

An introduction to

Building Clouds with Apache CloudStack



apachecloudstack[™]
open source cloud computing

Apache Roadshow, Berlin

Giles Sirett

About me

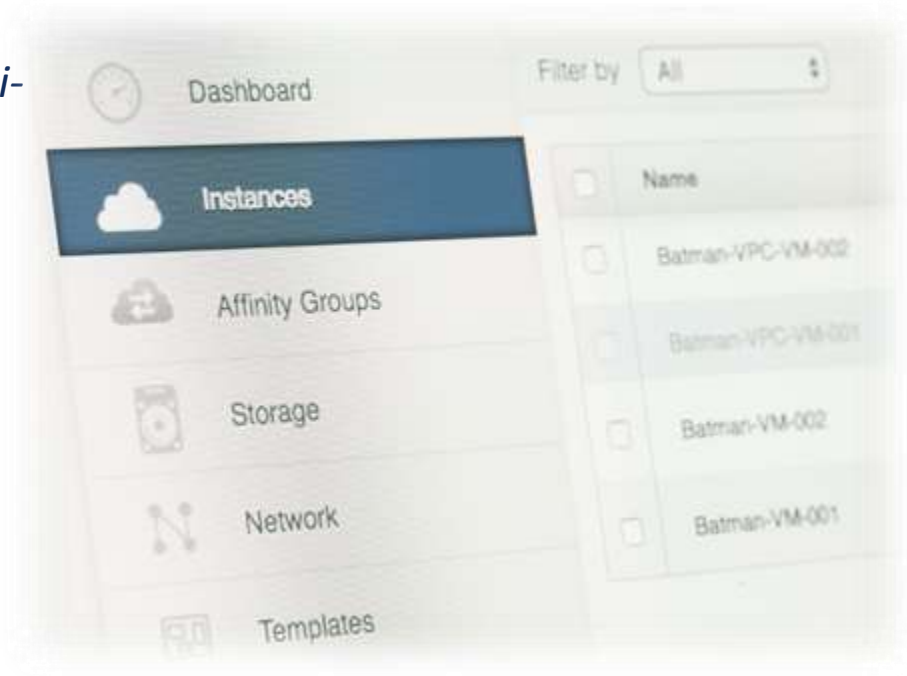


- PMC member & Committer - Apache CloudStack
- Chair –CloudStack European user group
- CEO - ShapeBlue
- Declaration: I'm a business guy

- Also: Physicist, ex-programmer, husband, runner, Dad, rugby coach, proud Brit AND European

What is CloudStack?

Apache CloudStack is a scalable, multi-tenant, open-source, purpose-built, cloud orchestration platform for delivering turnkey Infrastructure-as-a-Service clouds



How to build an IaaS cloud

PaaS

Developer tooling

Multi-cloud
management

CaaS

Cloud Monkey

Ecommerce platform

Management

CloudStack API

Apache CloudStack

Choice of Hypervisor (KVM, VMWare,
Xen, hyper-V, OVM, XCP-ng)

Networking

compute

Storage

Key cloudStack features

- Broad & deep Hypervisor support
 - XenServer, KVM, VMware, OracleVM, Hyper-V, XCP-ng
- Enterprise grade tenant Virtual Networking model
- Scalable architecture
 - Support thousands of hosts and virtual machine guest
 - Largest known production cloud 35k+ physical hosts
- High availability
 - Configurations that provide automatic failover for virtual machines
- Choice of interfaces
 - Web UI, command line, REST-based API

CloudStack history

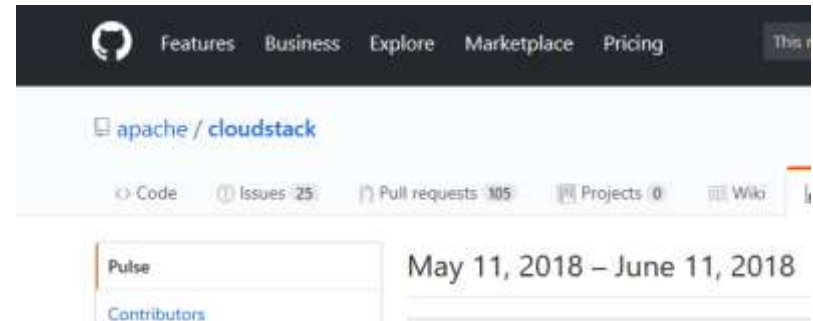
- 2008 – Vmops launches (rebrands Cloud.com)
- April 2010 – Cloud.com Releases CloudStack under GPLv3
- July 2011 - Citrix acquires CloudStack
- April 2012 - CloudStack donated to Apache Software Foundation
- November 2012 – First Apache CloudStack Release
- March 2013 - CloudStack graduates from ASF Incubator
- 2014 – Majority of committers are not from Citrix
- 2016 – Citrix leave the project
- 2014-2018 Lots of releases, adoption continues to grow

CloudStack today

- 3-4 releases per year
- Widespread production deployment
 - Public cloud providers
 - Private cloud use-cases
- LTS releases
- Diverse user driven developer community.....

CloudStack today

- **C.200 project committers**
- **Diverse PMC**
- **Last 4 weeks (to 11 June)**
 - 400 mailing list msgs
 - 60 mailing list contributors
 - 34 merged PRs, 13 authors
 - 1600 package downloads
- **Lots of meetups & events....**



