Automating CloudStack with Puppet

Puppet Camp Silicon Valley

David Nalley

david@gnsa.us

@ke4qqq

#whoami

- Recovering sysadmin
- Committer on Apache CloudStack
- Fedora Project Contributor
- Fan of “The Phoenix Project”

The plan

- Overview of Apache CloudStack
- Using puppet to manage your CloudStack-based VMs
- Using puppet to manage your VM deployment.

What is CloudStack?

- Open source IaaS platform
- ASLv2 licensed
- History tl;dr
  - began development in 2008
  - production deployments by 2009
  - open sourced in 2010
  - moved to ASF in 2012

Design goals

- Integrate with untold number of yet to be identified hardware.
- Provide an API platform on which to run cloud operations.
- Orchestrate hardware resources that may be protected by a firewall.
- Horizontally scalable management layer.
- Enable the best data paths to accomplish cloud operations.
- A beautiful and functional UI

Architectural Overview

- Division of physical resources
- Storage
- Borg drones VMs
- Networking
- Management and orchestration

Physical hosts

- Hypervisors
  - KVM
  - Xenserver
  - XCP
  - VMware
- Baremetal (with IPMI)

Clusters

- Collections of hosts
- Typically 1-15 hosts in a cluster
- Homogenity
  - Network
  - Hypervisor
  - CPU type

Clusters

- Hosts share storage
- Fault domain for individual VM availability
- Lowest level for allocation decisions

Pods

- Collection of clusters
- Typically a rack or row of racks
- Can contain multiple types of hypervisors
- Largely just an arbitrary division

Zones

- Typically a datacenter
- Single networking model within a zone
- Visible to the end user

Storage

- CloudStack doesn't really provide storage, but does consume and orchestrate it.

Local Storage

- Typically faster than SAN/NAS
- Failure of a host means loss of a VM
- Can be far more scalable than trying to scale a large traditional storage platform

