Virtualization Overview

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What are we using this Year?

- NUC servers
- Intel core i5 quad core 8 hyperthreads
- 32GB of ram
- 2 x 256GB SATA SSD
- A pretty hefty server
- Less than $2k
- Drawbacks
  - One psu
  - OOB is kind of a pain
- Ubuntu 14.04 / KVM

What is it?

- Virtualization is the abstraction of the manifestation of a resource from the actual physical instance of that resource.
- What Computing/Network resources can be virtualized?
  - Virtually anything! :)

Anything?

- In the context of this course. We're interested in virtualization along two dimensions:
  - Services
  - Hosts

Resource/Service virtualization

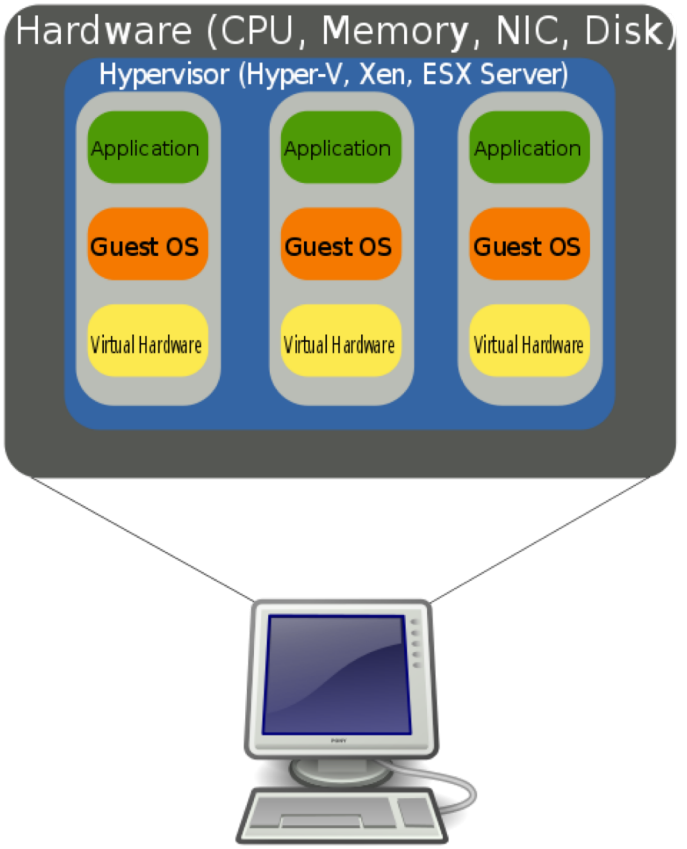
- Examples:
  - Load-balancers
  - DNS Based GLB
  - HTTP(S) Virtual Hosting
  - MX records
  - Virtual Switches
  - Virtual Routers
  - Virtual Firewalls

Resource Virtualization - Continued

- HTTP virtual hosts
  - Multiple websites on one system
- Load Balancing
  - One (or many sites or applications) across many systems
  - Can be done at Layer-3/4/7

Host Virtualization

- Examples
  - VMware
  - KVM (Used in class)
  - Virtual-Box (Simplest to use)
  - XEN
  - FreeBSD and Linux Jails
  - Windows Hyper-V
  - LXC/D (I shall never recommend)
  - Proxmox



What problem are we attempting to solve with host virtualization.

- Problem 1 – Idle capacity.
  - Most of the machines in your datacenter are idle most of the time.
  - Capacity you're not using:
    - Cost money up front
    - Cost money to operate
    - Reduces you return on capital
  - Packing discreet systems into a smaller number of servers provides savings along virtually every dimension.

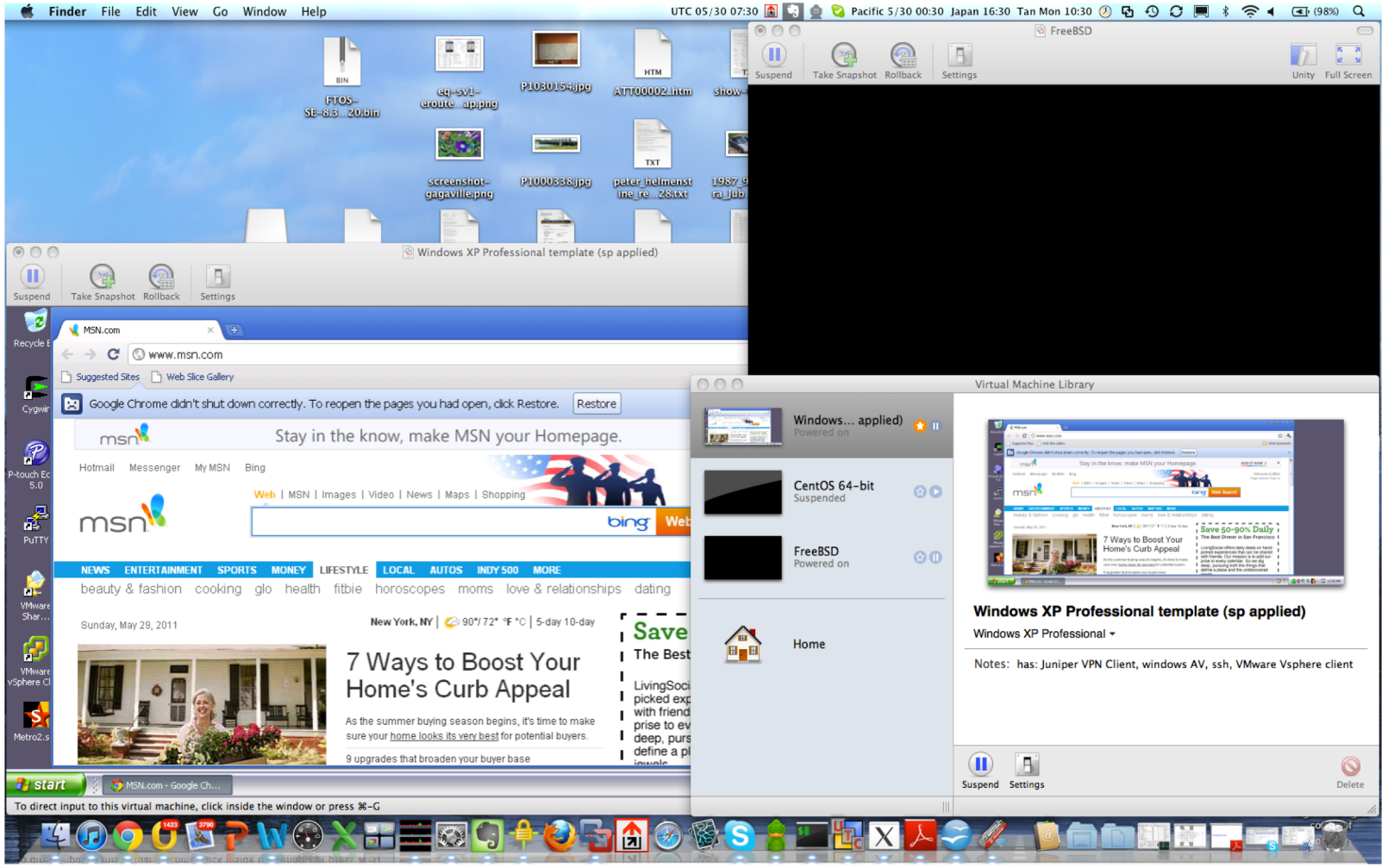
Problems - Continued

- Problem 2 – Provisioning
  - Spinning up a new service involves:
    - Acquiring the hardware
    - Building the server
    - Integration with existing services
  - With virtualization we're aiming to short-circuit that
    - Capacity is a resource
    - Machine instances may be cloned or provisioned from common basic images
    - Resources are purchased in bulk and assigned to applications as necessary.

Problems - Continued

- Problem 3 – Hardware abstraction
  - Operating systems, servers, and applications evolve at different rates.
  - Providing a common set of infrastructure resources means, virtualized systems are portable across servers
  - Hardware failure can more easily be managed.
- Abstraction may come at a performance cost however. (some workloads are more expensive than others)
  - See: http://blog.xen.org/index.php/2011/11/29/baremetal-vs-xen-vs-kvm-redux/

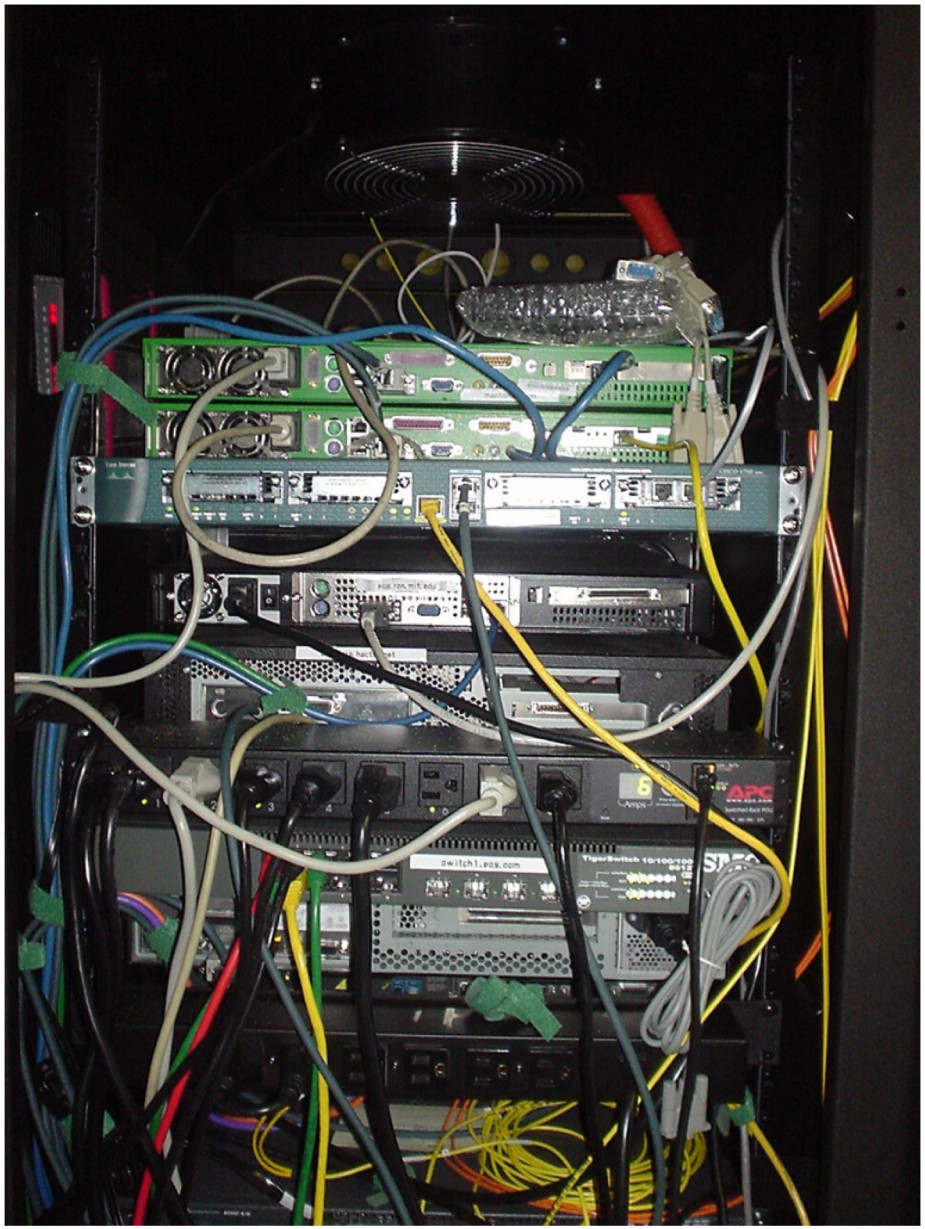
Examples – Desktop Virtualization



Desktop Virtualization

- Uses
  - Prototyping services or applications before deployment
  - Utilities that don't run on your operating system
  - Maintaining multiple versions of an environment for support purposes.
  - Staying familiar with unix while running windows (consider compared to the alternative (dual-booting)
- Issues
  - Emulating multiple computers on your laptop/desktop is somewhat resource intensive
- Vmware player and VirtualBox are free.
  - http://www.virtualbox.org/wiki/Downloads
  - https://my.vmware.com/web/vmware/downloads

Examples – Server Virtualization



Virtualized Servers as a Service (Amazon Web Services)

- Much as collocated servers, are available from a hosting provider, virtual servers are also available.
- Model is:
  - You pay for what you use.
  - Flexibility, need fewer servers today than you used, yesterday.
  - Leverage other amazon tools (storage/map-reduce/load-balancing/payments etc)

AWS Steps

- Select availability zone
- Launch new instance
- Select appropriate ami
- Associate with ssh key
- Launch instance
- Add ip
- SSH into new machine instance.
- t1-micro-instances run $54 a year + bandwidth

Try it for free...

- Free tier for the first Calender year is (per month):
  - 750 hours of EC2 running Linux/Unix Micro instance usage
  - 750 hours of Elastic Load Balancing plus 15 GB data processing
  - 10 GB of Amazon Elastic Block Storage (EBS) plus 1 million IOs, 1 GB snapshot storage, 10,000 snapshot Get Requests and 1,000 snapshot Put Requests
  - 15 GB of bandwidth in and 15 GB of bandwidth out aggregated across all AWS services
- Which is not to say that, at scale EC2 is particularly cheap, (It isn't)
  - Limited capital at risk is in the context of prototyping or experimentation however.

AWS - Continued

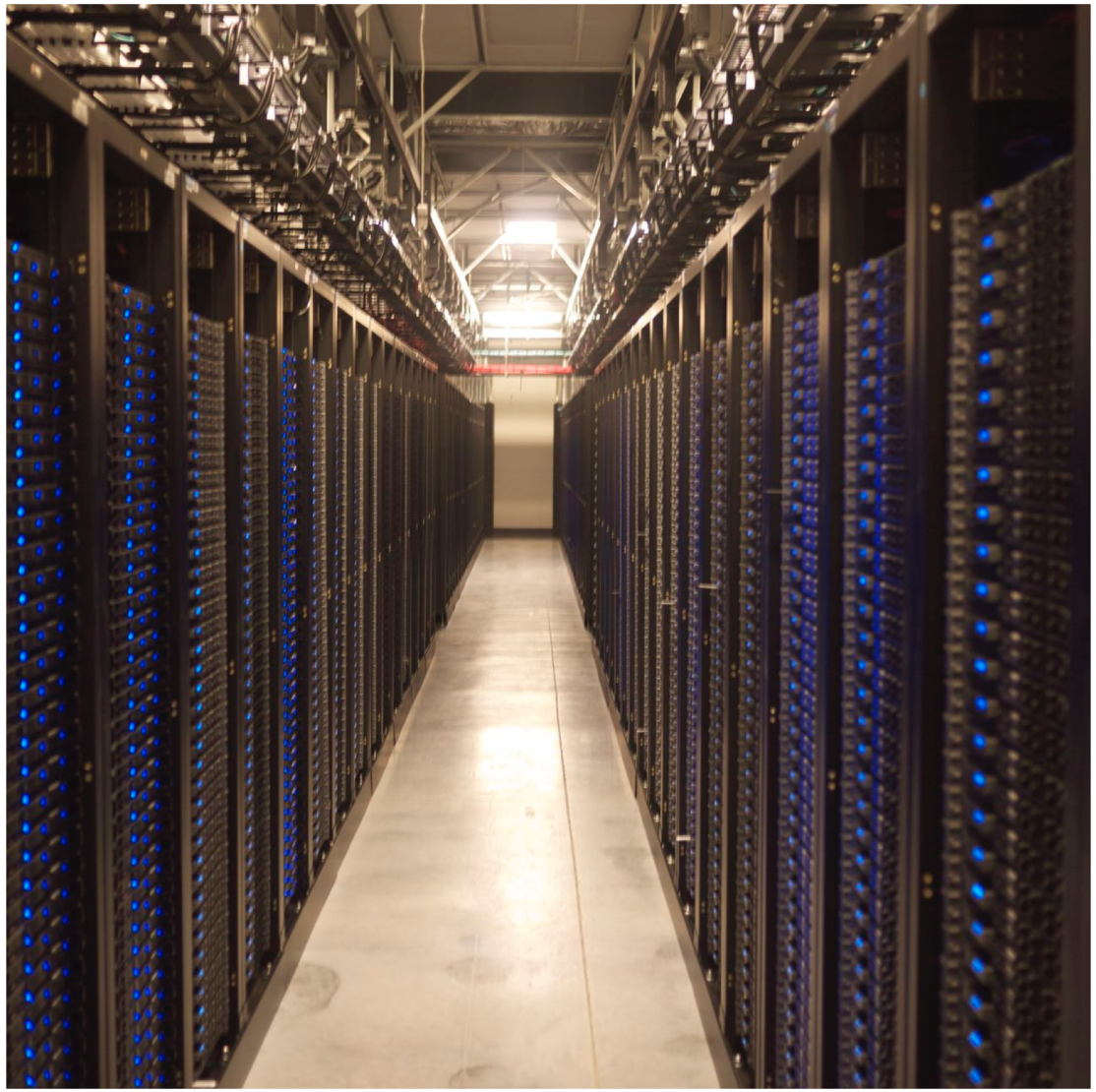
- For provisioning purposes cli interaction is possible:
  - http://aws.amazon.com/developertools/351
- Along with tools to support the provisioning and destruction of virtual machines.

Provisioning and management

- Is the glue that makes virtualization usable
- In commercial virtualization environments the provisioning/management toolkits represent the bulk of the licensing cost (VMware) and the secret sauce (VMotion, disaster recovery, backup, etc)
- Examples:
  - XEN tools – a collection of perl scripts for spinning VMs http://www.xen-tools.org/software/xen-tools/
  - KVM tools - http://www.linux-kvm.org/page/Management_Tools
  - Cloud.com/cloud-stack (orchestration) - http://www.cloudstack.org/
  - Rightscale – (orchestration multiple public/private clouds) http://www.rightscale.com
  - Puppet (host / configuration management) - http://puppetlabs.com/puppet/
  - PDSH – (Parallel Shell execution) http://code.google.com/p/pdsh/

Can you spot the...

- Web-node?
- Database-node?
- Load-balancer?
- Nameserver?
- DHCP Server?
- Email cluster?
- Devnodes?



Complimentary technologies

- NIC teaming or Link aggregation
- Network attached storage and network centric filesystems
  - NFS
  - Hadoopfs
  - GFS2
- Distributed databases
  - Example mysql cluster
  - Couchbase/Membase
  - OracleRAC