CloudStack Collaboration Conferences



<http://Cloudstackcollab.org>

CloudStack use-cases



Private Cloud

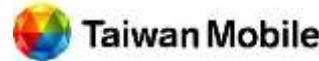


Hybrid Cloud



Public Cloud

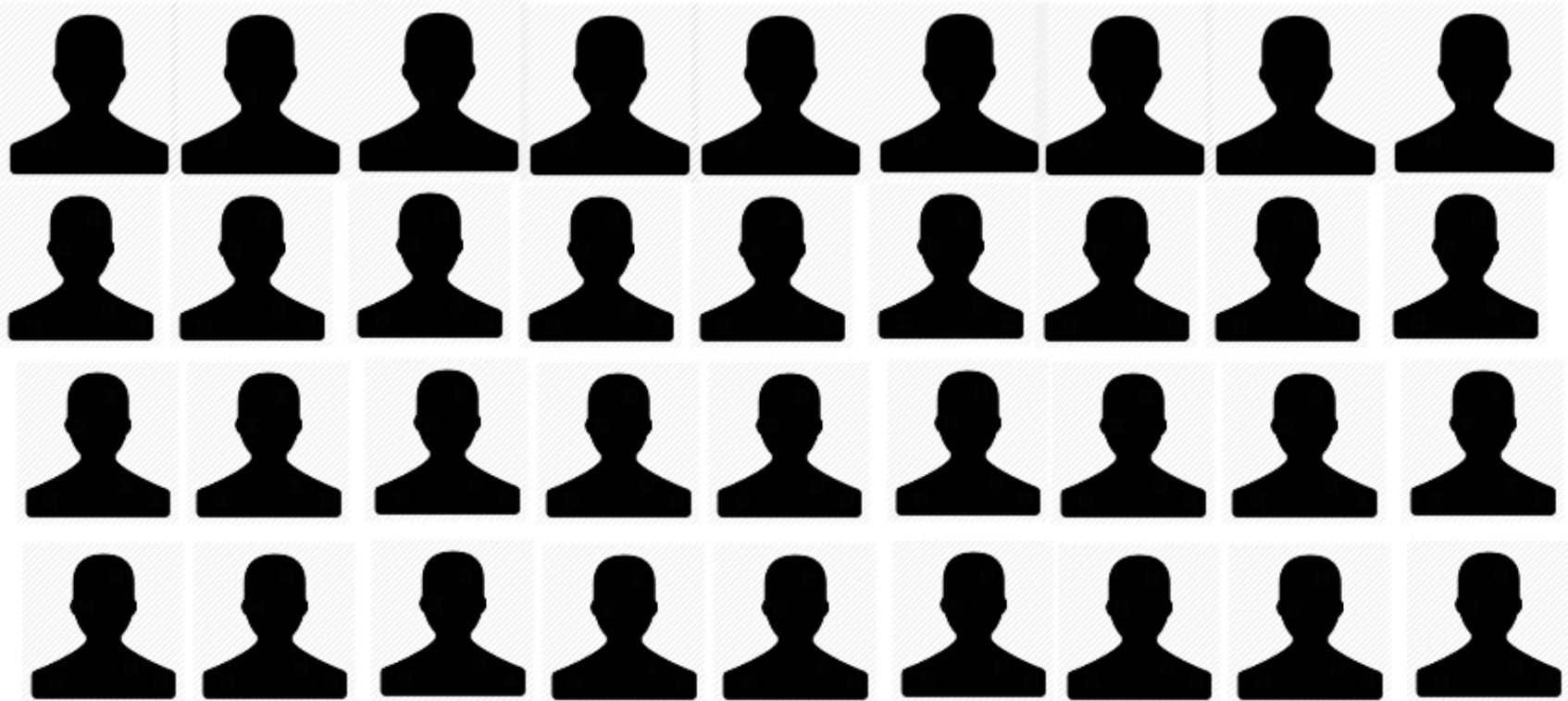
Cloudstack “known users”



Cloudstack *known users*



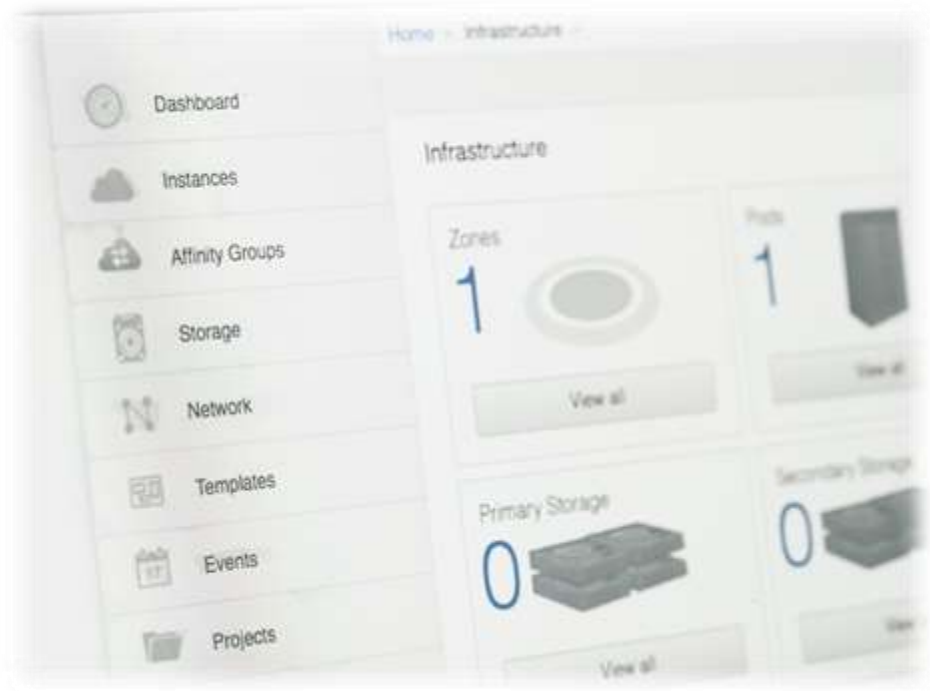
CloudStack *known* users



What can you do with CloudStack?

- **Self service of all resources – compute, storage and networking – *with no requirements for highly skilled technical staff.***
- **Automation of all provisioning and management through API.**
- **E.g.**
 - Create Virtual Machines from templates or ISOs
 - All Virtual Machine lifecycle actions: start/stop/delete/storage/networking
 - Manage storage volumes
 - Create Isolated, Shared and Multi-Tiered Networks
 - Manage firewall and port forwarding rules
 - Manage Network Services such as Load Balancing, Static and Source NAT, VPNs, Global Load Balancing and Autoscaling





CloudStack demo

API examples

Examples of Cloudstack Rest API:

- List VMs for all users:
<http://10.2.3.183:8096/client/api?command=listVirtualMachines&listall=true>
- List all my templates:
<http://10.2.3.183:8096/client/api?command=listTemplates&templatefilter=all>
- Create new network "RootNet2"
 - <http://10.2.3.183:8096/client/api?command=createNetwork&zoneid=ea2edb5f-2fbd-4390-a731-b4e252d2f5c7&name=RootNet2&displayText=RootNet2&networkOfferingId=d323caa4-976b-4cd3-b57c-58864b842a40&domainid=d30d22bf-6afd-11e8-aa6b-06227e0108af&account=admin>
- Create a new VM attached to RootNet1
 - <http://10.2.3.183:8096/client/api?command=deployVirtualMachine&response=json&zoneid=ea2edb5f-2fbd-4390-a731-b4e252d2f5c7&templateid=d3121fc3-6afd-11e8-aa6b-06227e0108af&hypervisor=VMware&serviceofferingid=89e3afd9-3ed6-4975-a9a9-58953f94a9f2&iptonetworklist%5B0%5D.networkid=af048a31-f140-4907-b2ac-85ae67767ff9&displayname=RootVM2&name=RootVM2&keyboard=uk&domainid=d30d22bf-6afd-11e8-aa6b-06227e0108af&account=admin>

