Darwin

iOS
macOS

Linux



CentOS

ubuntu



fedora



debian

Why do you need to know about OSes?

Why do you need to know about OSes?

- Many (if not majority) of bioinformatic applications were developed for Unix-like or Linux OS
- If you want to develop a web application, web servers usually run with Linux
- Many free and open-source applications must be run on Unix-like or Linux OS

Operating system (OS)

- Old machine, legacy application and IoT:
 - 32-bit vs 64-bit (32-bit apps on Windows?)
 - Lite version/distribution of OS (e.g. Alpine, Lubuntu)
- Users of your application
 - Windows
 - General users with probably no or little bioinformatic background
 - Graphical user interface is likely to be expected
 - Unix-like/Linux
 - Bioinformaticians
 - Command lines are acceptable

Distinct features of each OS

- OS-specific file extensions
 - Microsoft Windows
 - File.exe
 - File.msi
 - Mac OS
 - File.dmg
 - Linux
 - File.deb

Distinct features of each OS

- File naming rules
 - Microsoft Windows
 - Reserved characters: \, /, :, ?, *, >, <, |, “
 - Linux and Mac OS
 - Reserved characters: /, >, <, |, &, (,), “, ‘
 - Reserved characters but will be “automatically escaped”: \, *, :, space
- As bioinformatician: Please AVOID using “space” in the file name
 - FileName.txt
 - File_Name.txt

Distinct features of each OS

- File paths to YourFile.txt in your “home” directory
 - Microsoft Windows
 - C:\Users\YourName\YourFile.txt
 - Mac OS
 - /Users/YourName/YourFile.txt
 - Linux
 - /home/YourName/YourFile.txt
 - Linux (root access)
 - /root/YourFile.txt

Distinct features of each OS

- Application for accessing command line
 - Microsoft Windows
 - Command Prompt
 - Mac OS
 - Terminal
 - Linux
 - Terminal

Distinct features of each OS

- Application for Back-up
 - Microsoft Windows
 - System Restore and Restore Point
 - Mac OS
 - Time Machine
 - Linux
 - Ubuntu backups
 - Backups application

Distinct features of each OS

- Application for Hardware Management/List
 - Microsoft Windows
 - Device Manager
 - Mac OS
 - System Reports (“About this Mac”)
 - Linux (Ubuntu)
 - hardinfo, lspci, lsusb

Distinct features of each OS

- Checking or interrupting programs
 - Microsoft Windows
 - Task Manager
 - Mac OS
 - top (basic) and htop (to be installed)
 - Linux (Ubuntu)
 - top (basic) and htop (to be installed)

Distinct features of each OS

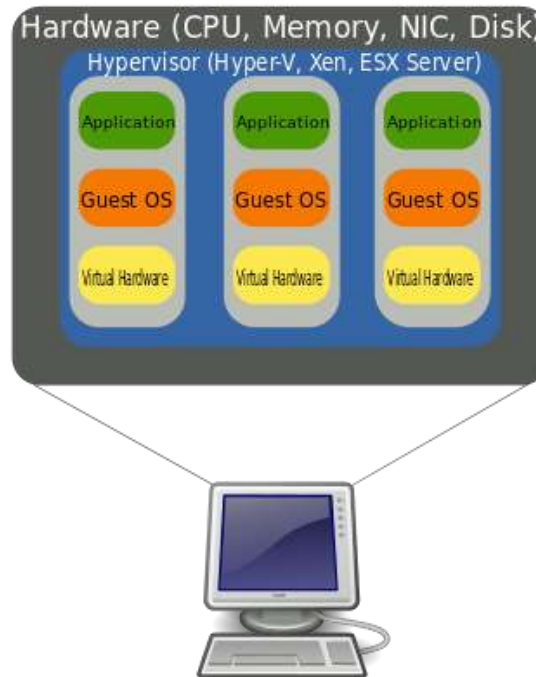
- Any other features?

Virtual Machine (VM)

- What is it?

Virtual Machine (VM)

- What is it?
 - A complete environment for a guest operating system to function as though that operating system were installed on its own computer



Virtual Machine (VM)

- What VM is not:
 - Virtual machine \neq Emulator
 - Emulator converts commands to and from a host machine to an entirely different platform
 - Emulator: DosBOX (CPU), PuTTY (Terminal), ZSNES (Gaming), PCSX2 (Gaming), N64 Emulator (Gaming)

Why do you need to know about VMs?

Why do you need to know about VMs?

- **SENARIO 1 (Flexibility):** The OS of your machine is not compatible with the application you need to run/test:
 - No spare machine for installing a new OS
 - No space or resources to create a dual boot

Why do you need to know about VMs?

- SENARIO 2 (Simulation): You want to simulate network connection to your web application in your own machine
 - No spare machine
 - Do not want to deploy in web server yet

Why do you need to know about VMs?

- SENARIO 3 (Security): Controlled/Quarantined environment for developing, testing or running applications
 - Potentially harmful applications
 - Secured VM

Why do you need to know about VMs?

- Any other scenario?

Let's create the first VM

- Applications for virtualization:
 - VM ware (Commercial)
 - **Oracle VM VirtualBox (Free and open-source)**
 - Vagrant (Free and open-source, but no GUI)
 - Other...

Let's create the first VM

- Check your machine
 - CPU: at least 2 cores
 - RAM: Host OS minimal requirement + Guest OS minimal requirement
 - Hard disk: Guest OS minimal requirement or External HDD or USB Flash drive

Let's create the first VM



The screenshot shows the VirtualBox website's Downloads page. The browser's address bar displays the URL <https://www.virtualbox.org/wiki/Downloads>. The page features the VirtualBox logo and a navigation menu on the left with links to About, Screenshots, Downloads, Documentation, End-user docs, Technical docs, Contribute, and Community. The main content area is titled 'Download VirtualBox' and provides information about downloading binaries and source code. A section titled 'VirtualBox binaries' includes a warning about license terms and a link to 'VirtualBox 5.1 builds'. Below this, the 'VirtualBox 5.2.18 platform packages' section lists links for Windows hosts, OS X hosts, Linux distributions, and Solaris hosts. A blue arrow points to the 'OS X hosts' link. The page also includes a changelog link, a note about checksums, and a note about upgrading guest additions.

VirtualBox

Download VirtualBox

Here you will find links to VirtualBox binaries and its source code.

VirtualBox binaries

By downloading, you agree to the terms and conditions of the respective license.

If you're looking for the latest VirtualBox 5.1 packages, see [VirtualBox 5.1 builds](#). Consider upgrading.

VirtualBox 5.2.18 platform packages

- [Windows hosts](#)
- [OS X hosts](#)
- [Linux distributions](#)
- [Solaris hosts](#)

The binaries are released under the terms of the GPL version 2.

See the [changelog](#) for what has changed.

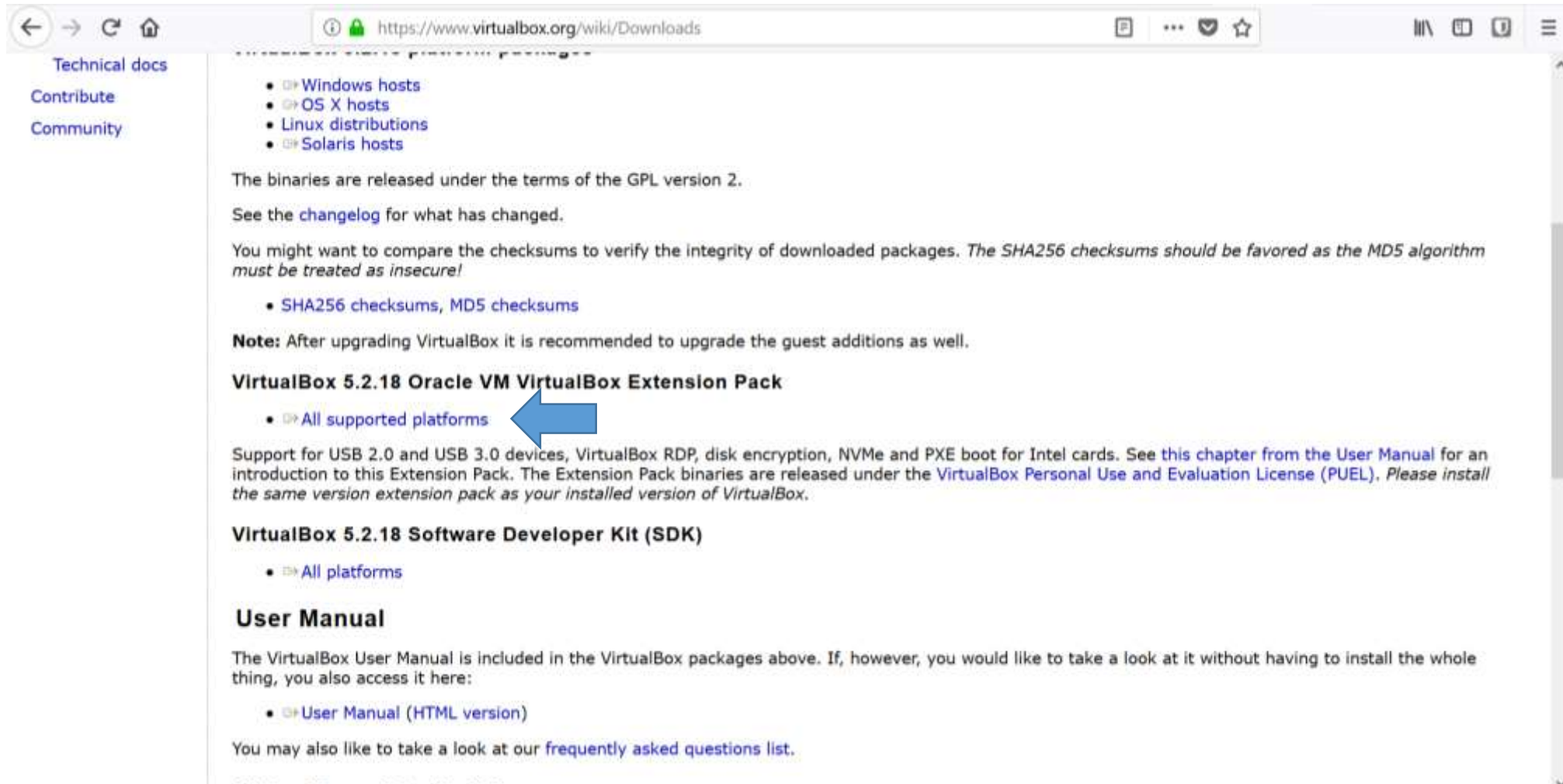
You might want to compare the checksums to verify the integrity of downloaded packages. *The SHA256 checksums should be favored as the MD5 algorithm must be treated as insecure!*

- [SHA256 checksums](#), [MD5 checksums](#)

Note: After upgrading VirtualBox it is recommended to upgrade the guest additions as well.

