Module 0: Virtual Machine

Working with Pathogen Genomes

What is an Operating System?

- Software that supports the computer's basic functions
- Manages computer hardware (screen, mouse, keyboard)
- Provides tools for managing files, running software
- Provides a way via software applications to interact with the computer

Examples include:

- Windows
- OSX
- Linux



What is a virtual machine?

A virtual machine (VM) is a software computer that, like a physical computer, runs an operating system and a set of software applications. It allows you to run one operating system (e.g. Linux) within another operating system (e.g. Windows).

The VM produced for this course already includes the data and software you'll need for the exercises.

Why use a VM?

The virtual machines can be built once and then run in a range of different environments without problems. This makes it a lot easier for you to reproduce what you've learnt on this course after you've left as well as making it easier for us to jump straight into teaching you new things without lots of setup.

A lot of bioinformatics software is built to run on Linux, some of this runs on OSX and a bit runs on Windows. This is because many high performance clusters run variants of Linux. We therefore want to teach in a similar environment.

Adding the virtual machine to Oracle VirtualBox

On this course we will be running a VM based on <u>BioLinux</u> which is based on a distribution of Linux called Ubuntu. We periodically provide <u>updates for the VM</u> on our website but you should use the supplied copy for now.

We will be running the VM on a Windows machine using the VirtualBox software. Other software is available to run the VM but this is a good free alternative. The following instructions walk you through how to setup the VM.

IMPORTANT NOTE: There are small differences between the images below, the instructions and what you'll see on the computer. If there's any doubt, follow the instructions in the text rather than the images.

Insert the USB stick into your machine. Our sticks will use USB 3 and run faster if you *plug the stick into a blue port.* Then open *Oracle VirtualBox* on your machine and select *'New'*. On these machines you'll find VirtualBox under the Windows Start Menu.

	Oracle VM VirtualBox Manager	
New Settings Discard Start	🐉 Details 🛛 💿	
	Name and operating system Please choose a descriptive name for the new virtual machine and select the type of operating system you intend to install on it. The name you choose will be used throughout VirtualBox to identify this machine. Name: Type: Microsoft Windows Wirsion: Windows 7 (64-bit) O 	The list is
	Expert Mode Go Back Continue Cancel	

Enter a name for your VM, **'Vietnam_2017'**. Select **'Linux'** as the type of operating system that will run on your VM. Select the version as **'Ubuntu (64bit)'** and click **Continue**.

•			Oracle VM VirtualBox Manager	
Settings	Discard	Start,	🐉 Details	 Snapshots
			Name and operating system	The list is
			Please choose a descriptive name for the new virtual machine and select the type of operating system you intend to install on it. The name you choose will be used throughout VirtualBox to identify this machine. Name: Vietnam_2017 Type: Linux Version: Ubuntu (64-bit)	
		4	Expert Mode Go Back Continue Cancel	
	Settings	Settings Discard	Settings Discard Start,	Vacle VM VirtualBox Manager

Select the amount of memory (RAM) to allocate to this VM, the values available to you will depend on the amount of memory (RAM) available on the host machine. On both our machines and your machine at home move the slider to the top of the green section.

New Settings Discard Start	Oracle VM VirtualBox Manager	Snapshots
	Memory size Select the amount of memory (RAM) in megabytes to be allocated to the virtual machine. The recommended memory size is 1024 MB. 12072 C MB 4 MB 16384 MB	The list is
	Go Back Continue Cancel	

As we have already created the virtual hard disk for you, select **'Use an existing virtual** *hard disk file*' and click on the *folder with a green arrow* on the right hand side.

wew Settings Discard Start _♥	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 8.00 GB . Oo not add a virtual hard disk O to not add a virtual hard disk file Use an existing virtual hard disk file Empty Go Back Create Cancel	The list is

New	Settings	Discard	Start _y	Oracle VM VirtualBox Manager	
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Navigate to the USB drive and select the file 'Vietnam_2017.vdi' and click 'Create'.

You should then see the screen below containing your VM '*Vietnam_2017*' in the Powered Off state.

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Video Memory: 16 MB Remote Desktop Server: Disabled Video Capture: Disabled Storage Controller: IDE IDE Secondary Master: [Optical Drive] Empty Controller: SATA SATA Port 0: Vietnam_2017.vdi (Normal, 410.65 GB) Audio Host Driver: CoreAudio Controller: ICH AC97		Display
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Host Driver: CoreAudio Controller: ICH AC97		🕒 Audio
		Host Driver: CoreAudio Controller: ICH AC97

Update Settings

Left click on **'Vietnam_2017'**, then click on Settings at the top of the window. Click General >> Advanced and then change "Shared Clipboard" to Bidirectional. This will make it possible to copy and paste things from the Windows "host" into and out of the Linux "guest".