Note: for simplicity, these commands are being run over an unauthenticated port (8096) - this is not recommended for production use and would usually be disabled

Cloudmonkey

```
[root@trl-1441-v-cs411-dsonstebo-mgmt1 ~]# cloudmonkey list templates templatefilter=all name=CentOS7-VMware
count = 1
template:
id = 016840ac-8201-4d00-879b-b642b21cce37
name = CentOS7-VMware
account = admin
bits = 0
checksum = 9f17bb3eba92bf740eb1cf0148a4b17b
childtemplates:
created = 2018-06-11T14:45:57+0000
crossZones = True
details:
keyboard = uk
nicAdapter = E1000
rootDiskController = osdefault
directdownload = False
displaytext = CentOS7 VMware template
domain = ROOT
domainid = d30d22bf-6afd-11e8-aa6b-06227e0108af
format = OVA
hypervisor = VMware
isdynamicallyscalable = False
isextractable = False
```



“CloudStack –
Never heard of
it!”

Architect at unnamed
company, 2016, that
now runs a 800 host
production Cloudstack
production environment



In 2011

Figure 1. Hype Cycle for Cloud Computing, 2011



Source: Gartner (July 2011)



Wrong
place, wrong
time

falscher Ort
falsche Zeit

We LOVE the ASF, but....



The mission of the Apache Software Foundation (ASF) is to provide software for the public good. We do this by providing services and support for many like-minded software project communities of individuals who choose to join the ASF.

 [@CloudStack](#) [@GilesSirett](#)



Governance/Foundation/Mission

< [Governance](#) | [Foundation](#)

The Foundation Mission: The OpenStack Foundation is an independent body providing shared resources to help achieve the OpenStack Mission by Protecting, Empowering, and Promoting OpenStack software and the community around it, including users, developers and the entire ecosystem.

Community wide goals the Foundation helps achieve:

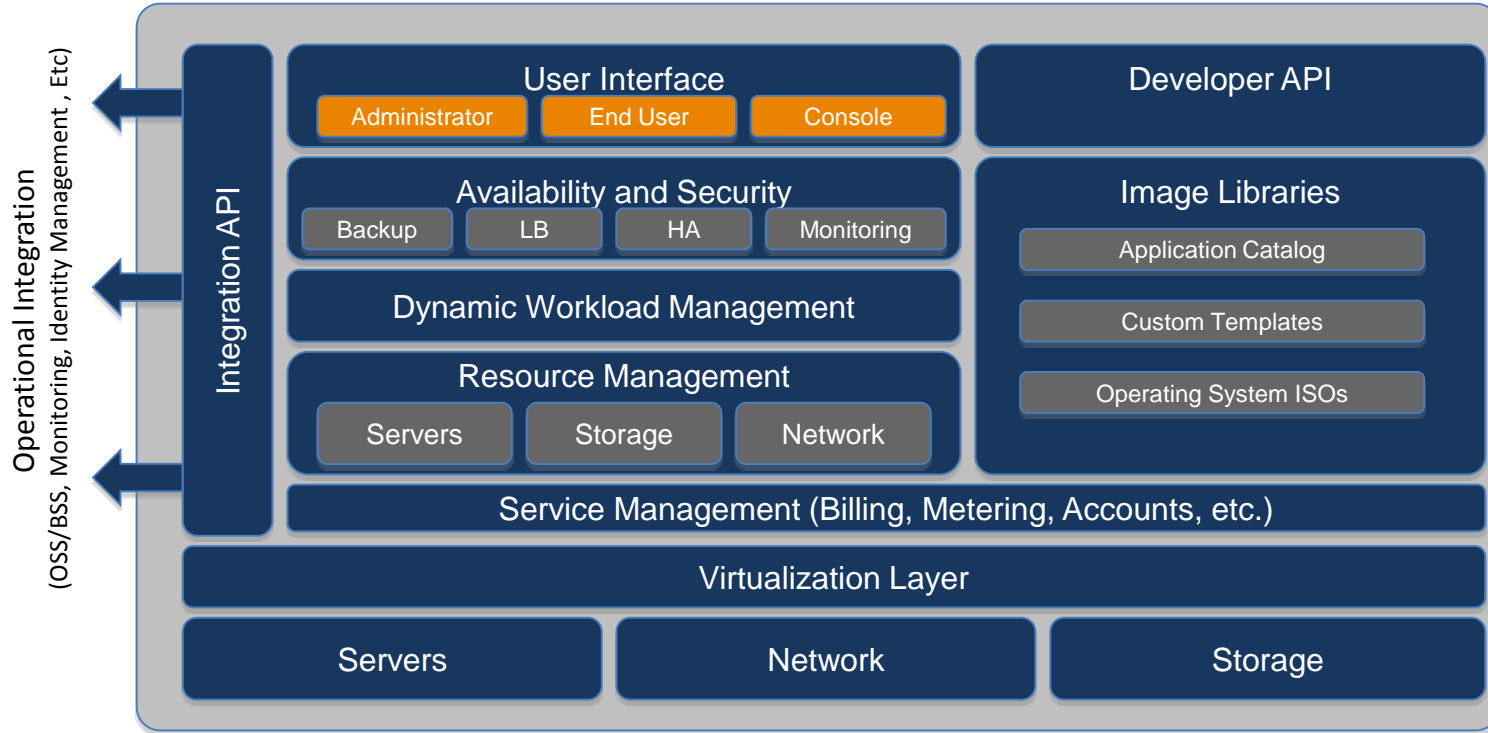
- Make OpenStack the ubiquitous cloud operating system
- Deliver high quality software releases that companies can rely on to run their business
- Ensure interoperability among OpenStack clouds
- Nurture a healthy community, with broad participation and a sharp focus on the OpenStack Mission
- Grow the ecosystem around OpenStack to strengthen the platform and provide opportunity
- Build and protect the OpenStack brand to the benefit of the community's participants