VirtualBox 5.2.18 Oracle VM VirtualBox Extension Pack

Let's create the first VM



The screenshot shows a web browser window with the address bar displaying <https://www.virtualbox.org/wiki/Downloads>. The left sidebar contains links for [Technical docs](#), [Contribute](#), and [Community](#). The main content area lists download links for various operating systems: [Windows hosts](#), [OS X hosts](#), [Linux distributions](#), and [Solaris hosts](#). Below this, it states that binaries are released under the terms of the GPL version 2 and provides a link to the [changelog](#). A note mentions comparing checksums, favoring SHA256 over MD5. A section titled **VirtualBox 5.2.18 Oracle VM VirtualBox Extension Pack** features a blue arrow pointing to the [All supported platforms](#) link. Below this, it describes the extension pack's features and provides a link to the [User Manual](#) chapter. Another section titled **VirtualBox 5.2.18 Software Developer Kit (SDK)** includes a link to [All platforms](#). The **User Manual** section explains that the manual is included in the packages and provides a link to the [User Manual \(HTML version\)](#). At the bottom, it suggests looking at the [frequently asked questions list](#).

Technical docs
Contribute
Community

- [Windows hosts](#)
- [OS X hosts](#)
- [Linux distributions](#)
- [Solaris hosts](#)

The binaries are released under the terms of the GPL version 2.

See the [changelog](#) for what has changed.

You might want to compare the checksums to verify the integrity of downloaded packages. *The SHA256 checksums should be favored as the MD5 algorithm must be treated as insecure!*

- [SHA256 checksums, MD5 checksums](#)

Note: After upgrading VirtualBox it is recommended to upgrade the guest additions as well.

VirtualBox 5.2.18 Oracle VM VirtualBox Extension Pack

- [All supported platforms](#)

Support for USB 2.0 and USB 3.0 devices, VirtualBox RDP, disk encryption, NVMe and PXE boot for Intel cards. See [this chapter from the User Manual](#) for an introduction to this Extension Pack. The Extension Pack binaries are released under the [VirtualBox Personal Use and Evaluation License \(PUEL\)](#). Please install the same version extension pack as your installed version of VirtualBox.

VirtualBox 5.2.18 Software Developer Kit (SDK)

- [All platforms](#)

User Manual

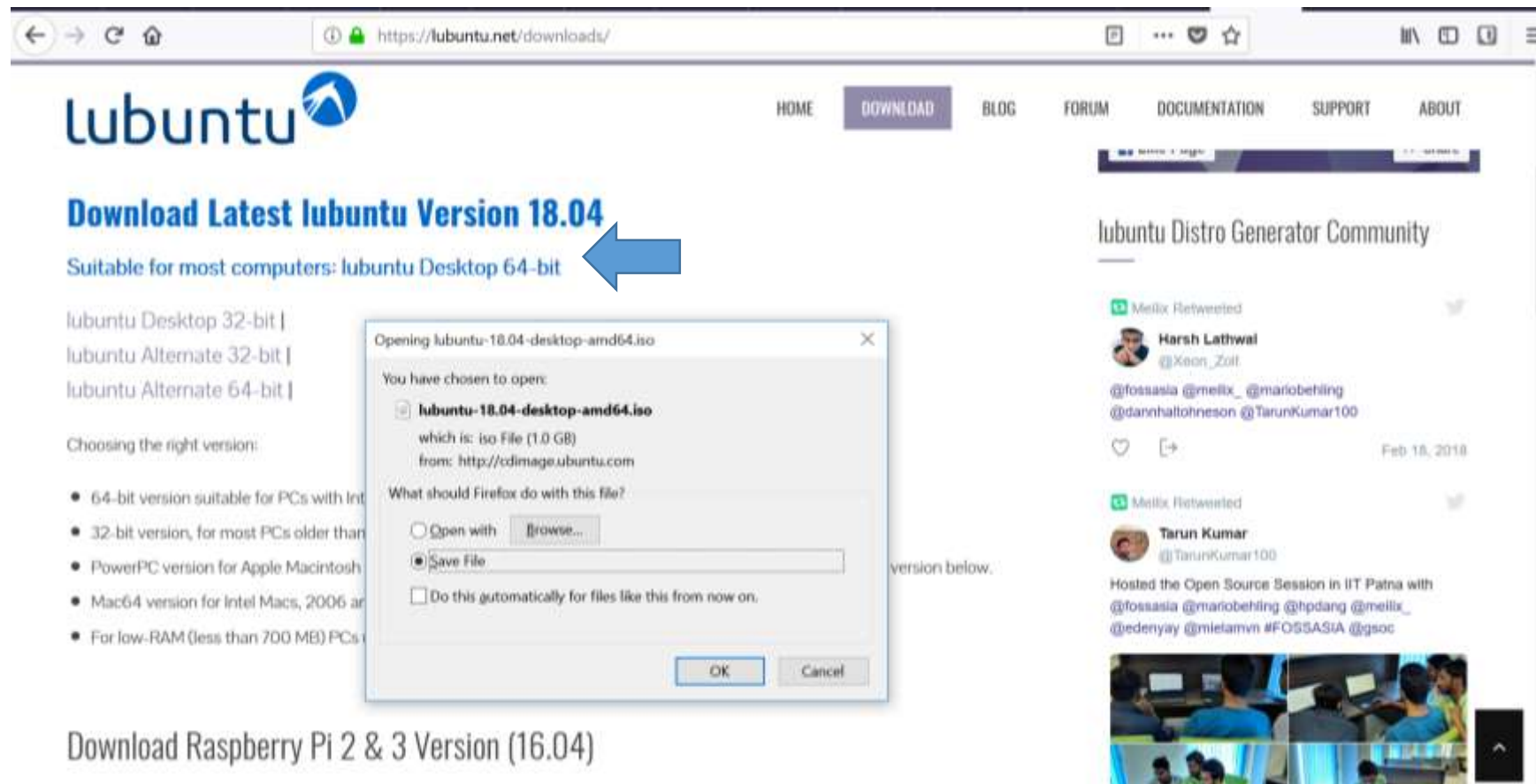
The VirtualBox User Manual is included in the VirtualBox packages above. If, however, you would like to take a look at it without having to install the whole thing, you also access it here:

- [User Manual \(HTML version\)](#)

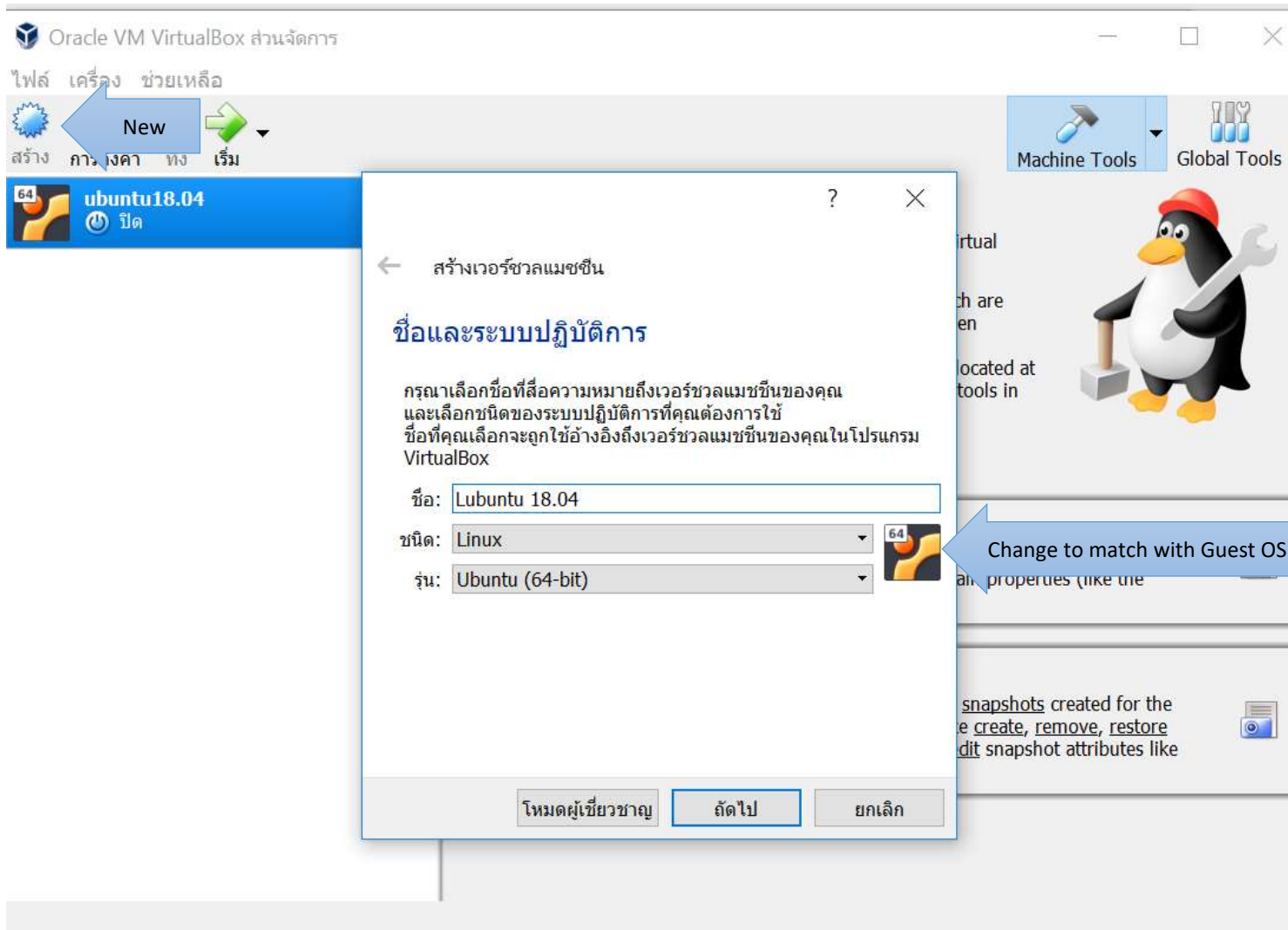
You may also like to take a look at our [frequently asked questions list](#).

