Virtualization Overview

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AFNOG SS-E 2013

What are we using this Year?

- Mac-mini servers
- Intel core i7 quad core 8 hyperthreads
- 16GB of ram
- 2 x 256GB SATA SSD
- A pretty hefty server
- Less than $2k
- Drawbacks
  - One psu
  - OOB is kind of a pain
- Ubuntu / KVM

What is it?

- Virtualization of 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

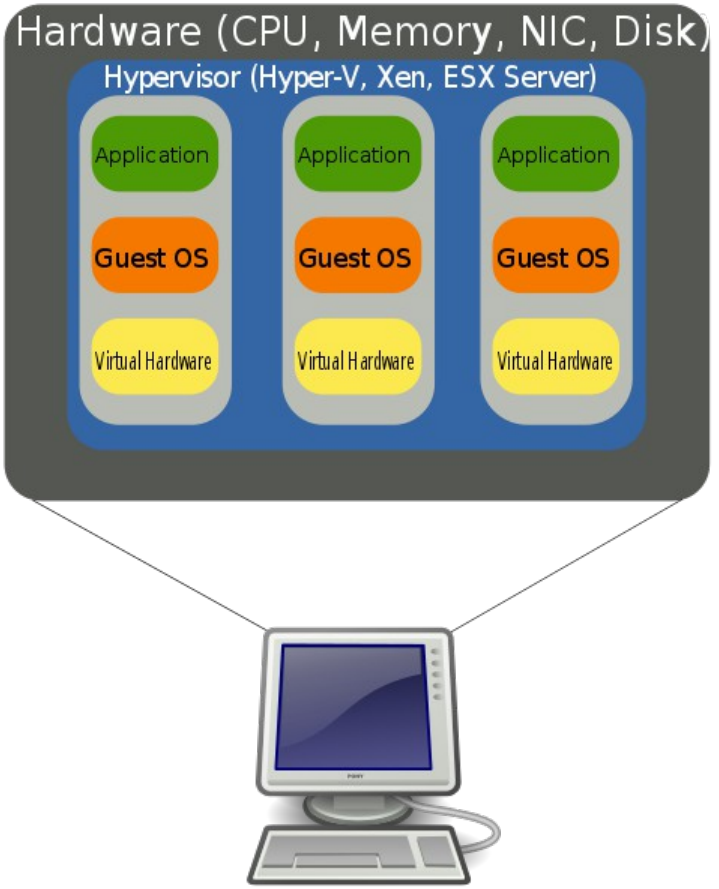
- Examples:
  - Load-balancers
  - DNS Based GLB
  - HTTP(S) Virtual Hosting
  - MX records
  - Virtual Switches
  - Virtual Routers
  - Virtual Firewalls

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
  - Virtual-Box (used in class)
  - KVM
  - XEN
  - FreeBSD and Linux Jails
  - Windows Hyper-V



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.

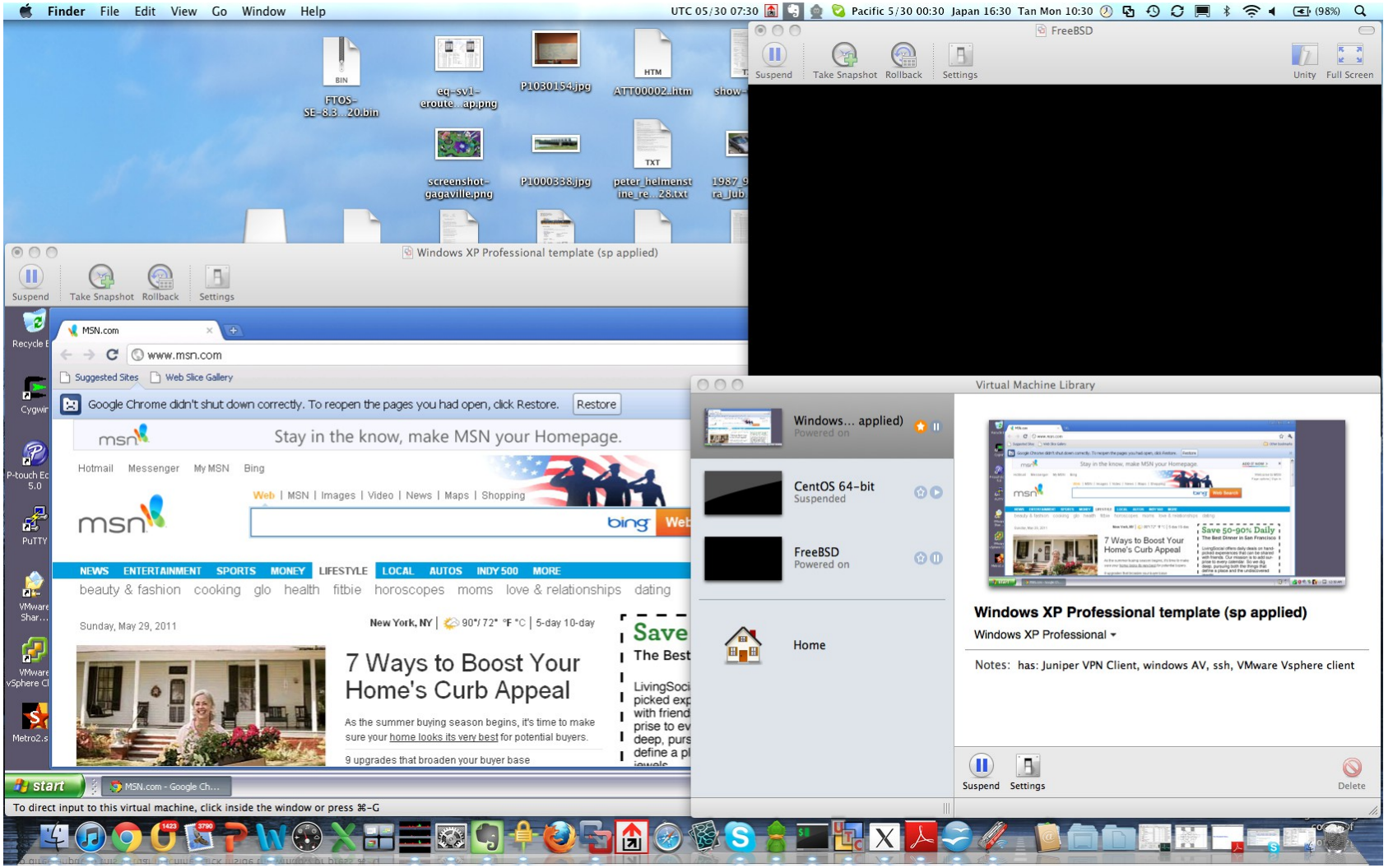
Problems - Continued

- 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 my 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/

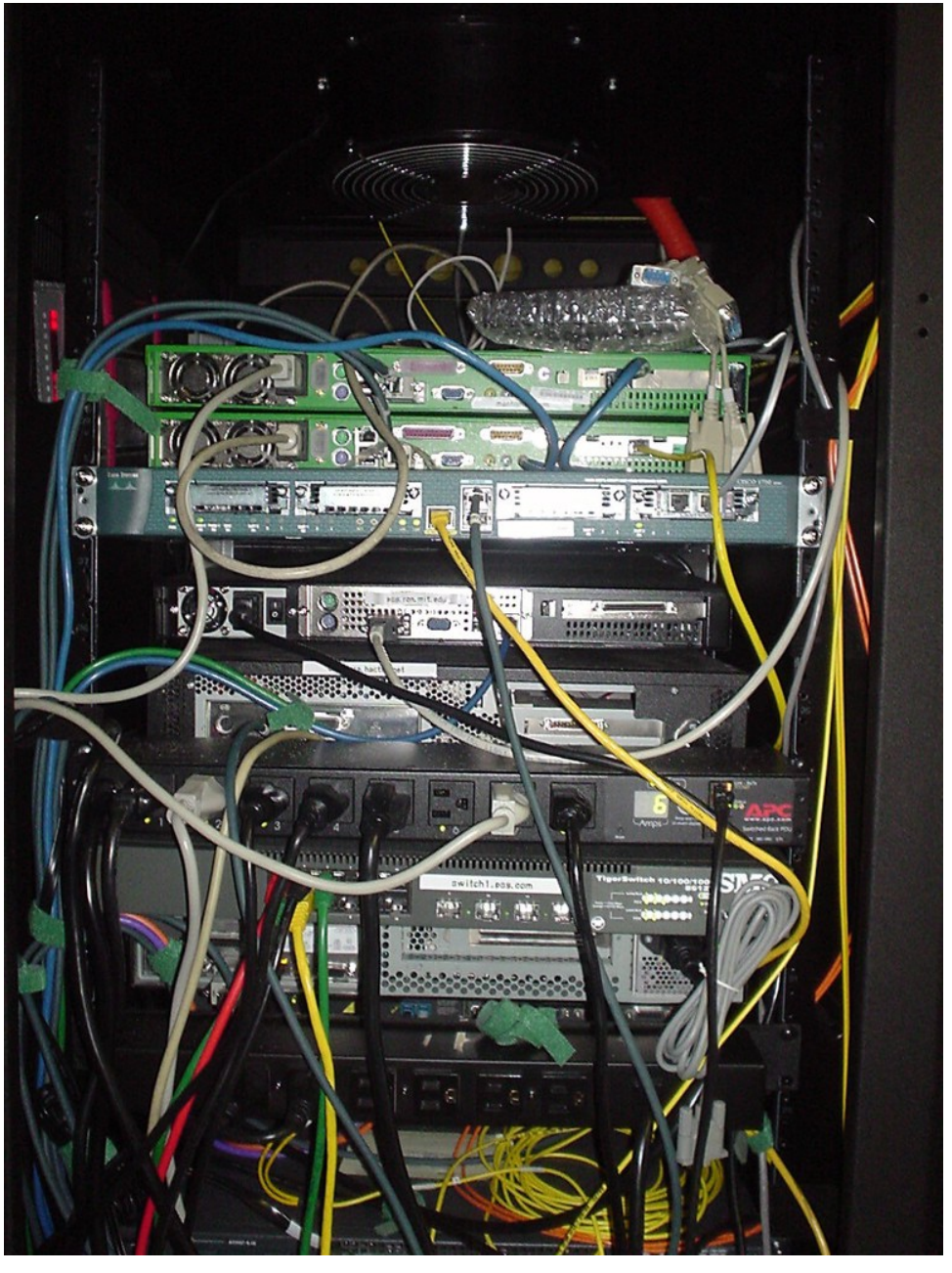
Examples – Desktop Virtualization



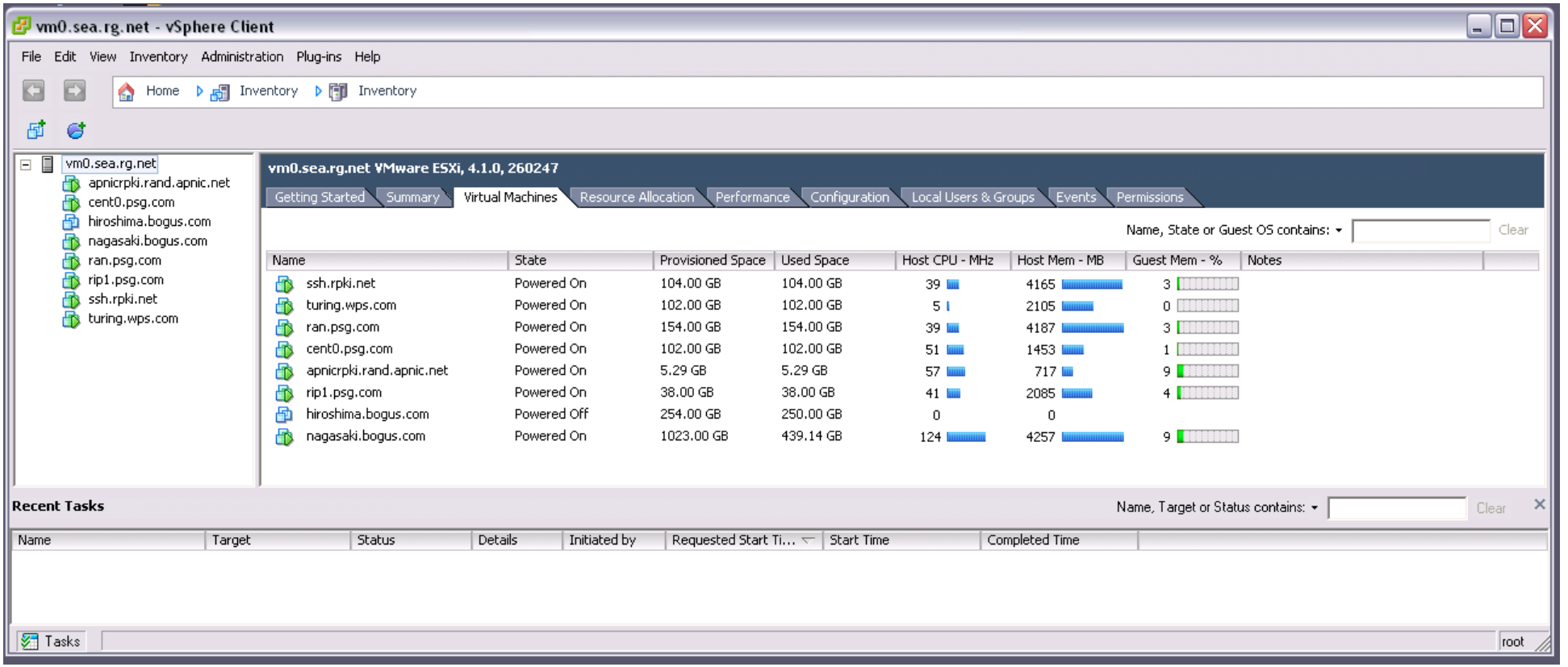
Desktop Virtualization

- Uses
  - Prototyping services or applications before deployment
  - Utilities that don't run on your operating system
  - Isolation of sandbox environments from your desktop
  - 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

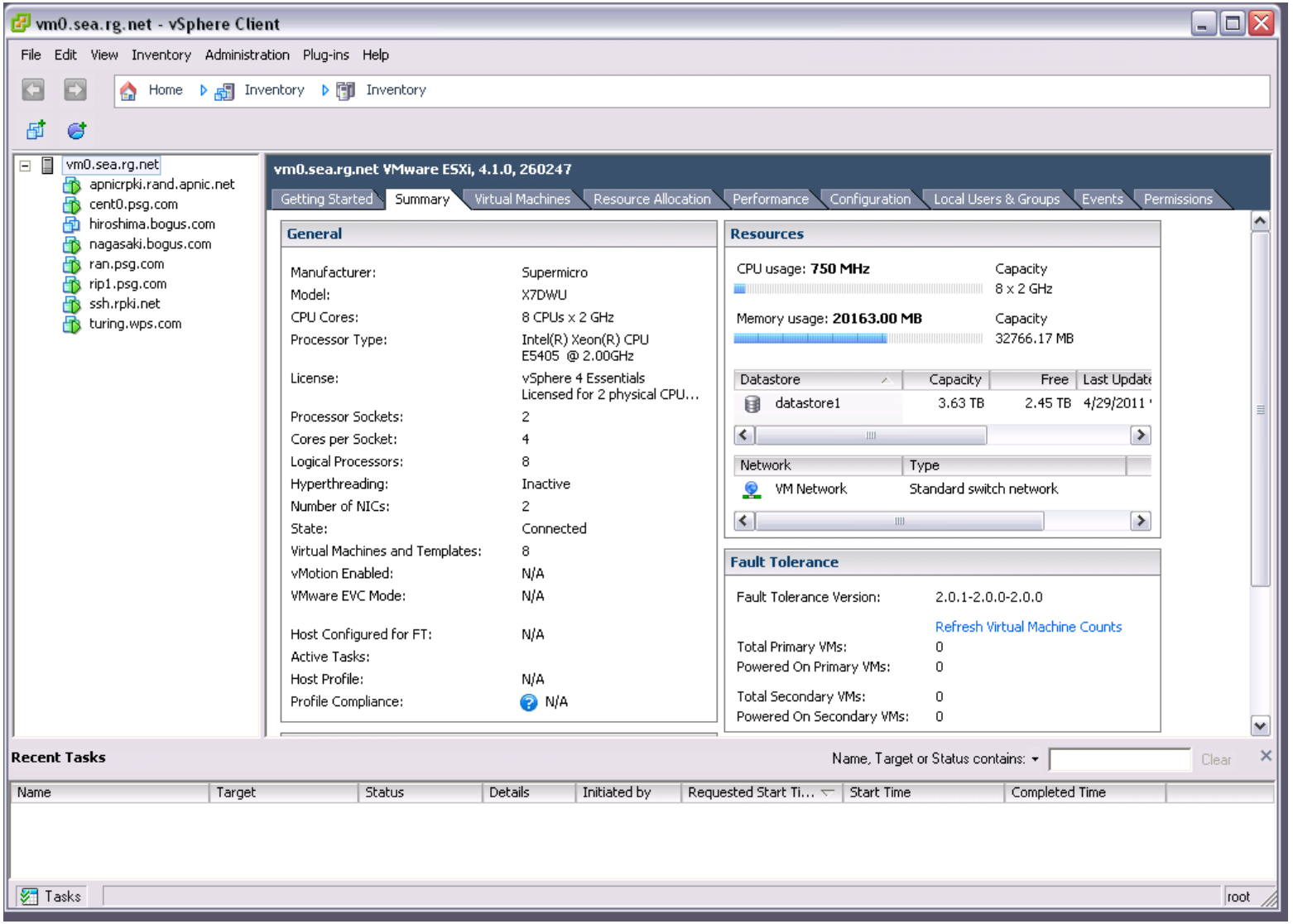
Examples – Server Virtualization



Server Virtualization - Continued



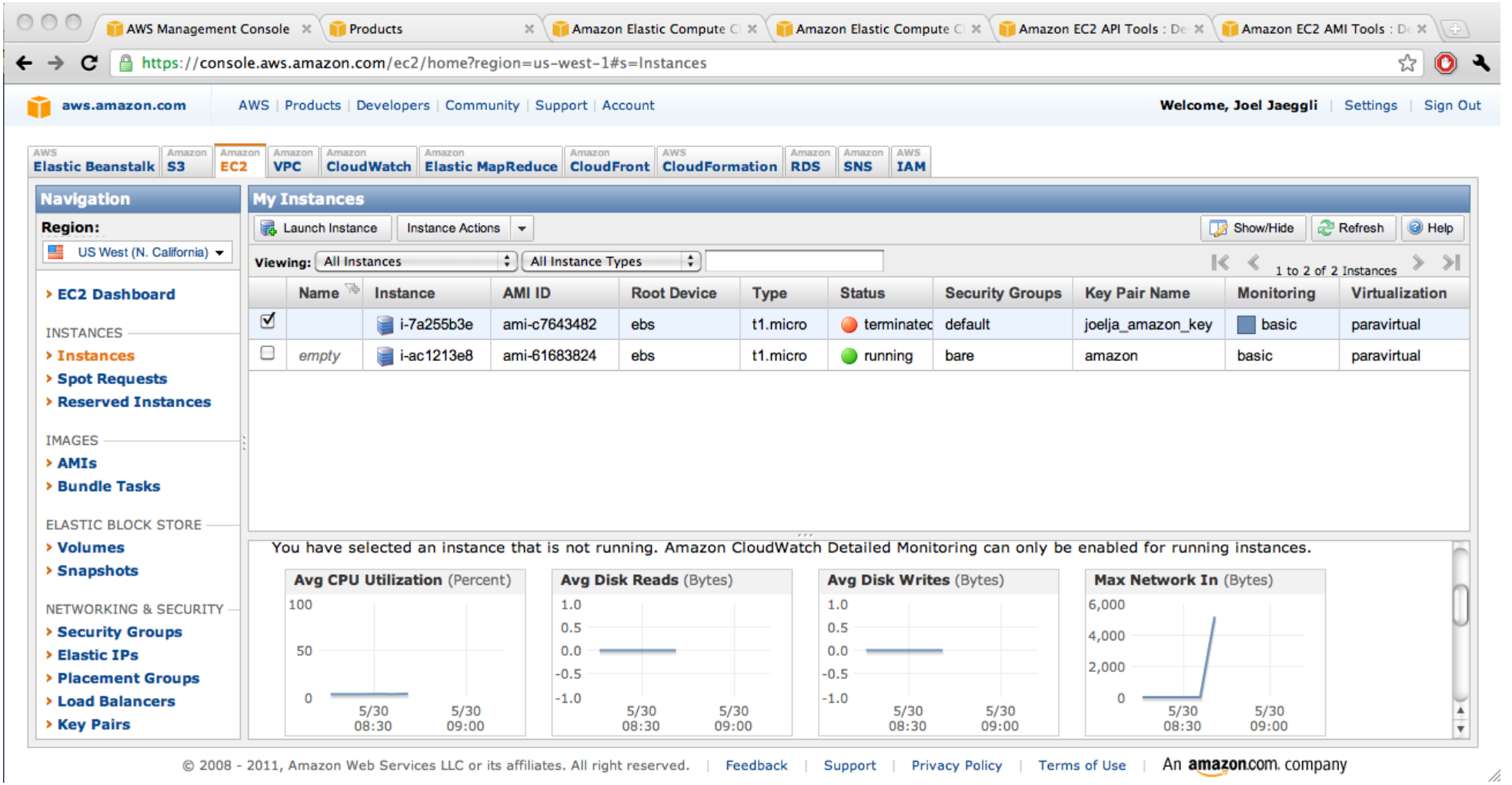
Server Virtualization



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 then you used, yesterday.
  - Leverage other amazon tools (storage/map-reduce/load-balancing/payments etc)

AWS


AWS Management Console
Products
Amazon Elastic Compute C
Amazon Elastic Compute C
Amazon EC2 API Tools : De
Amazon EC2 AMI Tools : De
https://console.aws.amazon.com/ec2/home?region=us-west-1#s=Instances
aws.amazon.com
AWS | Products | Developers | Community | Support | Account
Welcome, Joel Jaeggli | Settings | Sign Out
Elastic Beanstalk
S3
EC2
VPC
CloudWatch
Elastic MapReduce
CloudFront
CloudFormation
RDS
SNS
IAM
Navigation
Region:
US West (N. California)
EC2 Dashboard
INSTANCES
Instances
Spot Requests
Reserved Instances
IMAGES
AMIs
Bundle Tasks
ELASTIC BLOCK STORE
Volumes
Snapshots
NETWORKING & SECURITY
Security Groups
Elastic IPs
Placement Groups
Load Balancers
Key Pairs
My Instances
Launch Instance
Instance Actions
Show/Hide
Refresh
Help
Viewing: All Instances
All Instance Types
1 to 2 of 2 Instances
Name
Instance
AMI ID
Root Device
Type
Status
Security Groups
Key Pair Name
Monitoring
Virtualization
i-7a255b3e
ami-c7643482
ebs
t1.micro
terminated
default
joelja_amazon_key
basic
paravirtual
empty
i-ac1213e8
ami-61683824
ebs
t1.micro
running
bare
amazon
basic
paravirtual
You have selected an instance that is not running. Amazon CloudWatch Detailed Monitoring can only be enabled for running instances.
Avg CPU Utilization (Percent)
Avg Disk Reads (Bytes)
Avg Disk Writes (Bytes)
Max Network In (Bytes)
5/30 08:30
5/30 09:00
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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

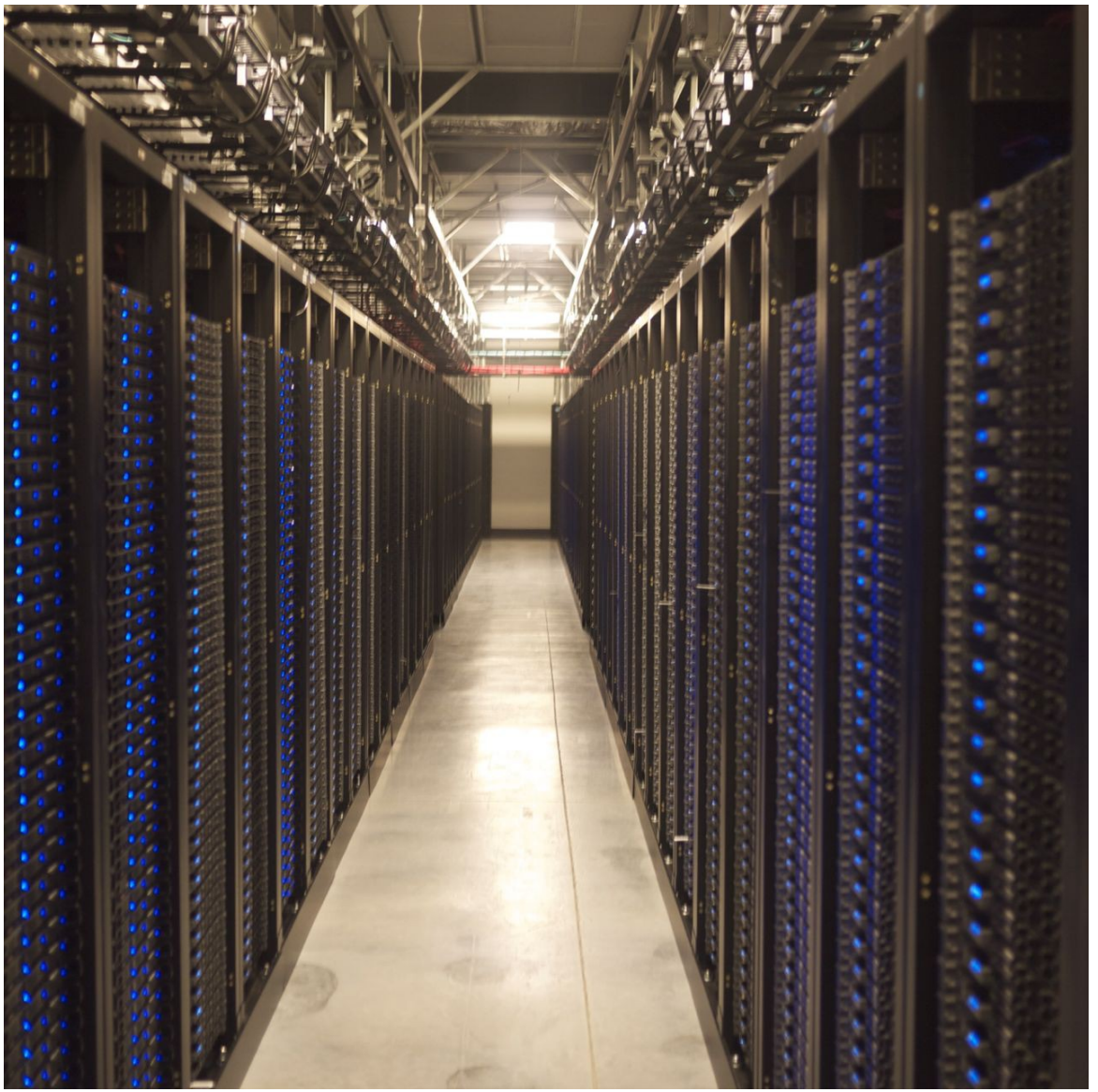
- Is the glue that makes virtualization usable
- In commercial virtualization environments the provisioning/management toolkits represent the bulk of the licensing cost (VMware) and the secret sauce (VMotion, disaster recovery, backup, etc)
- Examples:
  - XEN tools – a collection of perl scripts for 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/

Variation In virtualized environments

- Enterprise and Government virtualized environments may tend towards heterogeneity.
  - e.g. the applications (servers) that are being virtualized have accumulated over time
  - Are different enough that management may be depressingly manual
- ASP/Internet services environments may be more homogenous.
  - Leverage a common set infrastructure primitives
  - Thousands of like-systems providing overlapping functionality across hundreds of servers
  - Traditional network elements (e.g. loadblancers/firewalls) may be virtualized along with the application.

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