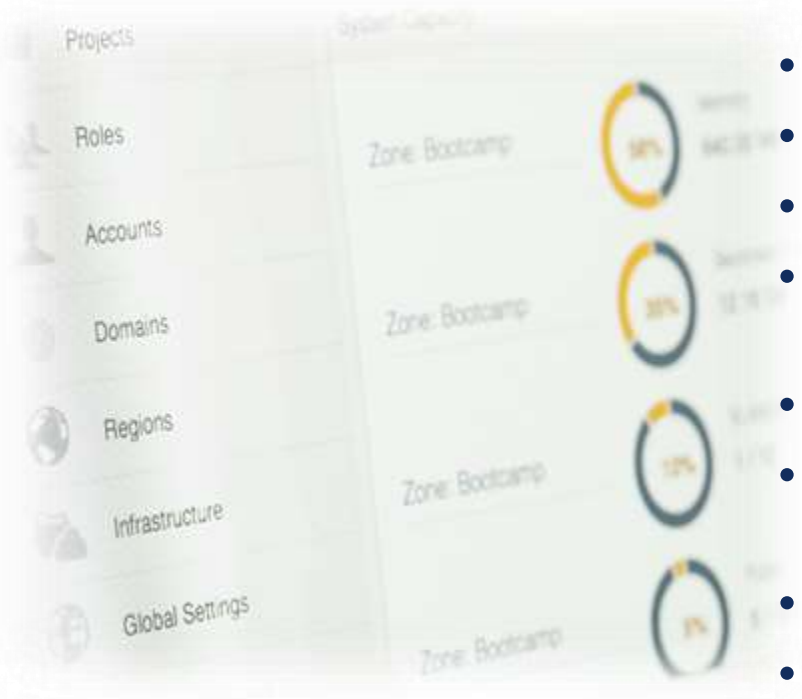
@CloudStack @GilesSirett



CloudStack is simple

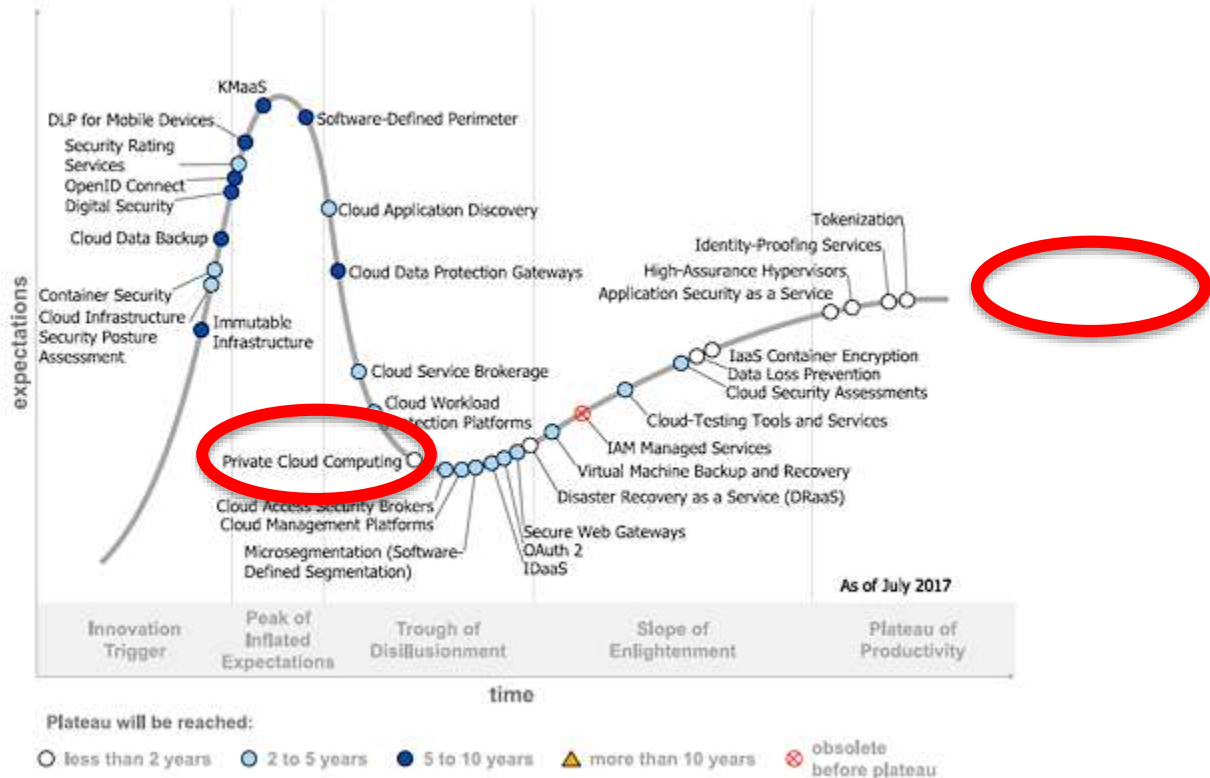


Why CloudStack ?



- Integrated end-to-end IaaS product
- Proven at scale, widespread adoption
- Rapid time to value
- Low implementation & operational costs
- Truly multi-tenant
- Focussed, user led, development community
- Narrow scope / easy integration
- **#CloudStackWorks**