Let's create the first VM

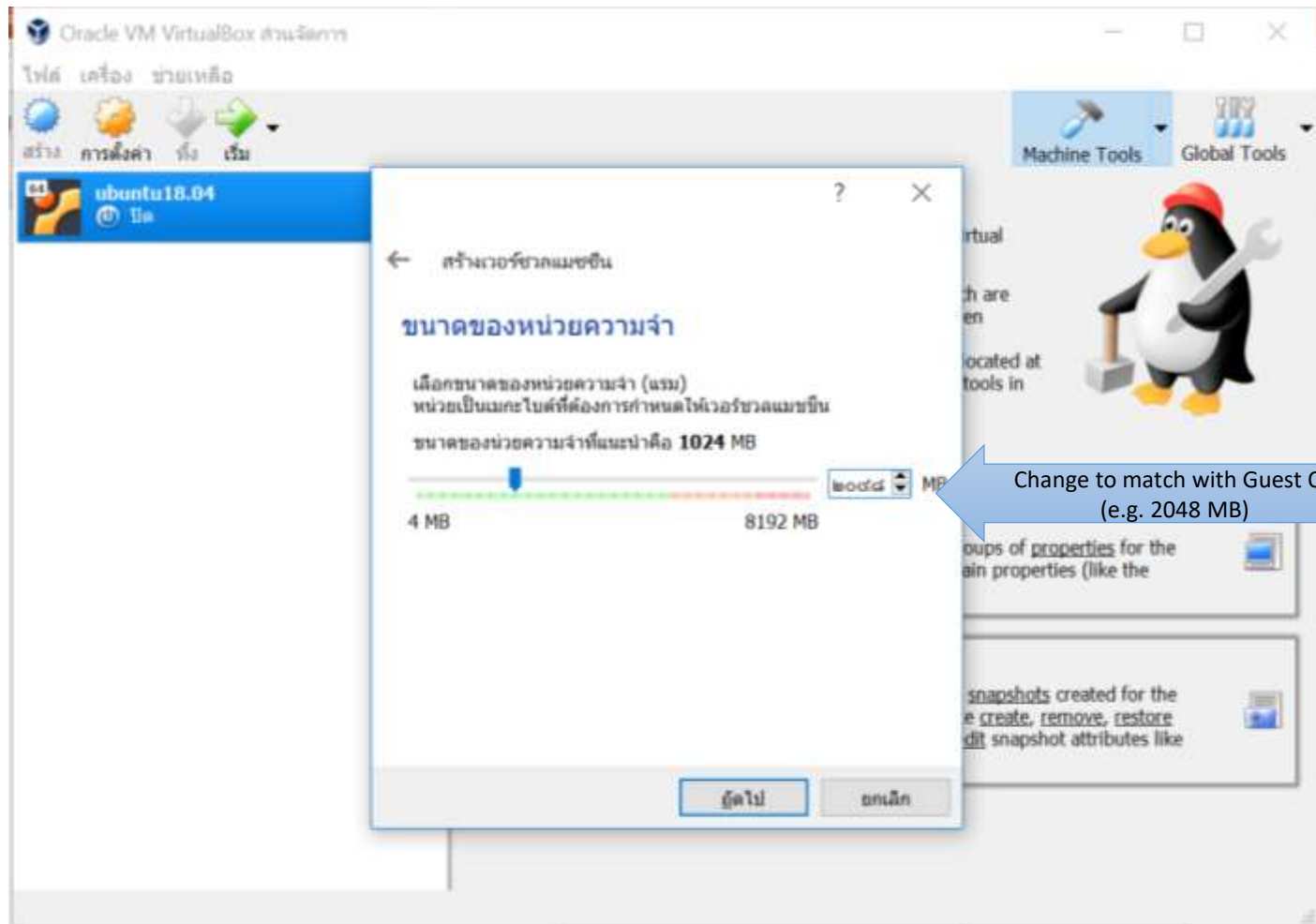
- Ubuntu.iso will be used for the demonstration



