

Virtualization is now easy: VirtualBox OSE

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Preface

- I am not a VM guru
- All examples are for VirtualBox OSE
 - <http://www.virtualbox.org>

Goals

- Basic definition of Virtual Machine
 - Simple uses of VirtualBox OSE
- Expanded definition of Virtual Machine
 - Other similar concepts
- What's it good for?
- What's it bad for?
- Complex ways to use VirtualBox OSE

Virtual Machine: Basic Definition

- Wikipedia says: "A virtual machine (VM) is a software implementation of a machine (i.e. a computer) that executes programs like a physical machine."

Virtual Machine: Basic Definition

- I say: A VM is like *The Matrix* for software.
 - “Whoah.” – Neo, *The Matrix*
- Unless it is designed to check, software won't know it's running on a VM.

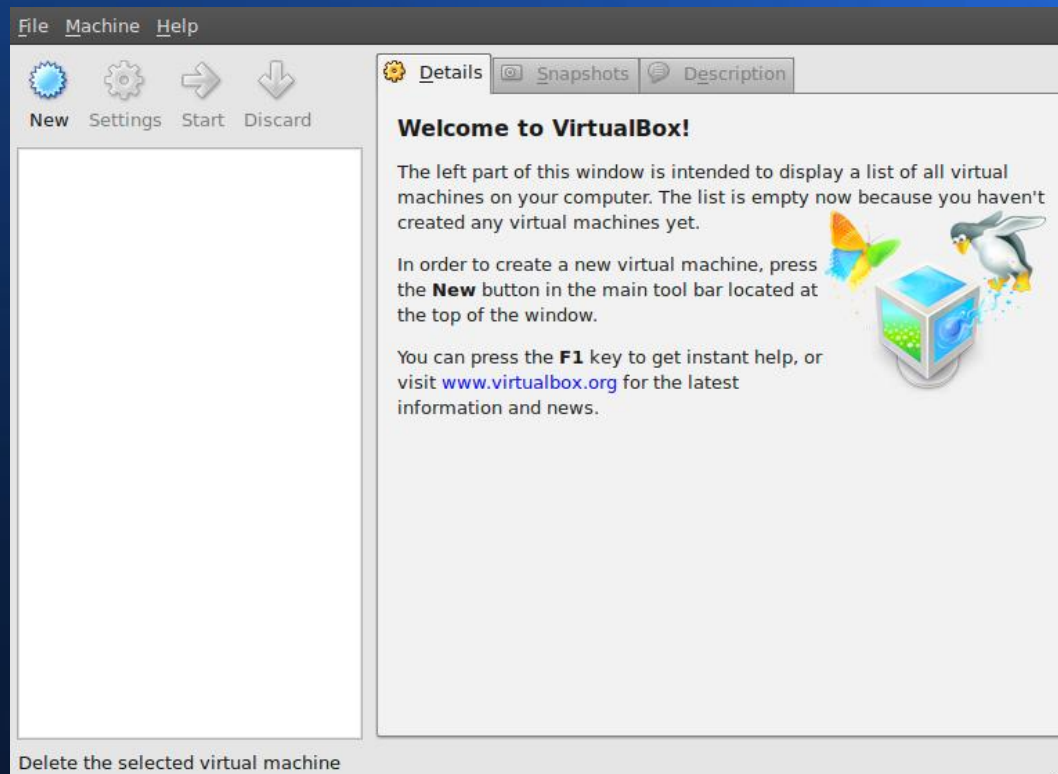
Virtual Machine: Basic Definition

- Questions so far?
- Simple uses coming up.

Simple Use #1


- Run a live Linux ISO in parallel with your current OS without rebooting.
 - You can do this within seconds of installing VirtualBox on your host OS.
 - Default network configuration lets the VM get out to the WAN, but nothing else can get in.

Simple Use #1 HOWTO



Simple Use #1 HOWTO

Welcome to the New Virtual Machine Wizard!




This wizard will guide you through the steps that are necessary to create a new virtual machine for VirtualBox.

Use the **Next** button to go the next page of the wizard and the **Back** button to return to the previous page.

< Back Next > Cancel

VM Name and OS Type




Enter a name for the new virtual machine and select the type of the guest operating system you plan to install onto the virtual machine.

The name of the virtual machine usually indicates its software and hardware configuration. It will be used by all VirtualBox components to identify your virtual machine.

Name

OS Type

Operating System: Linux 

Version: Ubuntu

< Back Next > Cancel


Simple Use #1 HOWTO

Memory


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

The recommended base memory size is **384 MB**.

Base Memory Size



4 MB 2560 MB 384 MB



< Back Next > Cancel

Virtual Hard Disk

Select a hard disk image to be used as the boot hard disk of the virtual machine. You can either create a new hard disk using the **New** button or select an existing hard disk image from the drop-down list or by pressing the **Existing** button (to invoke the Virtual Media Manager dialog).

If you need a more complicated hard disk setup, you can also skip this step and attach hard disks later using the VM Settings dialog.

The recommended size of the boot hard disk is **8192 MB**.

Boot Hard Disk (Primary Master)

Create new hard disk

Use existing hard disk





< Back Next > Cancel

Simple Use #1 HOWTO



You didn't attach a hard disk to the new virtual machine. The machine will not be able to boot unless you attach a hard disk with a guest operating system or some other bootable media to it later using the machine settings dialog or the First Run Wizard.

Do you want to continue?

Go Back

Continue

Summary



You are going to create a new virtual machine with the following parameters:

Name: Ubuntu 9.10 beta live

OS Type: Ubuntu

Base Memory: 384 MB

If the above is correct press the **Finish** button. Once you press it, a new virtual machine will be created.