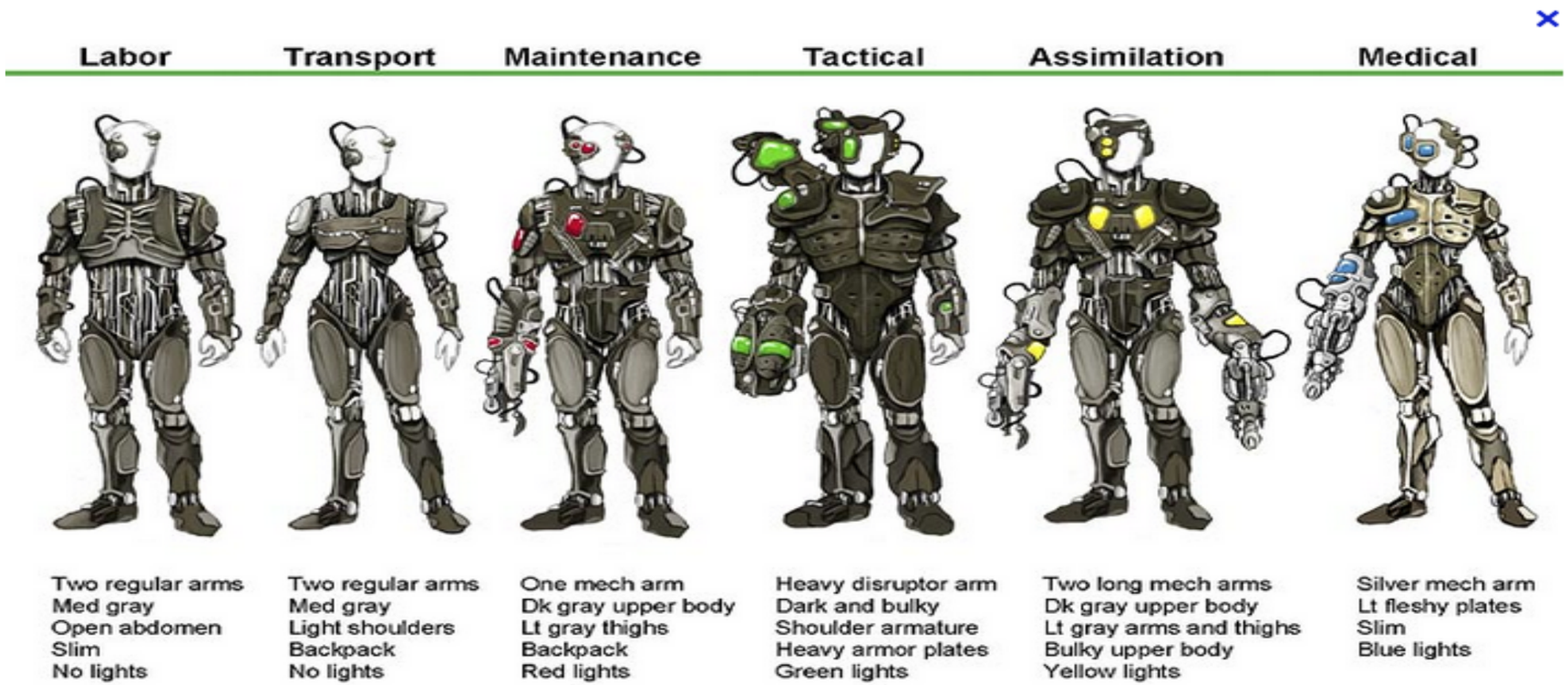
Primary (shared) storage

- Shared at the cluster level
- Where running disk images live
- All hosts in the cluster can write to the resource
- Most commonly NFS and iSCSI, but essentially anything the hypervisor can mount
- 'New' storage types like Ceph RBD

Secondary Storage

- Primary storage is focused on running VMs, Secondary storage is focused on immutable items.
  - Snapshots
  - Disk images
  - ISOs
- Zone wide storage resource
- Can employ object storage

Borg drone VMs



Console Proxy VM

- AJAX-based VNC console access
- Allows CloudStack to deal with auth{n,z} for console access.
- Abstracts away hypervisor access
- Not a replacement for ssh/RDP but no more painful than DRAC/iLO
- Stateless; horizontally scalable

Secondary Storage VM

- Secondary Storage is the resource, the SSVM that handles the following operations:
  - Copying snapshots from primary to secondary storage
  - Copying disk images from secondary to primary storage
  - Making all items stored in secondary storage downloadable and a place to transfer items into secondary storage
  - Aging the snapshots according to policy