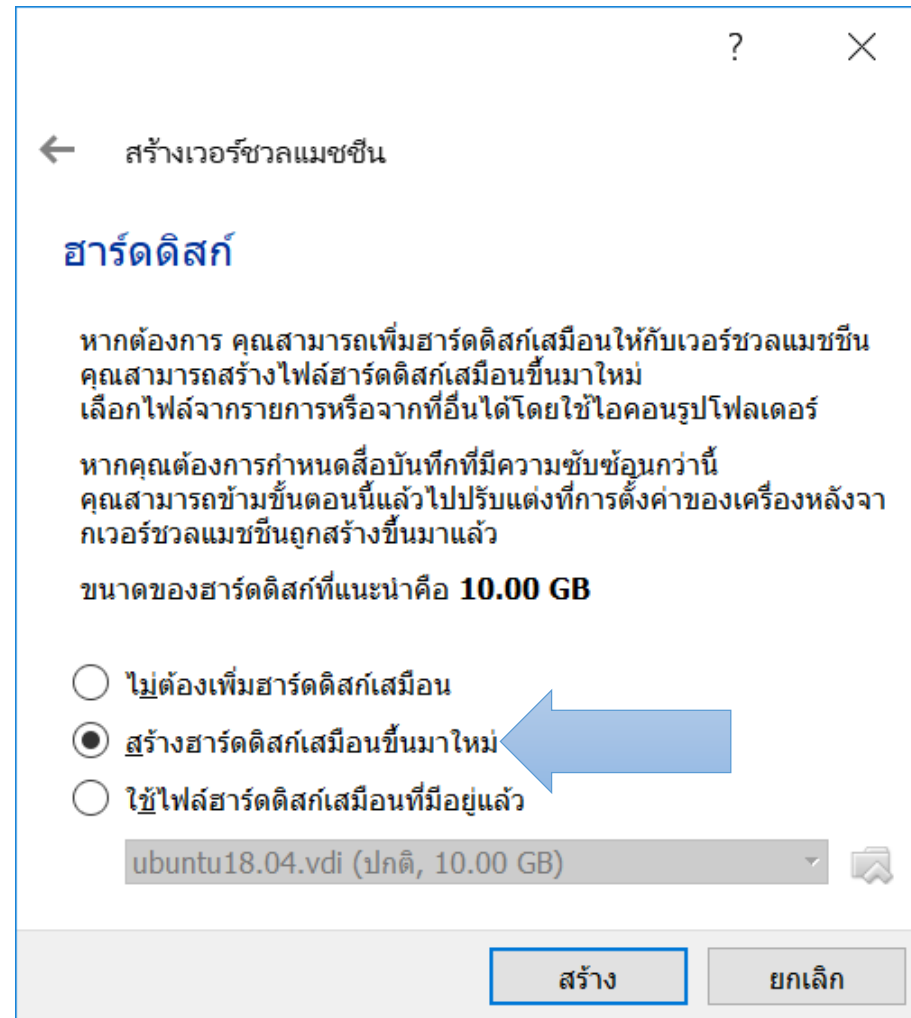
Let's create the first VM



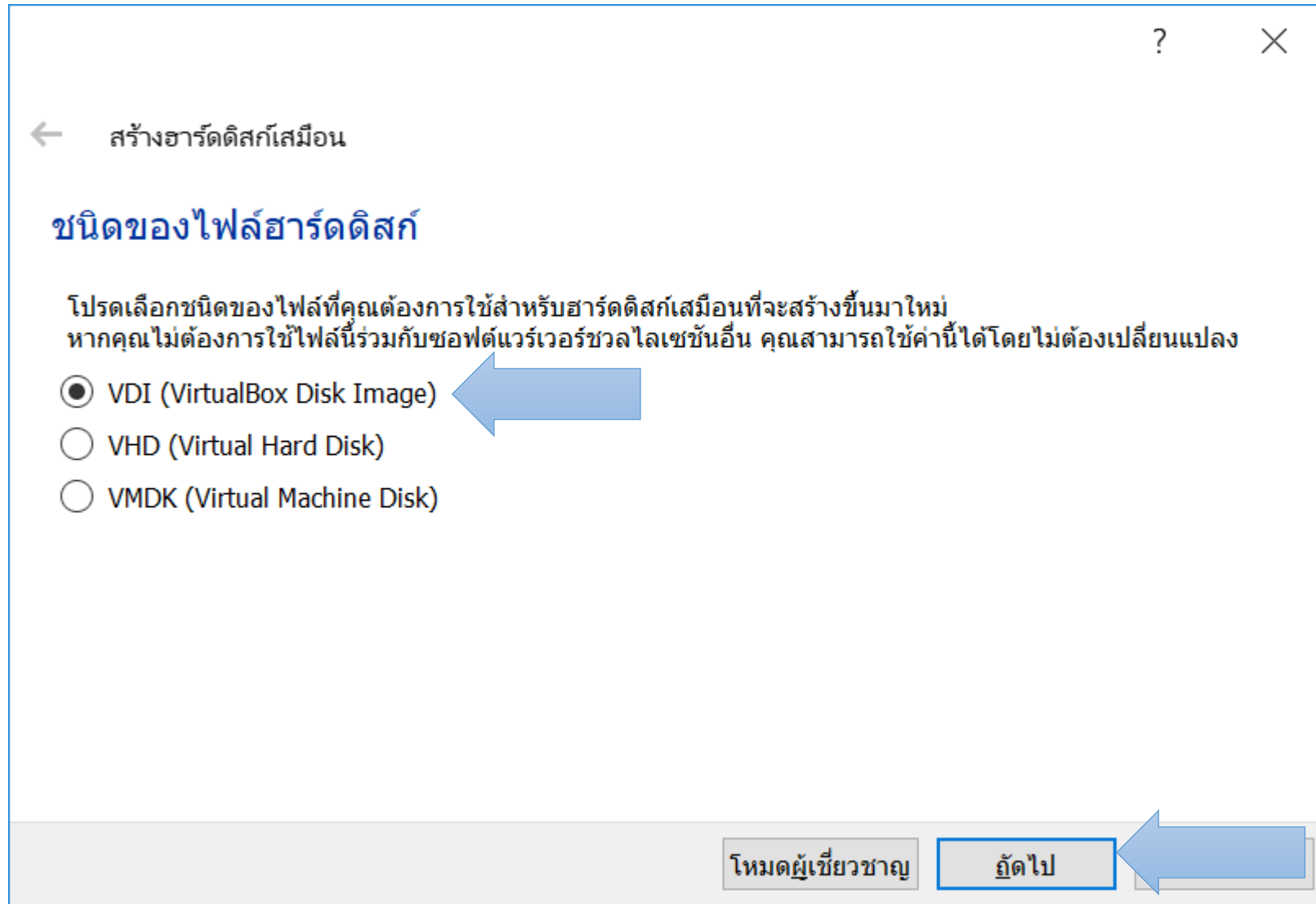
Let's create the first VM



Let's create the first VM



Let's create the first VM



Let's create the first VM

? ×

← สร้างฮาร์ดดิสก์เสมือน

สื่อบันทึกบนฮาร์ดดิสก์จริง

โปรดเลือกไฟล์ฮาร์ดดิสก์เวอร์ชวลบล็อกซ์ควรขยายขนาดตามการใช้งาน (จัดสรรแบบพลวัต)
หรือควรสร้างโดยใช้ขนาดสูงสุด (ขนาดคงที่)

ฮาร์ดดิสก์ที่**จัดสรรแบบพลวัต** จะใช้พื้นที่บนฮาร์ดดิสก์กายภาพของคุณเพิ่มขึ้นตามการใช้งาน (จนถึง **ขนาดคงที่** ที่ระบุไว้) แต่มันจะไม่ลดขนาดลงโดยอัตโนมัติแม้พื้นที่ภายในจะว่างลง

ไฟล์ฮาร์ดดิสก์ **ขนาดคงที่** อาจใช้เวลานานในการสร้างบนบางระบบ แต่มักทำงานได้เร็วกว่า

☒ จัดสรรแบบ**พลวัต** ← Dynamics
☐ ขนาด**คงที่**

ถัดไป

←

Let's create the first VM

← สร้างฮาร์ดดิสก์เสมือน

ที่ตั้งและขนาดของไฟล์

โปรดป้อนชื่อไฟล์สำหรับฮาร์ดดิสก์เสมือนที่สร้างขึ้นใหม่ลงในกล่องด้านล่าง
หรือคลิกไอคอนโฟลเดอร์เพื่อเลือกโฟลเดอร์อื่นสำหรับการสร้างไฟล์

D:\virtualbox\Lubuntu 18.04.vdi

เลือกขนาดไฟล์เวอร์ชวลฮาร์ดดิสก์มีหน่วยเป็นเมกะไบต์
ขนาดนี้ถูกใช้เพื่อจำกัดขนาดของข้อมูลที่เวอร์ชวลแมชีนจะสามารถบันทึกลงในฮาร์ดดิสก์ได้

