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*
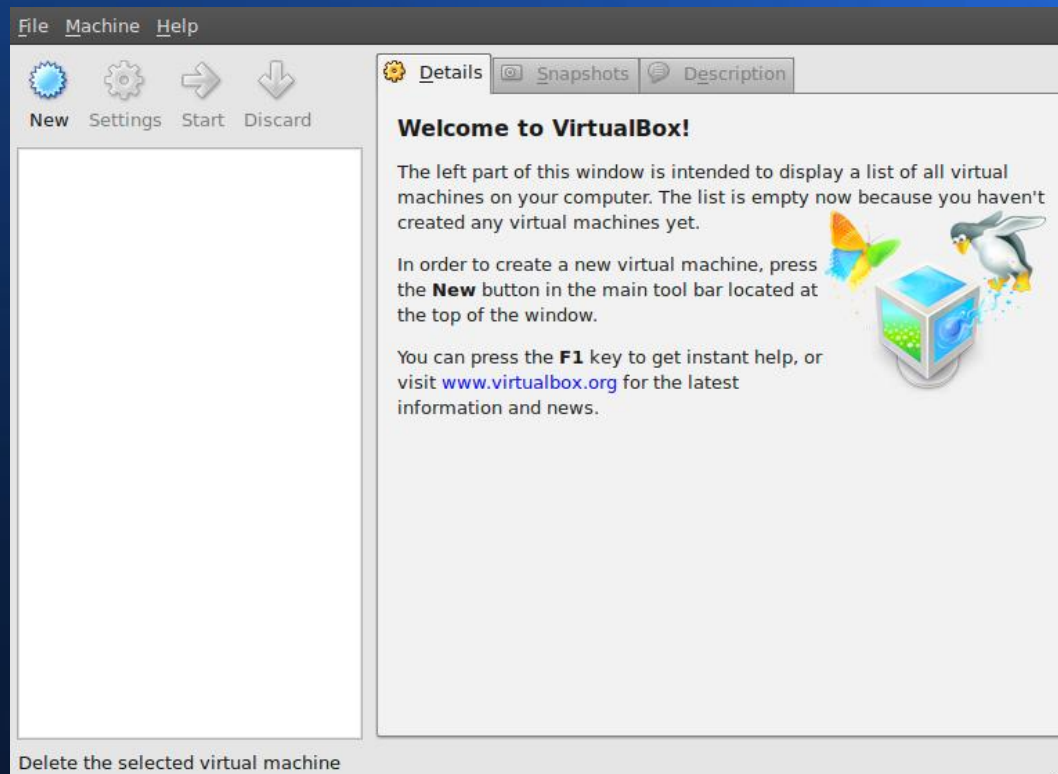- Unless it is designed to check, software won't know it's running on a VM.

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

Simple Use #1 HOWTO

Simple Use #1 HOWTO

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).

Simple Use #2 HOWTO

Simple Use #2 HOWTO

Creating fixed hard disk storage unit '/home/igo/.VirtualBox/HardDisks/4GB_disk.vdi'...

10%

Time remaining: 00:01:08   ❌ Cancel

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

Summary

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

Name: Ubuntu 9.10 beta
OS Type: Ubuntu
Base Memory: 384 MB
Boot Hard Disk: 4GB_disk.vdi (Normal, 4.00 GB)