And in 2017



Apache CloudStack – an open flexible platform

Compute



XenServer

VMware

OVM

KVM

Hyper-V

UCS

Bare metal

Compute primary storage



Local Disk

iSCSI

Fibre
Channel

NFS

Ceph

User accessible secondary storage



NFS

Swift

S3

CloudStack networking – 2 models

Network



Isolation

Advanced – L2

Basic – L3

Services

Routing

Firewall

DHCP

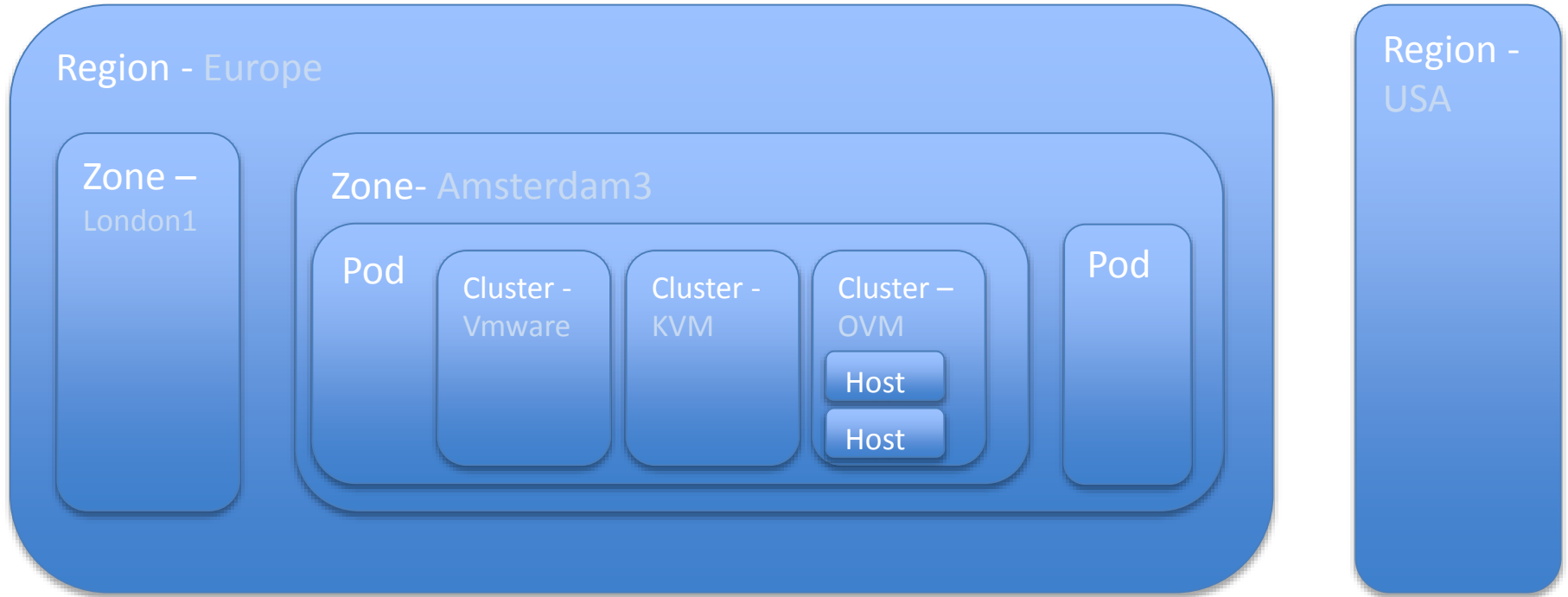
DNS

LB

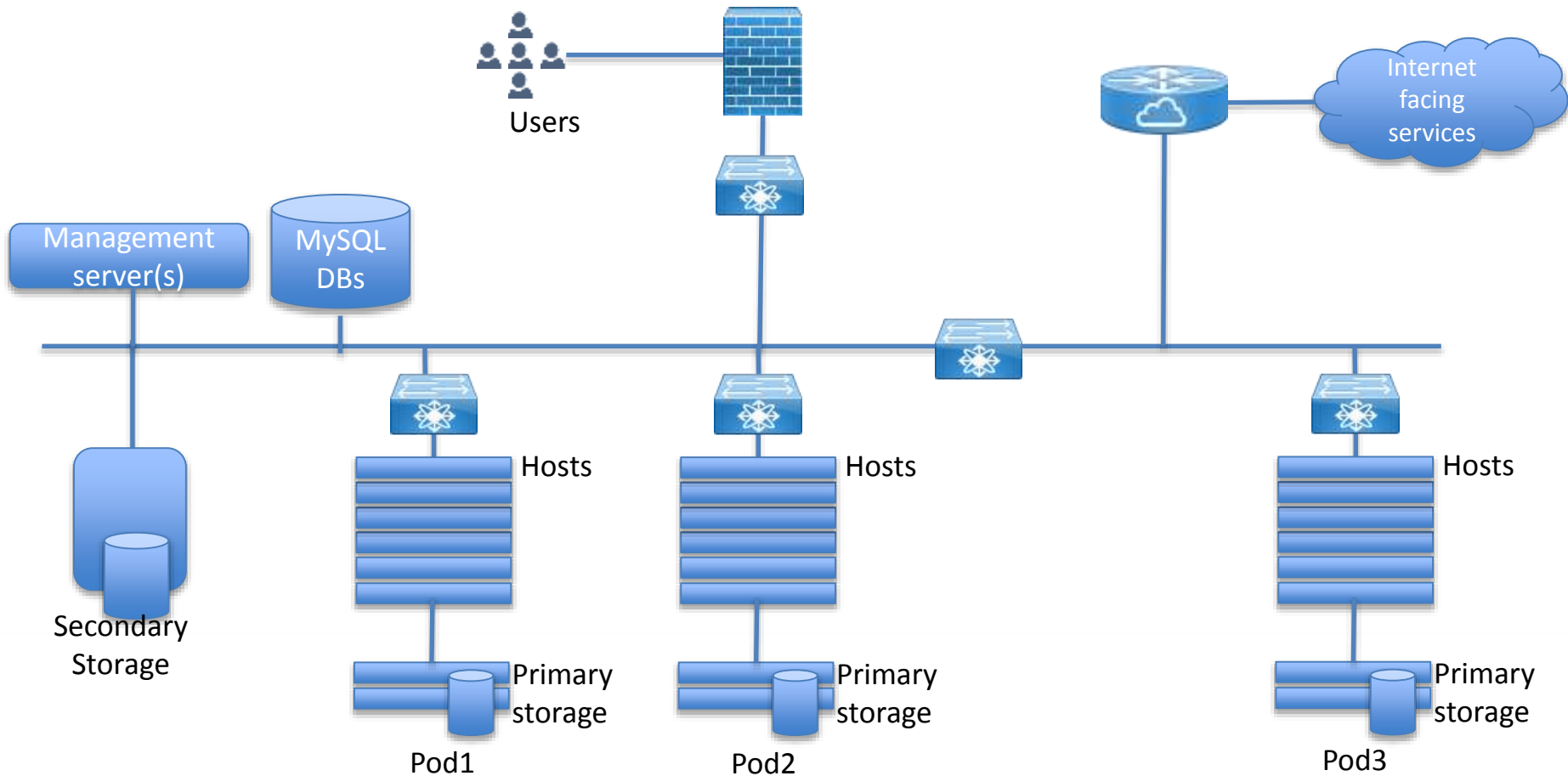
GSLB

VPN

CloudStack - Scalable constructs



Deployment model



CloudStack container Service

- Seamless Container as a Service offering in IaaS environment
- Built with Kubernetes & CloudStack
- Deploy cloud-native apps into clusters
- No changes to product catalogue or billing process