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Now click **System >> Processor** and slide the slider to the top of the green section (i.e. use half the CPUs).

	Oracle	VM VirtualBox N	lanager		
New Setti				•	inapshots
General System Display	Storage Audio	Network Ports	Shared Folders	User Interface	
	Motherboard	Processor	Acceleration		
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			otroller.				Cance	el OK	
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Click *Display* >> *Screen* and change Video Memory to the maximum amount.

Click OK to save these changes. You should now be able to start the VM: *click on Vietnam_2017* and then *press the Start button*.

New Settings Discard Start		Details Of Snapshots
Vietnam_2017	🧕 General	Preview
Powered Off	Name: Vietnam_2017 Operating System: Ubuntu (64-bit)	
	System	
	Base Memory: 12072 MB Processors: 2 Boot Order: Floppy, Optical, Hard Disk Acceleration: VT-x/AMD-V, Nested Paging, KVM Paravirtualization	Vietnam_2017
	Display	
	Video Memory: 128 MB Remote Desktop Server: Disabled Video Capture: Disabled	
	Storage	
	Controller: IDE IDE Secondary Master: [Optical Drive] E Controller: SATA SATA Port 0: Vietnam_2017.vc	Empty di (Normal, 410.65 GB)
	🕞 Audio	
	Host Driver: CoreAudio Controller: ICH AC97	

It should then look a little like this:



You can make the VM use the entire screen by pressing the right hand 'Ctrl' key and 'f' at the same time. This should work on Windows and (probably) Linux hosts; on OSX you should press the right 'Cmd' key (the funny box with circles on the corners) and the 'f' key. You can escape by using the same key combination.

Username and password

If you need them, the username is "manager" and the password is also "manager".

Using the VM at home

You get to keep the USB stick after the course and can use it to continue working on the exercises.

- On Mac OSX you will probably need to copy the virtual machine onto your hard disk. Copy Vietnam_2017.vdi from the USB stick onto your hard drive and then follow these instructions again. Note, when selecting the "existing hard disk" in one of the steps, you need to point it at the copy on your hard disk.
- On Linux, you may or may not be able to run the VM from the USB stick.
- On Windows, you should be able to run the VM from the USB stick by following these instructions. You may see a slight performance benefit from moving it onto your hard disk though.

Removing the virtual machine from VirtualBox

DO NOT DO THIS UNTIL THE END OF THE COURSE OR UNLESS TOLD OTHERWISE

In the main *VirtualBox* window, *right click* on your virtual machine (seen in the left hand column). Select *'Remove'* from the menu.



Then select *'Remove only'*, do not select the 'Delete all files' option as this will delete the the vdi file that contains the virtual machine.



Shared folders

This is an optional step which you can do at home. It is not needed as part of the course.

By default, none of the files on the host machine are visible from inside the virtual machine; this describes how to share data between the host and the virtual machine. This might be

useful if you want to rerun some analysis with your own data or you want to share your results with a colleague.

First, *shut down the virtual machine.* In the main *VirtualBox* window, *select your virtual machine* (on the left). Then go to *Settings >> Shared Folders*.

General	Shared Folders		
System	Eolders List		
Display	Name Path	Auto-mount	Access
Storage	Machine Folders		
Audio			
Network			
Serial Ports			
USB			
Shared Folders			
User Interface			

Click on the blue folder with a green plus on the right hand side. In the pop up box, *select "Other"* from the Folder Path option.

🥝 Add Share	-?- × -
Folder Path: Folder Name:	<not selected=""> <not selected=""></not> Other Read-only Displays a</not>
	OK Cancel

Find the folder that you would like to share with the Virtual Machine. It should now be visible in the Folder Path box. *Tick the Automount box*.

🥝 Add Share		? 🔀
Folder Path:	🐌 H:\shared_data	•
Folder Name:	shared_data	
	Read-only	
	Auto-mount	
	OK	Cancel

Now *click on OK*. The new shared folder should be in the Folders List:

	Shared Folders					
System	Eolders List					
Display	Name	Path		Auto-mount	Access	
	Machine Folders					
Storage	shared_da	ta H:\shared_data		Yes	Full	
Audio						
Network						
Serial Ports						
USB						
Shared Folders						
Shared Folders User Interface						

Select OK and you will return to the main VirtualBox window. Now start the virtual machine.

Finding the shared folder in the virtual machine

Inside the virtual machine, the shared folder will be inside the directory "/media". It will have the same name as on the folder on the host machine, but with "sf_" added. For example, if the folder is called "shared_data" on the host, then it will be called "/media/sf_shared_data/" inside the virtual machine.