If the above is correct press the **Finish** button. Once you press it, a new virtual machine will be created.
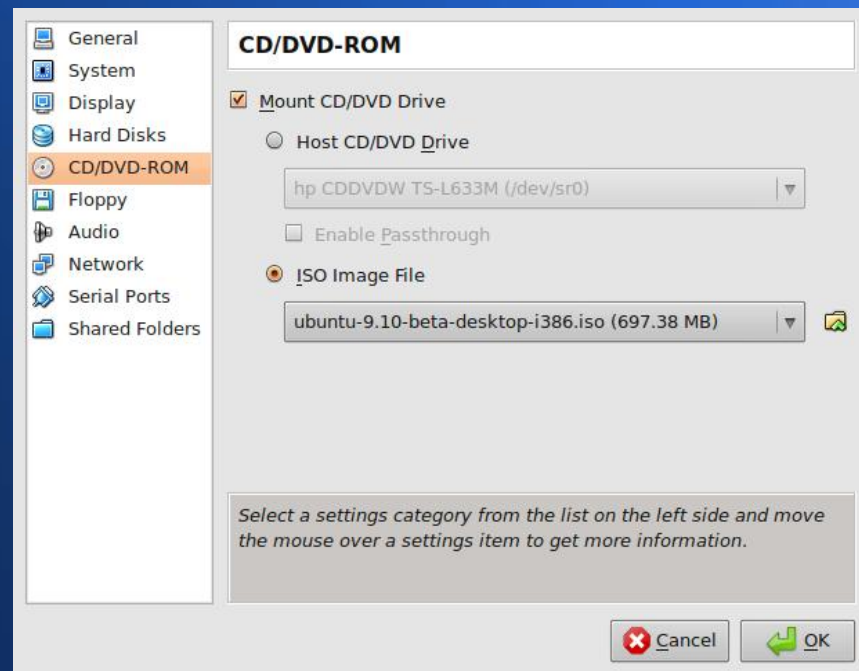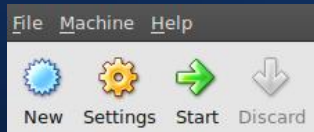
Note that you can alter these and all other setting of the created virtual machine at any time using the **Settings** dialog accessible through the menu of the main window.
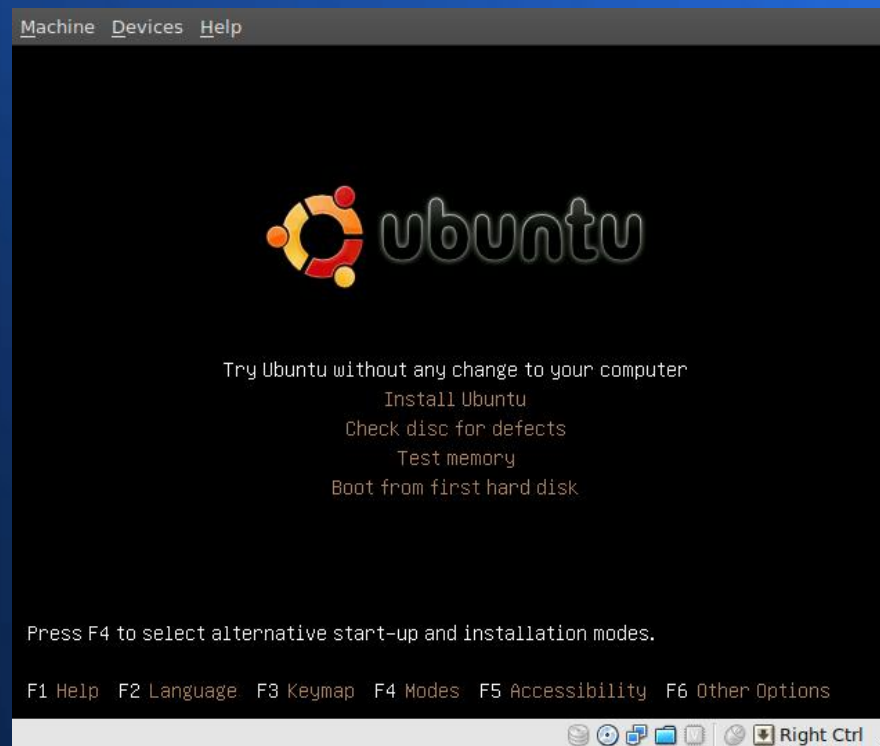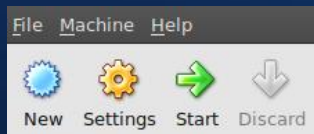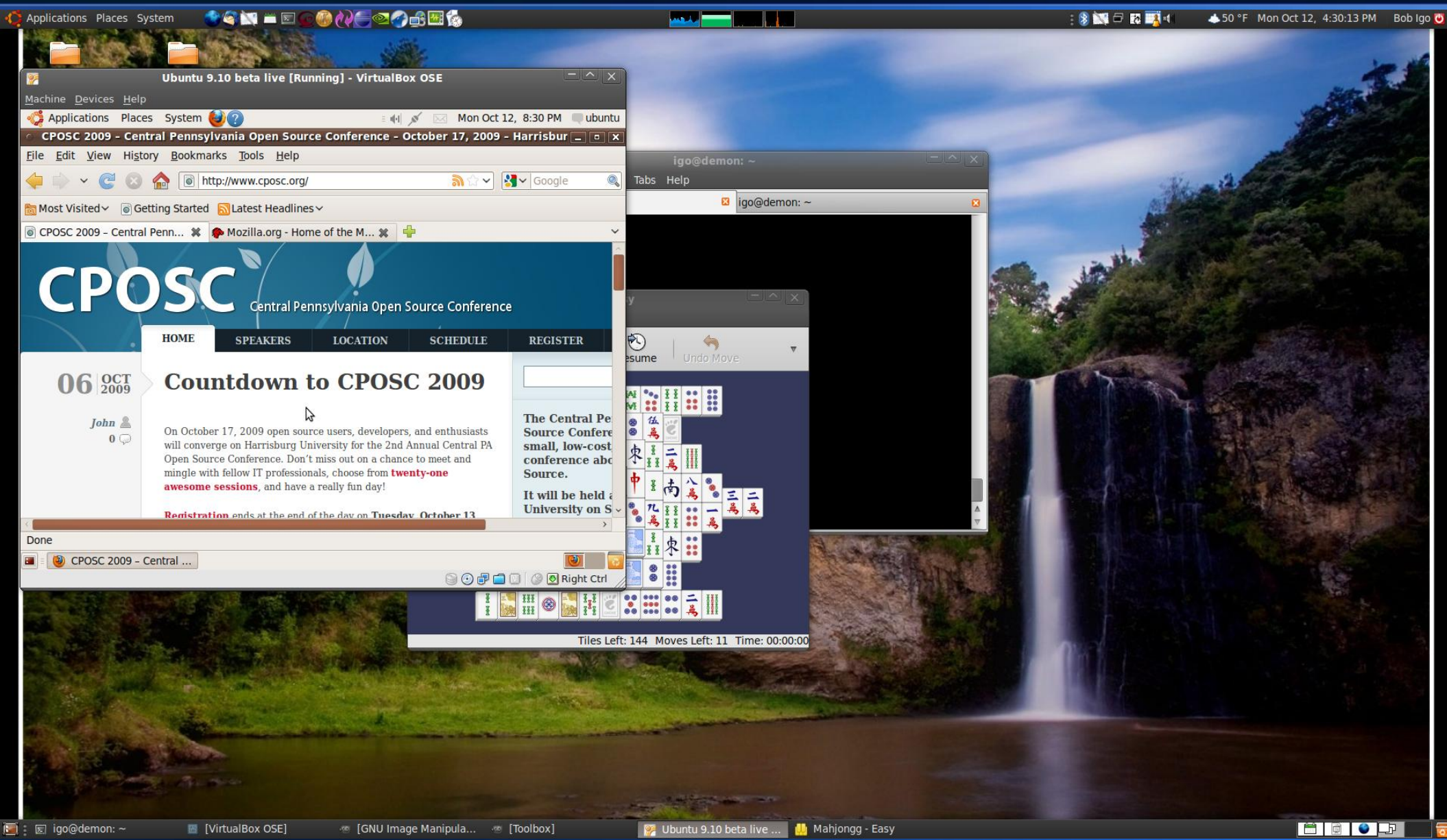
< Back   Finish   Cancel