Recipe 1

completely ignore design best-practice

- **Ingredients: A hypervisor host, some NFS storage, CloudStack Management server, Cloudstack MYSQL server**



Method

1. Read the recipe & understand your ingredients
<http://docs.cloudstack.apache.org/en/latest/>
2. Read on Cloudstack networking
3. Does CloudStack support?.....
 1. It's the hypervisor stupid
4. Do not try to do this in AWS – you need hypervisor hosts



Method

5. Install MYSQL
6. Install Cloudstack
7. Start cloud XXX
8. Follow the GUI



My first CloudStack build

Host 1

- Centos
- MySQL DB for Cloudstack
- Cloudstack Management server
- NFS storage

Host 2

- Hypervisor host of your choice (as long as its KVM or Xen)

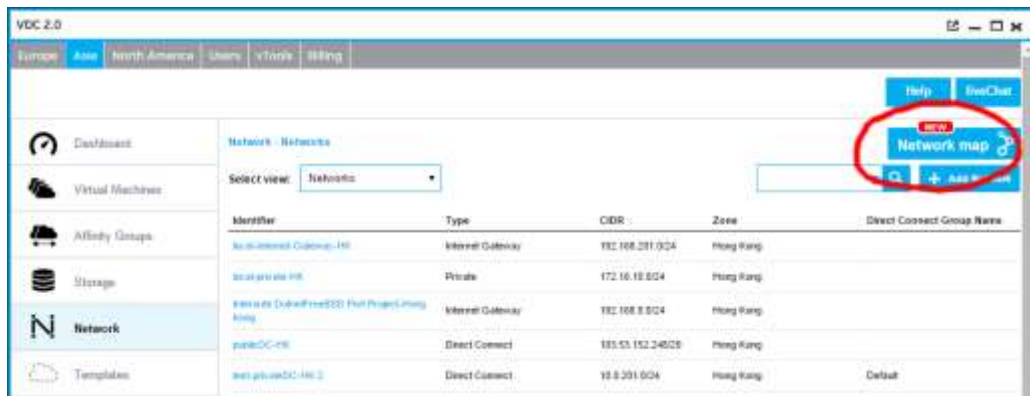
Switch with VLAN support



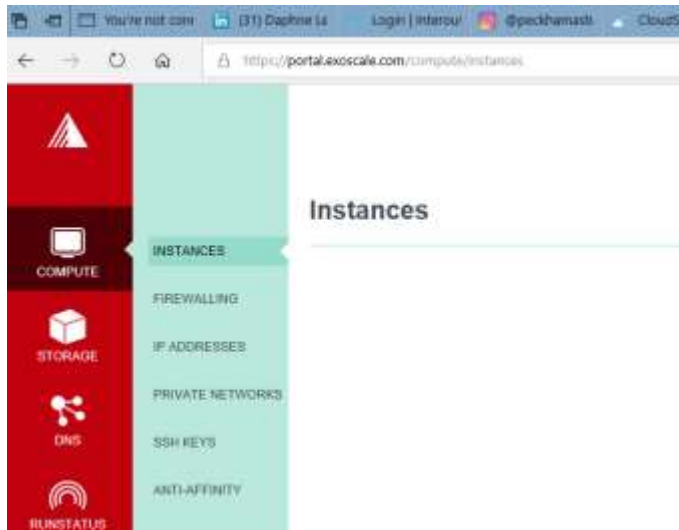
Learning Cloudstack features – use somebody else's



- **Interoute VDC**
 - Full stack IaaS offering based on Cloudstack
 - Includes hybrid “VDC Edge”
 - Massive growth – now 17 global zones



Learning CloudStack features - use somebody else's



- **Swiss based cloud provider, based on CloudStack**
- **“made for developers”**
- **Abstracted a number of CloudStack features**

Recipe 2

- **More realistic storage**
 - Primary
 - Secondary
- **Add at least one more host**
 - Test deployment
 - Test HA
- **Consider pod, clusters**
- **Introduce 2nd hypervisor**
 - Understand different hypervisor communication techniques