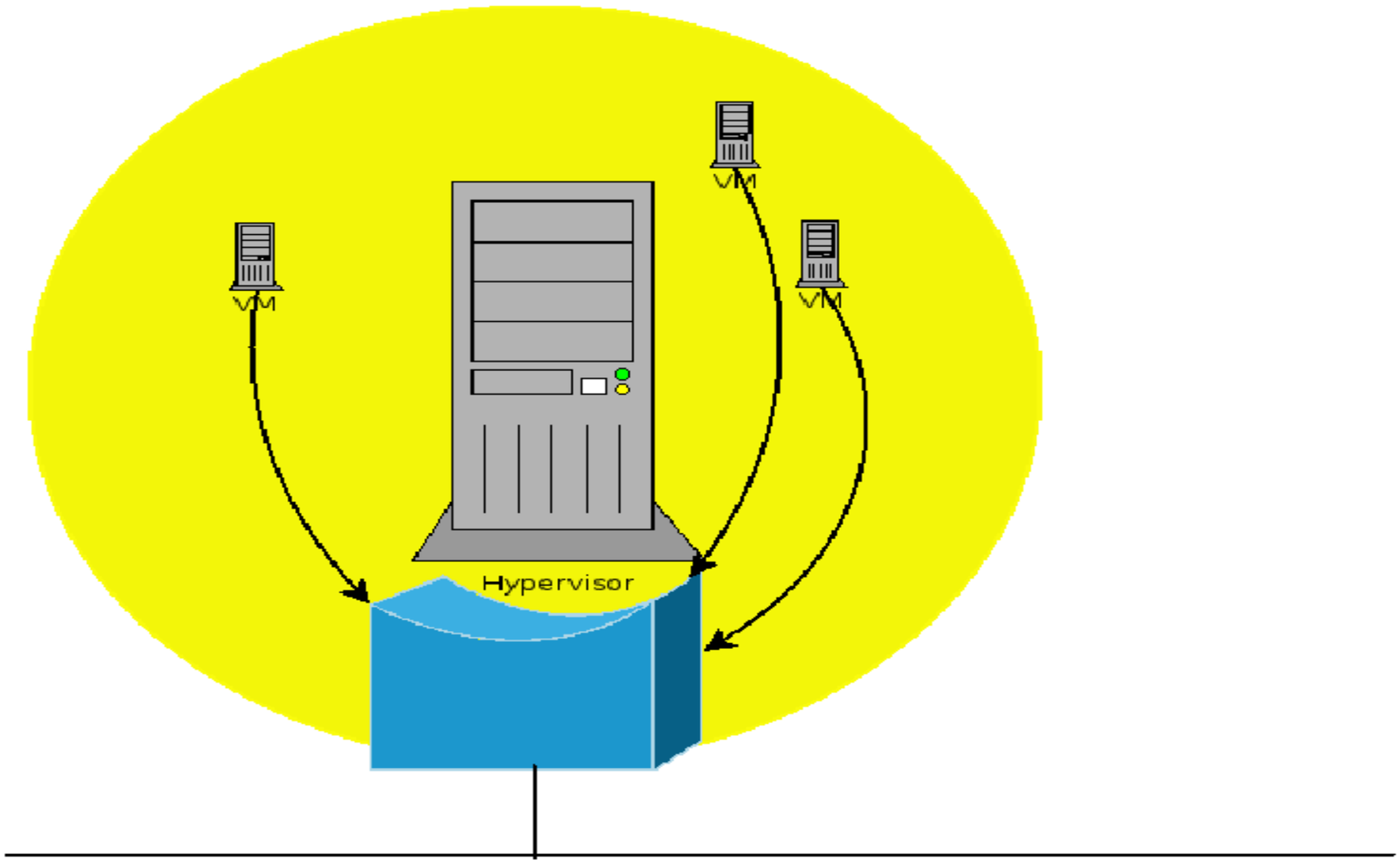
Networking Model: VLANs

- Traditional L2 isolation
- CloudStack given a block of VLANs and allocates them on demand
- Each account gets allocated at least one VLAN.
- Inherent limitations of VLANs

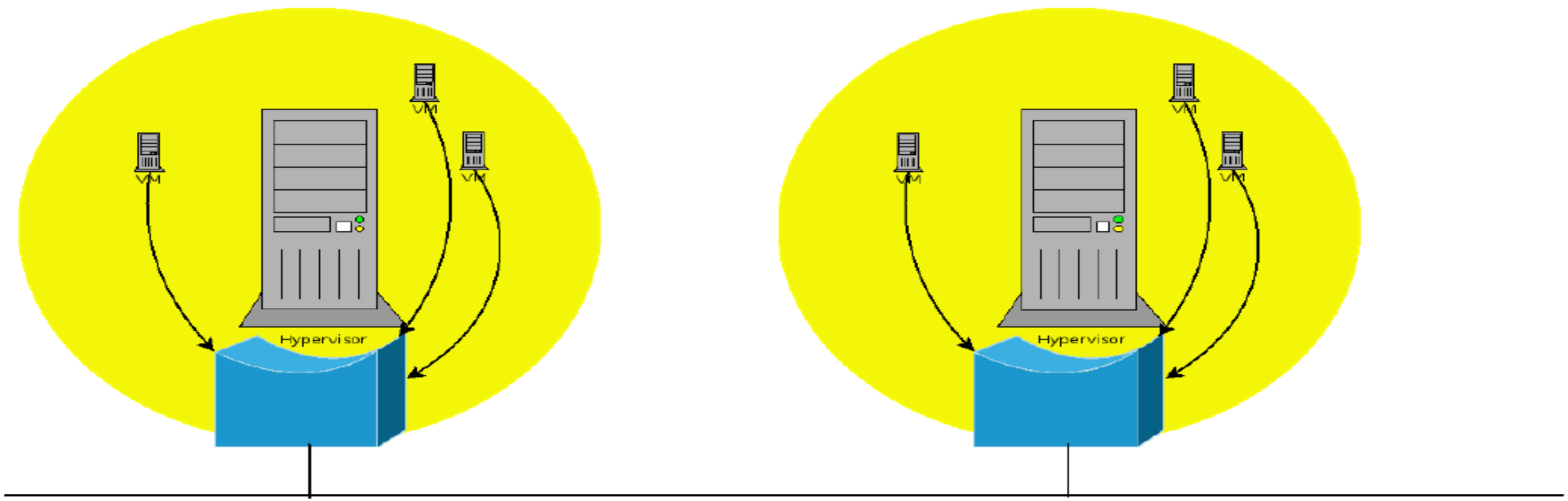
Networking model: L3 Isolation

- L3 isolation; aka Security Groups
- Pushes ACLs down to each hypervisor host
- Far more scalable, decentralized (more Borg)
- Filter at the bridge device