Simple 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

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
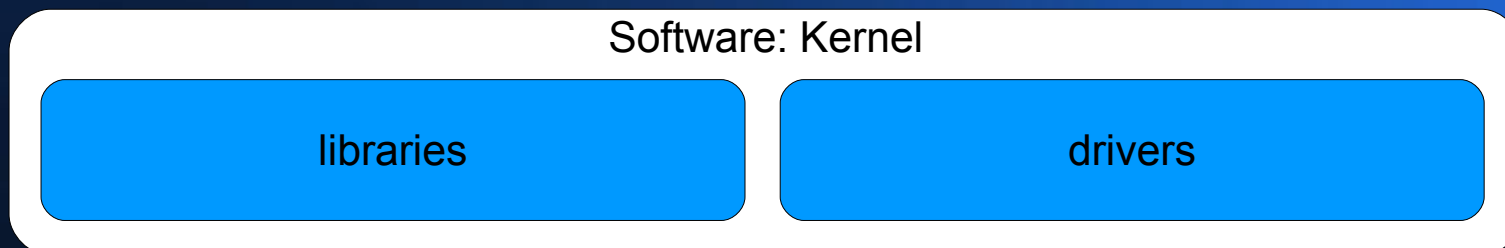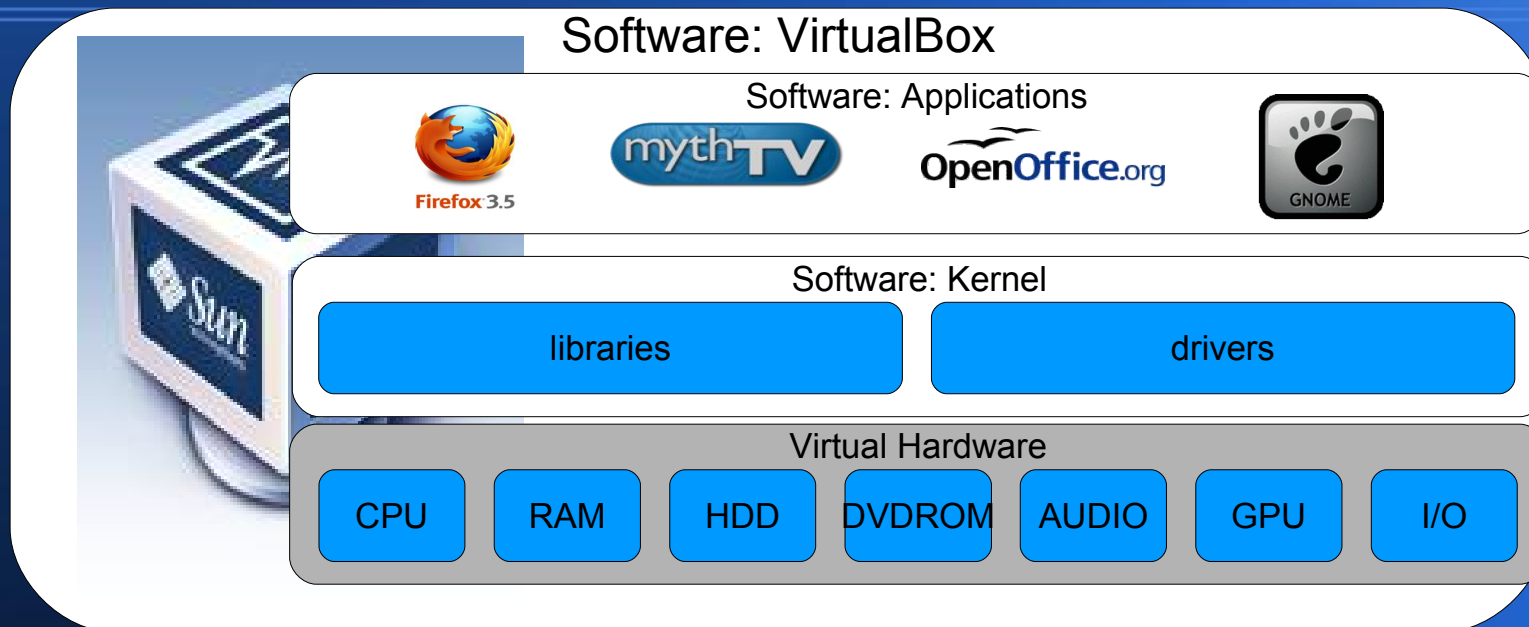
Virtual Machine: Expanded Definition

- 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?
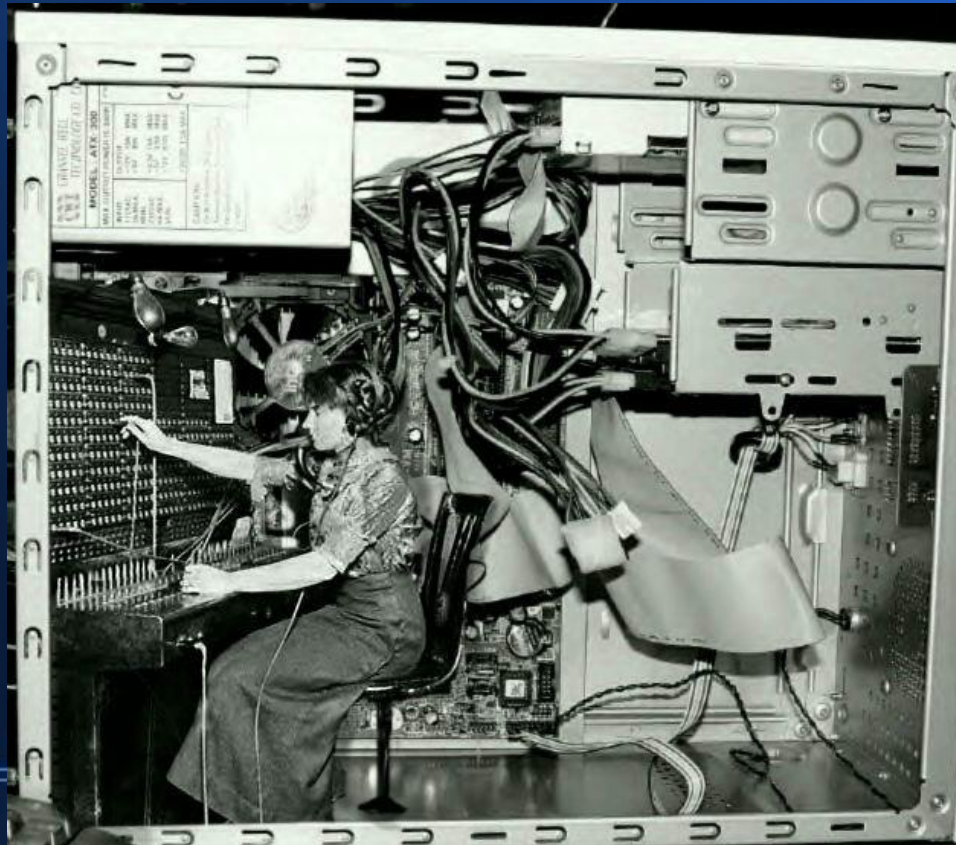
Emulators of Hardware: Cousins of VMs

- If you were given software that aliens used on their hardware, you'd need a 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

>=

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.
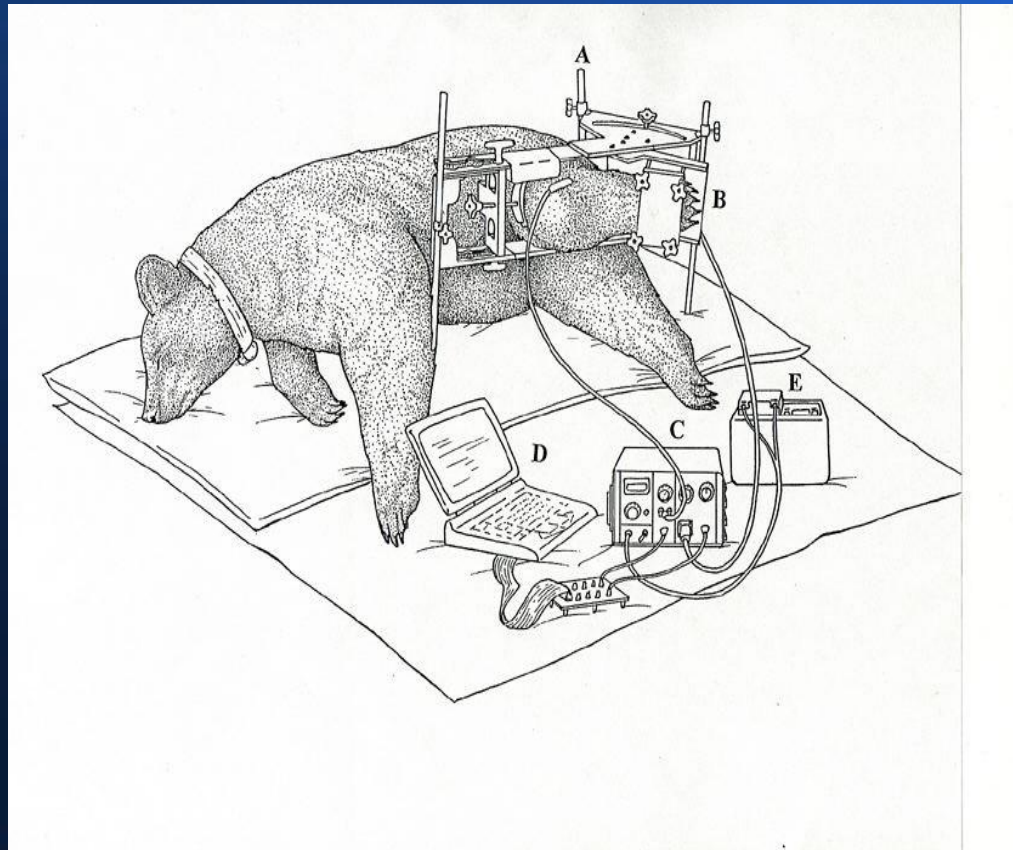
What are VMs are good/bad for?

- 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
```
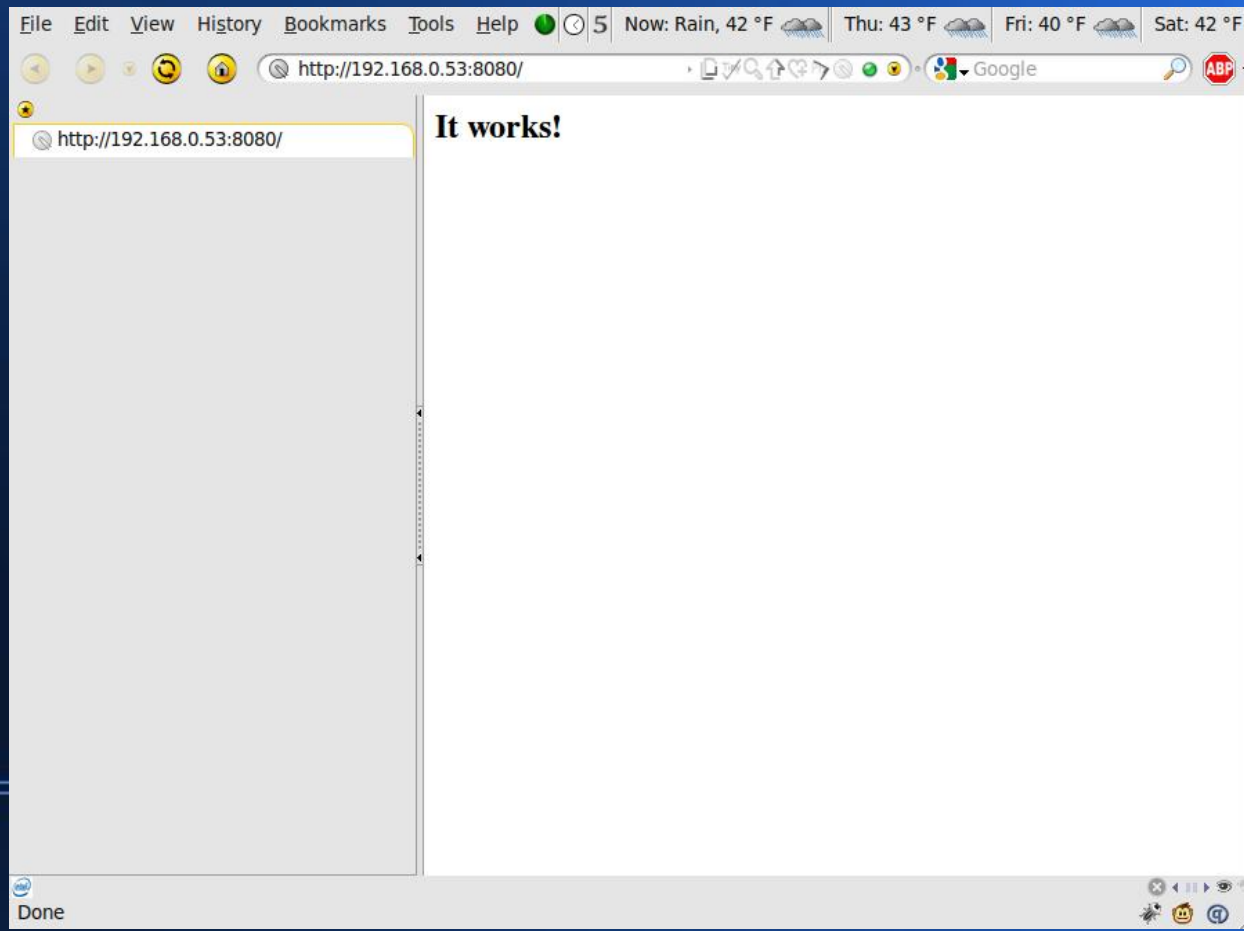
Complex Use #1 HOWTO

- 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
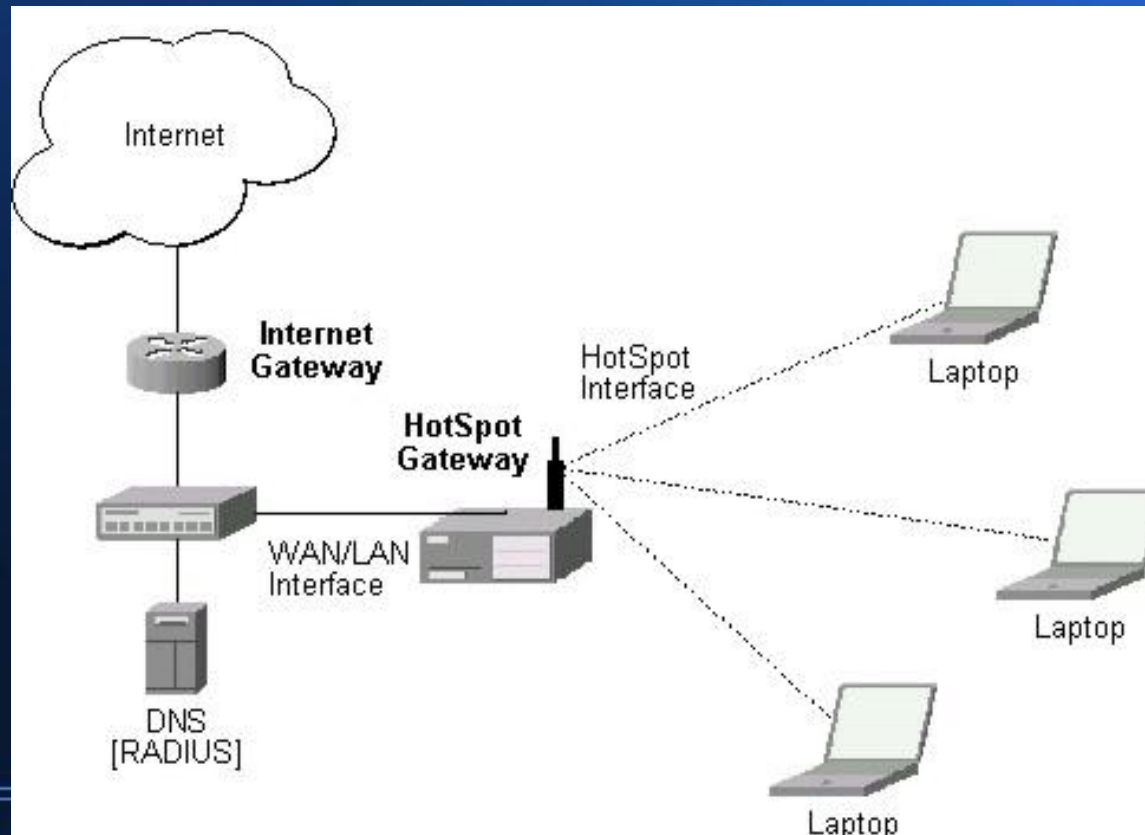
Complex Use #2

- 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
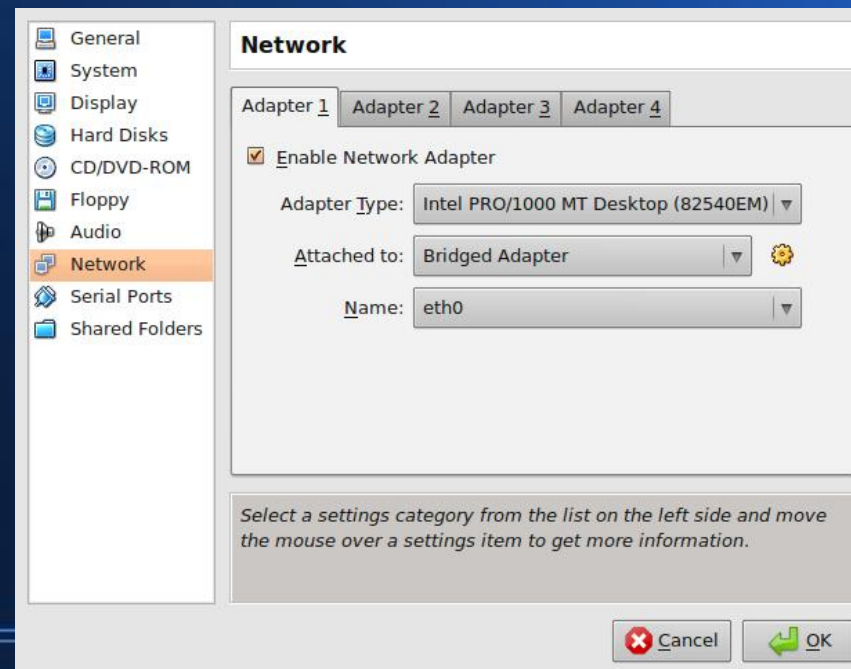
- OS is BSD/FreeBSD

Complex Use #2 HOWTO

- Change NIC to "Bridged Adapter" in Settings → Network

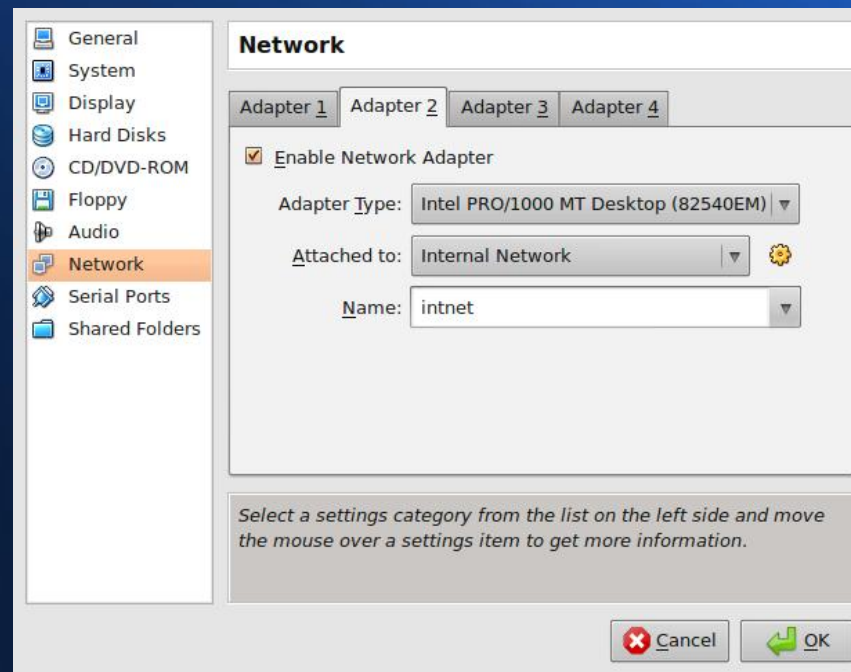- Use your host machine's primary NIC for "Name"

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
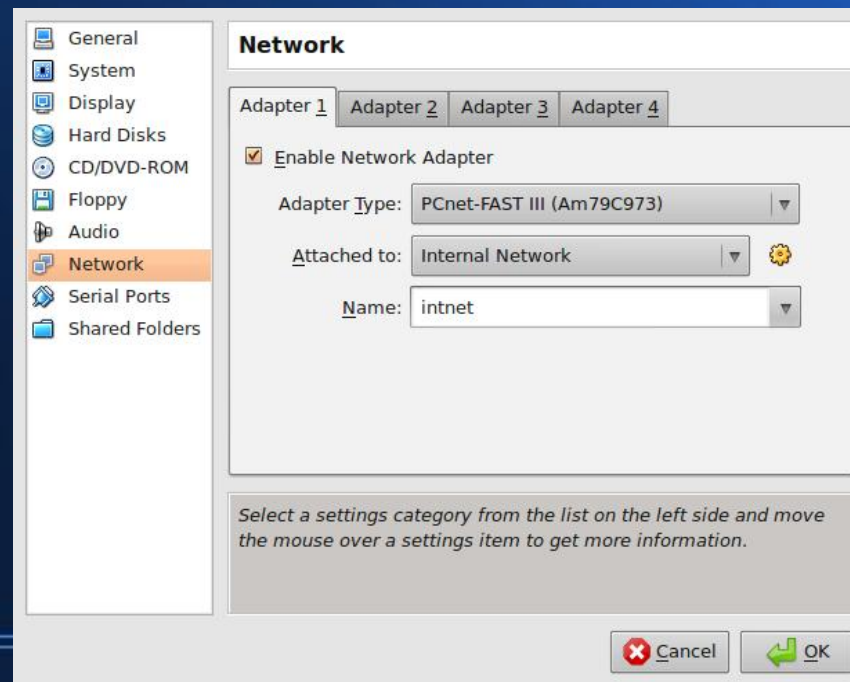
Complex Use #2 INFO

- "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.
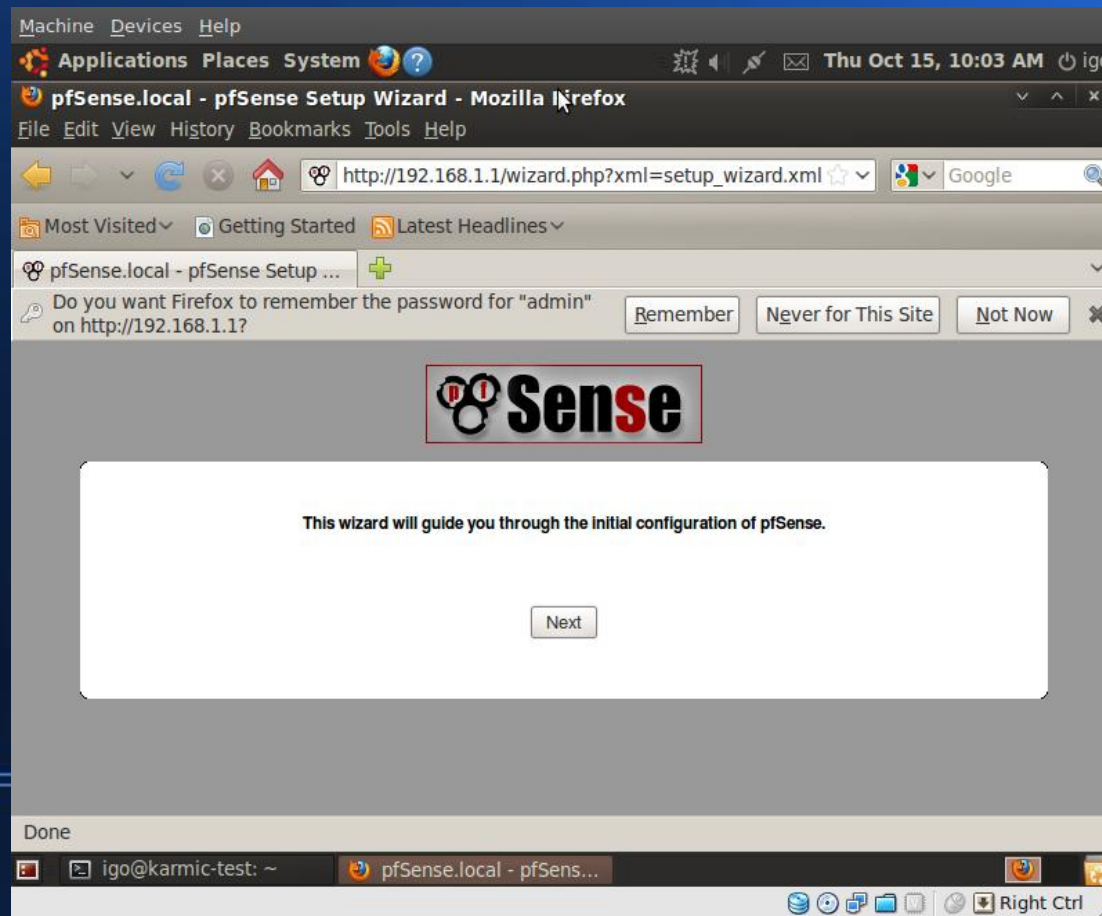
Complex Uses

- 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*