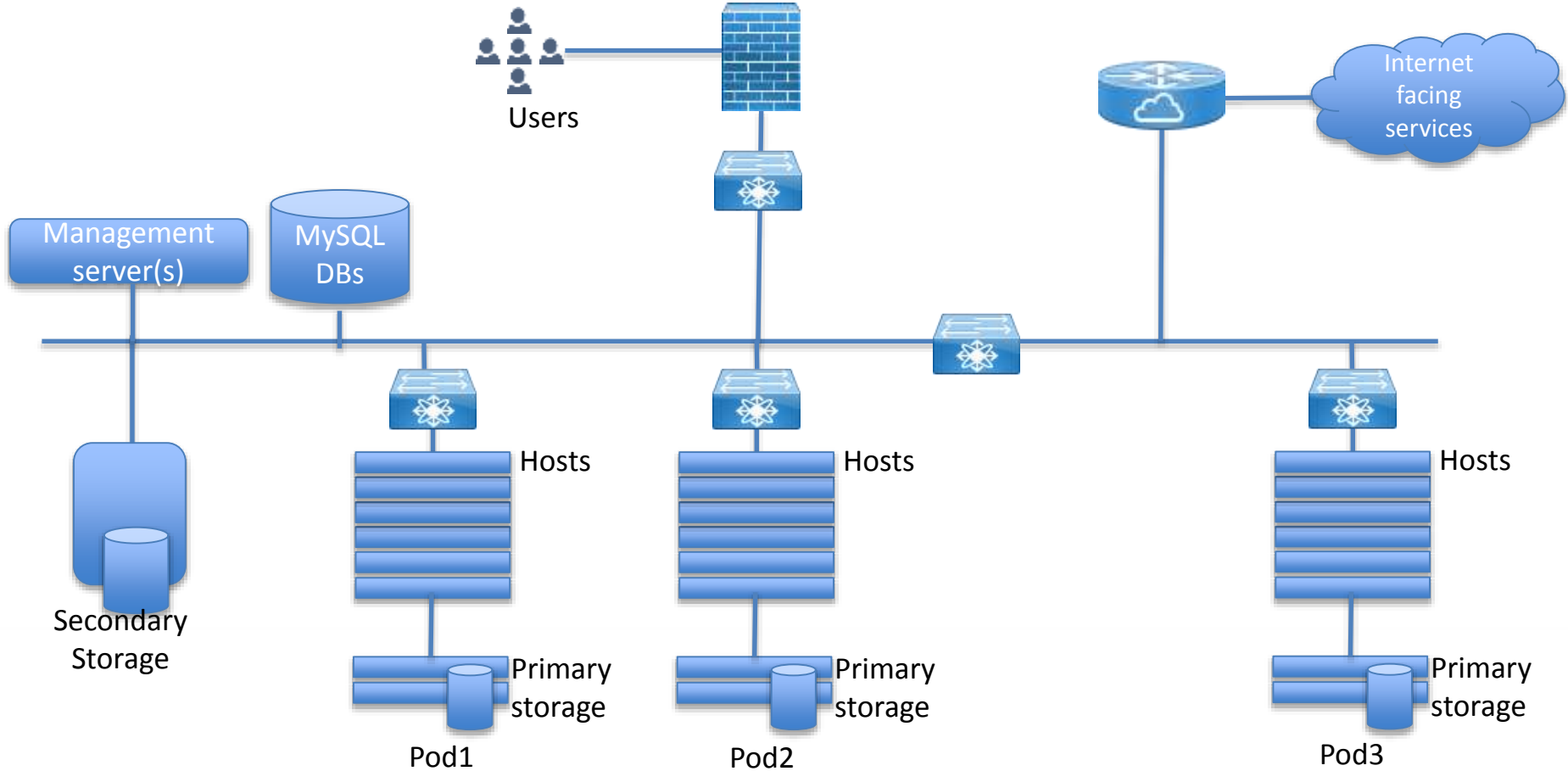


Recipe 2

- **Build a management farm**
Spilt MySQL, use master/slave
Redundant pair of management servers
- **Split Storage, guest, public and management networks**



Deployment model



- **Analyse your workloads**
- **Capacity planning:**
 - Storage
 - CPU/memory
- **Version of CloudStack (go LTS)**
- **Choose networking model**
- **Management farm**
 - Resilience – multiple management servers & DB servers
- **Hypervisor choice**
 - Good for your workloads
 - Compatible with your hardware?

Some picture about
restaurant quality

- **Network design: isolate management, guest, public & storage traffic**
- **Scale**
scale point – usually by pod
- **Plan templates**
- **Plan service offerings**
- **Plan disk offerings**
- **Tagging model ?**
- **Collecting & analysis of your usage data**



Where to go next

- **Documentation** <http://docs.cloudstack.apache.org/en/latest/>
- **Mailing lists**
<https://cloudstack.apache.org/mailling-lists.html>
Start with users list
- **Events & meetups**
CloudStack European User Group
<https://www.linkedin.com/groups/4294158>
CloudStack Collaboration Conferences
<http://cloudstackcollab.org>
Specifically in Germany
<https://www.meetup.com/german-CloudStack-user-group/>

<https://listi.jpberlin.de/mailman/listinfo/german-cloudstack-usergroup>



@CloudStack @GilesSirett



#CloudStackWorks



Giles.Sirett@ShapeBlue.com

Giles@apache.org



@GilesSirett @cloudstack



www.cloudstack.org



@CloudStack @GilesSirett



Dashboard

Instances

Affinity Groups

Storage

Network

Templates

Events

Projects

Accounts

Regions

Virtual machines

Running VMs

1

Stopped VMs

4

Total VMs

5

Latest events

[View all](#)

USER.LOGIN

user has logged in from IP Address 10.0.3.2

USER.LOGIN

user has logged in from IP Address 10.0.3.2

VM.DESTROY

Successfully completed destroying Vm. Vm Id: 50

VM.DESTROY

destroying vm: 50

Network

[View all](#)

Isolated networks:

4

Public IP Addresses:

4

+ Add Instance

1

Setup

2

Select a
template

3

Compute
offering

4

Data Disk
Offering

5

Affinity

6

Network

7

Review

Select a zone

A zone typically corresponds to a single datacenter. Multiple zones help make the cloud more reliable by providing physical isolation and redundancy.

Linuxcon

Select ISO or template



Template

OS image that can be used
to boot VMs



ISO

Disc image containing data
or bootable media for OS



Cancel

Next

+ Add Instance

- 1 Setup
- 2 Select a template
- 3 Compute offering
- 4 Data Disk Offering
- 5 Affinity
- 6 Network
- 7 Review

Please select a template for your new virtual instance.

Featured

Community

My templates

- Ubuntu 12.04 64-bit (VMware)**
Ubuntu 12.04 64-bit (VMware)
- RHEL 6.4 (64-bit) (XenServer)**
RHEL 6.4 (64-bit) (XenServer)
- CentOS 5.6 (64-bit) (XenServer)**
CentOS 5.6 (64-bit) (XenServer)
- Windows 2012 Enterprise (VMware)**
Windows 2012 Enterprise (VMware)



Previous

Cancel

Next

- Micro, Shared Storage**
1vCPU, 128MB RAM, Shared Storage
- Tiny, Local Storage**
1vCPU, 256MB RAM, Local Storage
- Medium, Local Storage, 50 IOPS**
2vCPU, 1 GB RAM, Local Storage, 50 IOPS
- Large, Shared Storage, 200 IOPS, HA**
2 vCPU, 8 GB RAM, Shared Storage, 200 IOPS, HA
- Ultra, Shared Storage, 1000 IOPS, HA**
4 vCPU, 32 GB RAM, Shared Storage, 1000 IOPS, HA



Previous

Cancel

Next

No thanks

Custom GB, Shared

Custom GB, Shared

10GB, Shared, 200 IOPS

10GB, Shared, 200 IOPS

5GB, Shared, 100 IOPS

5GB, Shared, 100 IOPS

100GB, Local, 50 IOPS

100GB, Local, 50 IOPS



Previous

Cancel

Next

Please select networks for your virtual machine. VPC: All

Networks			
<input type="checkbox"/>	BM-DB-Tier	Isolated	<input type="radio"/> Default
<input type="checkbox"/>	BM-App-Tier	Isolated	<input type="radio"/> Default
<input type="checkbox"/>	BM-Web-Tier	Isolated	<input type="radio"/> Default
<input checked="" type="checkbox"/>	batman	Isolated	<input checked="" type="radio"/> Default

Add Network

<input type="checkbox"/>	New
--------------------------	-----



Previous

Cancel

Next

+ Add Instance

- 1 Setup
- 2 Select a template
- 3 Compute offering
- 4 Data Disk Offering
- 5 Affinity
- 6 Network
- 7 Review

Please review the following information and confirm that your virtual instance is correct before launch.