Security Groups



Security Groups



Network Model: SDN

- OVS (GRE overlay tunnels)
- Nicira NVP
- Others rapidly appearing:
  - BigSwitch
  - Midokura

Virtual networking hardware

- DHCP
- VLAN allocation
- Firewall
- NAT/Port forwarding
- Routing
- VPN
- Load Balancing

Virtual networking hardware

- Cisco Nexus 1000v
- NetScaler VPX
- F5 Big IP virtual edition

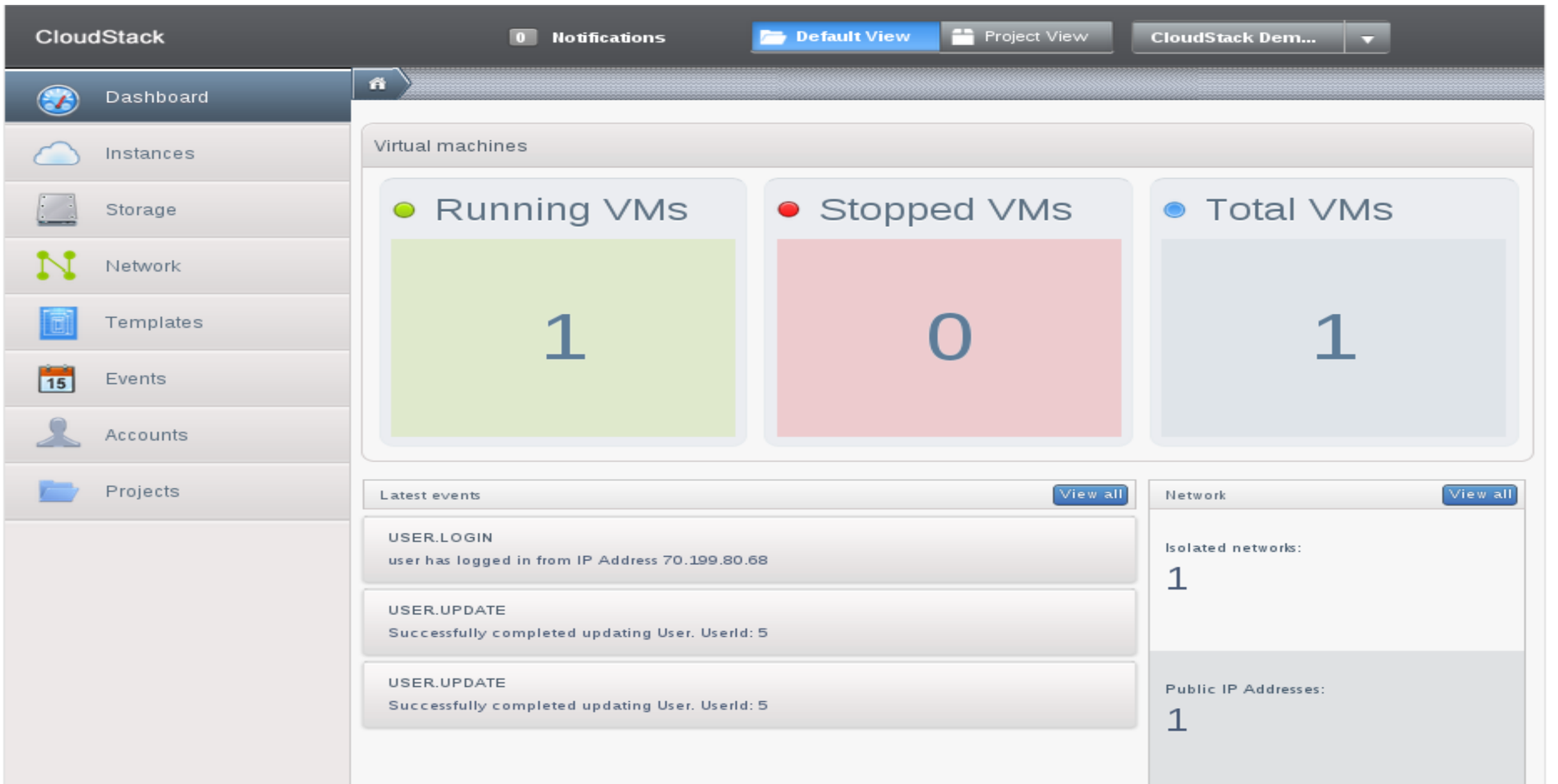
Physical networking hardware

- Juniper SRX
- F5 BigIP LB
- NetScaler

Management Server

- Management server is stateless, horizontally scalable platform for orchestrating all of the resources.
- Provides isolation in what is assumed to be a multi-tenant environment

UI


CloudStack
0 Notifications
Default View
Project View
CloudStack Dem...
Dashboard
Instances
Storage
Network
Templates
Events
Accounts
Projects
Virtual machines
Running VMs
1
Stopped VMs
0
Total VMs
1
Latest events
View all
USER.LOGIN
user has logged in from IP Address 70.199.80.68
USER.UPDATE
Successfully completed updating User. Userld: 5
USER.UPDATE
Successfully completed updating User. Userld: 5
Network
View all
Isolated networks:
1
Public IP Addresses:
1

API

- EC2/S3 translation layer
- CloudStack native API:
  - http://incubator.apache.org/cloudstack/docs/api

More info

- http://incubator.apache.org/cloudstack
- #cloudstack on irc.freenode.net
- cloudstack-users-subscribe@incubator.apache.org

Using puppet to manage VMs

- Being able to deploy 500 VMs in 10 minutes means you need some method to classify and apply configuration management.
- Most of the work for this awesomeness was done by Jason Hancock (@jsnby)

A couple of upfront goals

- Minimize the number of templates
- Have all instances receive config via Puppet
- Zero manual intervention

Make one API call to launch a VM, and get out of the way and watch the automation do wonderful things.

A word about auto-signing

- You can use auto-signing.
- Automatically signs any cert from a given domain
- Potential security issues if folks can connect to your puppetmaster
- You can pre-seed templates with a signed key - but there are gotchas

Run puppet ASAP

- Turn off splay - you want to minimize the time that the box remains unconfigured.
- Make sure puppet is configured to start on boot (enable the service, not cron)

Classifying nodes - options

- {site,node}.pp
- hostname-based regex
- PE/Dashboard
- ENC
- facts
- $other_things

facts

What to base a fact on...

http://incubator.apache.org/cloudstack/docs/api/apidocs-4.0.0/user/deployVirtualMachine.html

userdata	an optional binary data that can be sent to the virtual machine upon a successful deployment. This binary data must be base64 encoded before adding it to the request. Currently only HTTP GET is supported. Using HTTP GET (via querystring), you can send up to 2KB of data after base64 encoding.

Sample userdata

role=webserver

location=datacenter1

environment=production

Custom fact for userdata

- http://s.apache.org/acs_userdata

Implementing ::role in puppet

Everyone is a default node.

No need to add nodes to site.pp or use an ENC.

Sample, skeletonized, site.pp

```
import 'base'


node default {
 include base
}
```

Sample, skeletonized, base.pp

```
class base.pp {
 # Includes that apply to all machines


 case $::role {
   'somerole': {
     include somemodule
   }
   'otherrole': {
     include someothermodule
   }
```

This is only the beginning...

- Setting environment, purging terminated instances, and more.
- Check out Jason's blog: http://geek.jasonhancock.com

Making puppet deploy your infrastructure in CloudStack

- Most of the real work that follows was done by Dan Bode.

deployVirtualMachine API

- CloudStack provides an API for provisioning machines.

Puppet...

- converts freshly provisioned VMs into functional machines ready to do work.

When combined....

you can start from nothing, deploy the machines and wind up with a completely automated deployment system.

CloudStack resources in puppet

https://github.com/bodepd/cloudstack_resources

Still a bit raw....potentially unstable, use with caution, file bug reports and patches.

Defining application stacks

```
class my_app_stack {
 cloudstack_instance {'web1':
   ensure    => present,
   group     => 'role=web',
 }
 cloudstack_instance {'db1':
   ensure    => present,
   group     => 'role=db',
 }
}
```

Setting defaults

```
Cloudstack_instance {
 image      => 'Fedora18_x86_64',
 flavor     => 'm1.medium',
 zone       => 'SanJose',
 network  => 'default own',
 keypair   => 'my_secret_keypair',
}
cloudstack_instance { 'web1':
 ensure => $::ensure,
 group   => 'role=web',
```

Now machines and their configuration are deployable all from puppet.

(This also exists for GCE and OpenNebula.)