4.00 MB 2.00 TB

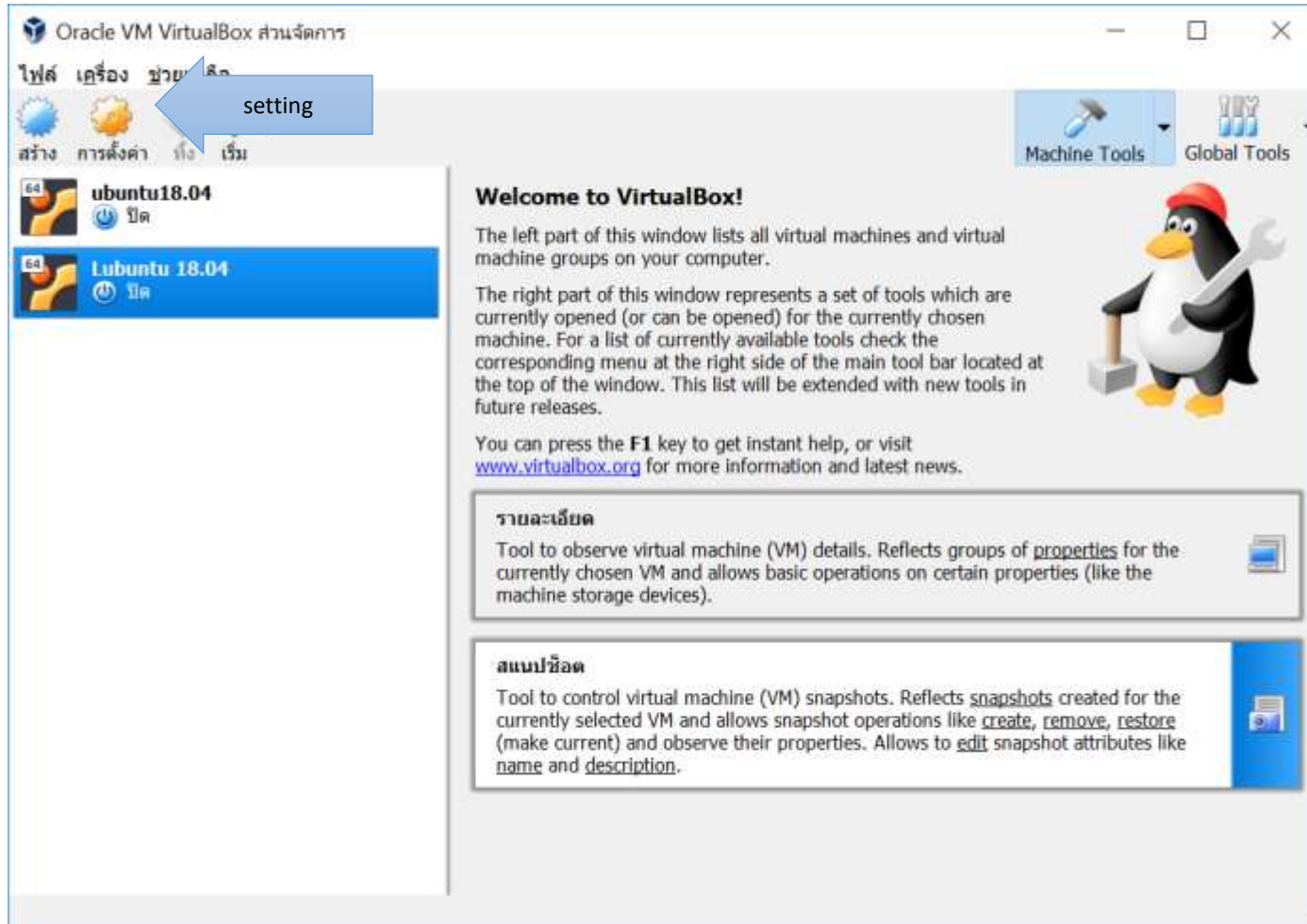
50 GB

สร้าง

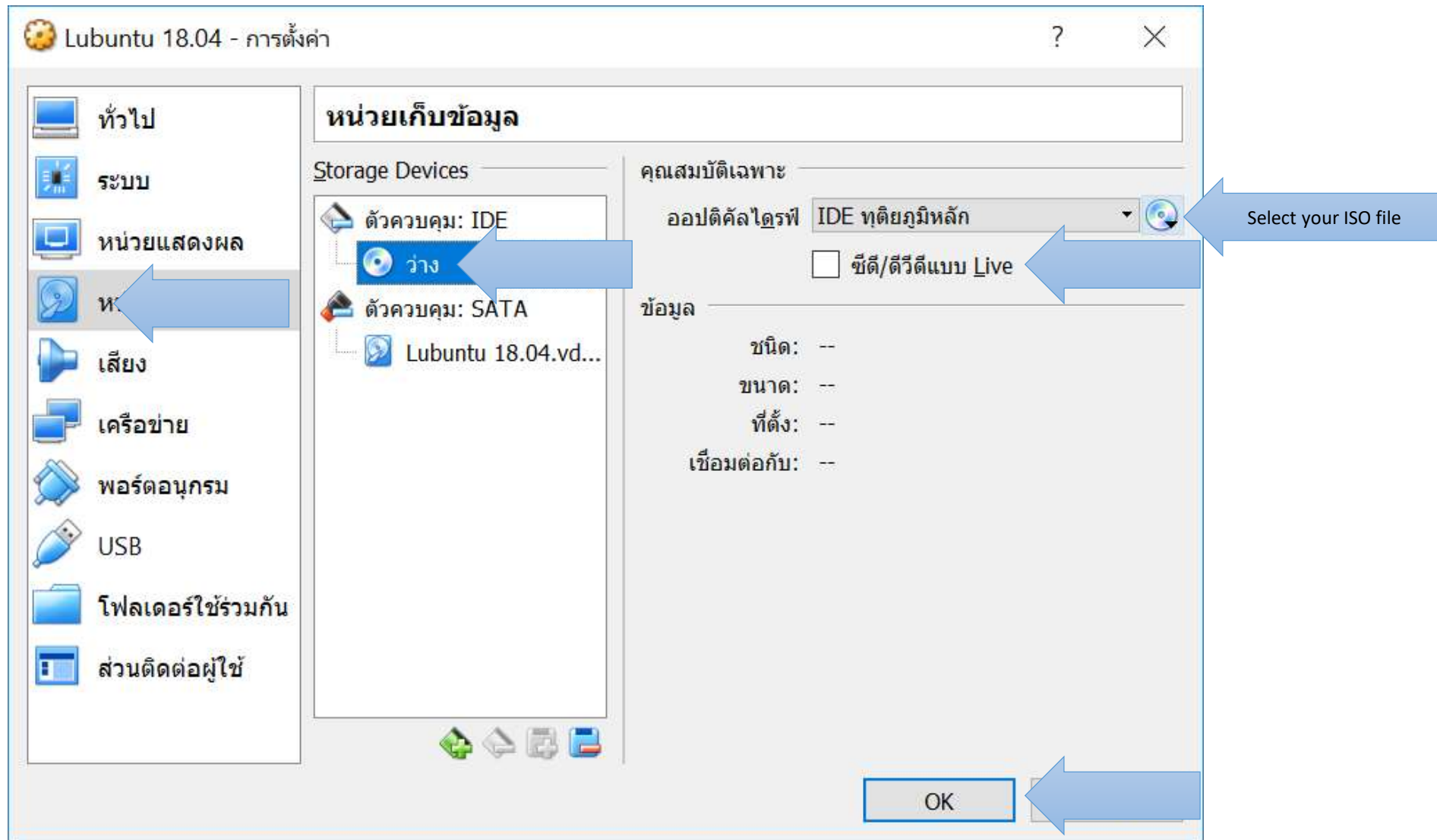
Change to appropriate path

Change to appropriate size

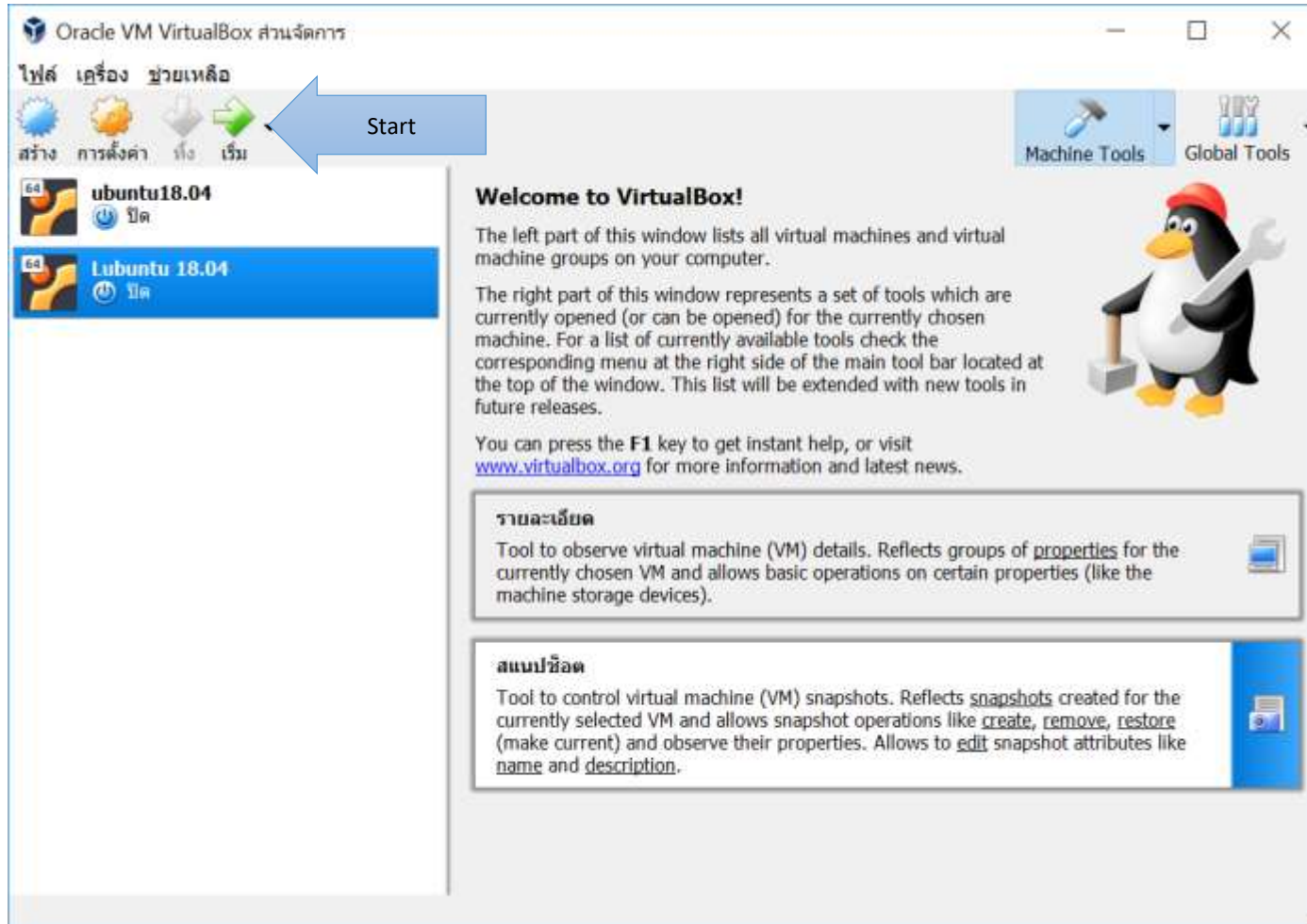
Let's create the first VM



Let's create the first VM