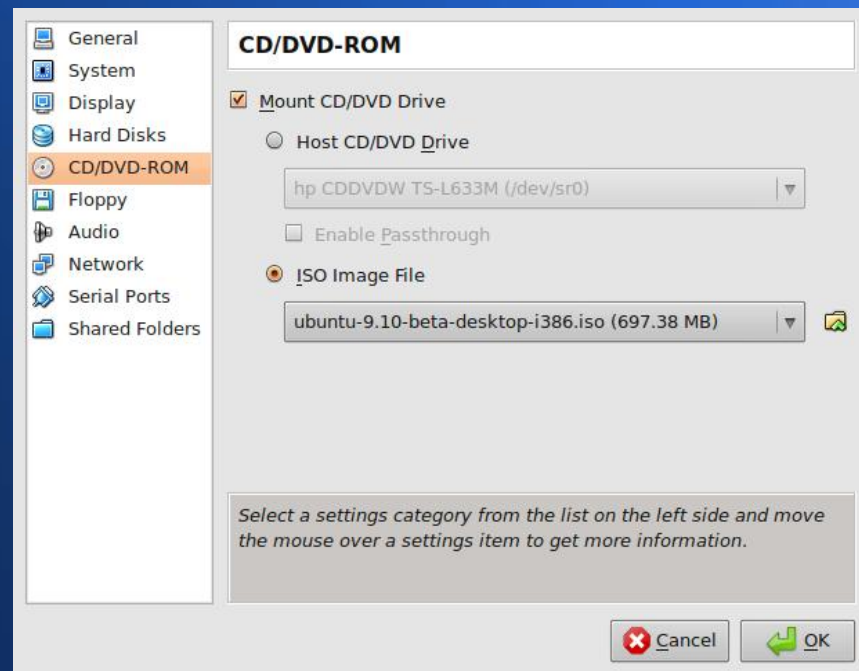
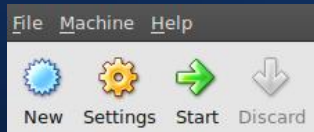
Note that you can alter these and all other setting of the created virtual machine at any time using the **Settings** dialog accessible through the menu of the main window.

< Back

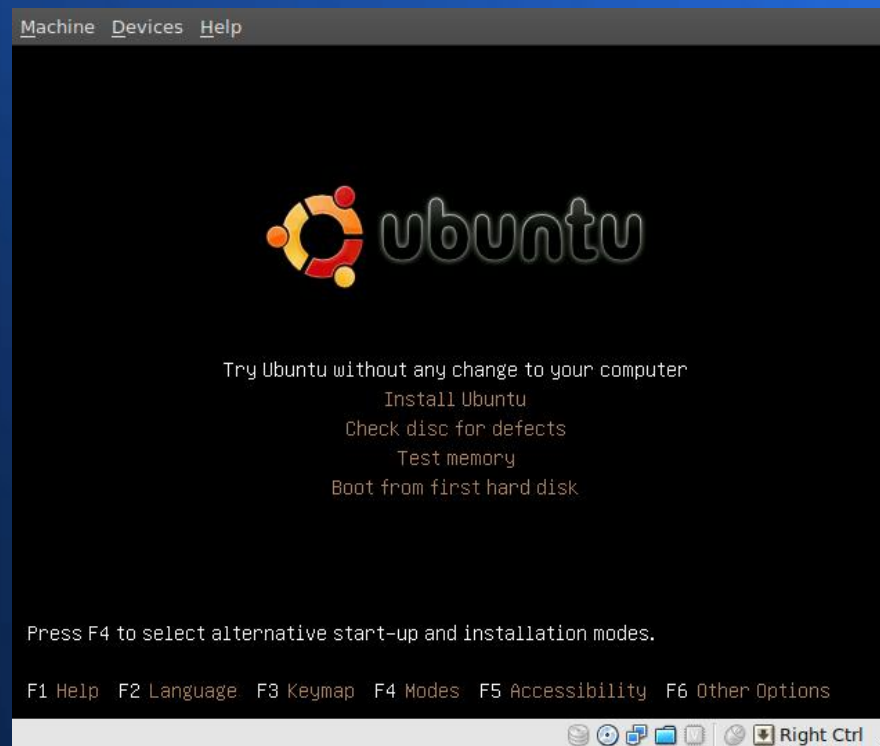
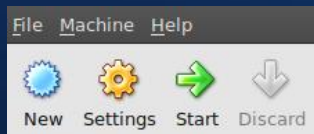
Finish

