



2012云计算架构师峰会

Cloud Computing Architects Summit China 2012

揭示企业级IT架构转型 分享最新技术的应用落地





DevOps in OpenStack Public Cloud

Presented at OpenStack Summit, Fall 2012, San Diego

Hui Cheng

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Community Manager of COSUG

Technical Manager in Sina Corporation

2012/10/17

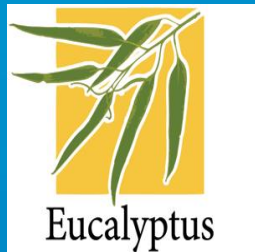


新浪云计算
sinacloud.com

Why OpenStack?

Why OpenStack?

vmware®



Open Source



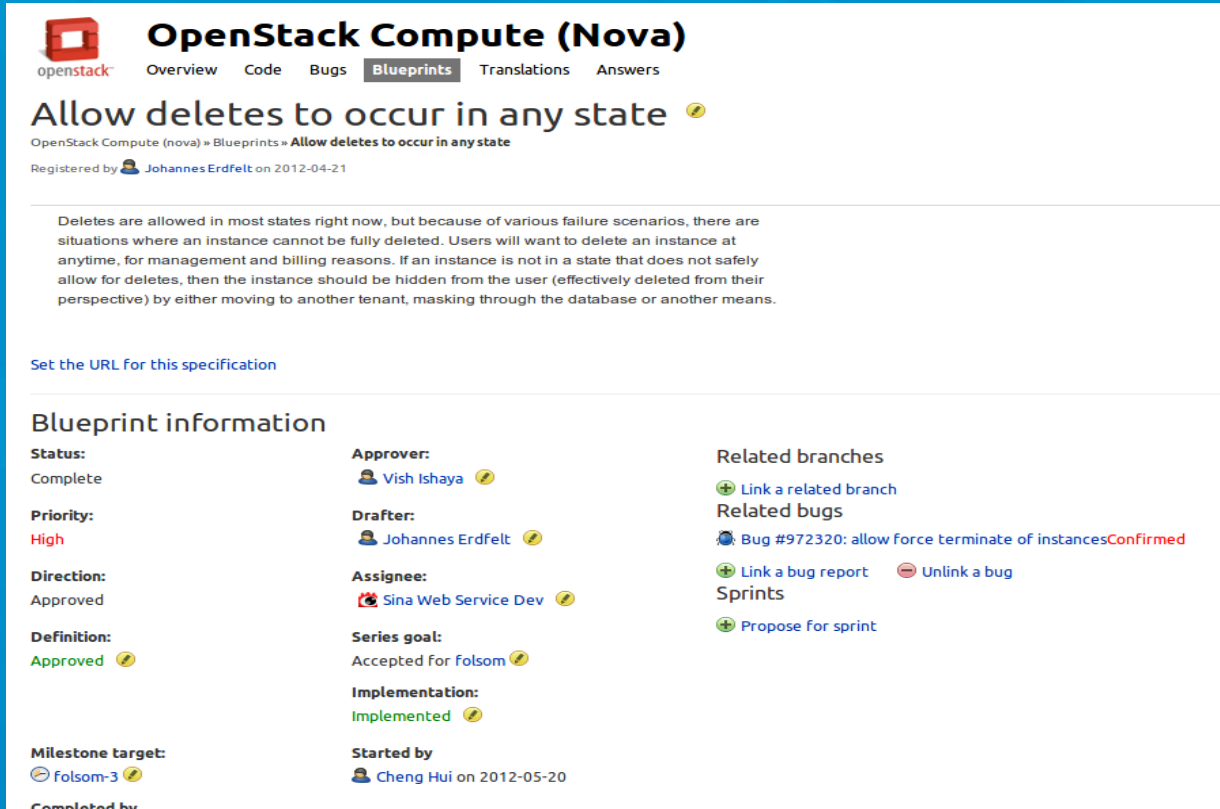
Apache 2 License

Open Design



Grizzly Design Summit

Open Development



OpenStack Compute (Nova)
Overview Code Bugs **Blueprints** Translations Answers

Allow deletes to occur in any state

OpenStack Compute (nova) » Blueprints » **Allow deletes to occur in any state**

Registered by Johannes Erdfelt on 2012-04-21

Deletes are allowed in most states right now, but because of various failure scenarios, there are situations where an instance cannot be fully deleted. Users will want to delete an instance at anytime, for management and billing reasons. If an instance is not in a state that does not safely allow for deletes, then the instance should be hidden from the user (effectively deleted from their perspective) by either moving to another tenant, masking through the database or another means.

[Set the URL for this specification](#)

Blueprint information

Status: Complete	Approver: Vish Ishaya	Related branches Link a related branch
Priority: High	Drafter: Johannes Erdfelt	Related bugs Bug #972320: allow force terminate of instances Confirmed
Direction: Approved	Assignee: Sina Web Service Dev	Link a bug report Unlink a bug
Definition: Approved	Series goal: Accepted for Folsom	Sprints Propose for sprint
Milestone target: Folsom-3	Implementation: Implemented	
Completed by:	Started by Cheng Hui on 2012-05-20	

Propose features in launchpad

Open Development

 **openstack** Code Review
CLOUD SOFTWARE

[All Changes](#) [My Changes](#) [Admin](#) [Documentation](#)
[Important Changes](#) [Drafts](#) [Watched Changes](#) [Starred Changes](#)

☆ **Change I1038c314: Deletes vm in any state**

Change-Id:	I1038c3149395a26f35235a91c841fda041e697cc
Owner	wenjianhn
Project	openstack/nova
Branch	master
Topic	bp/delete-in-any-state
Uploaded	Aug 8, 2012 4:48 PM
Updated	Aug 8, 2012 6:05 PM
Status	Review in Progress

[Permalink](#)

Deletes vm in any state

As commit 129b87e17d3333a9e855a70dea51e6581ea63 says now we allow delete to be called no matter what vm_state says.

Add a flag to show that whether tenant wants to delete the insatnce. If the flag is set we should never bill. Add a peridic task to make sure the instance which the above flag is set is going to be deleted.

Implements blueprint delete-in-any-state.

Change-Id: I1038c3149395a26f35235a91c841fda041e697cc

Reviewer	Verified	Code-Review	Approved
wenjianhn			
Jenkins	+1		
Vish Ishaya			
Yun Mao			

- Need Verified
- Need Code-Review
- Need Approved

Dependencies

Old Version History: Base

Patch Set 2 19c98c0c1ce9f25356f604162647c503baa46155 (gitweb)

Author	Jian Wen <wenjianhn@gmail.com> Aug 8, 2012 2:19 PM
Committer	Jian Wen <wenjianhn@gmail.com> Aug 8, 2012 5:43 PM
Parent(s)	a418654b070c63c4bed5e3e5523fb947934626f9 Merge "Cleanup consoles test cases"
Download	checkout pull cherry-pick patch Anonymous HTTP SSH HTTP

git fetch https://review.openstack.org/openstack/nova refs/changes/14/11014/2 && git checkout FETCH_HEAD

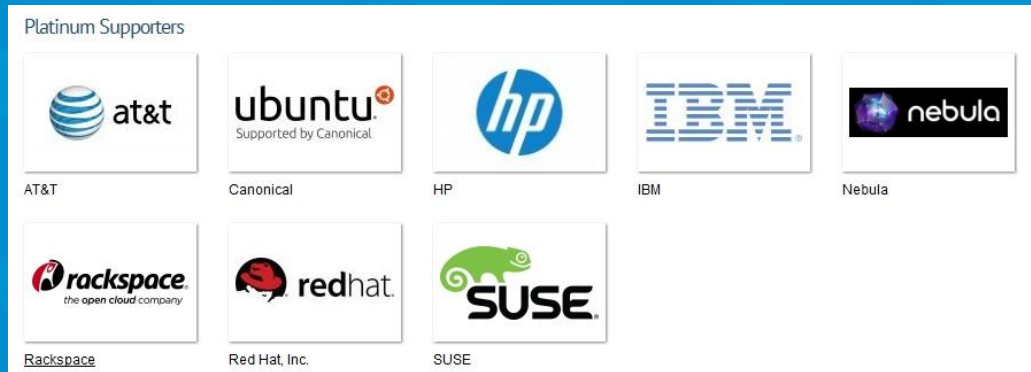
Code Review

OpenStack is the #2 FOSS foundation

1. The Linux Foundation = \$9.6M
2. Openstack = \$6M
3. Mozilla Foundation = \$1.9M
4. The Apache Foundation - \$0.53M

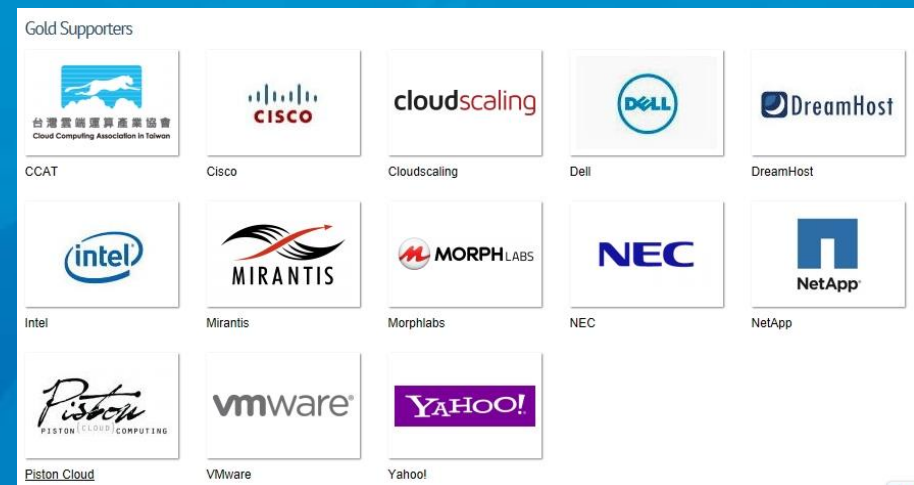
Open Foundation Board

Platinum Members(8)



Gold Members(8)

DreamHost, Cloudscaling, ITRI/CCAT, DELL, Piston, Mirantis, Yahoo!, Cisco



Open Foundation Board

Individual Members(8)

Rank	Candidate	Weighted Votes	%	Voters	Weight per vote	%	Company	Title
1	Rob Hirschfeld	2218	14.52	514	4.315	26.56	Dell	Principal Architect / OpenStack Lead
2	Monty Taylor	1981.25	12.97	375	5.283	19.38	HP	OpenStack Automation Engineering Manager
3	Hui Cheng	1766.12	11.56	350	5.046	18.09	Sina	Technical Manager
4	Joseph George	1373.38	8.99	390	3.521	20.16	Dell	Director of Product Strategy
5	Yujie Du	760.25	4.98	201	3.782	10.39	99Cloud	Community Development Director
6	Troy Toman	677.12	4.43	209	3.240	10.8	Rackspace	Senior Director of Cloud Compute Engineering
7	Anne Gentle	561.12	3.67	268	2.094	13.85	Rackspace	Community Documentation Coordinator
8	Thierry Carrez	435.38	2.85	239	1.822	12.35	Rackspace	Release Manager for OpenStack
9	Tim Bell	434.5	2.84	243	1.788	12.56	CERN	Infrastructure manager
10	Tristan Goode	424	2.78	123	3.447	6.36	Aptira	CEO
11	Jesse Andrews	418.12	2.74	208	2.010	10.75	Nebula	Director of Technology

“No one company may control more than two board seats”

OpenStack Public Cloud



Cloud Services



the
rackspace
cloud

eNocloud



Sina Web Services



at&t



However They never tell you how to operate
their public cloud based on OpenStack!

