Understanding Virtualization

- Virtual machines are self-contained computers running within a host OS
- Hypervisors support multiple VMs
- A type 1 hypervisor runs directly on top of the hardware as an OS
- A type 2 hypervisor runs as an app in an OS

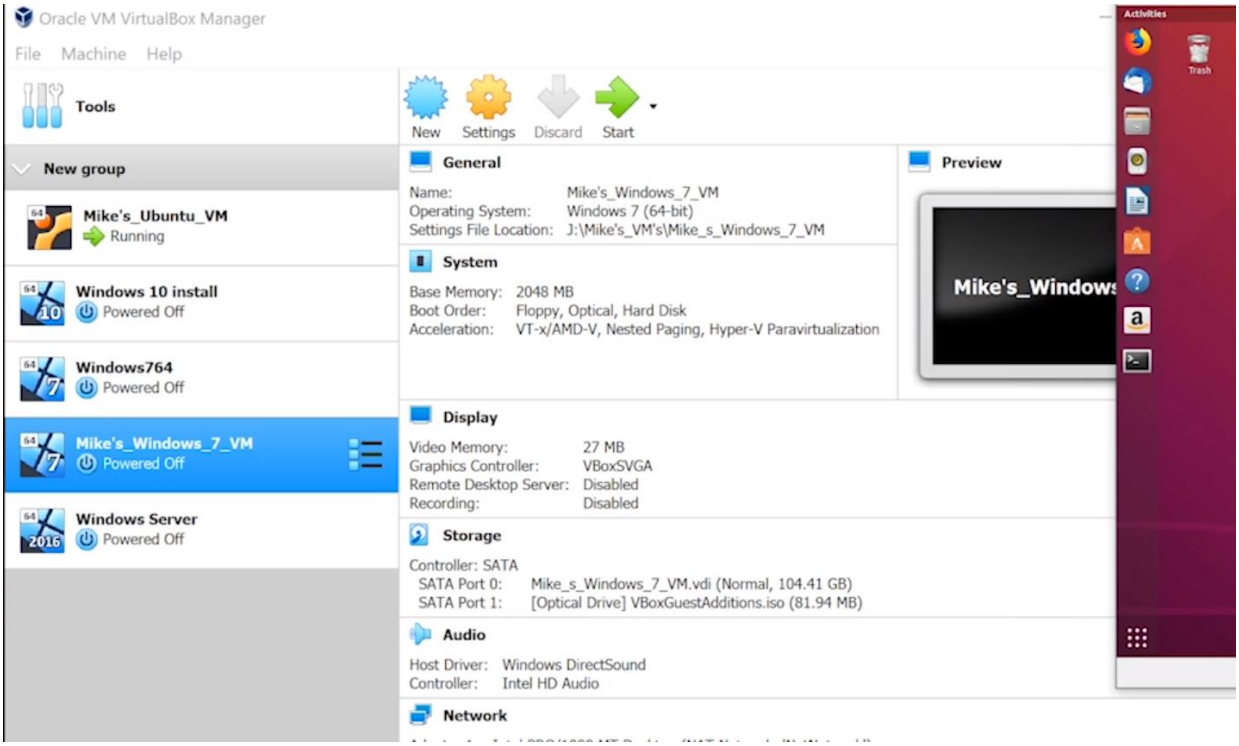
Virtual Machine - completely self-contained computer that is running in a Host OS

Virtualization - takes some of the real physical hardware your system has and allocate some of this to a separate internal system (CPU, RAM, Hard Drive)

Whereas….Emulation - pretends to have hardware that you don't have
(Nintendo 64 Emulator)

You need to have a CPU that supports Virtualization
You may have to go into your System Setup to make sure it's turned on
Chipset → VT-d → Enable

Once you have this turned on, you're going to need a Hypervisor



Hypervisor - Host that runs the Virtual Machine
Oracle VM VirtualBox ← Free!

Type 2 Hypervisor - not most efficient, but it's great for Individual Systems,
testing Windows Update, try New Version of Ubuntu

Mike has 5 Virtual Machines (only 1 currently running)
You can see he has VM's for Ubuntu, Win10, Win7, and Win Server

The VM's don't even see the Host OS

When you turn off a VM, it just turns into a file that just sits in your Hard Drive
If somebody was to hack into one of our websites on a Virtual Machine,
all we'd need to do is turn it off, get a backup copy of our file,
and just start it back up again!
Great for Security & Recovery!!