Cancel

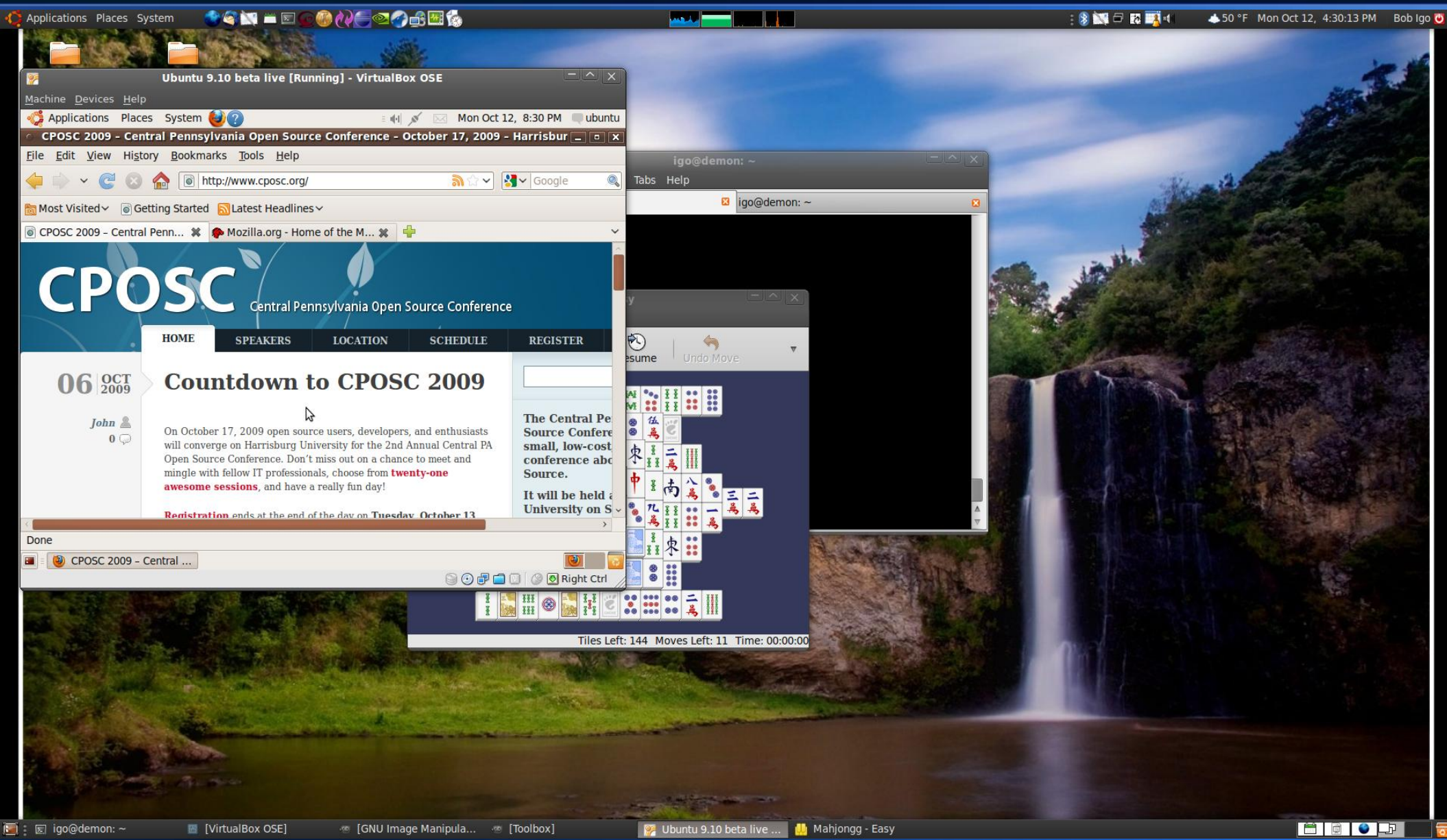
Simple Use #1 HOWTO



Simple Use #1 HOWTO



Simple Use #1 HOWTO



Simple Use #1

- Questions on using VirtualBox for live ISOs?
- A second example is next.

Simple Use #2

- Install and run in parallel as many OSes as your computer can handle.
 - You can start installing *guest* OSes within minutes of installing VirtualBox on your *host* OS.

Simple Use #2 HOWTO

- As before, except you just need to create and use a virtual HDD (.vdi file).

Virtual Hard Disk



Select a hard disk image to be used as the boot hard disk of the virtual machine. You can either create a new hard disk using the **New** button or select an existing hard disk image from the drop-down list or by pressing the **Existing** button (to invoke the Virtual Media Manager dialog).

If you need a more complicated hard disk setup, you can also skip this step and attach hard disks later using the VM Settings dialog.

The recommended size of the boot hard disk is **8192 MB**.

Boot Hard Disk (Primary Master)

Create new hard disk

Use existing hard disk

UpTo10GB.vdi (Normal, 10.00 GB) 

< Back Next > Cancel

Welcome to the Create New Virtual Disk Wizard!




This wizard will help you to create a new virtual hard disk for your virtual machine.

Use the **Next** button to go to the next page of the wizard and the **Back** button to return to the previous page.

< Back Next > Cancel

Hard Disk Storage Type



Select the type of virtual hard disk you want to create.

A **dynamically expanding storage** initially occupies a very small amount of space on your physical hard disk. It will grow dynamically (up to the size specified) as the Guest OS claims disk space.

A **fixed-size storage** does not grow. It is stored in a file of approximately the same size as the size of the virtual hard disk. The creation of a fixed-size storage may take a long time depending on the storage size and the write performance of your harddisk.

Storage Type

Dynamically expanding storage

Fixed-size storage


< Back Next > Cancel

Simple Use #2 HOWTO

Virtual Disk Location and Size


Press the **Select** button to select the location of a file to store the hard disk data or type a file name in the entry field.

Location

4GB_disk 

Select the size of the virtual hard disk in megabytes. This size will be reported to the Guest OS as the maximum size of this hard disk.

Size

 4 GB

4.00 MB 2.00 TB

< Back Next > Cancel

Summary

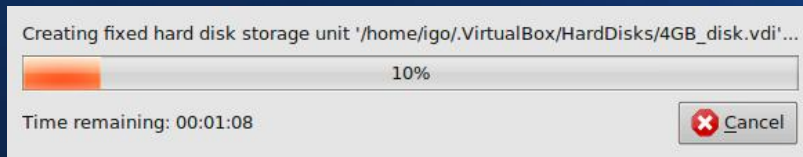
You are going to create a new virtual hard disk with the following parameters:

Type: Fixed-size storage
Location: /home/igo/.VirtualBox/HardDisks/4GB_disk.vdi
Size: 4.00 GB (4294967296 Bytes)

If the above settings are correct, press the **Finish** button. Once you press it, a new hard disk will be created.

< Back Finish Cancel

Simple Use #2 HOWTO



```
igo@demon:~$ du -h ~/.VirtualBox/HardDisks/4GB_disk.vdi
4.1G    /home/igo/.VirtualBox/HardDisks/4GB_disk.vdi
```



Simple Uses

- Questions about simple uses?
- Expanded definition of Virtual Machine is next.

Virtual Machine: Expanded Definition

- A Virtual Machine is fake hardware, written in software.
 - In some cases, the host computer's real hardware can be exposed.
- A virtual disk is just a file accessible from your host computer.
- The VM mediates between your real hardware and software running in the VM.

Virtual Machine: Expanded Definition

- GPU on host:

```
igo@demon:~/Desktop$ lspci | grep VGA
01:00.0 VGA compatible controller: nVidia Corporation GeForce 9600M GT (rev a1)
```



- GPU in VM:

```
igo@karmic-test:~/Desktop$ lspci | grep VGA
00:02.0 VGA compatible controller: InnoTek Systemberatung GmbH VirtualBox Graphics Adapter
```



Virtual Machine: Expanded Definition

- How does software work on real hardware?



Virtual Machine: Expanded Definition

Software: Applications



Firefox 3.5



Software: Kernel

libraries

drivers

Hardware

CPU

RAM

HDD

DVDROM

AUDIO

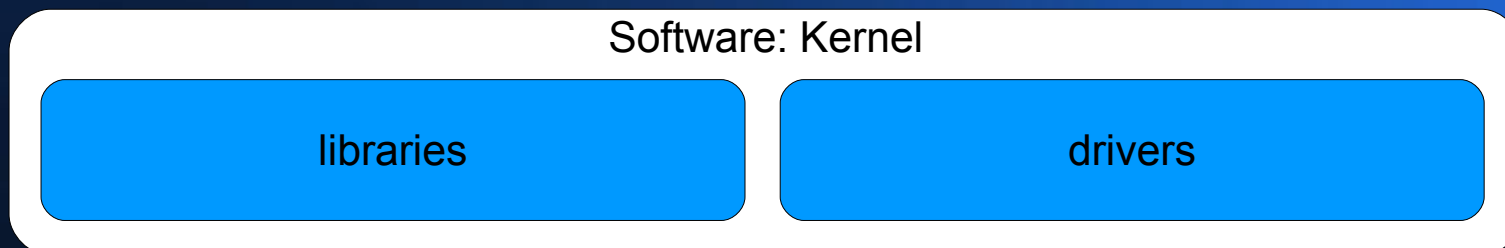
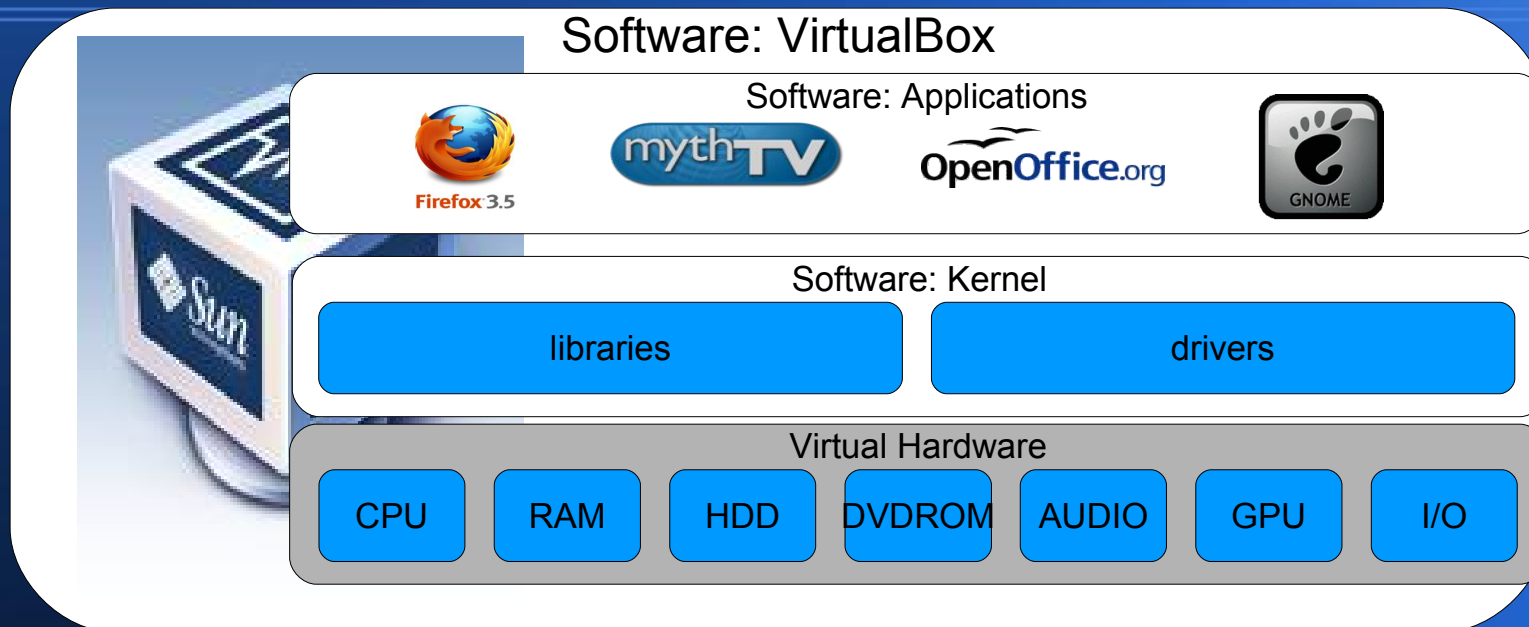
GPU

I/O

Virtual Machine: Expanded Definition

- How does software work on virtual hardware?
- First, remember that VirtualBox is just software that's running on real hardware.

Virtual Machine: Expanded Definition



Virtual Machine: Expanded Definition

- VirtualBox presents fake hardware to any software running in it.
- VirtualBox translates operations on fake hardware into something the host OS can perform.
 - E.g. Formatting a virtual disk → performing file operations on the .vdi file on the host OS

Virtual Machine: Expanded Definition

- Questions on how Virtual Machines work?
- Next up: Concepts similar to VMs.

Emulators

- Wikipedia says: "An emulator [...] duplicates (provides an emulation of) the functions of one system using a different system, so that the second system behaves like (and appears to be) the first system."
- There are two major kinds of emulators: emulators of hardware, and OS emulators.
- Let's start with emulators of hardware.

Example real-world emulator #1



- Early attempt at a bird flight emulator, in hardware

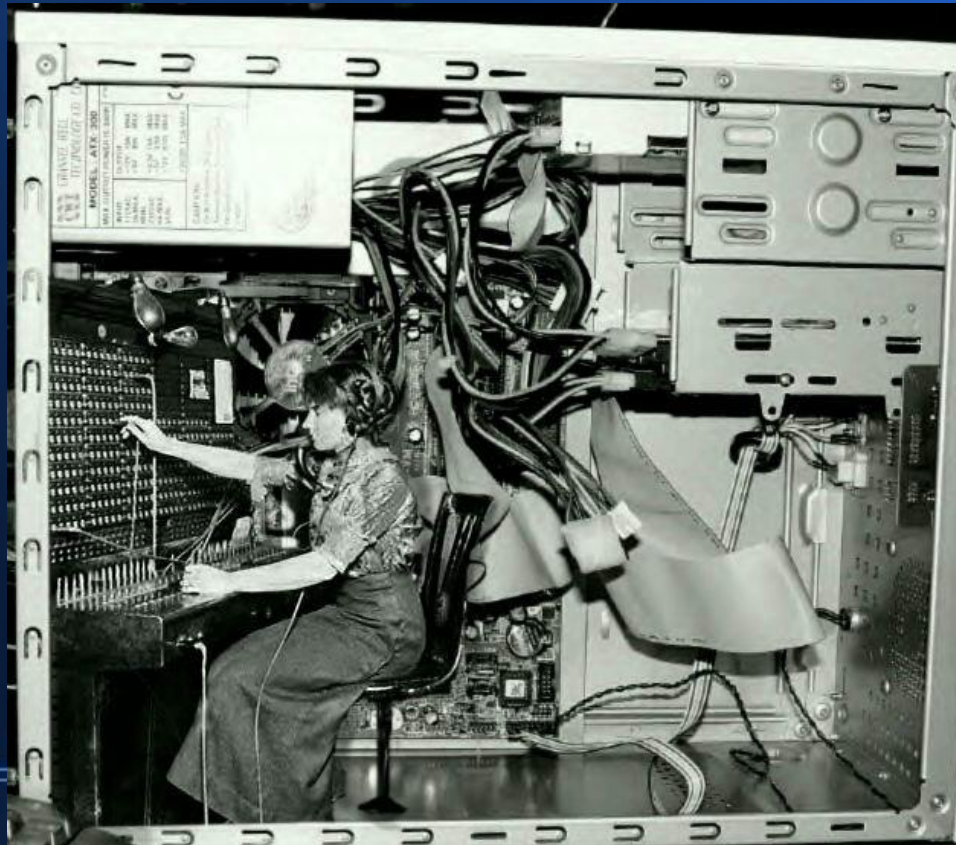
Example real-world emulator #2



- Robocarp, a fish swimming emulator in hardware

Emulators of Hardware: Cousins of VMs

- What if you needed a Virtual Machine to pretend it was hardware you don't have?



Emulators of Hardware: Cousins of VMs

- If you were given software that aliens used on their hardware, you'd need an emulator of alien hardware to run it.



Emulators of Hardware: Cousins of VMs

- Like a VM, the emulator of hardware presents fake hardware, but the translation from operations on fake hardware into operations on real hardware is more involved.
 - Human computers have no Illudium Q-36 Explosive Space Modulators, for example.

Emulators of Hardware: Cousins of VMs

- Unlike a VM, the emulator makes a fake IQ36ESM in software; it may or may not interact with the host hardware in any meaningful way.

Emulators of Hardware: Cousins of VMs

- Questions about the distinction between a VM and an emulator of hardware?
- Emulators of OSes are next.

OS Emulators: Cousins of VMs

- An OS emulator will run applications that were written for another OS.
 - If the OS emulator can be installed as the primary OS, it's a clone of the OS it's emulating.



OS Emulators: Cousins of VMs

- If the OS emulator needs to be run as an application of a full OS, it's closer to a VM.



Emulators: Cousins of VMs

- Some famous emulators:

- DOSEMU



- MAME*



- WINE**



* MAME emulates hardware

** WINE only lets you run Windows applications; it isn't otherwise a Windows substitute.

Emulators

- Questions on the difference between VMs and different kinds of emulators?
- Next up: What are VMs good for?

What are VMs good for?

- Reducing hardware bottlenecks
 - A VM on a good host can be faster than your spare PC
 - 1 PC can act like N Pcs



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What are VMs good for?

- VMs are far more flexible than physical hardware.
 - “disk” imaging is inherent
 - Recovering from hardware failures is easy
 - Easy to copy a VM and experiment with it

What are VMs good for?

- VM flexibility, continued...
 - Even some portability between different VMs
 - Your VM can more cores than the host*

* Of course, this gives bad performance, but it's good for testing.

What are VMs good for?

- If the host OS supports your hardware, the guest OS doesn't necessarily have to.
 - Vista not working? Run it in a VM inside Ubuntu



What are VMs bad for?

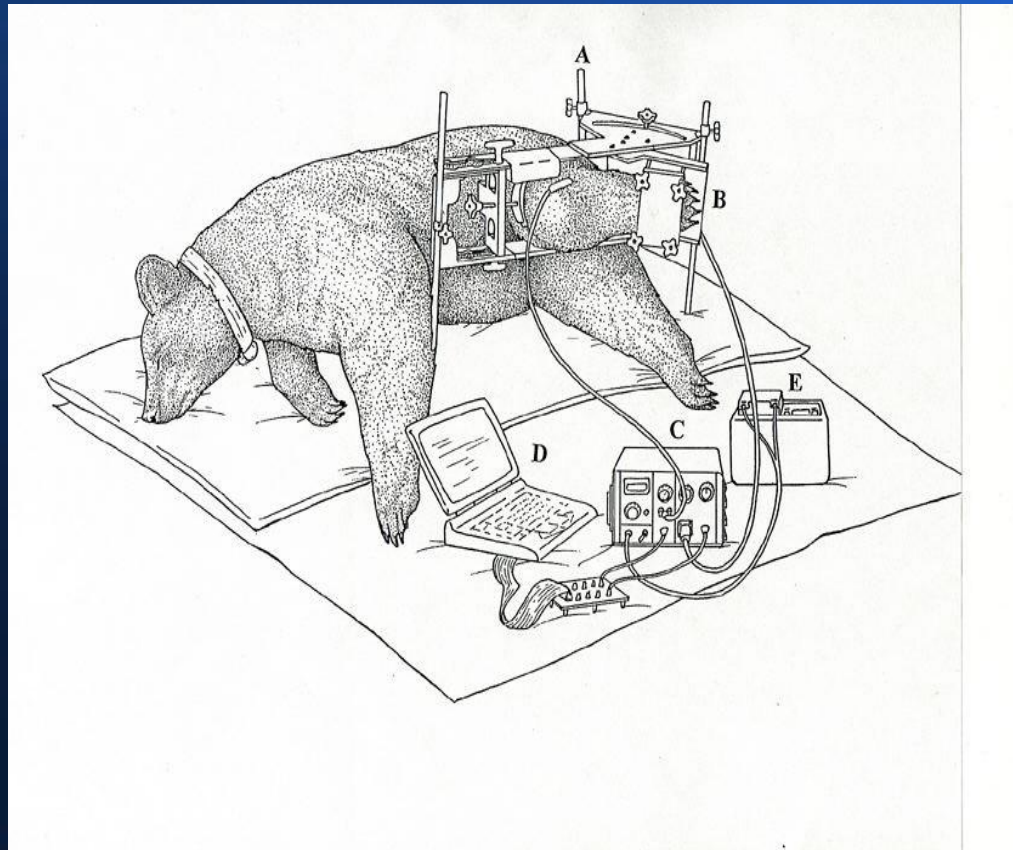
- Some VMs don't know how to pass through real hardware.
- Some VMs aren't yet feature-complete; it can take time to support newer OSes.

What are VMs bad for?

- Software running in a VM is generally slower than running directly on the host system.
- Testing in a VM is no substitute for testing on real hardware, or in a different VM.

What are VMs bad for?

- Hibernate/suspend may not work.



What are VMs are good/bad for?

- Questions about what VMs are good/bad for?
- Coming up: Complex Uses for VMs

Complex Use #1

- Make a VM for each server/daemon you need to run.
 - Some businesses do this.
- Example will use Apache



Complex Use #1

- Why do this sort of thing?
 - Very easy to test changes before deploying
 - Very easy to deploy changes
 - run both Apache server VMs
 - change the port forwarding to point to the latest live one
 - The "hidden" VM becomes your new test VM.

Complex Use #1 HOWTO

- Install Ubuntu 9.04 server in a VM named "Ubuntu 9.04 server"
 - Options as in Simple Use #2
 - When asked, choose to install "LAMP server"
- Once installed, halt the server.

Complex Use #1 HOWTO

- Configure port forwarding from your host machine to the guest server:

```
VBoxManage setextradata "Ubuntu 9.04 server" \  
"VBoxInternal/Devices/pcnet/0/LUN#0/Config/guestapache/Protocol" TCP
```

```
VBoxManage setextradata "Ubuntu 9.04 server" \  
"VboxInternal/Devices/pcnet/0/LUN#0/Config/guestapache/GuestPort" 80
```

```
VBoxManage setextradata "Ubuntu 9.04 server" \  
"VBoxInternal/Devices/pcnet/0/LUN#0/Config/guestapache/HostPort" 8080
```

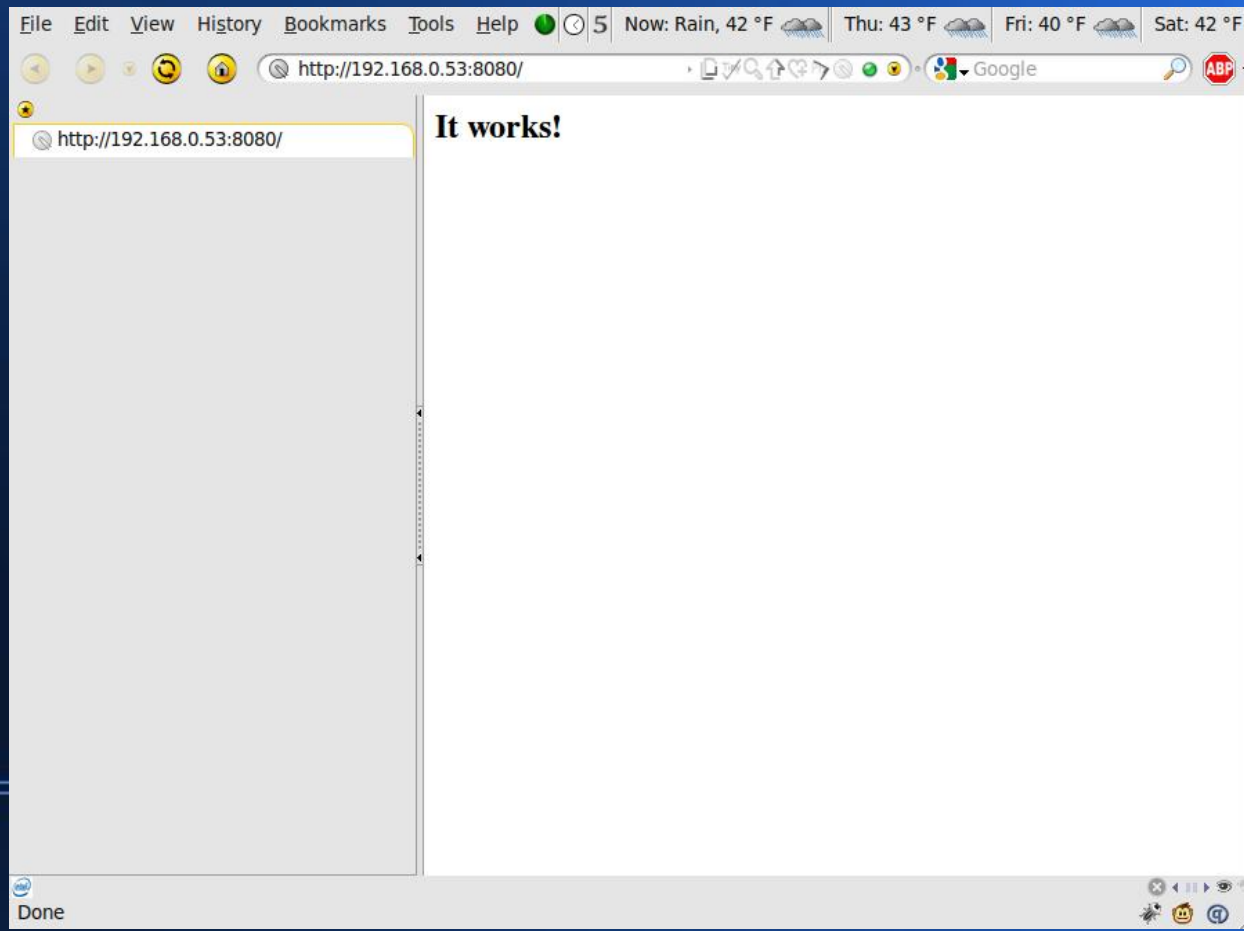


Complex Use #1 HOWTO

- Start VM Ubuntu 9.04 server

Complex Use #1 HOWTO

- Now, port 8080 on your host machine forwards to port 80 on your guest server.



Complex Use #1

- Questions about Complex Use #1?
- Coming up: Complex Use #2

Complex Use #2

- Testing a captive portal solution
 - If you used real hardware, you'd need:
 - a server/gateway box with two NICs
 - N client machines
 - a switch for the subnet
 - physical access to the server and clients

Complex Use #2

- That would look like this:



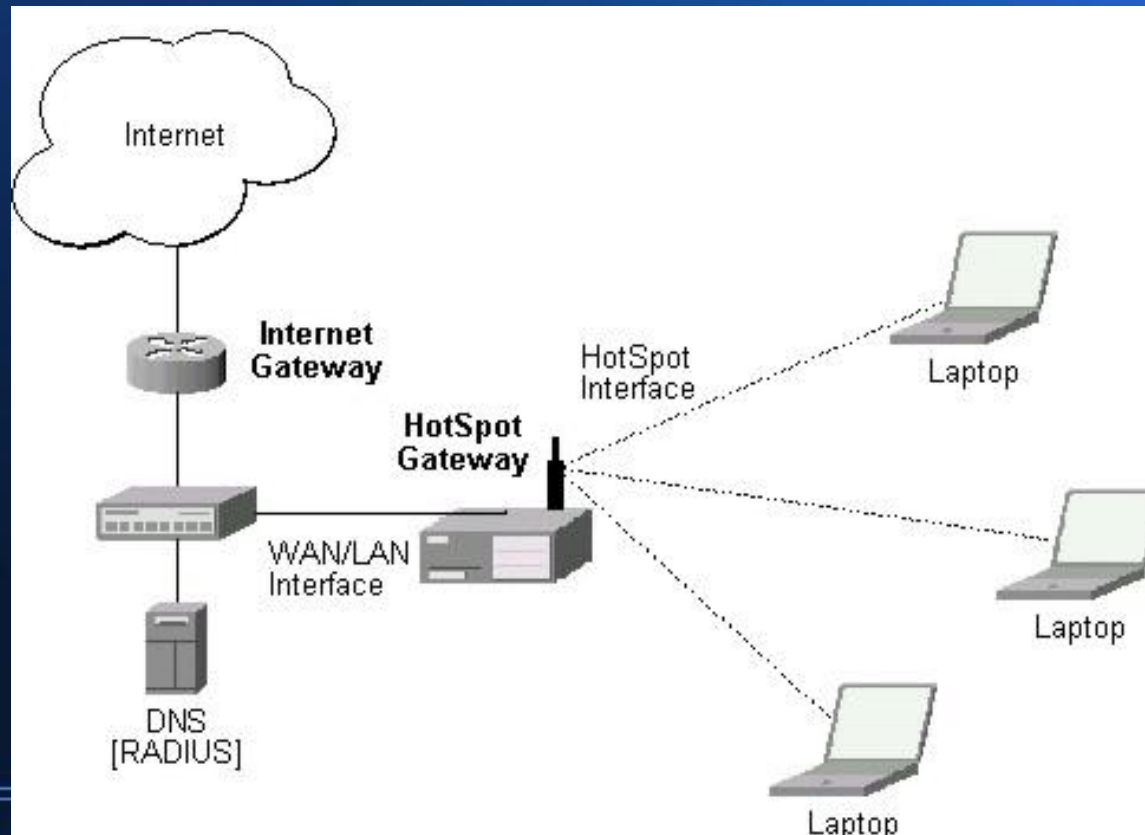
Complex Use #2

- With VirtualBox OSE, you need:
 - your host machine



Complex Use #2

- Scenario: Test pfSense as a captive portal for a cybercafe.



Complex Use #2 HOWTO

- Step 1: Configure the pfSense server VM.
 - As Simple Use #2, except...

Complex Use #2 HOWTO

- OS is BSD/FreeBSD

VM Name and OS Type


Enter a name for the new virtual machine and select the type of the guest operating system you plan to install onto the virtual machine.

The name of the virtual machine usually indicates its software and hardware configuration. It will be used by all VirtualBox components to identify your virtual machine.

Name


pfSense box

OS Type

Operating System: BSD 

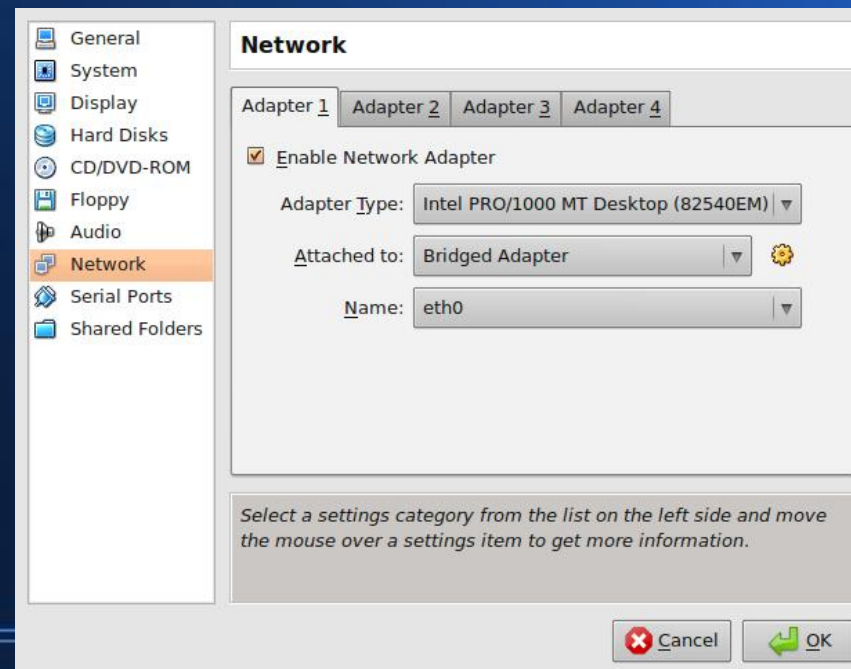
Version: FreeBSD

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Complex Use #2 HOWTO

- Change NIC to "Bridged Adapter" in Settings → Network
- Use your host machine's primary NIC for "Name"

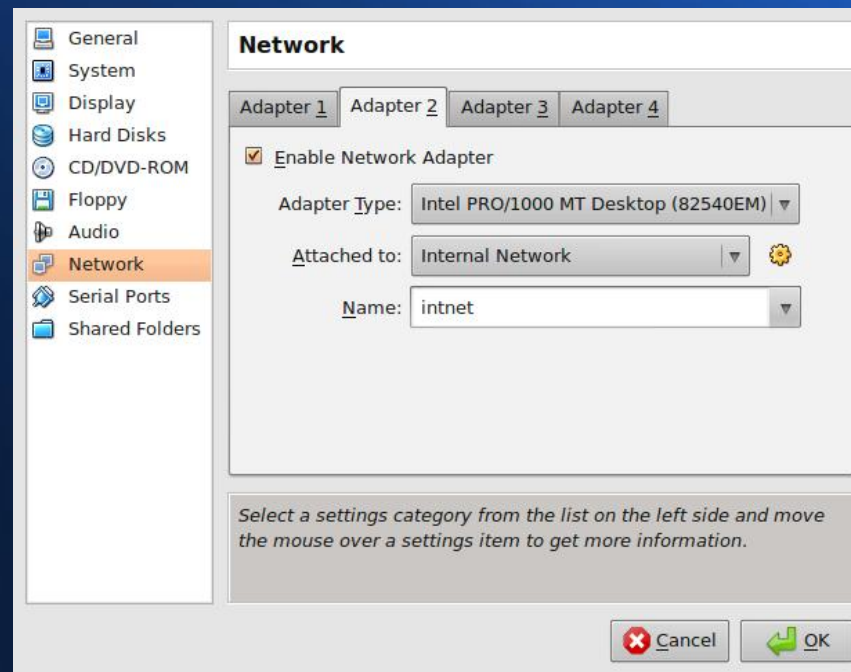


Complex Use #2 HOWTO

- "Bridged Adapter" networking uses the host's NIC to put your VM on your LAN
 - If your LAN has DHCP, VM gets IP address via your LAN's DHCP
 - To LAN machines, same effect as if the VM were a real machine on your LAN

Complex Use #2 HOWTO

- Add a second NIC on "Internal Network" in Settings → Network

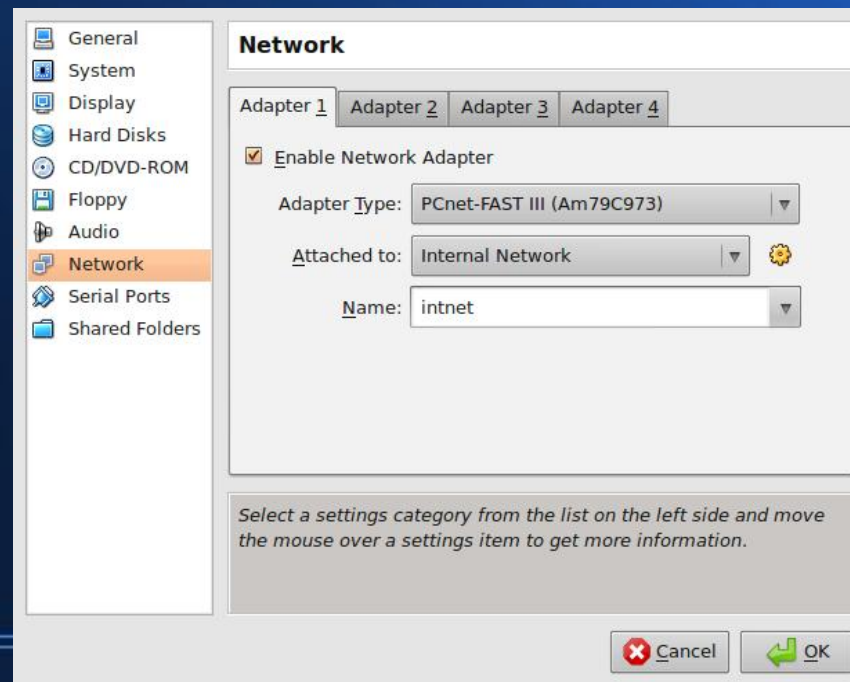


Complex Use #2 INFO

- "Internal Network" is a software-created subnet.
- All NICs on the same-named Internal Network can talk to each other but nothing else.

Complex Use #2 HOWTO

- Next, create a VM as in Simple VM Use #1
- Then, put its lone NIC on an Internal Network named intnet.

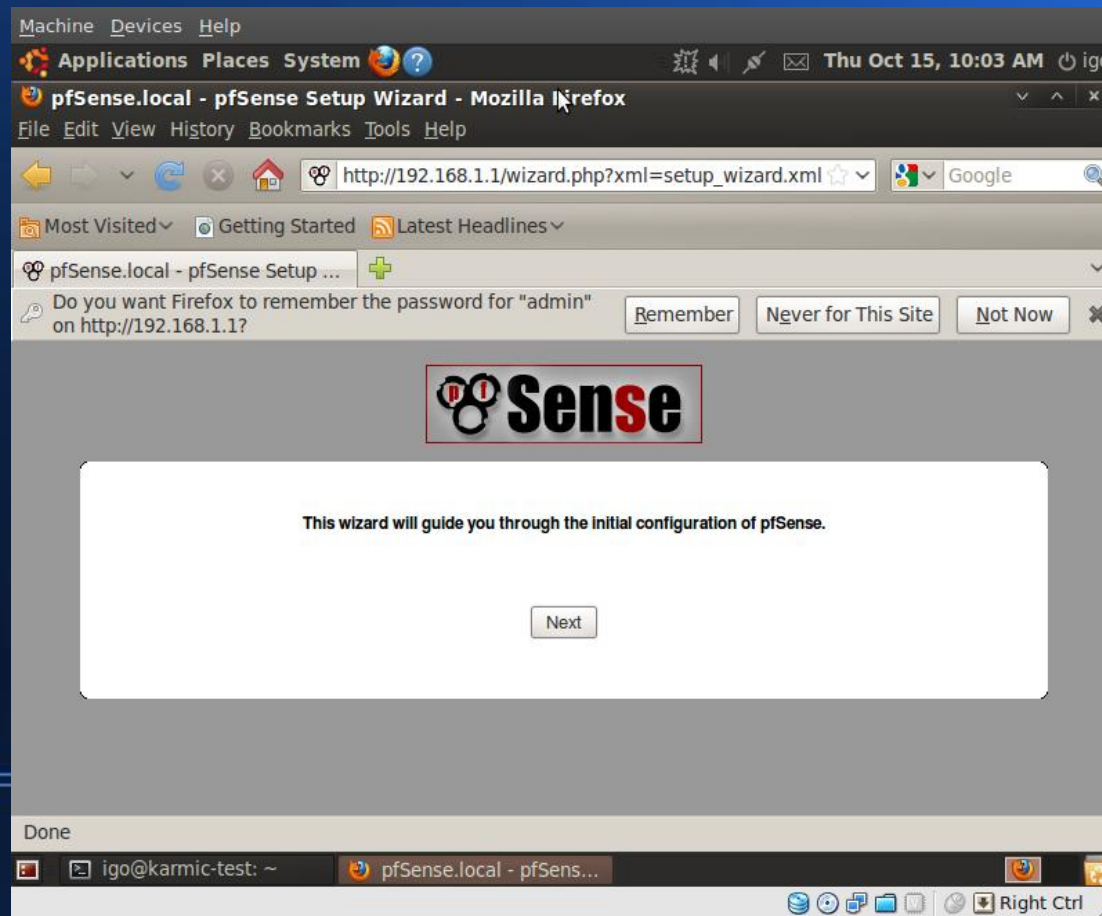


Complex Use #2 HOWTO

- Boot pfSense in VM; install and configure.
 - Use em0 for WAN ("bridged")
 - Use em1 for LAN ("intnet")
- Boot live Ubuntu VM and test the captive portal.
 - Live Ubuntu VM will acquire IP address from pfSense's DHCP server, by default in 192.168.1.x subnet.

Complex Use #2 HOWTO

- In live Ubuntu VM: `http://192.168.1.1` to finish pfSense configuration.



Complex Uses

- Questions on Complex Uses?
- Questions about anything?
- Next up: Summary

Summary

- Don't fear VMs
- Try VirtualBox OSE
- Use your best hardware
- Trap programs in *The Matrix*