Content

- **SinaCloud Introduction**
- **Challenges to build a OpenStack Public Cloud**
 1. Network topology
 2. Security Enhancement
 3. Storage Solution
 4. Identity Integration
 5. Billing & Monitoring
 6. Dashboard Improvement
- **Operate an production OpenStack**
 7. Platform stack
 8. Automated Deployment
 9. Continuous Integration
 10. Project Management
- **StackLab: A community OpenStack Public Cloud**
- **Summary**

Cloud Requirement



Sina.com

- Largest infotainment web portal in China
- Provides various on-line services, like news, Finance, video, email, blog hosting, etc.
- Needs unified infrastructure & app platform to host heterogeneous services and apps.

Sina Weibo

- twitter-like microblog service
- over **350m** users, #1 SNS in China.
- huge influence on China's society
- Weibo Open Platform to build a social ecosystem through Open API and cloud environmental.



We are building a **reliable**, **scalable** and **secure** cloud platform to support our business and external customers.

SinaCloud Portfolio



新浪云计算
sinacloud.com



Sina App Engine



新浪云商店
(Sina Cloud Market)



Sina Web Services

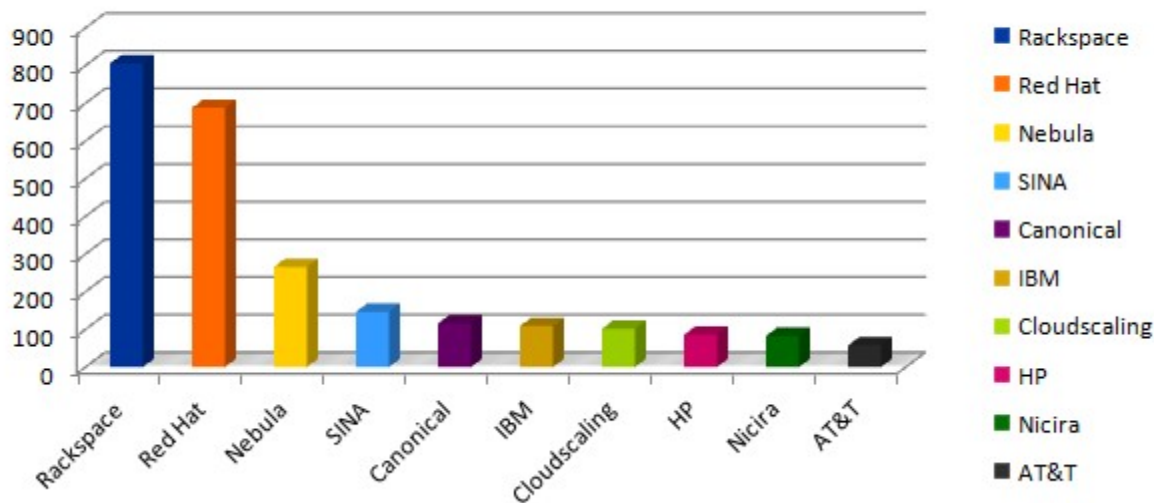
- First and most popular PaaS cloud in China, launched in 2009
- Support PHP, Python and Java runtime.
- 250,000 developers, 380,000 apps running on SAE.
- First commercial cloud app market in China.
- SaaS cloud based on SAE tech.
- Design for the common users, 1-Click purchase and install apps.
- ◆ First OpenStack based public IaaS cloud in China

Sina OpenStack dev Team

■ For Community

- Top 9 contributor by bugfix at Essex
- Top 4 contributor either by changeset or bugfix at Folsom
- Contribute community project Dough, Kanyun addressing Monitoring and Billing
- Develop Island as Cinder would-be plugin
- Lead COSUG to be largest OpenStack user group

Top Changeset Contributors by Employer



Content

- SinaCloud Introduction
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Network Topology

Nova-network vs Quantum

	Multi host	Multi Talent	Flat, FlatDHCP	Tunneling	SDN	Sec Group	Dashboard Support
Nova-Network	✓	✓	✓	✗	✗	✓	✗
Quantum	✗	✓	✓	✓	✓	✗	✓

- Nova-Network is simple, robust and reliable, except lack of some advanced features.
- Quantum is not ready for production use, it's OVS plugin has great potential to be open-source NVP solution.
- I would suggestion to continue use nova-network for production deployment until next release.

Nova-Network

- **Flat**

- Need external DHCP Server, and human intervention, not flexible, hardly use in practical deployment.

- **FlatDHCP**

- Like Amazon EC2 networking(not VPC, VPC corresponds to Quantum), VM get IP from single network pools.
- Simple, easy to hack.
- Widely used in public cloud, also preferred topology in many scenarios.

- **VLAN**

- A little complex, hardware configuration may be involved.
- Not suggest to use except strong requirement of tenant isolation,

Network Topology — Real User Case

Nova Network(FlatDHCP+Multi-host)

Capability:

- Accessibility of all VMs in the fixed IP range
- VM is able to access public network
- VM can be accessible from public network

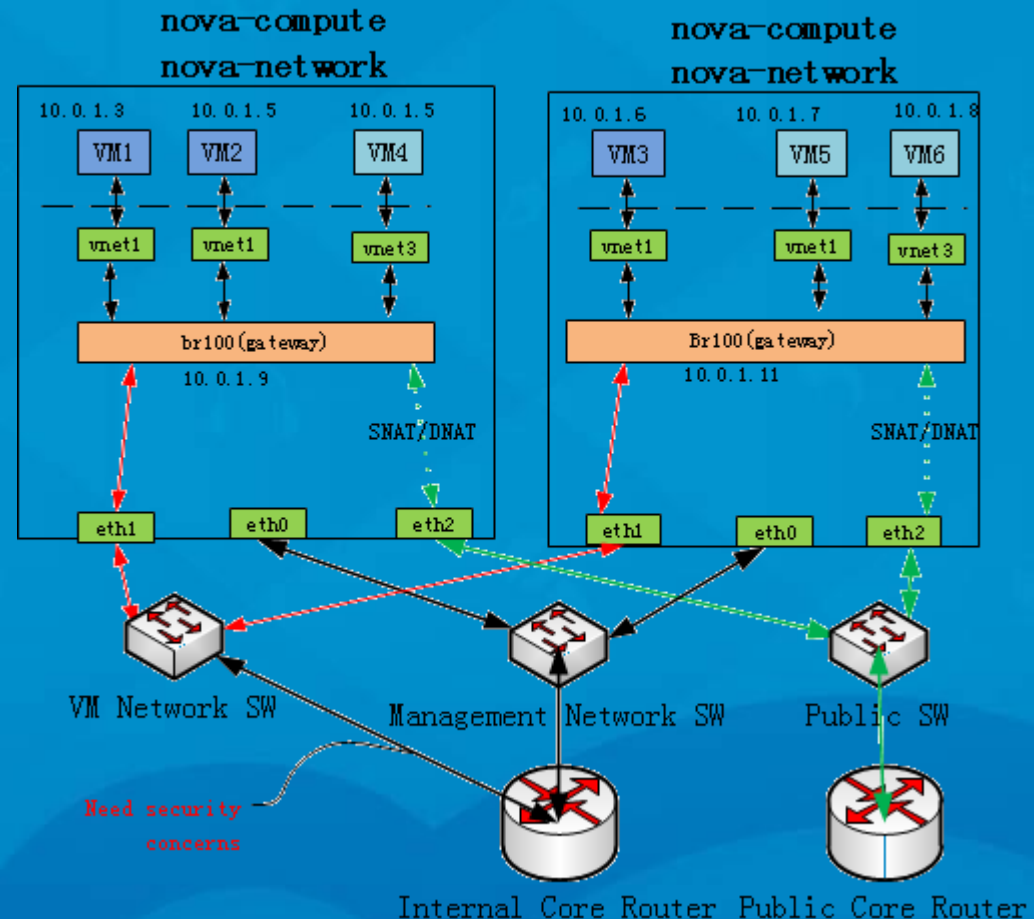
Bonus:

- Totally distributed architecture avoid single-point failure.
- Multiple gateway eliminates NAT bottleneck
- **High speed between OS regions**

Drawback:

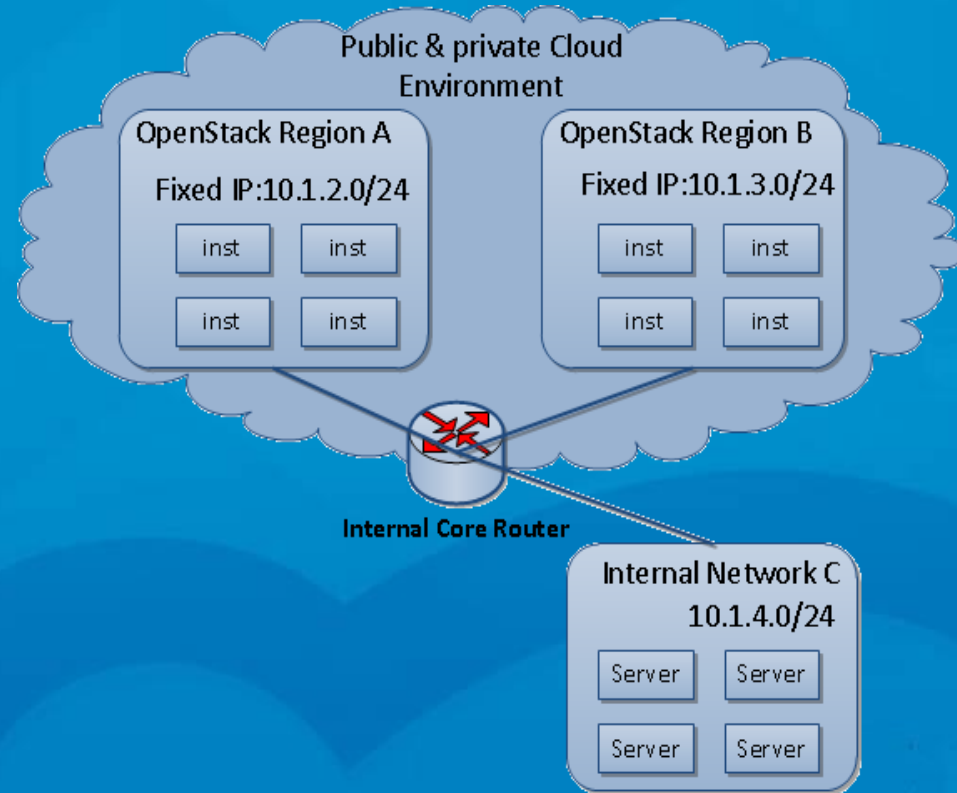
- Tenant isolation lessens
- Need security facility(*SWS-filter*) to protect intranet

Nova Network Topology(Flat & multihost)



Security Enhancement

- SWS Filter: an extension to security group in nova-network
 - Used to filter egress traffic from VM to internal network
 - Define whose traffic could be able to reach which internal network IP/segment.

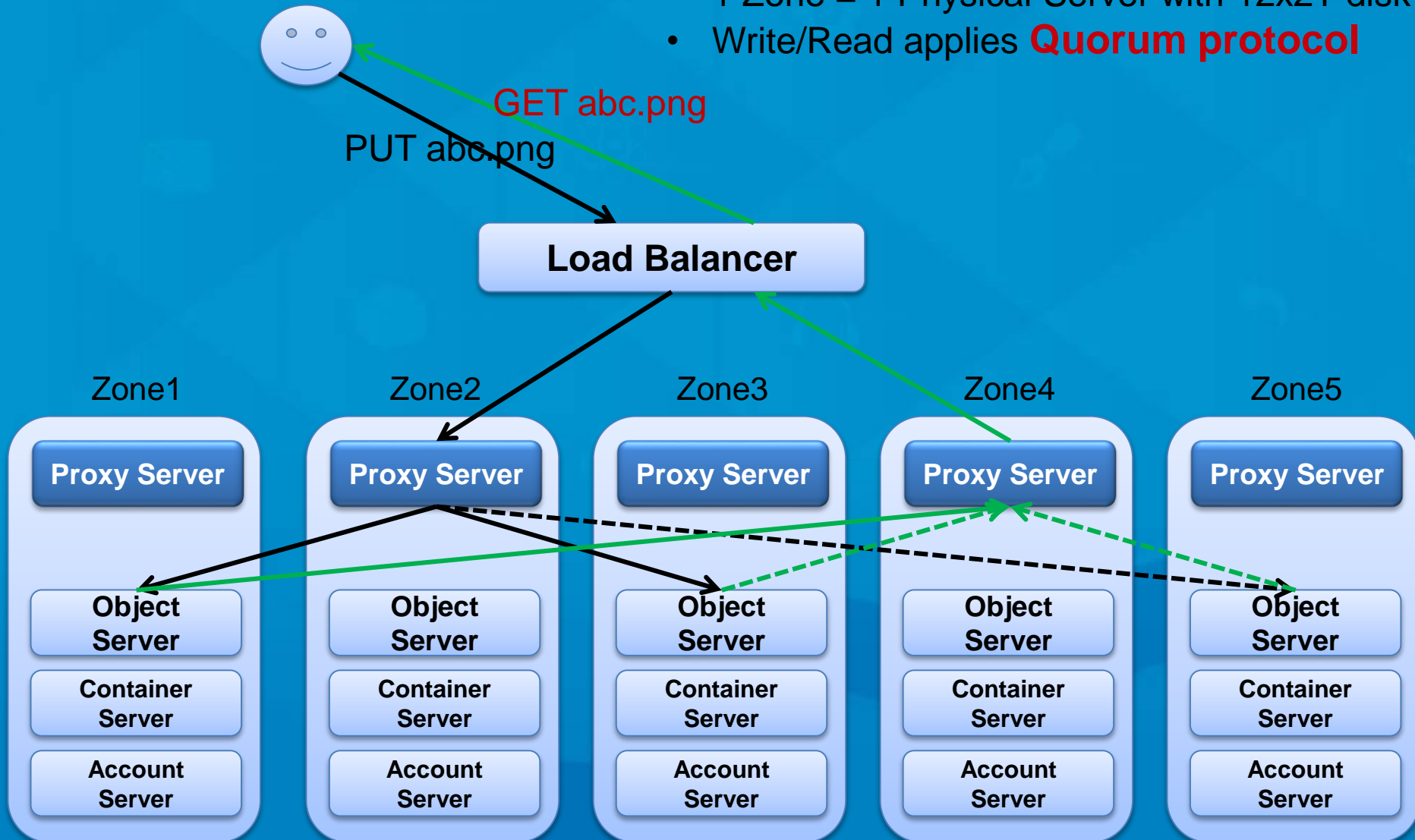


Storage Solution

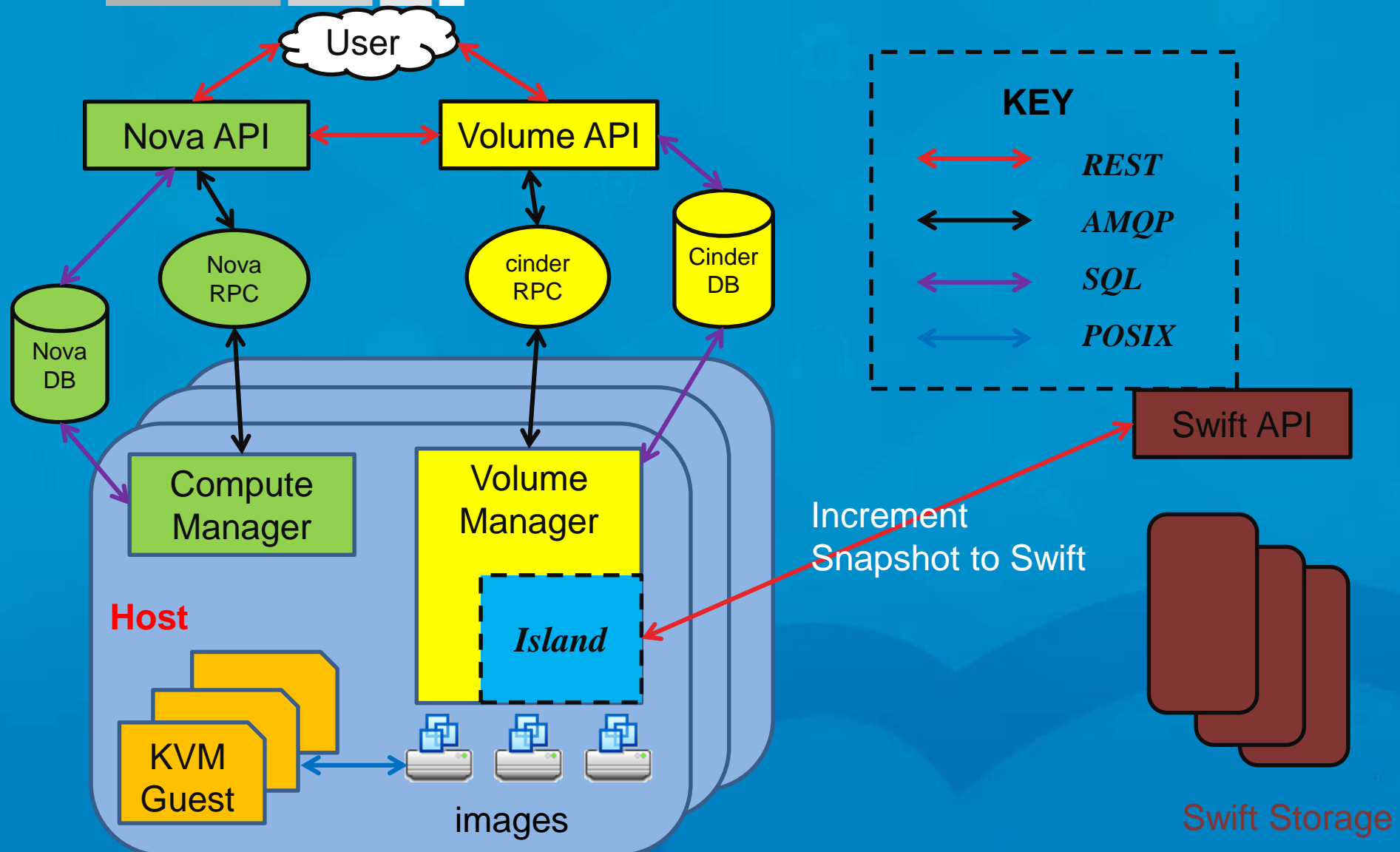
- Object Storage: Definitely we choose **Swift**
- Block Storage
 - Cinder is not Amazon EBS, just a framework to include multiple open-source/commercial storage solution.
 - Nova-volume/Cinder(iSCSI) is not applicable to public cloud.
 - Sheepdog/Gluster/Ceph plugins need time to be stable.
- **Island:** Local Storage Volume plugin for Cinder is coming.
 - High performance local storage
 - Incremental & independent snapshot
 - Snapshot store in swift

Swift Architecture

- 1 Zone = 1 Physical Server with 12x2T disk
- Write/Read applies **Quorum protocol**

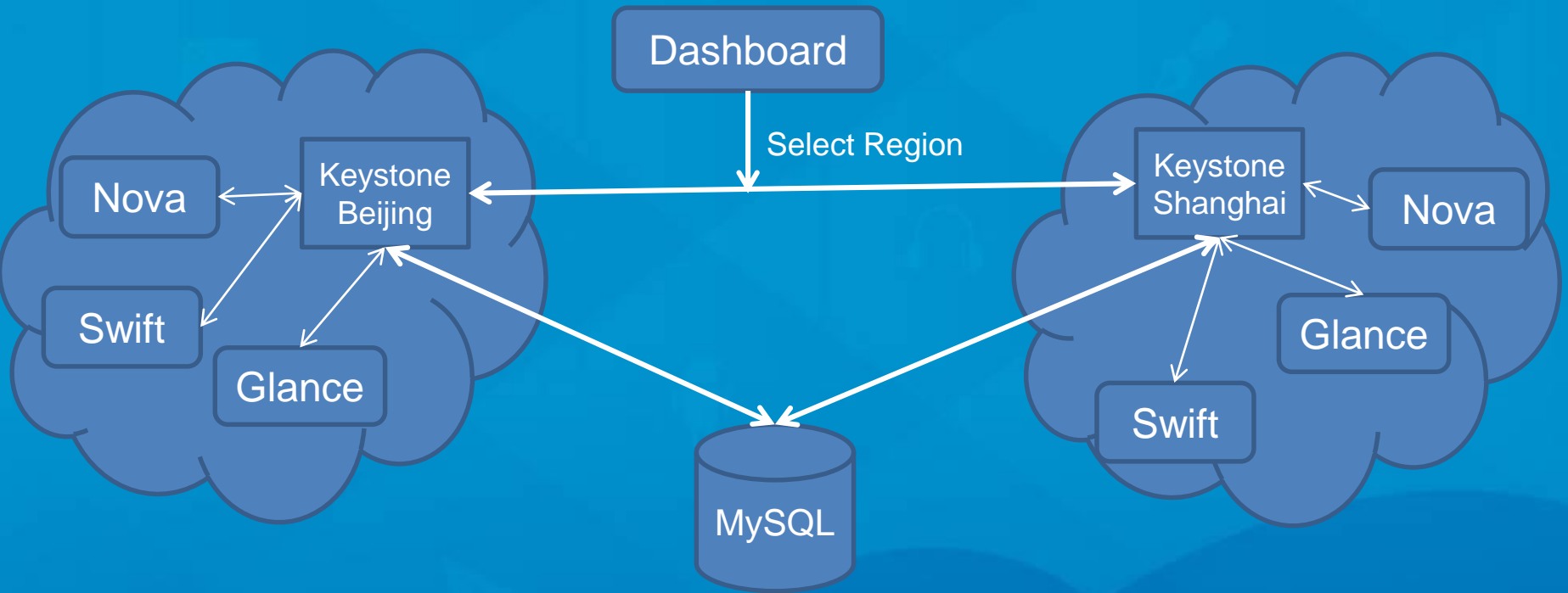


Cinder Island Plugin Architecture

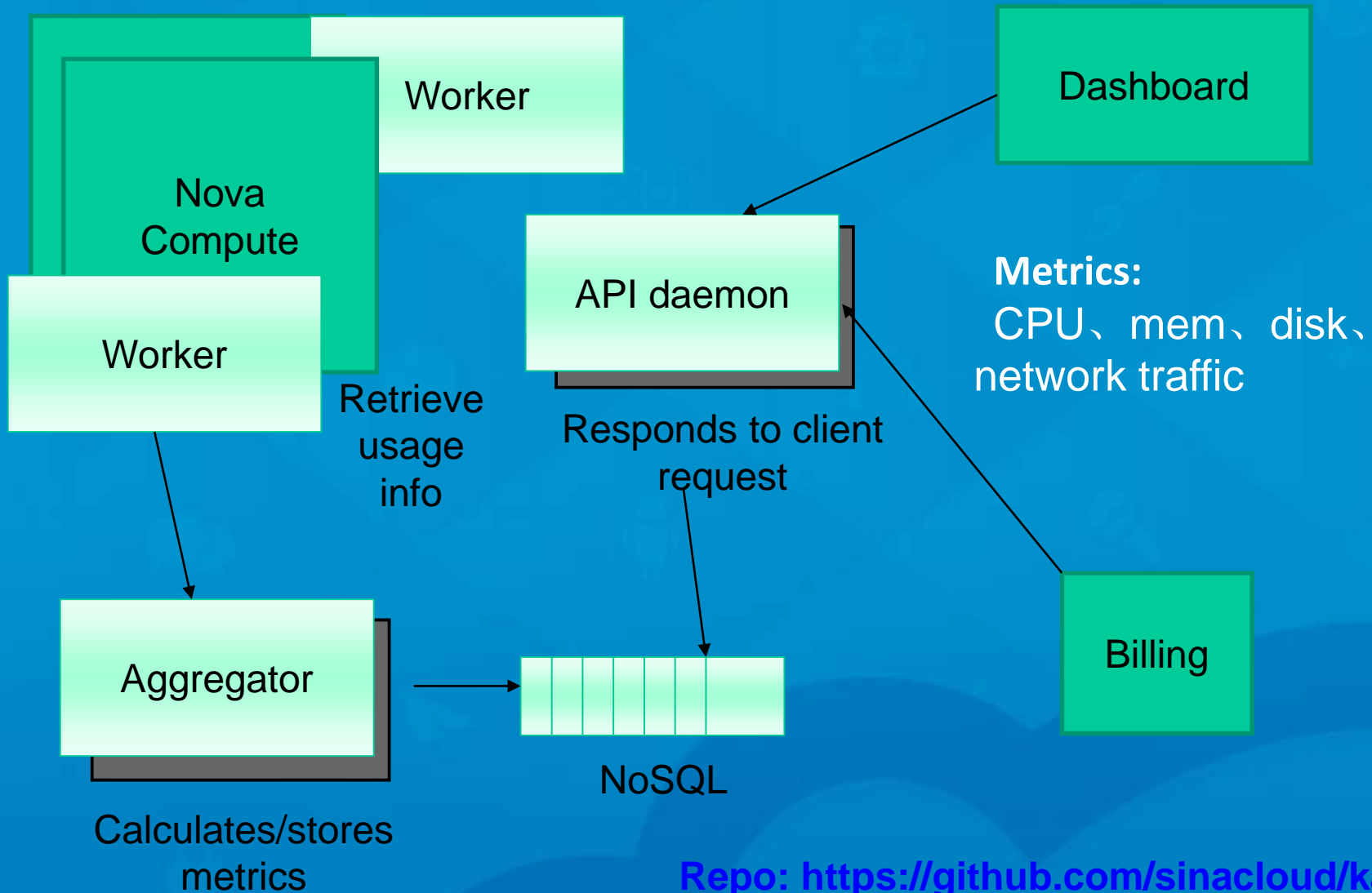


Identify Integration: Keystone

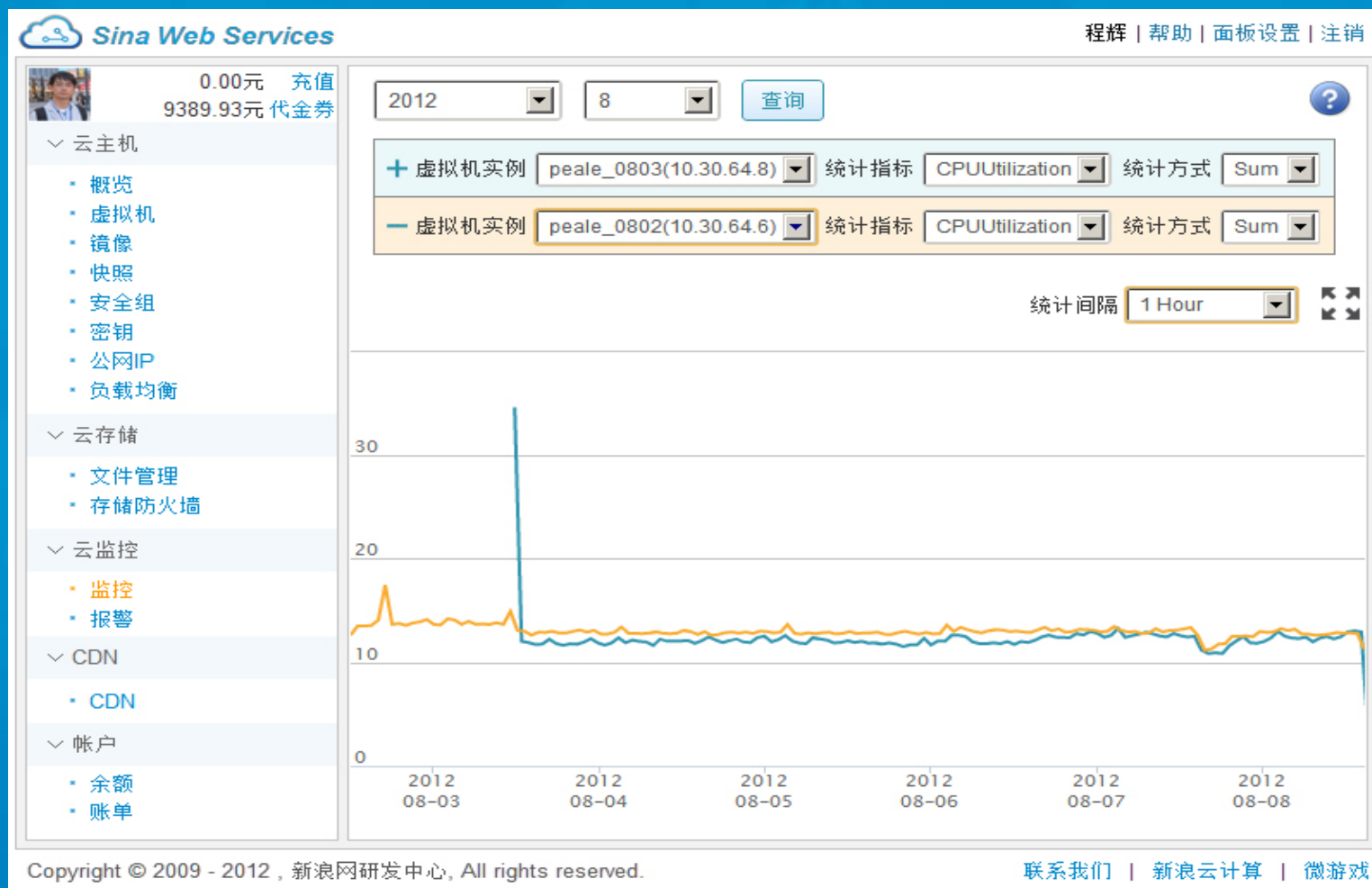
- AWS-like Multi-region support



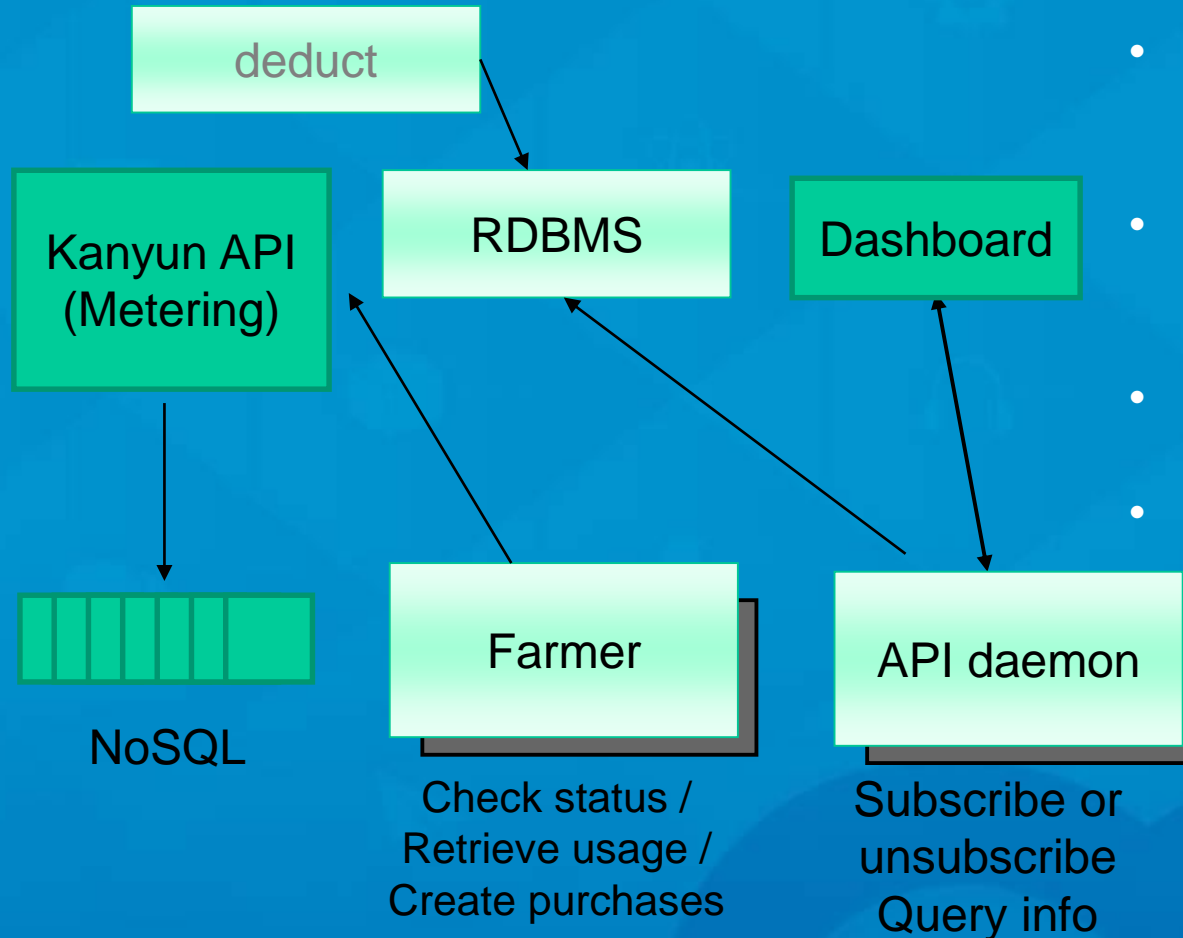
Kanyun: Monitoring system



Kanyun demo




Dough: Billing system



- Keep track of billing info to charge tenants
- Flexible customization of payment policies
- How much/often to charge for resource unit
- Handles prepaid or pay-as-you-go
- Coupon Support

Repo: <https://github.com/sinacloud/dough>, you should also consider *Celiometer* project.

Dough: Billing info page

 Sina Web Services

程辉 | 帮助 | 面板设置 | 注销



0.00元 充值
9389.93元 代金券

▼ 云主机

- 概览
- 虚拟机
- 镜像
- 快照
- 安全组
- 密钥
- 公网IP
- 负载均衡

▼ 云存储

- 文件管理
- 存储防火墙

▼ 云监控

- 监控
- 报警

▼ CDN

- CDN

▼ 帐户

- 余额
- 账单

月度账单 2012

<input type="checkbox"/>	月份	总计	虚拟机费用	带宽费用	公网IP费用	负载均衡费用
<input type="checkbox"/>	八月	95.71元	95.71元	0.00元	0.00元	0.00元
<input checked="" type="checkbox"/>	七月	6920.65元	6832.46元	0.19元	64.00元	24.00元
<input type="checkbox"/>	六月	5691.23元	5459.10元	41.13元	172.00元	19.00元
<input type="checkbox"/>	五月	3578.30元	3564.30元	0.00元	14.00元	0.00元

☐ 所有 ☐ 虚拟机 ☐ 带宽 ☐ 公网IP ☐ 负载均衡


类型	服务名	价格	开始时间	结束时间	数量	总计
load_balancer	pealetest	1.00 元/天	2012/06/11 09:57	2012/07/14 09:57	14 天	14.00 元
load_balancer	lbhttp2	1.00 元/天	2012/07/04 11:48	2012/07/14 11:48	10 天	10.00 元
instance	ps	0.42 元/小时	2012/05/29 15:27	2012/05/30 14:53	456 小时	191.52 元
instance	ux	3.33 元/小时	2012/05/29 18:39	2012/05/30 10:36	456 小时	1518.48 元
instance	ulcopy	1.67 元/小时	2012/05/29 18:42	2012/05/30 14:58	456 小时	761.52 元
instance	utcopy	0.17 元/小时	2012/05/29 18:49	2012/05/30 14:58	456 小时	77.52 元
instance	ps	400.00 元/月	2012/05/30 15:38	2012/05/30 17:14	1 月	400.00 元

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Dashboard Improvement

- **We did not use Horizon, because:**
 - Horizon's UI is not easy to customize
 - Front end and back end is tightly coupled
 - we need much customization, it's hard to keep pace with Horizon.
- **What we do?**
 - Decouple the frontend design and backend implementation.
 - Make dashboard a lightweight frontend.
 - Separate user console and admin console.

Horizon Dashboard


openstack
DASHBOARD

Project

PROJECT
freedomhui

Manage Compute

Overview

Instances & Volumes

Images & Snapshots

Access & Security

Instances & Volumes

Logged in as: freedomhui

Settings

Sign Out

Success: Instance "test" launched.

Instances

Launch Instance

Terminate Instances

<input type="checkbox"/>	Instance Name	IP Address	Size	Public Domain	Status	Task	Power State	Actions
<input type="checkbox"/>	test	10.0.0.25	512MB RAM 1 VCPU 0 Disk	93buegrf30.lb4.stacklab.org:11018	Active	None	Running	Edit Instance

Displaying 1 item


Volumes

Create Volume

<input type="checkbox"/>	Name	Description	Size	Status	Attachments	Actions
No items to display.						

Displaying 0 items

SWS v1



swscloud

Manage Compute

Overview

Instances

Images

Snapshots

Keypairs

Volumes

Floating IPs

Security Groups

Overview

CPU

Disk


RAM

ID	Instance Name	User	VCPUs	Ram Size	Disk Size	Flavor	Uptime	Status
5	Server 5	283303c0-f025-46ab-83ed-6e61e59092f2	1	2GB	50GB	m1.small	10 months, 1 week	Active
7	Server 7	283303c0-f025-46ab-83ed-6e61e59092f2	1	512MB	0GB	m1.tiny	10 months, 1 week	Active
8	Server 8	283303c0-f025-46ab-83ed-6e61e59092f2	1	512MB	0GB	m1.tiny	10 months, 1 week	Active
10	Server 10	283303c0-f025-46ab-83ed-6e61e59092f2	1	512MB	0GB	m1.tiny	10 months, 1 week	Active
11	Server 11	283303c0-f025-46ab-83ed-6e61e59092f2	1	512MB	0GB	m1.tiny	10 months, 1 week	Active
12	Server 12	283303c0-f025-46ab-83ed-6e61e59092f2	1	512MB	0GB	m1.tiny	10 months, 1 week	Active
13	Server 13	283303c0-f025-46ab-83ed-6e61e59092f2	1	512MB	0GB	m1.tiny	10 months, 1 week	Active
15	Server 15	283303c0-f025-46ab-83ed-6e61e59092f2	1	512MB	0GB	m1.tiny	10 months	Active
48	Server 48	283303c0-f025-46ab-83ed-6e61e59092f2	1	512MB	0GB	m1.tiny	10 months	Active
89	Server 89	283303c0-f025-46ab-83ed-6e61e59092f2	1	512MB	0GB	m1.tiny	9 months, 4 weeks	Active


Hello: swscloud

[Settings](#)[Sign Out](#)

SWS v2

 Sina Web Services

程辉 | [Help](#) | [Settings](#) | [Sign Out](#)



4.58RMB Deposit
1732.78RMB Coupon

Manage Compute

- Overview
- Instances
- Images
- Snapshots
- Security Groups
- Keypairs
- Floating IPs
- Load Balancers

Billing

- Balance
- Billing

Launch Instance

Terminate Instances

Connect

Edit Instance

	Instance Name	Fixed IP	Floating IP	Flavor	Public Domain	Status	Task	Power State
<input checked="" type="checkbox"/>	openstackblog	10.42.1.128		m1.small	aha6wufp0t.elb4.sinasws.com:11165	Active	None	Running
<input type="checkbox"/>	gitorious	10.42.1.97		m1.small	rgluu6plmj.elb4.sinasws.com:11186	Shutoff	None	Running
<input type="checkbox"/>	puppet	10.42.1.132		ssd.tiny	s0sgp7kmhx.elb4.sinasws.com:11086	Active	None	Running
<input type="checkbox"/>	gerrit	10.42.1.126		ssd.small	9sut1zc8hm.elb4.sinasws.com:11077	Active	None	Running
<input type="checkbox"/>	jenkins	10.42.1.122		ssd.tiny	7ubdkky84f.elb4.sinasws.com:11052	Active	None	Running
<input type="checkbox"/>	deprecated-dell-backup	10.42.1.160		m1.large	ayeybe5on4.elb4.sinasws.com:11076	Active	None	Running
<input type="checkbox"/>	devstack	10.42.1.154		m1.large	p5hc0arau6.elb4.sinasws.com:11075	Active	None	Running
<input type="checkbox"/>	sws-launchpad	10.42.1.59		m1.small	xay206w0my.elb4.sinasws.com:11078	Active	None	Running

Instance Name:

openstackblog

Instance ID:

7cf5e66c-82d5-4dc4-8d25-7159e7308056

Public Domain:

[aha6wufp0t.elb4.sinasws.com:11165](#)

Status:

ACTIVE

Flavor:

m1.small (1VCPU, 10GB+40GBDisk, 2GBMemory)

Key name:

Security Group(s):

[default](#)

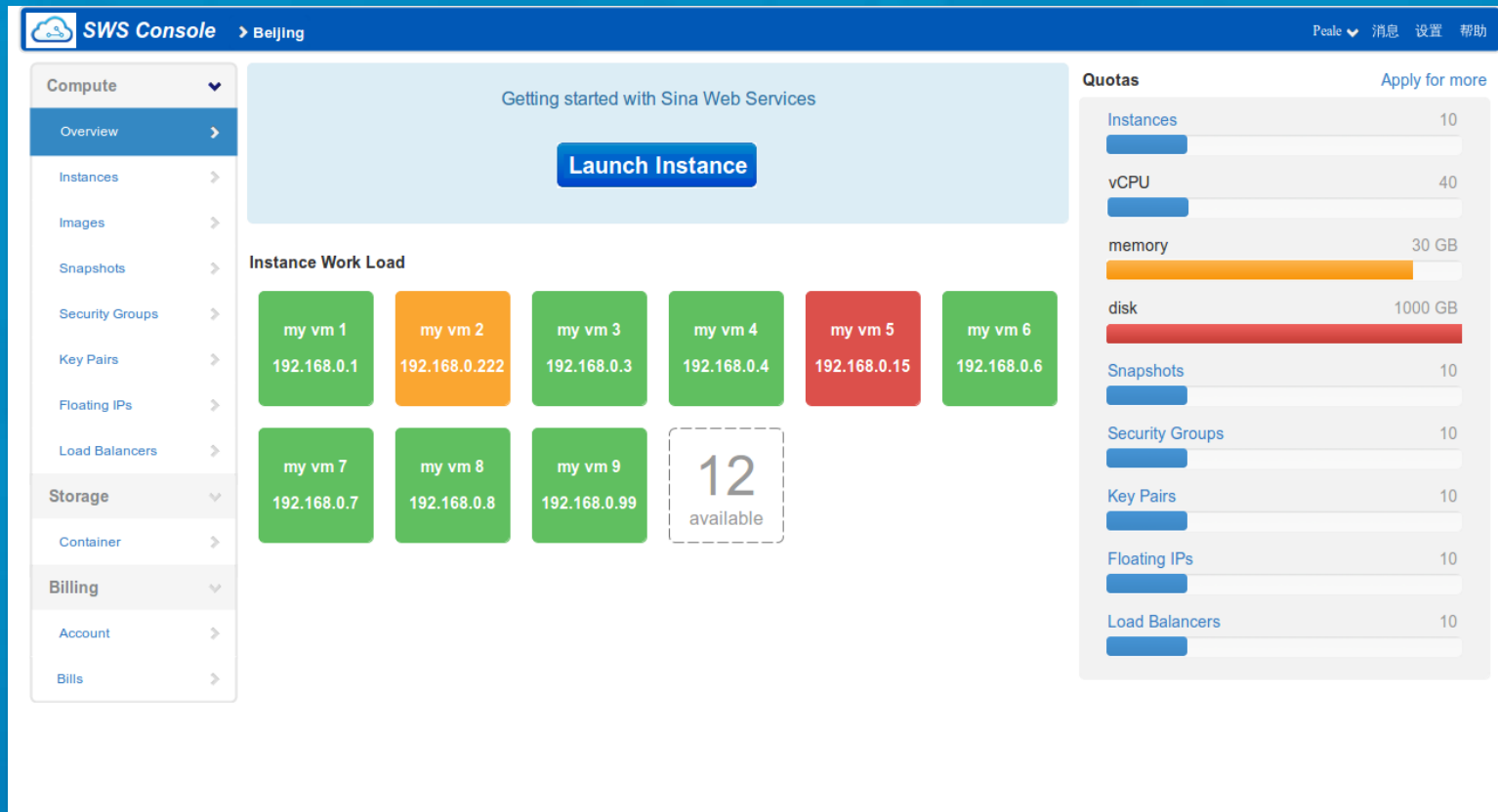
Fixed IP:

[10.42.1.128](#)

Floating IP:

-

SWS v3 – User Dashboard



SWS v3 - Monitoring

The screenshot displays the SWS Console interface for monitoring an instance. The top navigation bar includes the SWS Console logo, the path Beijing > Compute > Instances, and user information (Peale) with links for messages, settings, and help. The left sidebar lists various services: Compute (Overview, Instances, Images, Snapshots, Security Groups, Key Pairs, Floating IPs, Load Balancers), Monitoring (Instance Monitoring), Storage (Container), and Billing (Account, Bills). The main content area shows the 'Instances' page with a table of instance rows. The 'Monitoring' tab is active, displaying three line graphs for CPU Utilization, Disk Read, and Disk Write. The 'Disk Read' graph is highlighted with an orange border and shows a peak in activity. The 'Create Alarm' button is visible in the top right of the monitoring section.

Compute ▾

- Overview >
- Instances >**
- Images >
- Snapshots >
- Security Groups >
- Key Pairs >
- Floating IPs >
- Load Balancers >

Monitoring ▾

- Instance Monitoring >**

Storage ▾

- Container >

Billing ▾

- Account >
- Bills >

Instances

Launch Instance Connect System Log Snapshot Start Shut off Reboot Terminate filter1 filter2

<input type="checkbox"/>	Column 1 ↑	Column 2	Column 3
<input type="checkbox"/>	Column 1 Row 1	Column 2	Column 3
<input type="checkbox"/>	Column 1 Row 2 Rollover here	Column 2	Column 3
<input checked="" type="checkbox"/>	Column 1 Row 3	Column 2	Column 3
<input type="checkbox"/>	Column 1 Row 4	Column 2	Column 3
<input type="checkbox"/>	Column 1 Row 5	Column 2	Column 3

Monitoring

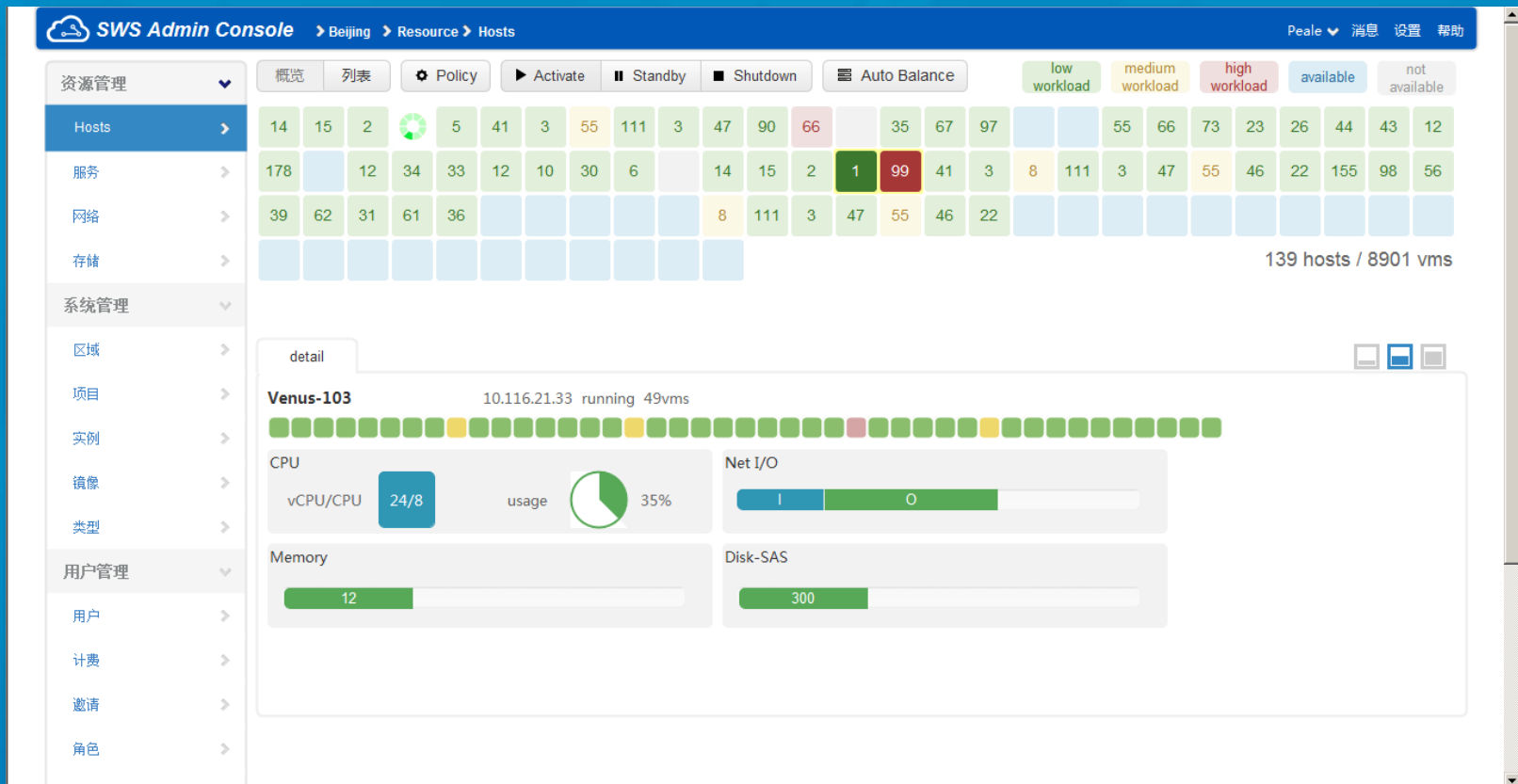
Instance name ip Time Range: 1 Hour Alarm: 3 of 3 in OK ☐ show alarms [Create Alarm](#)

CPU Utilization avg

Disk Read avg

Disk Write avg

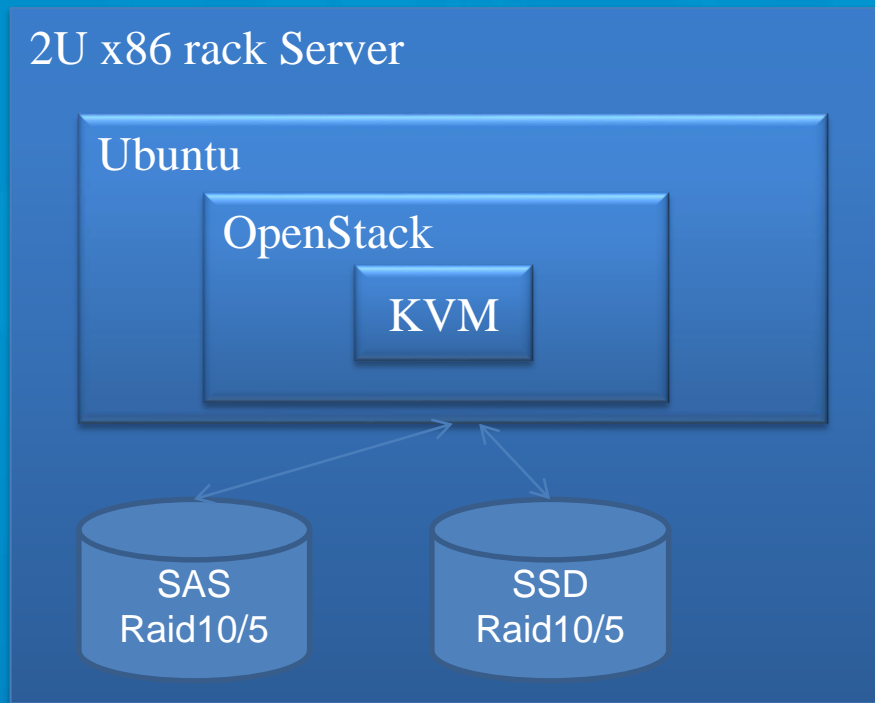
SWS v3 – Physical Server Mgt



Content

- **SinaCloud Introduction**
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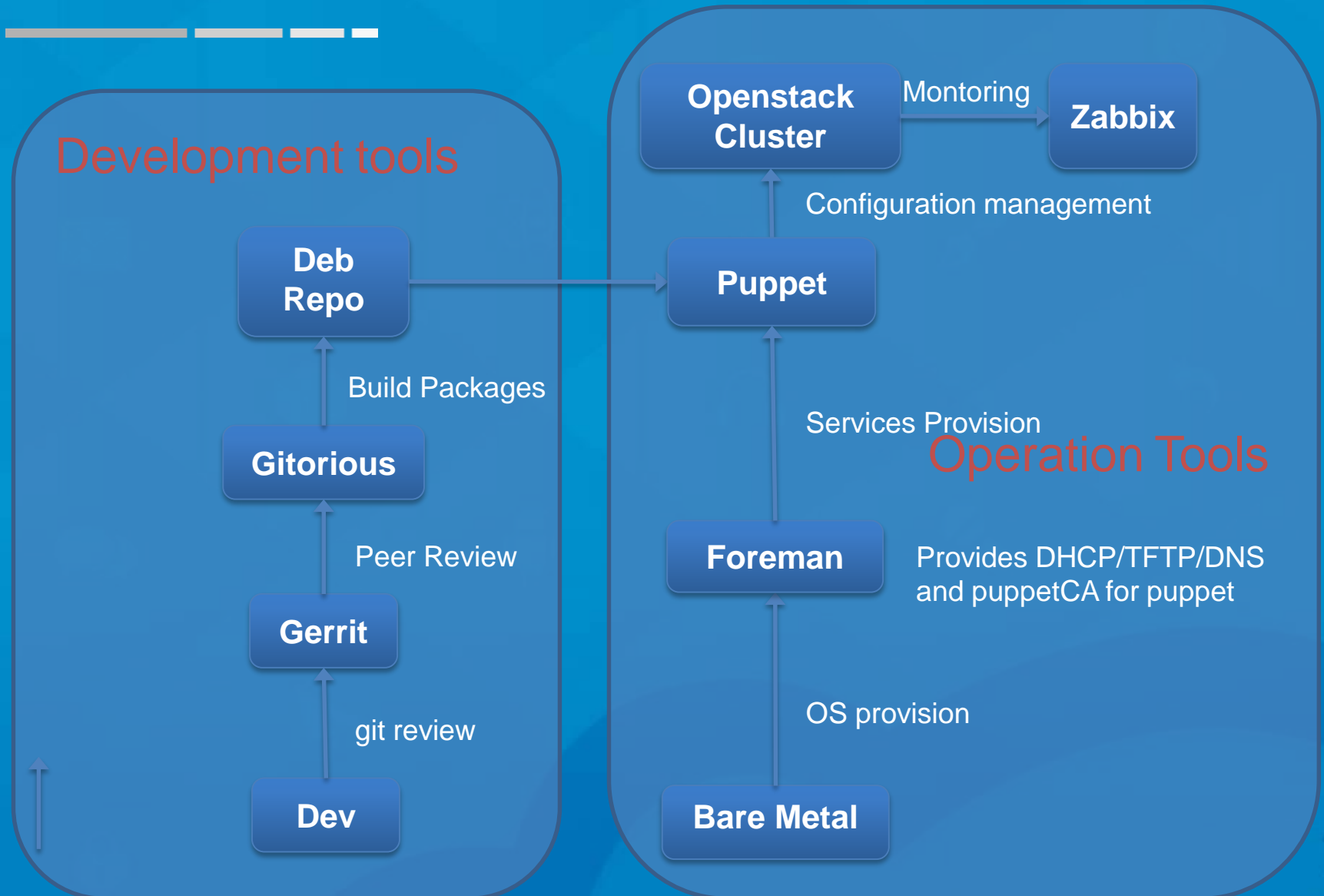
Platform Stack



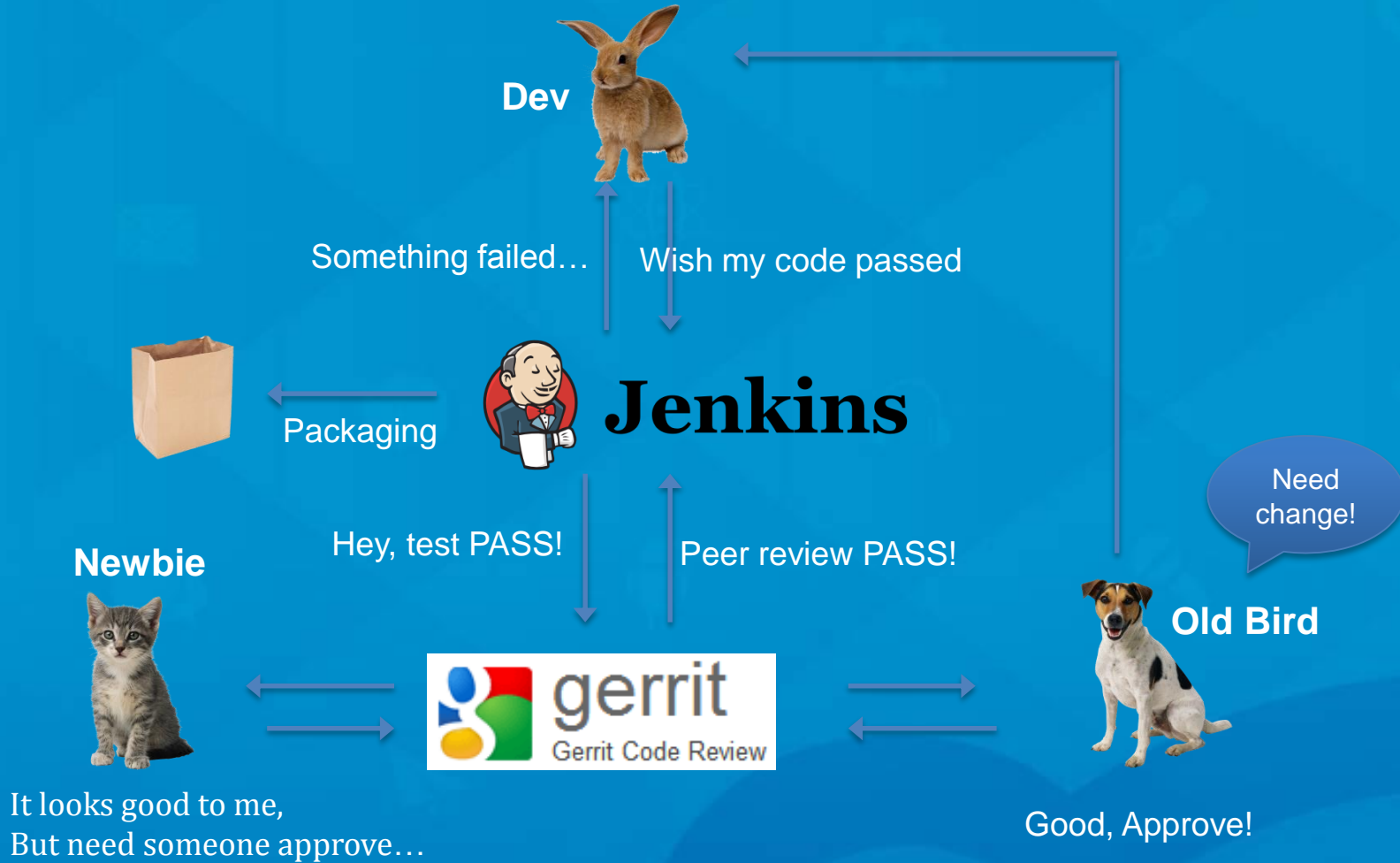
Challenges in Deploying Cloud

- Cloud in essence are big data centers
- Requirement:
 - Provision large scale physical infrastructures
 - Software deployment
 - Orchestrate all the heterogeneous components

SWS automation toolchain.



SWS continuous integration



Project Management

The screenshot displays the Kanyun project page on the Launchpad platform. The page is organized into several sections:

- Header:** Includes the Kanyun logo, navigation tabs (Overview, Code, Bugs, Blueprints, Translations, Answers), and user information (newstone (uxcer) • Log Out).
- Project Information:**
 - Maintainer:** yaguang
 - Development focus:** trunk series
 - Driver:** SWS Dev Team
 - Licences:** Apache Licence
 - Additional info:** Registered 2012-07-04 by yaguang, kanyun virtual instances monitor and data collector.
- Series and milestones:** kanyun trunk series is the current focus of development. Includes a link to [View milestones](#).
- Latest bugs reported:** A list of bugs with details like "Bug #51: 数据的组装应当放到kanyun-API内部实现" and "Bug #35: sws bug test". Includes a link to [All bugs](#).
- Latest blueprints:** Lists "kanyun-worker-monitor" registered on 2012-07-04. Includes a link to [All blueprints](#).
- Get Involved:** Links for "Report a bug", "Register a blueprint", "Ask a question", and "Help translate".
- Downloads:** States "kanyun does not have any download files registered with Launchpad."
- Footer:** Includes a Launchpad logo, "Take the tour • Read the guide", and copyright information: "© 2004-2012 Canonical Ltd. • Terms of use • Contact Launchpad Support • Blog • Careers • System status • r15383 (Get the code)"

Deploy open-source version Launchpad in-house as project management system.

Content

- **SinaCloud Introduction**
- **Challenges to build a OpenStack Public Cloud**
 1. Network topology
 2. Security Enhancement
 3. Storage Solution
 4. Identity Integration
 5. Billing & Monitoring
 6. Dashboard Improvement
- **Operate an production OpenStack**
 7. Platform stack
 8. Automated Deployment
 9. Continuous Integration
 10. Project Management
- **StackLab: A community OpenStack Public Cloud**
- **Summary**

StackLab.org

A Community free OpenStack Public Cloud, more than just a OpenStack sandbox.



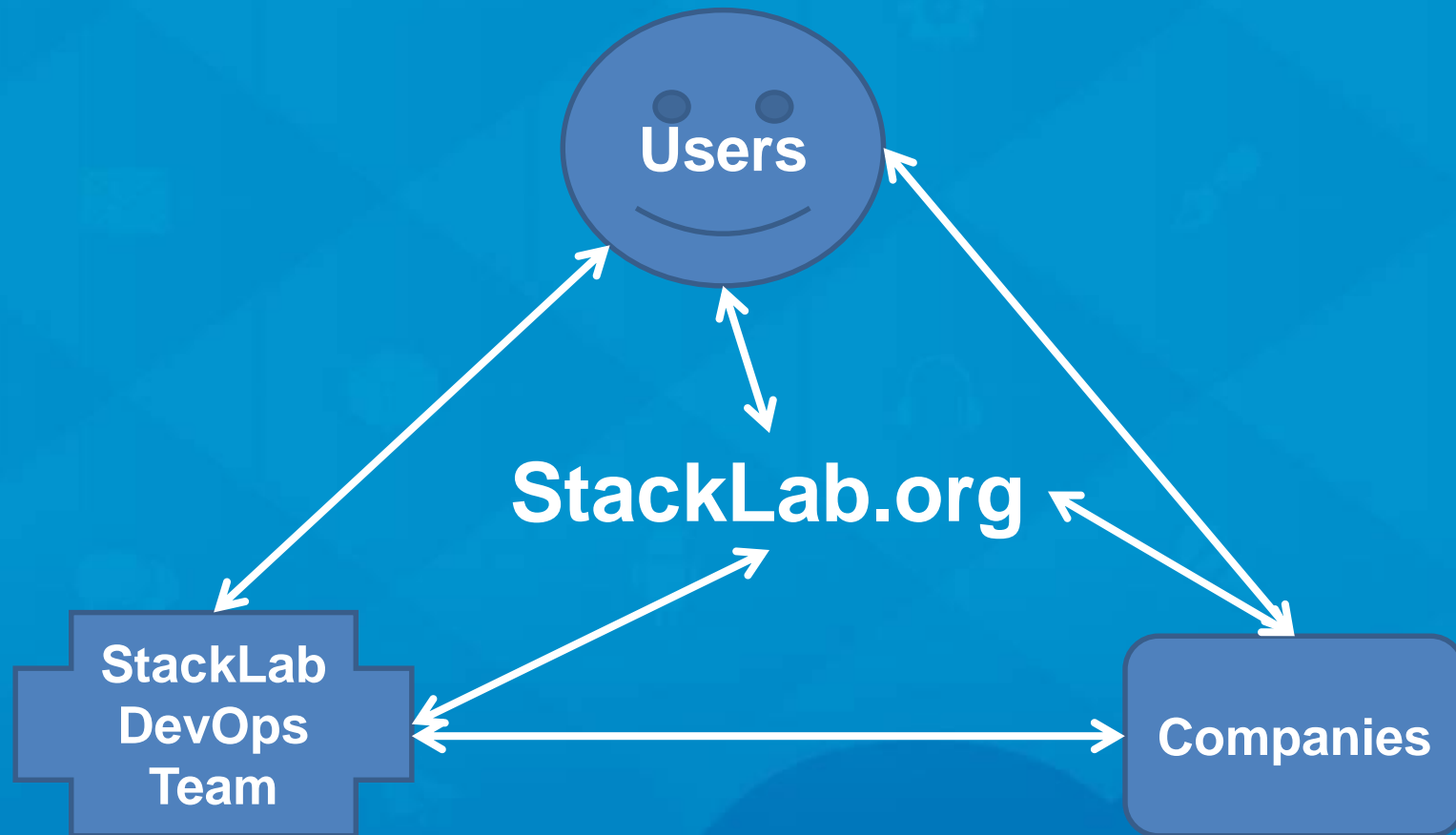
StackLab is initiated and operated by Sina OpenStack team, as well as tech volunteers from community, while resources sponsored by Sina, Intel.

StackLab news report: <http://freedomhui.com/2012/10/coscl-launches-stacklab/>

Why StackLab

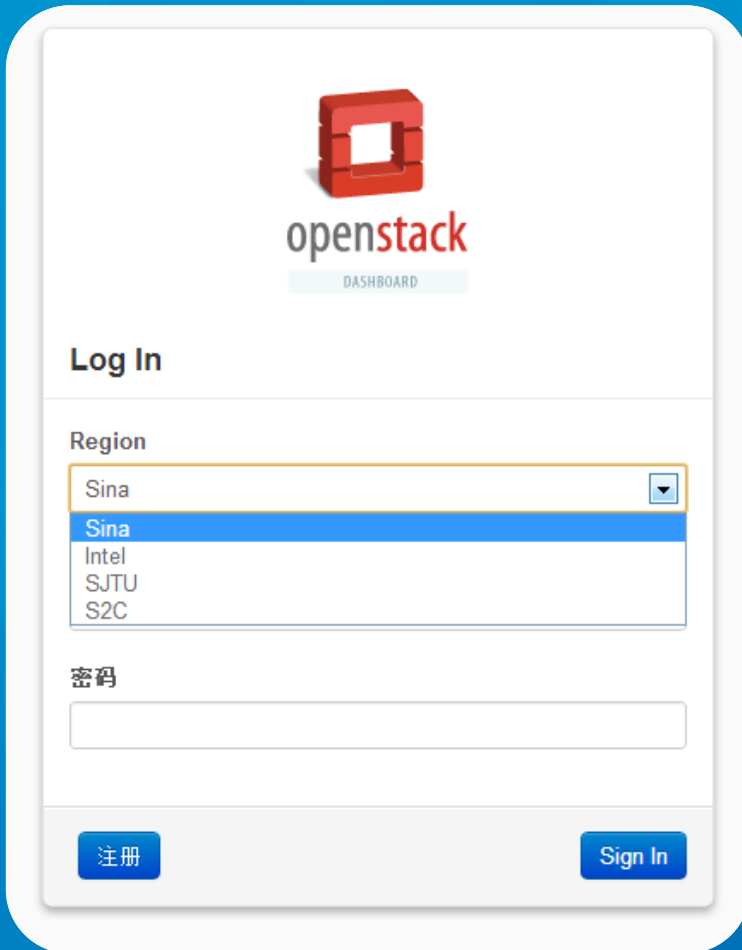
Not everyone has the opportunity to run a OpenStack public cloud when no resources, no users, no market, but StackLab will change this.

Why StackLab



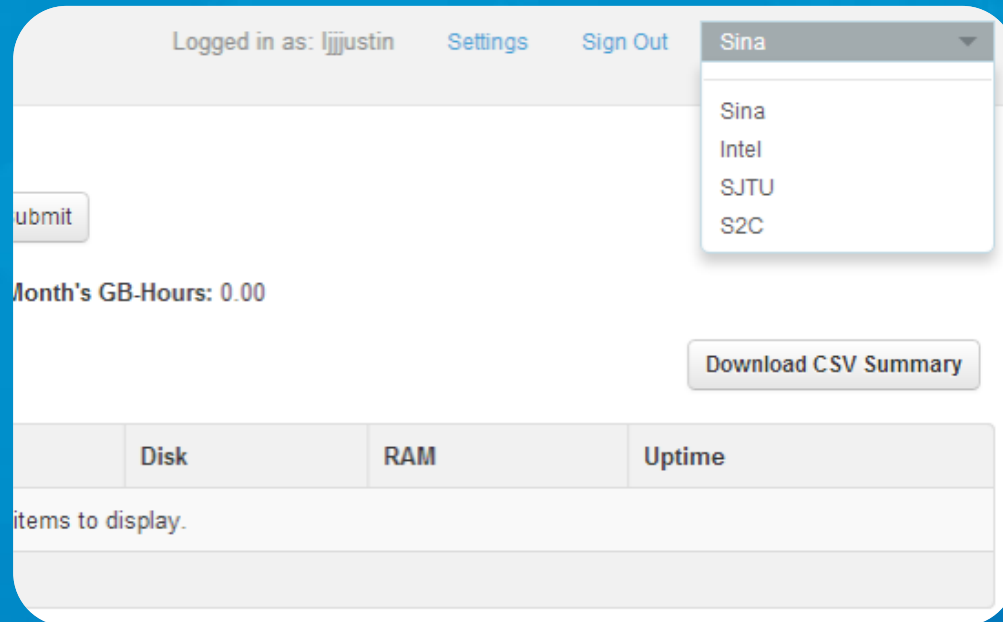
What does StackLab Look Like?

Choose the region before login



The image shows the OpenStack Dashboard login page. At the top is the OpenStack logo (a red cube) and the text "openstack" in a stylized font, with "DASHBOARD" in smaller letters below it. Below the logo is a "Log In" section. It features a "Region" dropdown menu with a list of options: Sina, Intel, SJTU, and S2C. The "Sina" option is currently selected and highlighted in blue. Below the region dropdown is a password input field labeled "密码" (Password). At the bottom of the login section are two buttons: "注册" (Register) on the left and "Sign In" on the right.

Or choose the region after login



The image shows a user menu in the OpenStack Dashboard. The user is logged in as "ljjustin". The menu includes links for "Settings" and "Sign Out". A dropdown menu is open, showing the user's name "Sina" at the top, followed by a list of regions: Sina, Intel, SJTU, and S2C. Below the menu, there is a "submit" button and a "Month's GB-Hours: 0.00" label. A "Download CSV Summary" button is also visible. At the bottom, there is a table with headers "Disk", "RAM", and "Uptime".

Disk	RAM	Uptime
items to display.		

StackLab Goals

A community OpenStack public cloud which benefits users, contributors and sponsors.

For OpenStack Users who experience StackLab

- Understand what exactly OpenStack is and what does it provide
- Develop application on StackLab or using OpenStack API
- Build faith on OpenStack, possibly become real adopters and supporter

For OpenStack contributors involved in StackLab

- Testing patches on real production-like environmental, and get feedback from users, thus facilitate development and QA processes
- Gains experiences through operating StackLab without risk of SLA
- Better understand the requirement of OpenStack users

For StackLab sponsors

- Build band acknowledgement in OpenStack community
- Own one StackLab region in their own data center
- Prior access to free technical support, consultant, of StackLab DevOps team

How to join StackLab

For OpenStack Users who want to experience StackLab

Really Easy! Goto StackLab.org, register a free account instantly without approvement by admin.

For OpenStack contributors to join StackLab DevOps team

1. Persuade your company to become a StackLab sponsor, thus you will have a StackLab region in your own DC, and you are one admin of StackLab.
2. Contact us to join as an individual member.

For StackLab sponsors

1. Send a email to openstacklab@gmail.com, expressing your willing to join StackLab
2. Sign a agreement with StackLab DevOps team
3. StackLab team help you build one StackLab region in your own DC. The minimum requirement is 3 servers with access to public network.
4. List your StackLab region in Stacklab.org portal.

How to join StackLab(cont.)

StackLab: <http://stacklab.org>

StackLab Discussion Group:

<https://groups.google.com/group/stacklab>
stacklab@googlegroups.com

StackLab DevOps Team:

<https://groups.google.com/group/stacklab-devops>
stacklab-devops@googlegroups.com

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Summary

- OpenStack definitely the best open-source cloud platform for building public cloud
 - Open, open, open, open
 - Fast growing ecosystem around OpenStack
 - No vendor lock-in
 - Etc.
- OpenStack Public cloud needs much more customization and development to differentiate.
- Require strong technical skills and involvement in community.

**Thank you, OpenStack Community
and Foundation.**

Q & A

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