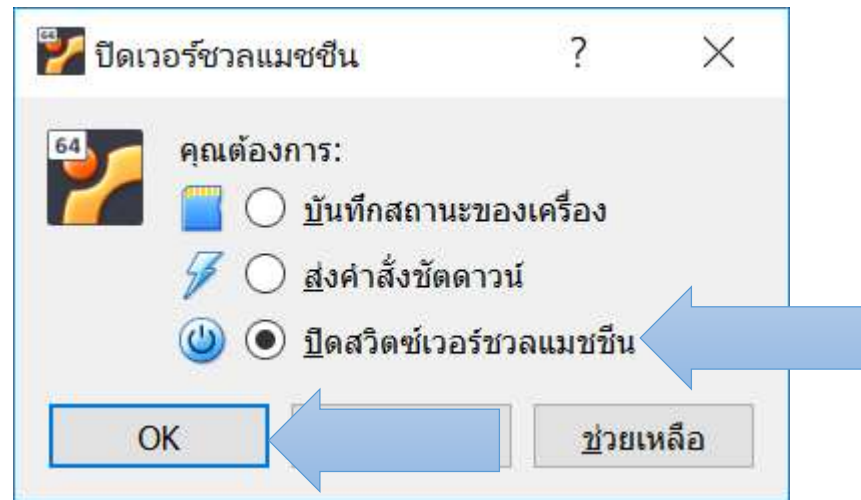


Let's create the first VM

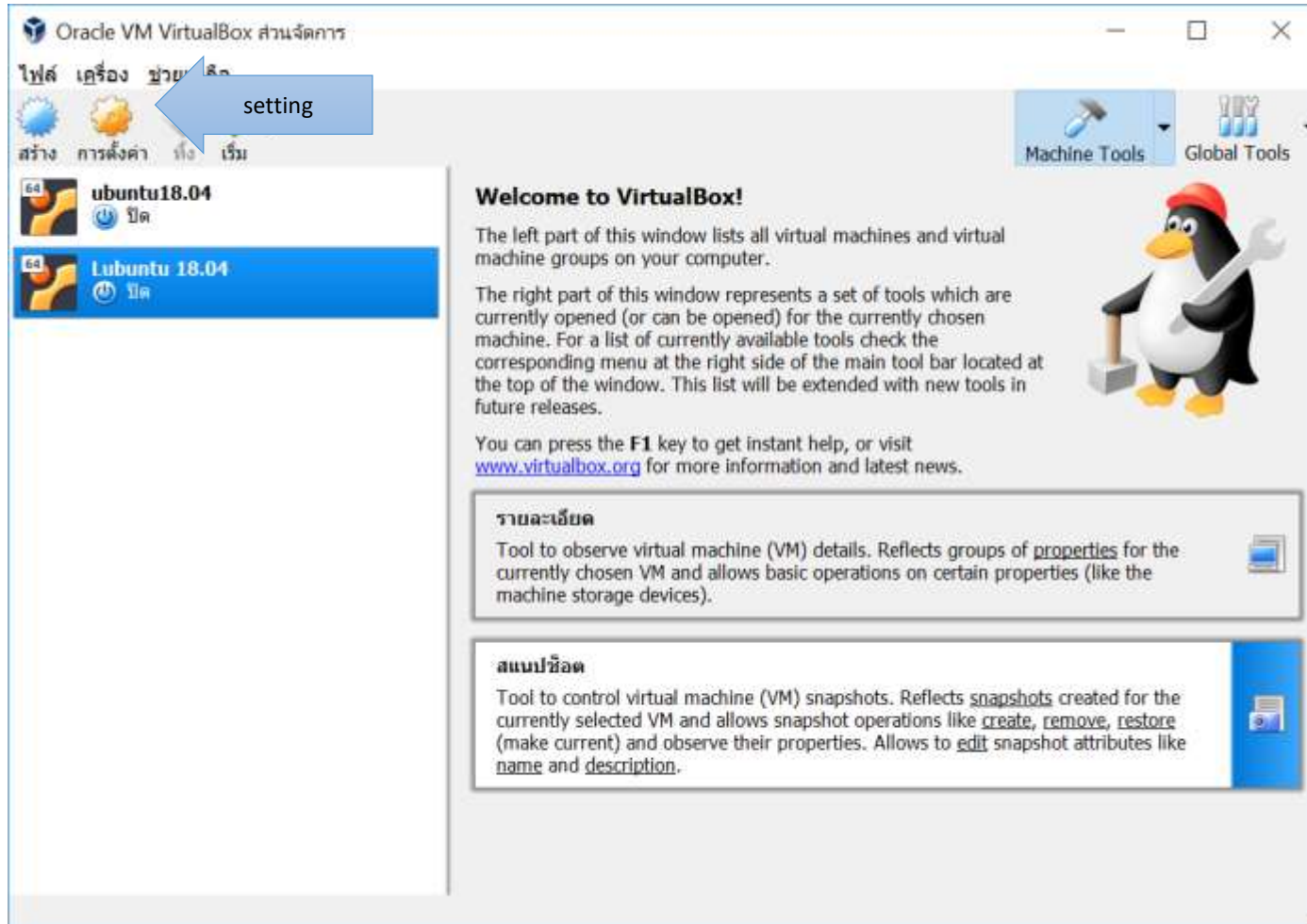


Let's create the first VM

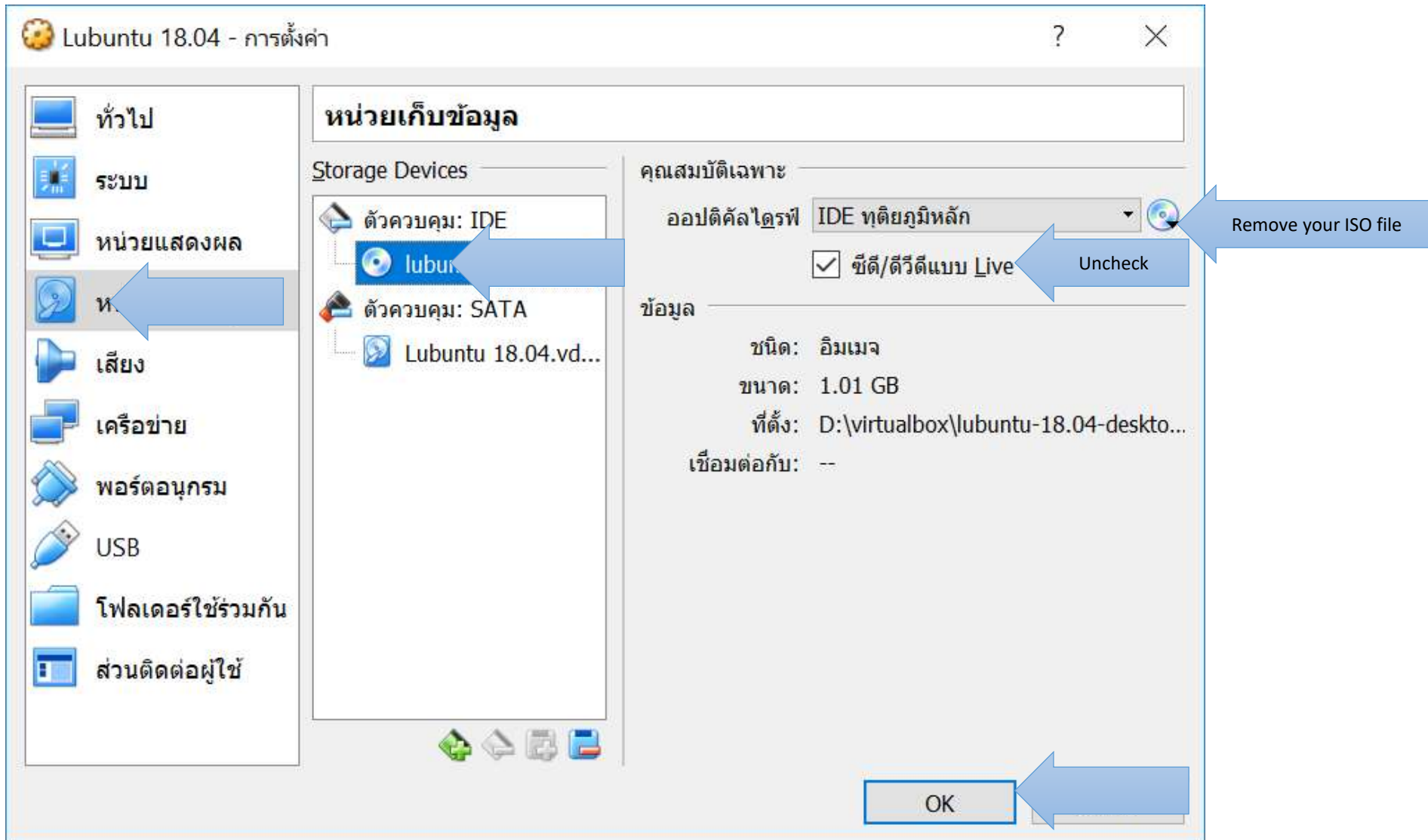
- Install Ubuntu according to instructions
- After installation is done, close the VM → Switch off



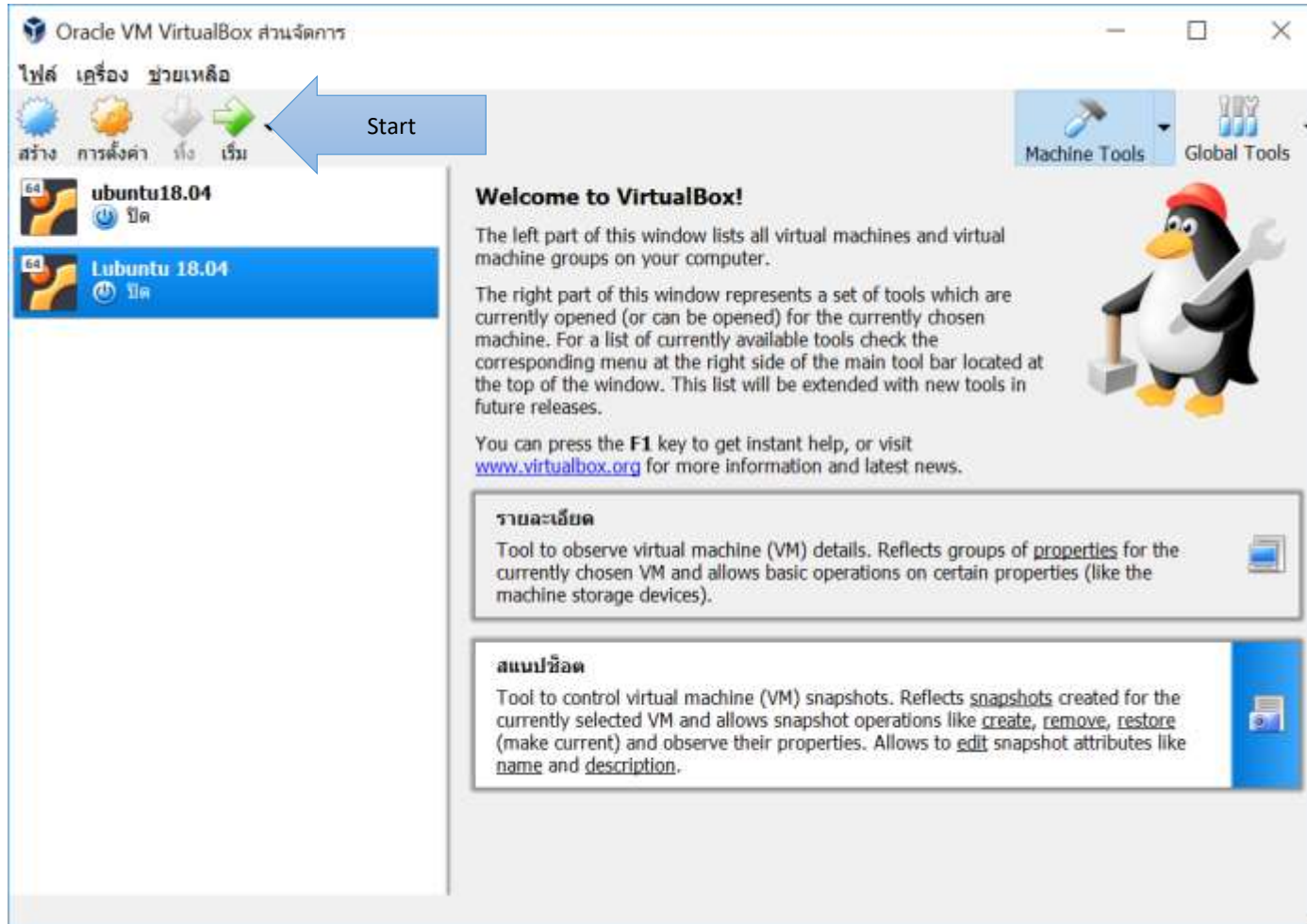
Let's create the first VM



Let's create the first VM



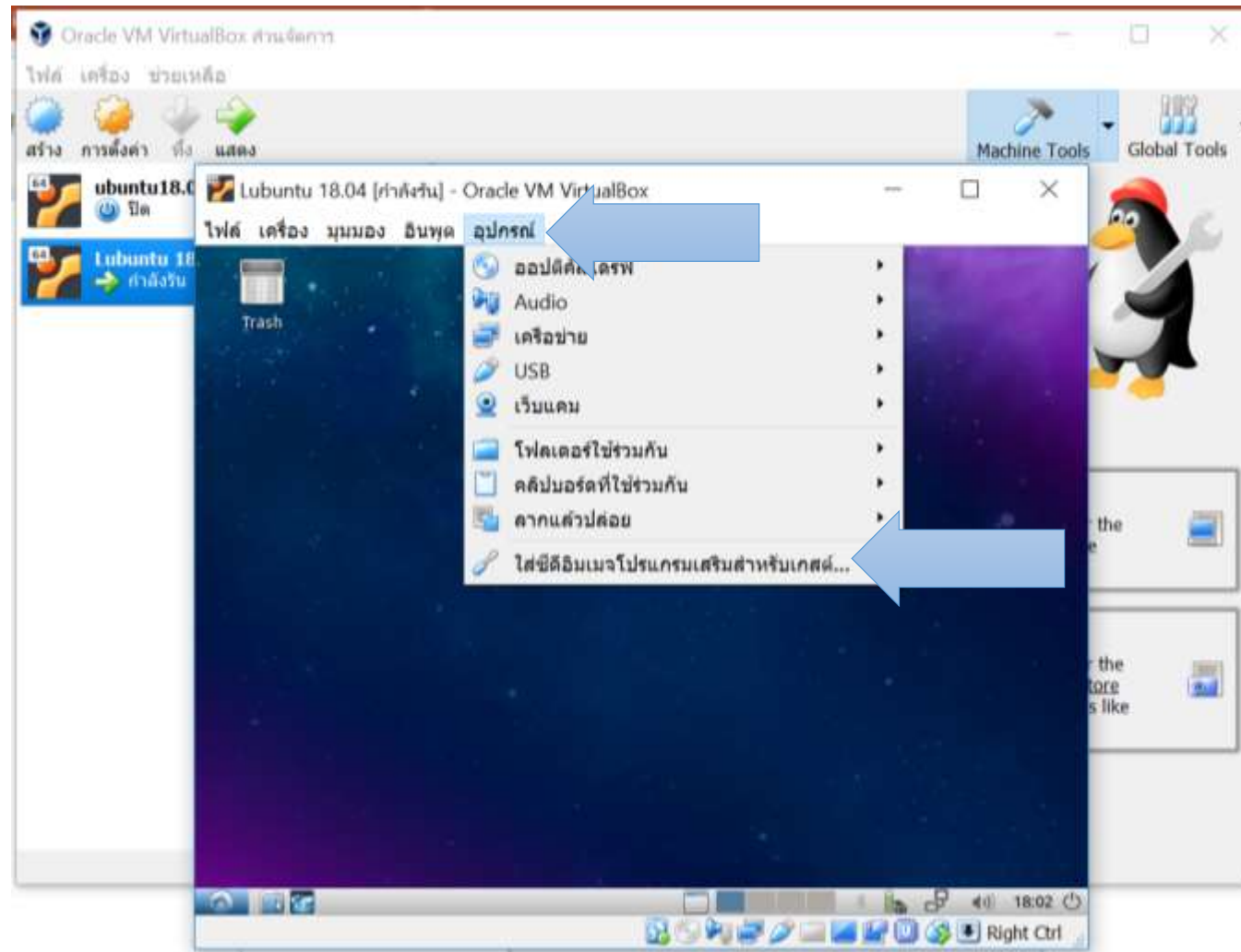
Let's create the first VM



Let's create the first VM

1. Run guest additions
2. Set a shared folder

Run guest additions



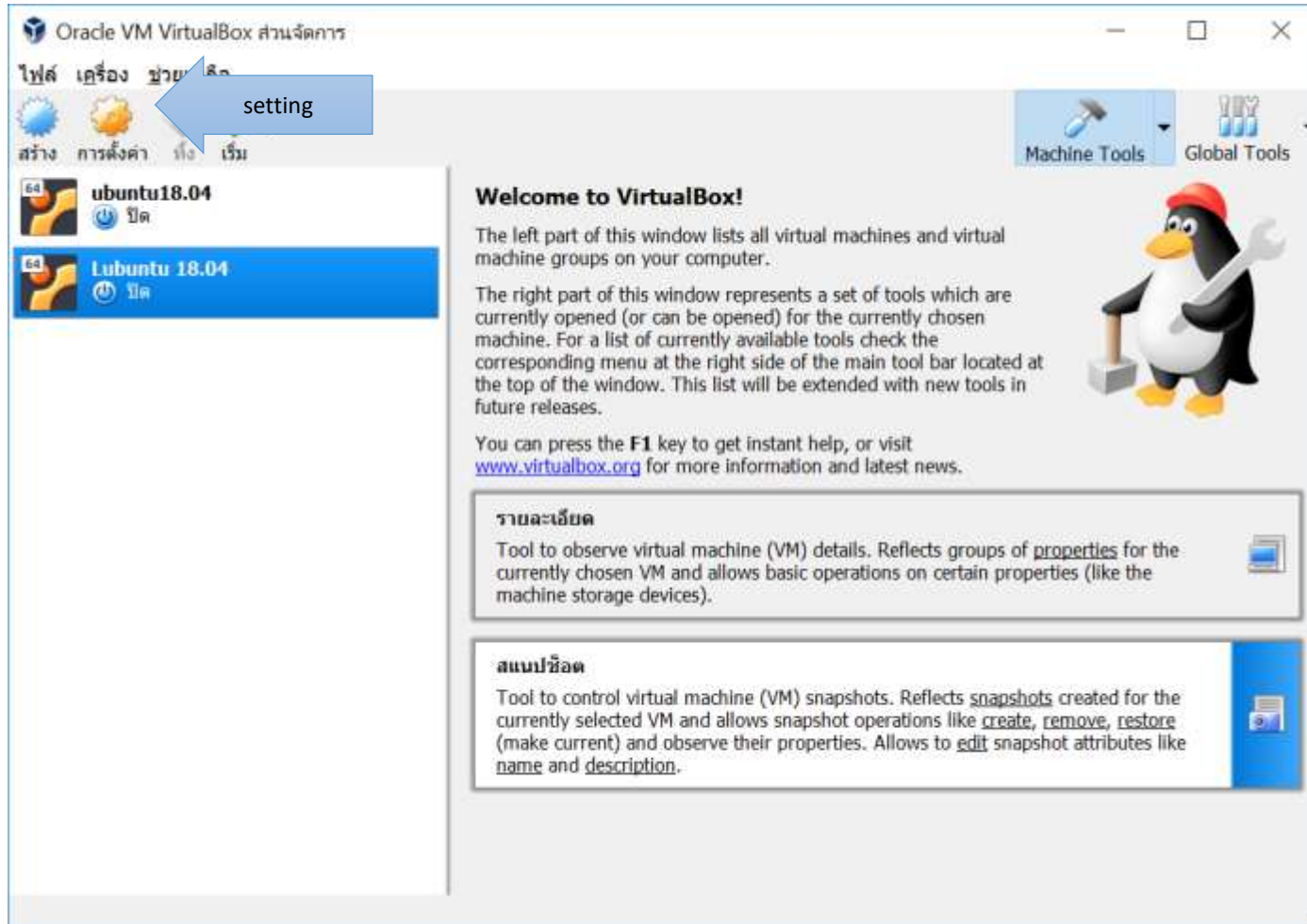
Run guest additions

- Open the Terminal

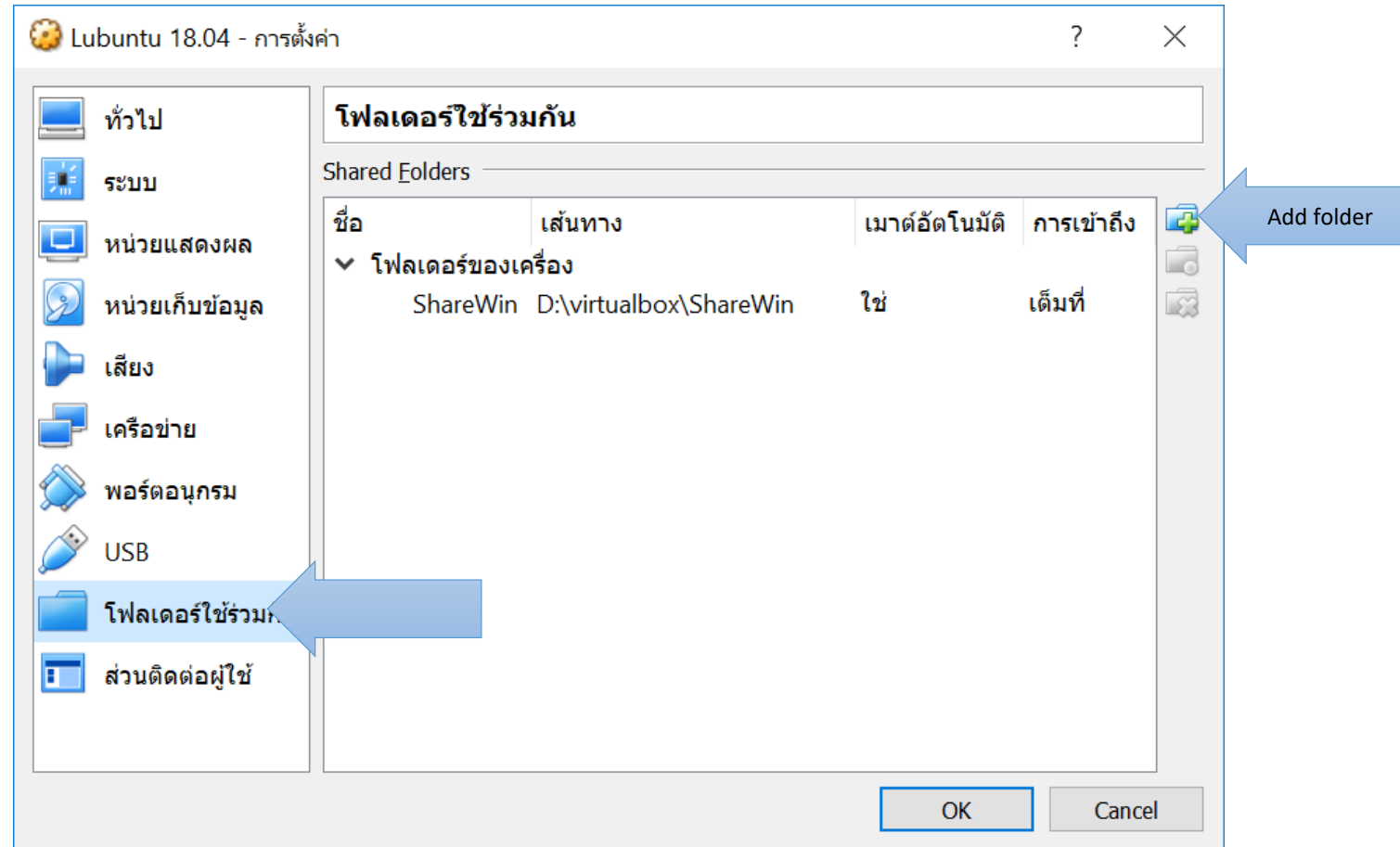
```
cd /media/YourName/VBox_GAs_5.x.x  
sudo sh ./VBoxLinuxAdditions.run
```

- Shutdown and restart

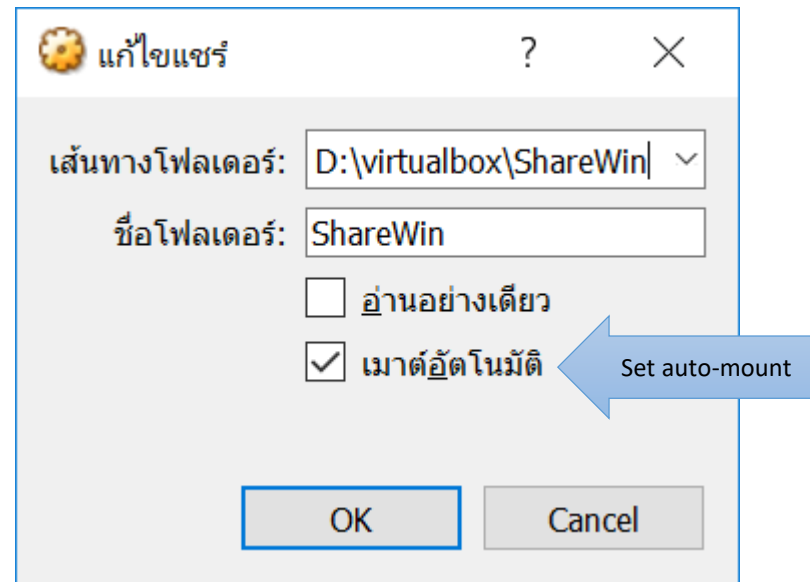
Set a shared folder



Set a shared folder



Set a shared folder



Set a shared folder

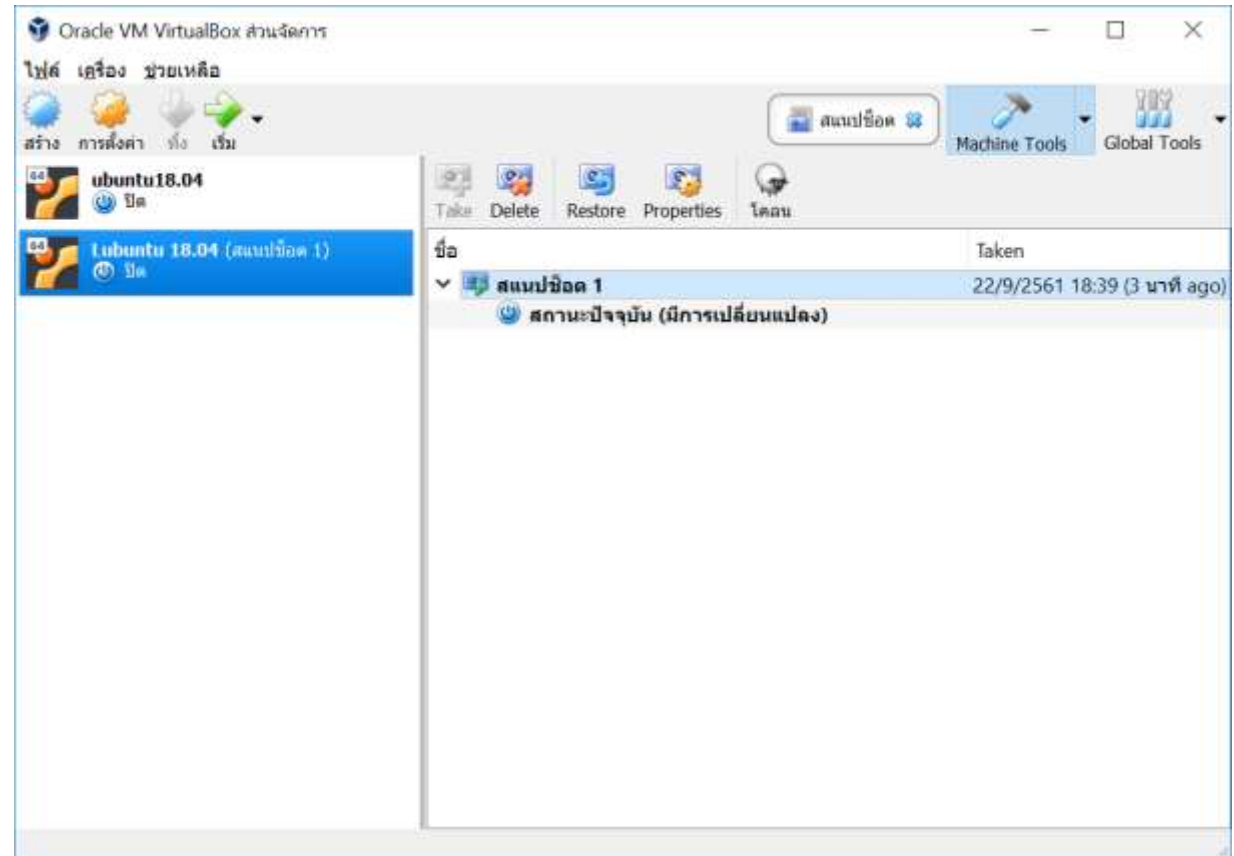
- Switch on the VM
- Open the Terminal

```
sudo usermod -aG vboxsf YourName
```

- Shutdown and restart

Backups by snapshot

- Backup = A copy of files from a computer's hard disk, usually made on some external medium such as CD-ROM or flash drive
- Save a snapshot (R Ctrl + T)



Portable VM

- You can save file.vdi to external HDD or USB flash drive
- Connect to any host machine with Virtualbox to quickly create a copy of VM in file.vdi
- **NOTE:**
 - USB flash drive must be formatted as NTFS
 - FAT32 format (default format in some USB flash drives) cannot accommodate a single file larger than 4GB

Cloud computing

- What is it?

Cloud computing

- What is it?
- Cloud computing, often referred to as simply “the cloud,” is the delivery of on-demand computing resources — everything from applications to data centers — over the internet on a pay-for-use basis.
 - Elastic resources — Scale up or down quickly and easily to meet demand
 - Metered service so you only pay for what you use
 - Self service — All the IT resources you need with self-service access








Why do you need to know Cloud Computing?

Why do you need to know Cloud Computing?

- Web application deployment
- Requiring intensive but transient computing power
- Backup and archive
- Sharing and hosting (Public cloud)
- Anything else?

Cloud service providers

- Amazon web services 
- Google cloud platform  Google Cloud Platform
- Microsoft Azure 
- IBM cloud  IBM **Cloud**
- Digital Ocean  **DigitalOcean**

Hands on: Cloud Computing PPT