All websites today are VM!

Type 1 Hypervisor - very efficient & robust It is an OS!
It only has 1 job which is to support & run VM's!

VMware is a company that pretty much invented all of this,
and has a lot of Type 1 Hypervisors

VMware ESXi, Microsoft Hyper-V, KVM

Type 2 is the best way to understand VM's, so we're sticking to that for now.

ipconfig for the Host vs one of the VM's shows 2 completely different IPv4 Addresses!

We can create……

Virtual Networks, with a Virtual Network Card built into the system.

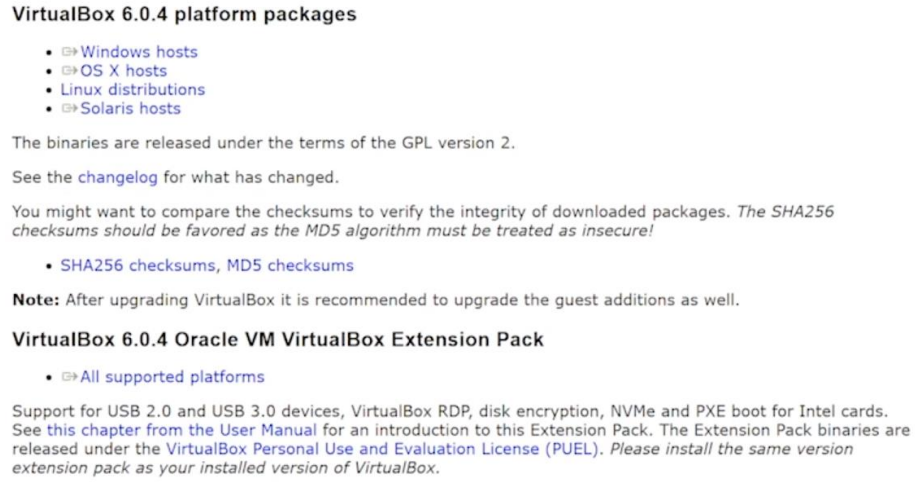
Virtual Switches, and make 4 computers connect, in their own Network.

Virtual Router, and that Router can do NAT, and all 4 of those computers can be connected to the Internet.

Your First Virtual Machine

- Setting up a new VM takes a few steps
- Install a hypervisor, like Oracle VirtualBox
- Create a virtual machine in the hypervisor
- Download and install an operating system, like Ubuntu Linux

If you want to have Ubuntu without messing with your Windows, use a VM!!



VirtualBox 6.0.4 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 6.0.4 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.*

Download & Install Oracle VM Virtual Box

also, get the Extension Pack (this adds a lot of nice features)

Once you have it Installed, Open the Program and Click “New”

When creating new VM’s, the #1 real estate is your RAM!!!

More RAM allows more VM’s

Watch Video 104 (1001) for Installation & Set up of Virtual Box, and Ubuntu!

Advanced Virtualization Setup

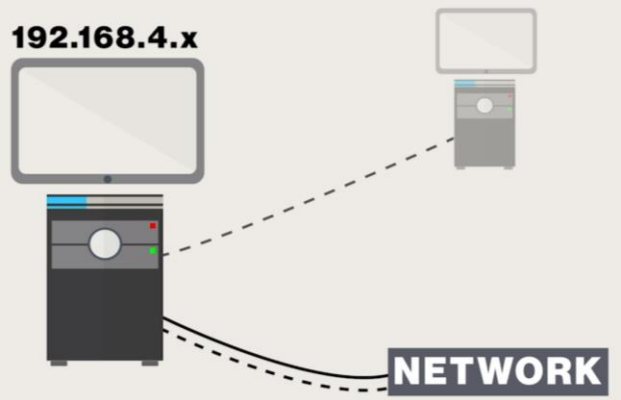
- You can modify virtual hardware easily, such as add a "drive"
- Bridge a VM to connect to same network (and DHCP server) as host OS
- Use NAT to put a VM in a unique network ID
- Use NAT network to put multiple VMs into a single network ID

Windows 7 VM - the mouse will get stuck in this window
To get your mouse out to your Host, use Right Ctrl

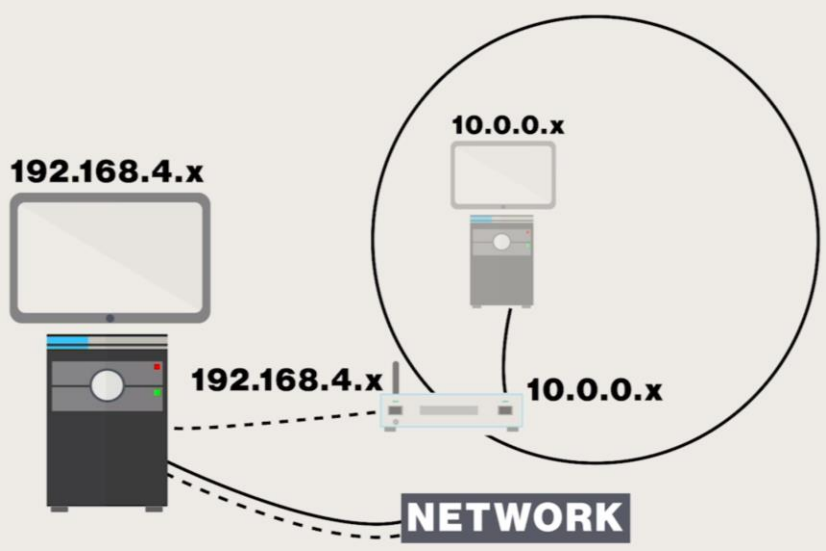
Windows 10 VM - you don't have this "problem"!
Your mouse is freely moving from the Win10 VM to the Host.
And, you can resize this window & your resolution will auto adjust! (not for Win7)

These are additional features you get with the Virtual Box Extension

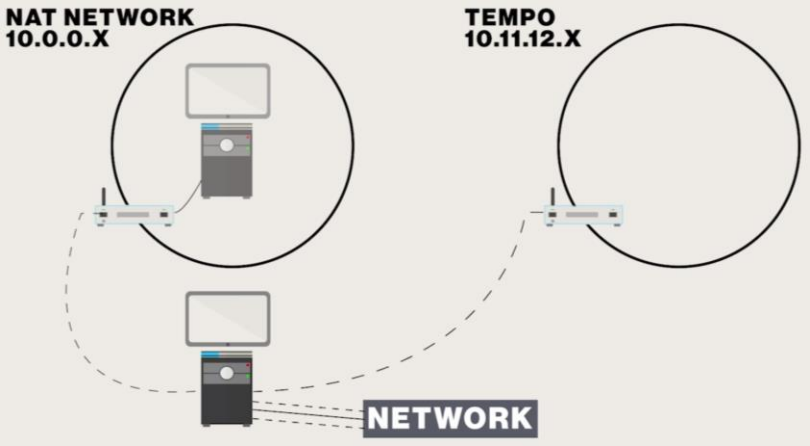
We can also create new Virtual Hard Drives



Bridged Network - when we Bridge the VM, we're installing a Virtual Network Card
on to the same exact Network as the Host Machine/Real Computer.
It acts the same as your real Network Card!
This is the most popular.



NAT - you're creating a Virtual Router. Creates its own Network ID
It only allows you to connect 1 computer to this Virtualized Network ID



NAT Network - can have multiple VM's on their own little Network, going through their own Virtual Router. Until we add computers to these Networks there won't be anything in them. We need to populate them.

Internal Network - bunch of computers on an Internal Network
but there will be no Router out to the Internet through your own computer.

Host-Only Adapter - directly connected to the Host Network Card (avoid using this)

Generic Driver - pretends to be a different kind of Network Card.
Used if you have a very old OS & you're trying to run a VM,
but it doesn't know about Modern Network Cards,
you can have it pretend to be a different Network Card (Emulation!!)

Cloud Computing

- Cloud computing moves the VMs "out there," but accessible via IP
- Cloud computing enables rapid elasticity, on-demand scaling,
and resource pooling
- IaaS moves network tasks such as firewalls into the Cloud
- PaaS moves the machines into the Cloud so you can concentrate on apps
- SaaS moves apps to the Cloud, such as Google Docs

The Cloud - Computer with a bunch of VM's located somewhere else,
and you can gain access to your own VM.
Anytime you don't know where a computer is physically located,
But you can access it by its IP Address.

Mike would argue, anytime you open up a Web Browser and go to Google,
you are doing a Cloud Function, because there is a Web Server
somewhere out there that's working for you.

Benefits of using The Cloud's VM's -

Rapid Elasticity - we can copy a VM with a website on it
and move it closer to other areas for people to access.
This allows the website to deal with more demand with just a few clicks!

On-Demand - you can take a VM and Clone it a billion times during the Superbowl,
and then after the event, you can shrink it back down
to stay up with the Demand.

Resource Pooling - you can have these multiple VM's share storage, electrical needs,
HVAC so all Heating & Cooling is all pooled in 1 big building,
and it allows for incredible efficiencies.

IaaS (Infrastructure as a Service) - with companies like Amazon Web Services,
we can log into the Amazon Web Services site, and create our own VM's
Amazon calls them "Virtual Private Clouds"
They back up their systems, and have backups for those systems!

PaaS (Platform as a Service) - you literally don't know you have VM's out there.
Great place for a Programmer. We might want to know if some code will run in a Web Browser.

This will take this code, it will build an Infrastructure as a Service (IaaS), loads the code into a system, puts a Web Server on there, runs it, and hands you a Public URL that you can then go open up your own Web Browser and check it out!
This is completely invisible to us. You just write code & make it go!

SaaS (Software as a Service) - Google Docs, Google Maps
These Websites are actually Applications which is software that you run as a Service to do something.

SaaS could technically be any website.

Cloud Ownership

- Private Clouds are owned and used only by a single organization
- Public clouds are privately owned buy are available for public use
- Hybrid clouds have both private and public aspects
- Community clouds - owned by multiple organizations for their own private use

Inside of a Cloud are the Servers, the Storage, all the people keeping this running, so ownership of a Cloud is something to take into consideration.

Private Cloud - let's say we have a bunch of computers. We can generate our own VM's but this is Private. Just for our own organization/company!

Public Cloud - Pretty much the opposite of a Private Cloud (Amazon S3, MS Azure)
This is open for business. Very popular.

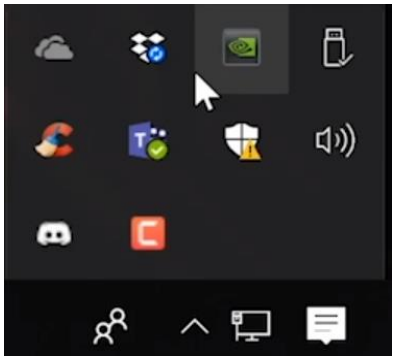
Hybrid Cloud - 1 big cloud, but segregated. Some of it is Private, and some is Public, so we can make some money!

Community Cloud - setting up your own cloud is expensive ($100k+). Multiple companies can come together as a group to build 1 Private Cloud.

Cloud-Based Applications

- Cloud storage enables access to synchronized saved files from any device
- Cloud-based applications move management to the Cloud or e-mail and more
- PVirtual desktops provide a consistent workspace in the Cloud
accessible from any device
- Virtual application streaming provides access to apps
without installing them locally

Cloud Storage - Mac's iCloud, Windows OneDrive, Google Drive, Dropbox



In the Windows Notification Area,
we see our Dropbox Icon (2nd Icon)
with a Blue Reload circle.

This is showing that Dropbox is Synchronizing!
This becomes an issue if 2 or more people
are editing the same file.
Saving conflicting copies, or last one to save wins.

Office 365 - Great to use for Configuring your Email Server
& don't need to deal with a Physical Server!
This can also be used as a Domain Controller!

Virtual Desktop - In a Web Browser!
You can access your Desktop no matter the Device (Windows, Mac, etc)

Streaming Applications - aspects that are in combination with using an app
in a Web Browser, and Downloading an app.