Name (Optional)	<input type="text" value="Demo"/>	
Add to group (Optional)	<input type="text"/>	
Zone	Linuxcon	Edit
Hypervisor	XenServer	Edit
Template	CentOS 5.6 (64-bit) (XenServer)	Edit
Compute offering	Micro, Shared Storage	Edit
Data Disk Offering	(None)	Edit
Affinity Groups	(None)	Edit
Network	batman	Edit

Previous

Cancel

 Launch VM



Details

NICs

Statistics



Reset VM

View Volumes

View Snapshots

View Affinity Groups

Display name	Demo
Name	Demo
State	Running
Template	CentOS 5.6 (64-bit) (XenServer)
Dynamically Scalable	Yes
OS Type	CentOS 5.3 (64-bit)

+ Recurring Snapshots

You can setup recurring snapshot schedules by selecting from the available options below and applying your policy preference

Schedule: Hourly Daily Weekly Monthly

Time: 1 00 AM

Timezone: [UTC-12:00] GMT-12:00

Keep: 8 snapshot(s)

Add

Scheduled Snapshots

Done



Refresh

Details

Egress rules

Source CIDR	Protocol	Start Port	End Port	Add
<input type="text"/>	TCP	<input type="text"/>	<input type="text"/>	<input type="button" value="Add"/>
10.1.1.0/24	ICMP	-1	-1	<input type="button" value="X"/>
10.1.1.0/24	TCP	443	443	<input type="button" value="X"/>
10.1.1.0/24	TCP	80	80	<input type="button" value="X"/>
10.1.1.0/24	TCP	123	123	<input type="button" value="X"/>
10.1.1.0/24	TCP	53	53	<input type="button" value="X"/>

[Home](#) > [Network - Guest networks](#) > [batman](#) > [IP Addresses](#) > [10.10.0.103 \[Source NAT\]](#)

Refresh

[Details](#) | [Configuration](#) | **[VPN](#)**

Your VPN access is currently enabled and can be accessed via the IP 10.10.0.103

Your IPsec pre-shared key is YH4VE5pmqTCyWGJDesNFHb4C

Username	Password	Add User	Actions
<input type="text"/>	<input type="text"/>	<input type="button" value="Add"/>	
james			<input type="button" value="X"/>



Refresh

Firewall

Source CIDR	Protocol	Start Port	End Port	ICMP Type	ICMP Code	Add rule	Actions
<input type="text"/>	TCP	<input type="text"/>	<input type="text"/>			<input type="button" value="Add"/>	
0.0.0.0/0	TCP	2221	2223				
0.0.0.0/0	UDP	4500	4500				
0.0.0.0/0	UDP	1701	1701				
0.0.0.0/0	UDP	500	500				
0.0.0.0/0	TCP	80	80				





Network - Guest networks

batman

IP Addresses

10.10.0.103 [Source NAT]

Port Forwarding

Refresh

Port Forwarding

Private Port	Public Port	Protocol	Add VM	Actions
<input type="text"/>	<input type="text"/>	TCP	<input type="button" value="Add"/>	
22 - 22	2223 - 2223	TCP	VM: VM-003 IP: 10.1.1.117	
22 - 22	2222 - 2222	TCP	VM: VM-002 IP: 10.1.1.213	
22 - 22	2221 - 2221	TCP	VM: VM-001 IP: 10.1.1.220	



Network - Guest networks

batman

IP Addresses

10.10.0.103 [Source NAT]

Load Balancing

Refresh

Load Balancing

Name	Public Port	Private Port	Algorithm	Stickiness	Health Check	AutoScale	Add VMs
<input type="text"/>	<input type="text"/>	<input type="text"/>	Round-robin ▼	<input type="button" value="Configure"/>	<input type="button" value="Configure"/>	<input type="button" value="Configure"/>	<input type="button" value="Add"/>
<input type="button" value="+"/> http	80	80	Round-robin	<input type="button" value="Configure"/>	<input type="button" value="Configure"/>	<input type="button" value="Configure"/>	<input type="button" value="Add"/>
VM-003				State - Stopped		<input type="button" value="X"/>	
VM-002				State - Stopped		<input type="button" value="X"/>	

Archive events

Delete events

Description	Level	Type	Domain	Account	Date	Quickview
Successfully completed starting Vm. Vm Id: 52	INFO	VM.CREATE	Wayne	batman	Tue, 22 Oct 2013 16:00:13 GMT	+
Successfully created entity for deploying Vm. Vm Id: 52	INFO	VM.CREATE	Wayne	batman	Tue, 22 Oct 2013 16:00:05 GMT	+
starting Vm. Vm Id: 52	INFO	VM.CREATE	Wayne	batman	Tue, 22 Oct 2013 16:00:05 GMT	+
starting Vm. Vm Id: 52	INFO	VM.CREATE	Wayne	batman	Tue, 22 Oct 2013 16:00:05 GMT	+
user has logged in from IP Address 10.0.3.2	INFO	USER.LOGIN	Wayne	batman	Tue, 22 Oct 2013 15:54:07 GMT	+
user has logged in from IP Address 10.0.3.2	INFO	USER.LOGIN	Wayne	batman	Tue, 22 Oct 2013 15:04:47 GMT	+
Successfully completed destroying Vm. Vm Id: 50	INFO	VM.DESTROY	Wayne	batman	Tue, 22 Oct 2013 13:45:00 GMT	+
destroying vm: 50	INFO	VM.DESTROY	Wayne	batman	Tue, 22 Oct 2013 13:44:35 GMT	+
destroying Vm. Vm Id: 50	INFO	VM.DESTROY	Wayne	batman	Tue, 22 Oct 2013 13:44:35 GMT	+
Successfully completed starting Vm. Vm Id: 50	INFO	VM.CREATE	Wayne	batman	Tue, 22 Oct 2013 13:36:31 GMT	+

+ Add GSLB

* Name:

Description:

* GSLB Domain Name:

Algorithm:

* Service Type: