MSIS 2868 – Fall 2015,
The Business of Cloud Computing
Santa Clara University

So how does a cloud look like

Phani Kumar
Member of Technical Staff
PayPal Inc

PayPal's Cloud Journey

Business Requirements

Goals & Principles

Deliverables

Learnings

Cloud Adoption @PayPal

- Havana
- 12k+ hypervisors
- 300k+ cores
- 10+ availabilityzones
- 15+virtual private clouds
- > 1.6 pb block storage
- 100% KVM(Kernel-based Virtual Machine)
- 100% OVS (Open View Stack)

PayPal's OpenStack based private cloud serves 160+M customers for payment, website interactions, mobile and more...

100% of PayPal web-tier and mid-tier services run on OpenStack cloud.

PayPal's Cloud Journey

Business Requirements

Goals & Principles

Deliverables

Learnings

Business Requirements

Journey to Cloud began in 2012 in response to specific business asks.

Business Agility	Cost Efficiency	Enhanced Service Quality
+ Reduce time spent between "code to LTS (Long Term Support"	+ Standardization	+ Superior to the current model
+ Rapid elasticity (scale up and down as needed)	+ Automation	
+ Self-service		

PayPal's Cloud Journey

Business Requirements

Goals & Principles

Deliverables

Learnings

Goal: Enable the Developer

1. Design/Code
2. Build/Test
3. Test/Integrate
4. Deploy/Monitor

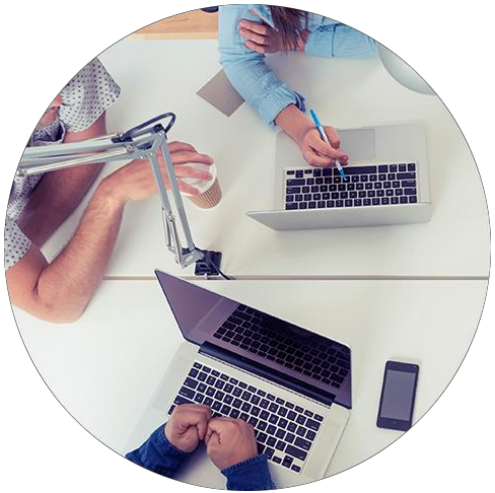
Goal: Enable the Business

1. Cloud as the interface for the data center
2. Improve resiliency & efficiency of apps
3. Lights Out Management (LOM)

Guiding Principles

Adopt Open Source Where Possible

Avoid Vendor Lock-In



Leverage eBay/PayPal Inc.-wide Investments

PayPal's Cloud Journey

Business Requirements

Goals & Principles

Deliverables

Learnings

Cloud Product Suite (Capabilities Aligned to Customer Needs)

PRODUCT TEAMS (MAJORITY)

PLATFORM AS A SERVICE

Auto-Scaling Dependencies

Self-Healing Deployment

Framework & Runtimes

System Services


DBaaS


Analytics


Logging


Metrics


Alerting


Messaging

ENGINEERING & ARCHITECTS

INFRASTRUCTURE AS A SERVICE

Compute SDN Storage DNS LBaaS Orchestration

OPS

PHYSICAL INFRASTRUCTURE

Compute DB Networking Firewall Storage

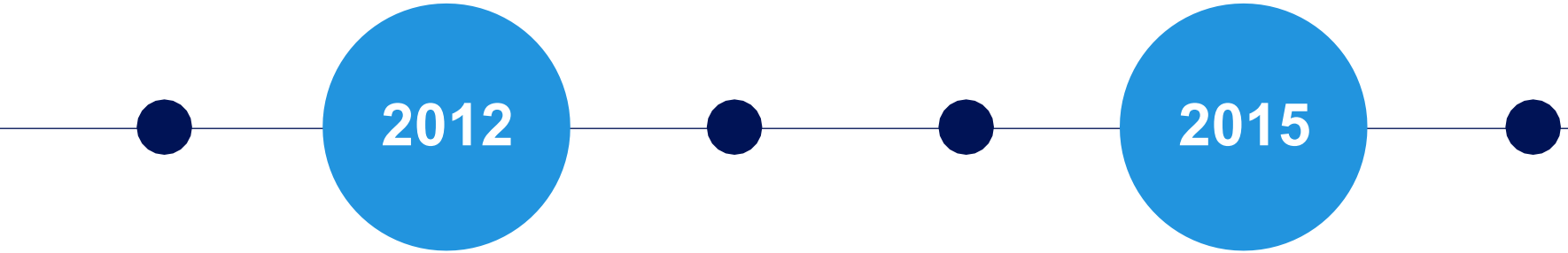
PayPal's Cloud Journey

Business Requirements

Goals & Principles

Deliverables

Learnings



- A Dev/TestCloud
- Less Than a Rack of Compute
- Handcrafted by an Engineer
- Supported by Another Engineer
- Zero Automation

- Thousands of Nodes
- Distributed Across Several AZs
- Automated
- Operated 24x7
- Runningthe Business

Treat Infrastructure As Code

1. **Fully Automate Deployments**

   Well defined and agreed upon

2. **Treat Automation Artifacts Like You Treat Code**

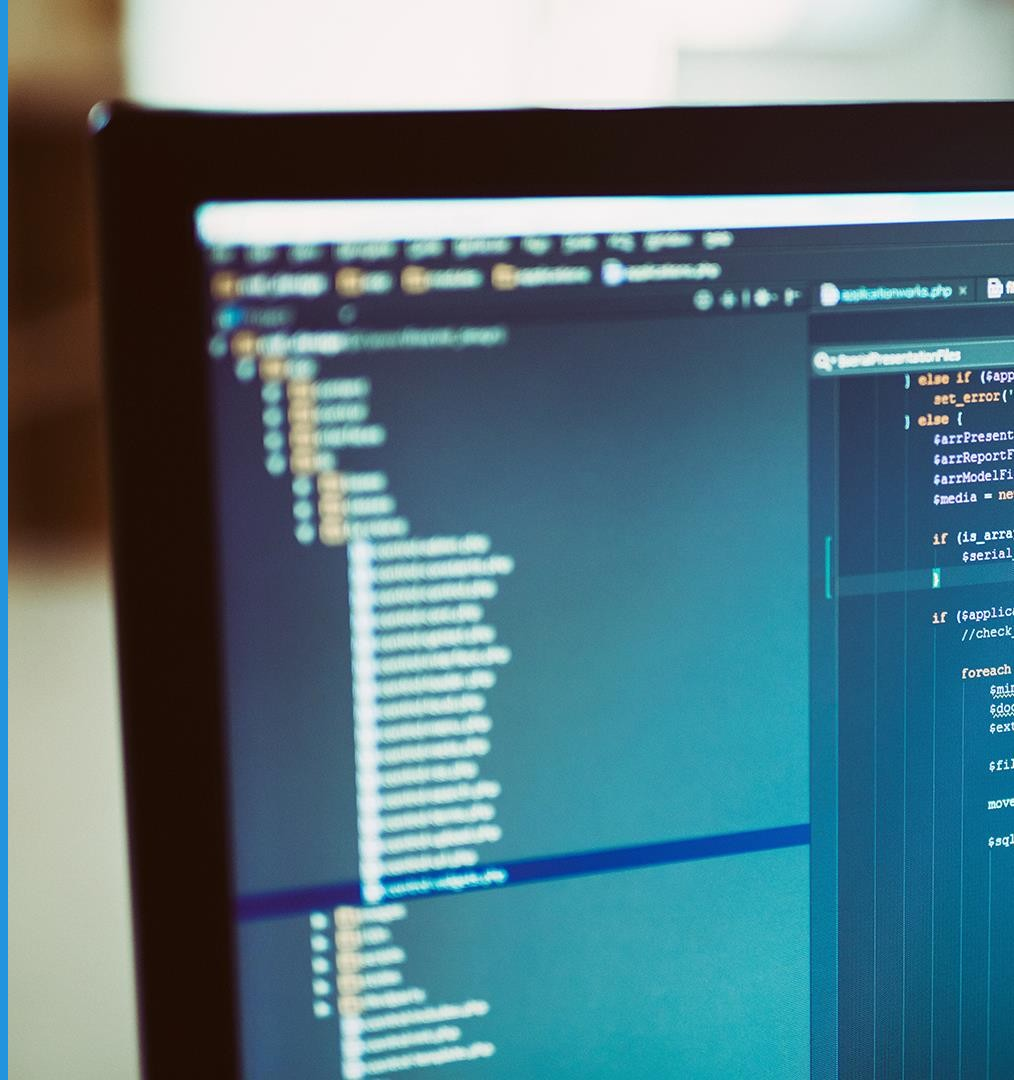
   Source Control ▸ Code Reviews ▸ Tests ▸ Deployment

3. **Take Automation as a Product Feature**

   Road Map, Sprints, Bugs, Backlog, Releases

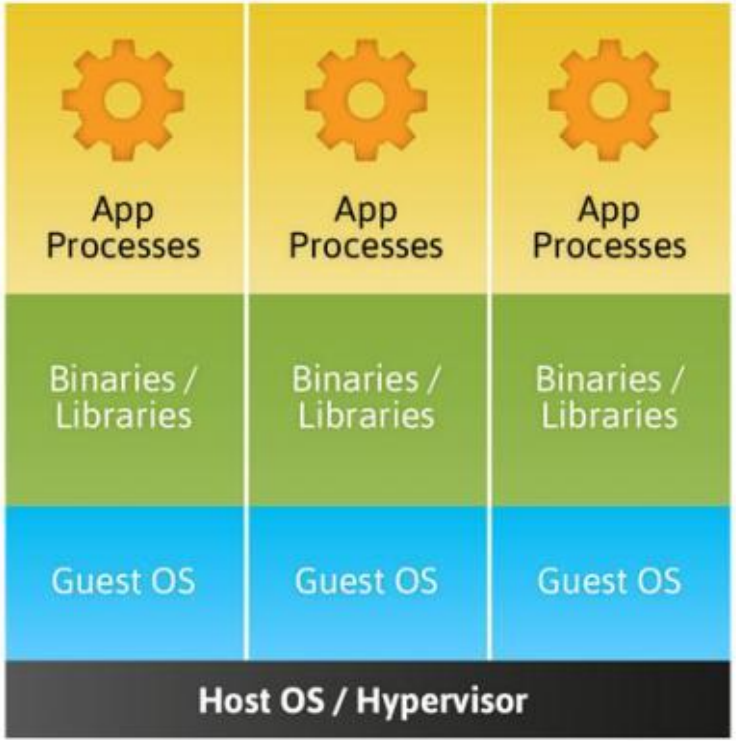
4. **Measure Outcomes with KPIs**

   Time to Deploy, Time to Recover, Time to Rollout a Change




Business KPIs
Alerts
Measure Everything
System Config
Drift

Current Cloud: Full OS for each VM



The Problem with VMs

Penalties:

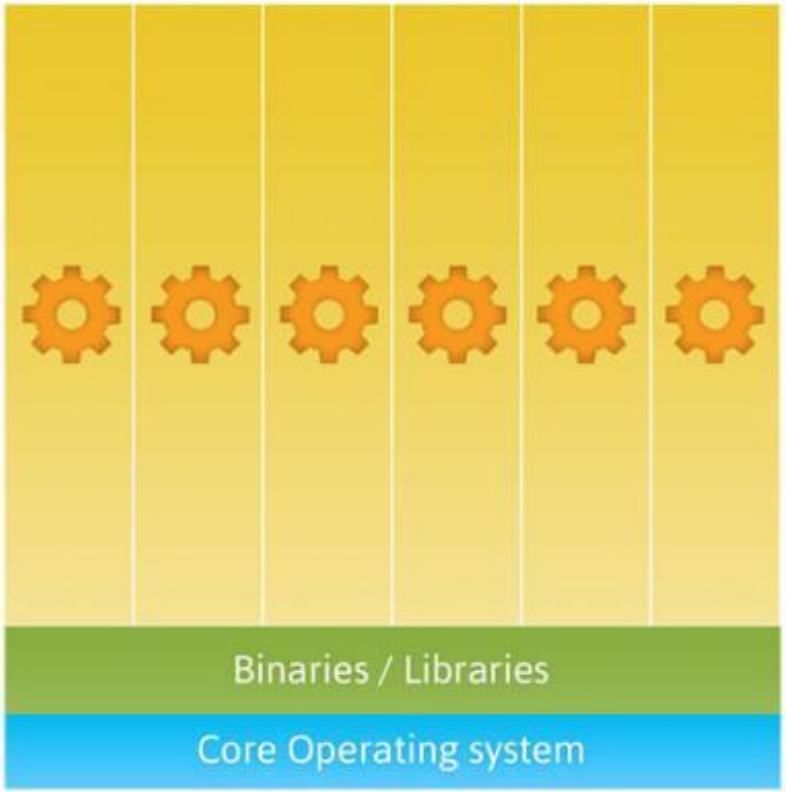
1) Running a whole separate operating system to get a resource and security isolation.

2) Slow startup time while waiting for the OS to boot.

3) The OS often consumes more memory and more disk than the actual application it hosts. The Rackspace Cloud recently discontinued 256MB instances because it didn't see them as practical. Yet, 256MB is a very practical size for an application if it doesn't need to share that memory with a full operating system.

Source: http://www.linuxjournal.com

Future Cloud: Containers (One OS for all VMs)



Compared to VM:

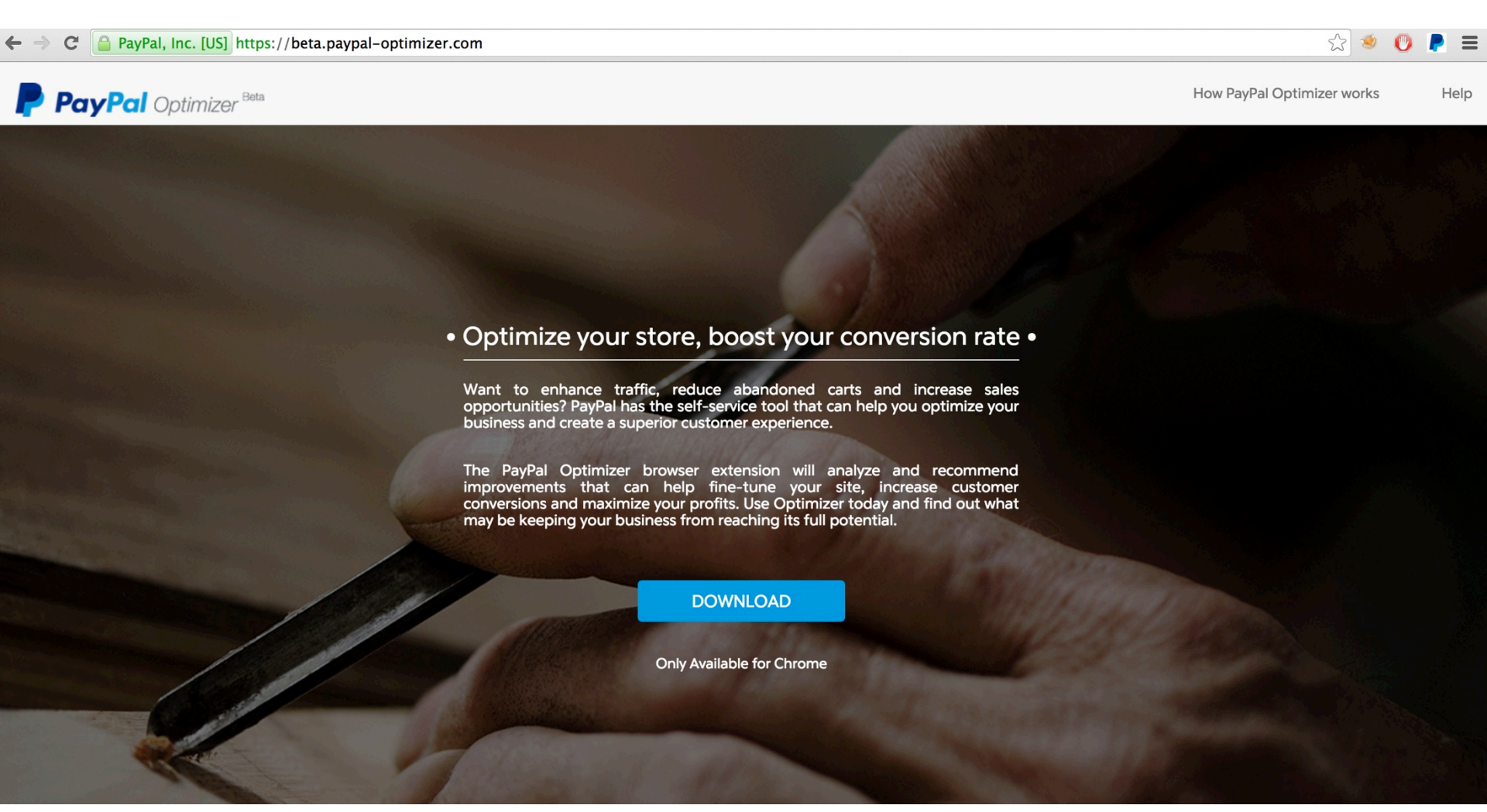
1) Overhead of a container is disruptively low.
2) They start so fast that many configurations can launch on-demand as requests come in, resulting in zero idle memory and CPU overhead.
3) A container running systemd or Upstart to manage its services has less than 5MB of system memory overhead and nearly zero CPU consumption.
4) With copy-on-write for disk, provisioning new containers can happen in seconds.

Source: http://www.linuxjournal.com

So how does a cloud look to a user and developer?

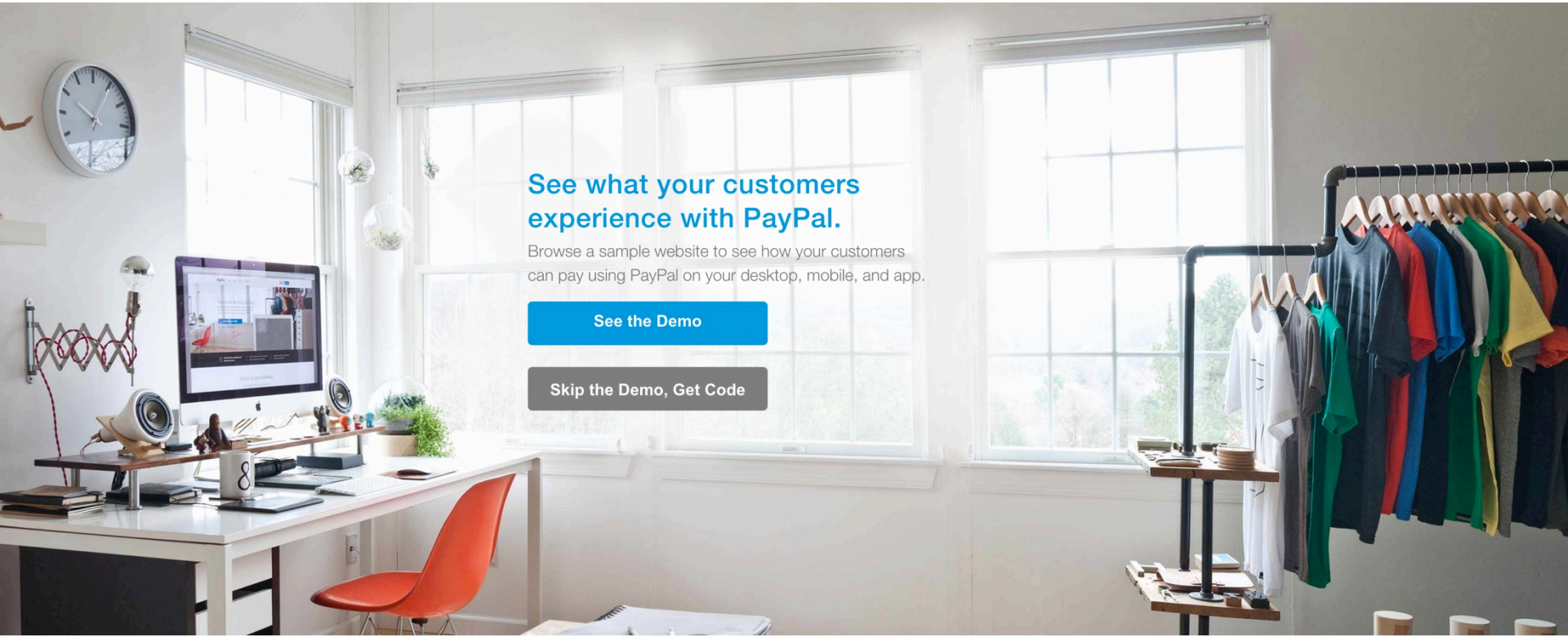
Not that different

Let’s take a look


PayPal, Inc. [US] https://beta.paypal-optimizer.com
PayPal Optimizer Beta
How PayPal Optimizer works
Help
• Optimize your store, boost your conversion rate •
Want to enhance traffic, reduce abandoned carts and increase sales opportunities? PayPal has the self-service tool that can help you optimize your business and create a superior customer experience.
The PayPal Optimizer browser extension will analyze and recommend improvements that can help fine-tune your site, increase customer conversions and maximize your profits. Use Optimizer today and find out what may be keeping your business from reaching its full potential.
DOWNLOAD
Only Available for Chrome

PayPal, Inc. [US] https://demo.paypal.com/us/home

PayPal Demo



FAQ

PayPal, Inc. [US] https://demo.paypal.com/us/home

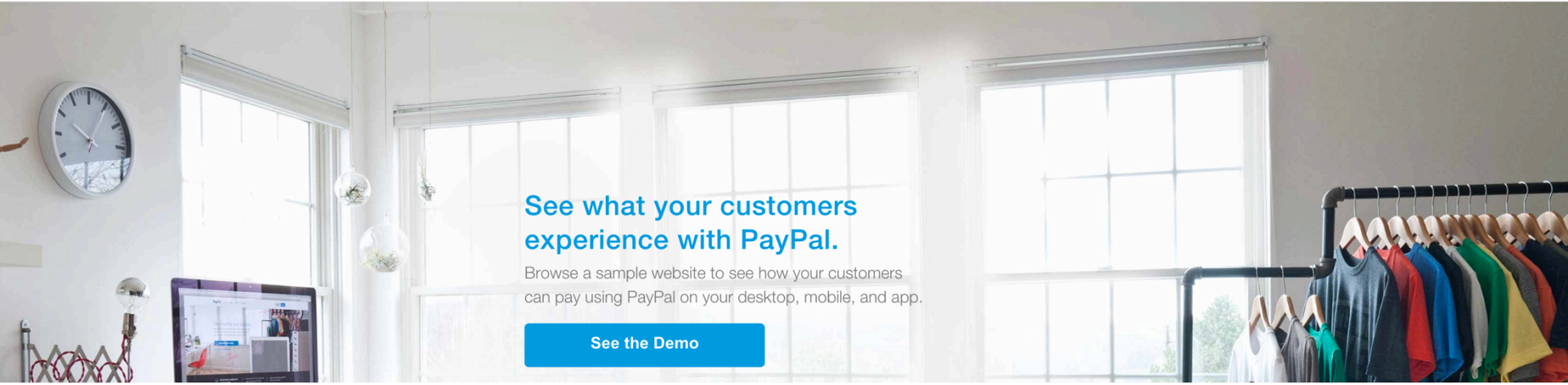
PayPal Optimizer Beta

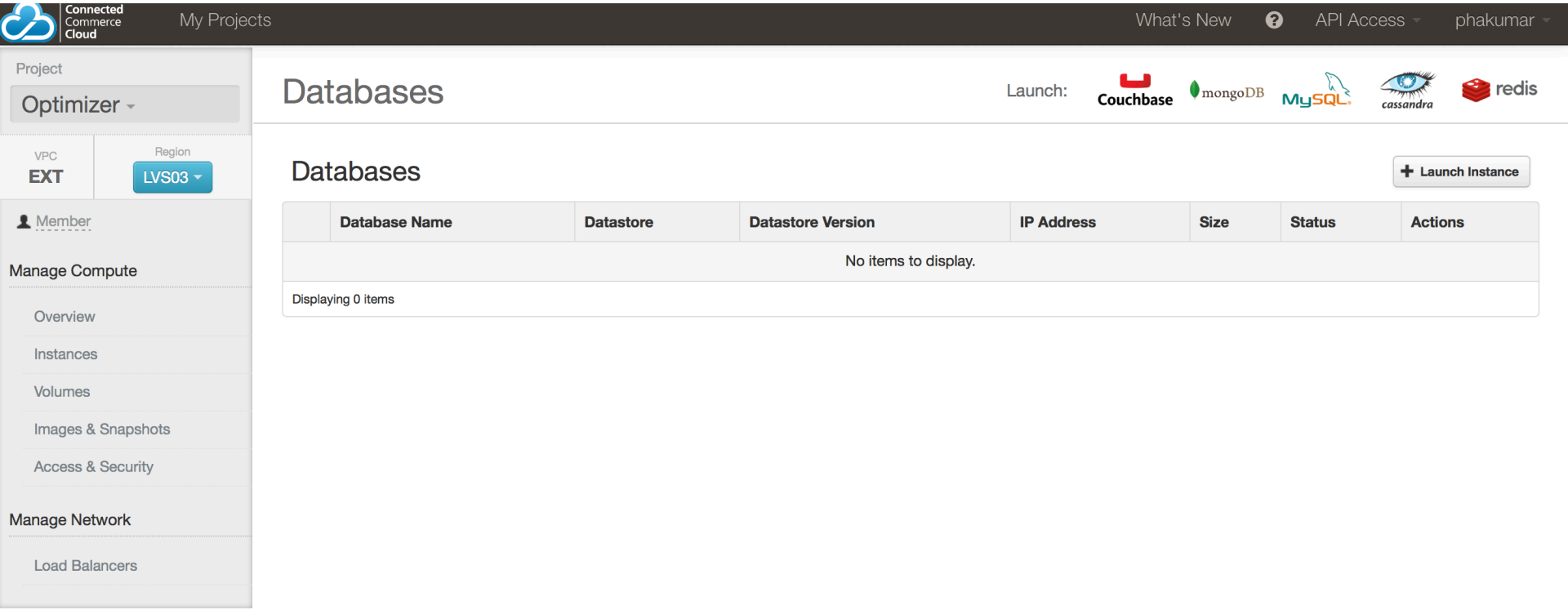
PayPal Optimizer tool helps you analyze and fine-tune your website. It recommends improvements, helps you enhance customer experience, increase customer conversions and maximize your profits.

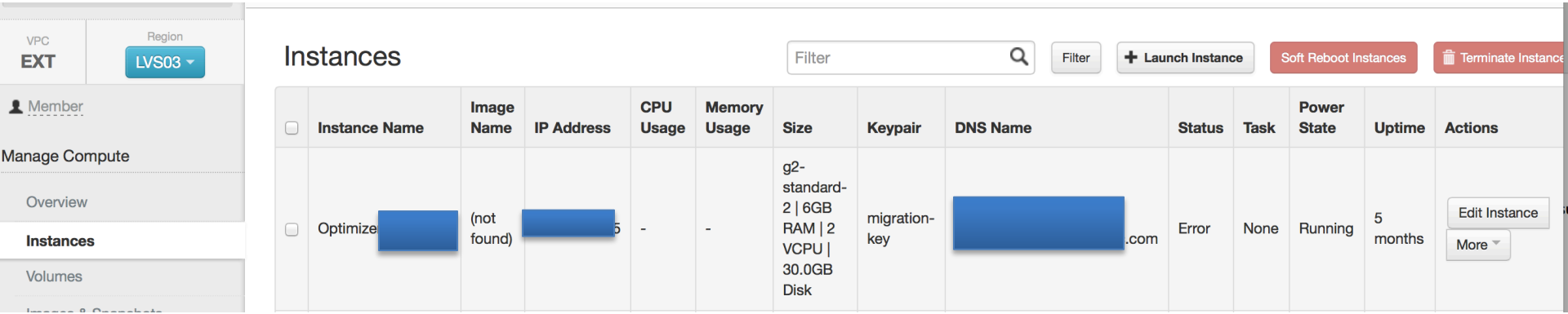
PayPal Optimizer scans the following pages from your website in the next steps. Please select the appropriate page as per the instructions in every page.

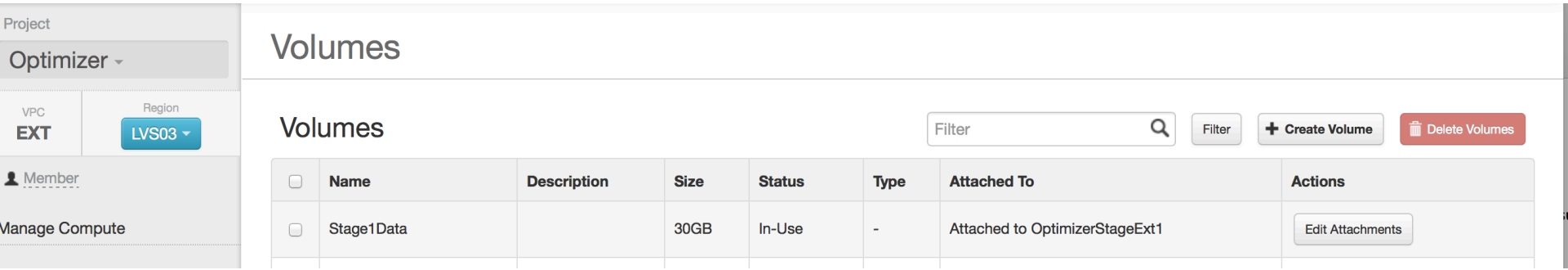
1. Home Page
2. Product Page
3. Shopping cart page
4. Payments Methods Page
5. Checkout Page

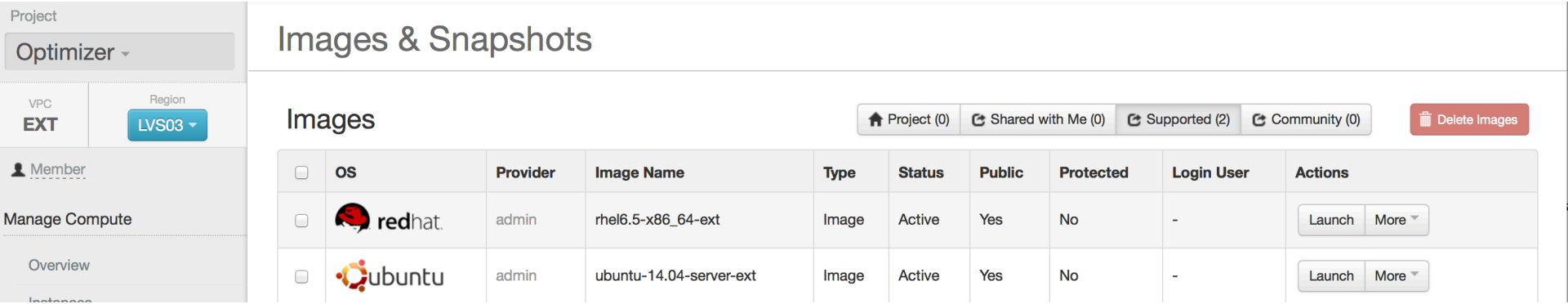
GET STARTED

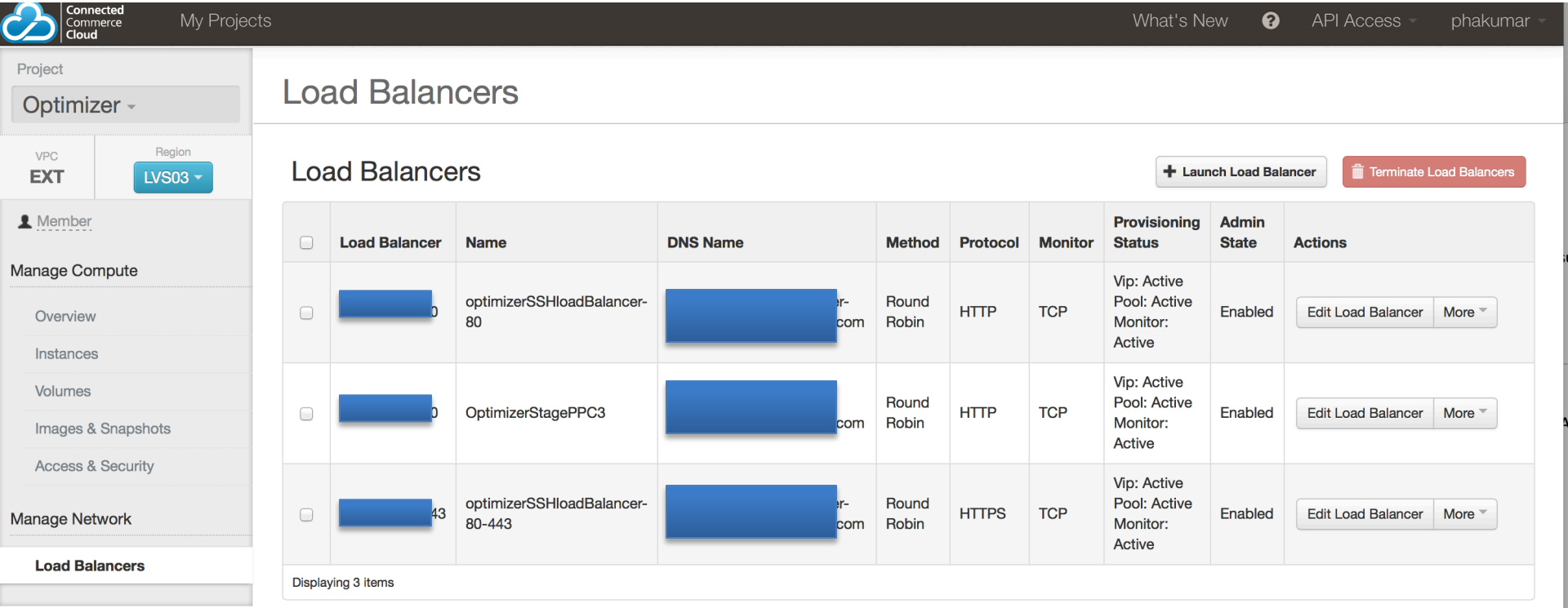


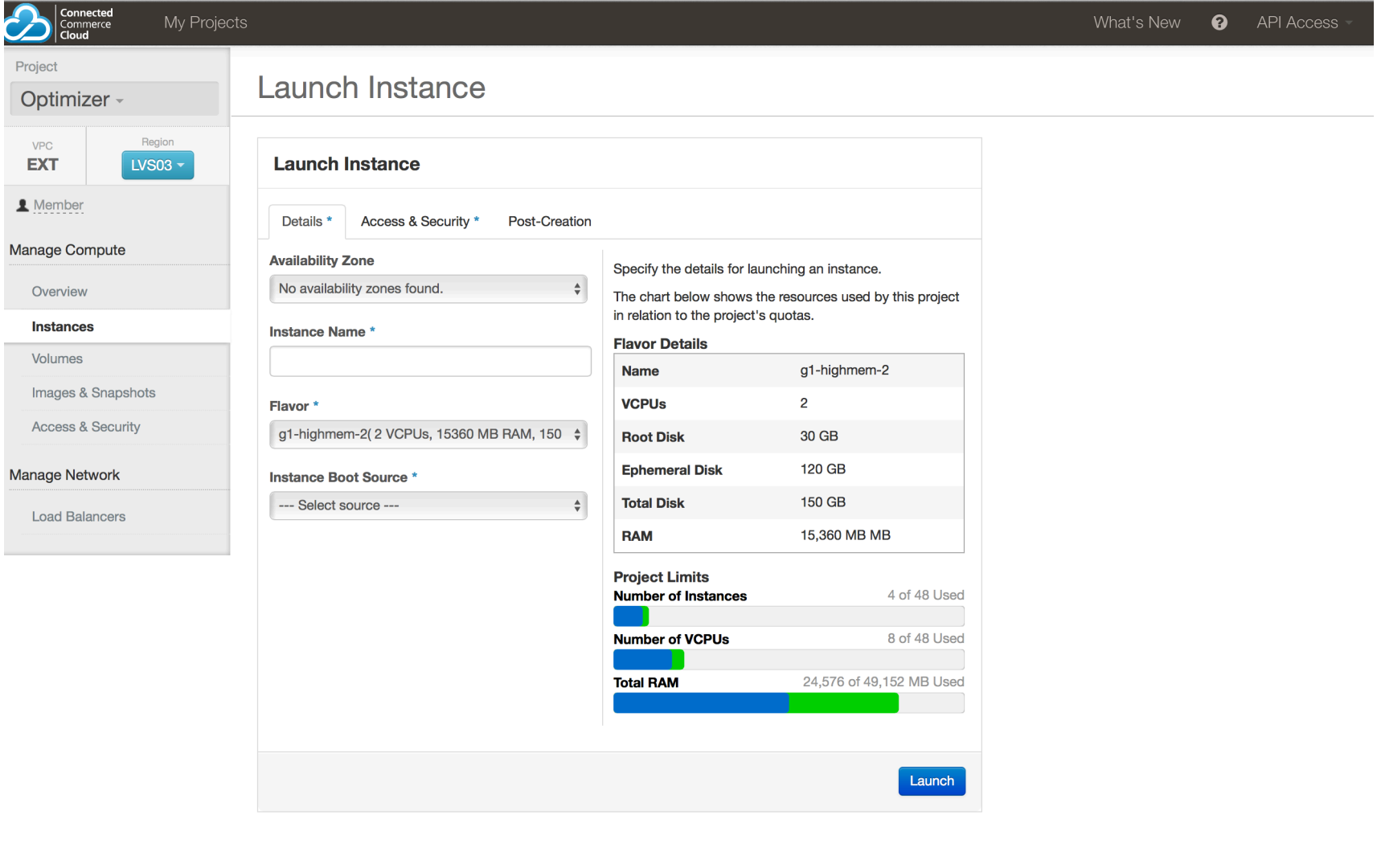

Connected Commerce Cloud
My Projects
What's New
API Access
phakumar
Project
Optimizer
VPC
EXT
Region
LVS03
Member
Manage Compute
Overview
Instances
Volumes
Images & Snapshots
Access & Security
Manage Network
Load Balancers
Databases
Launch:
Couchbase
mongoDB
MySQL
cassandra
redis
Databases
+ Launch Instance
Database Name
Datastore
Datastore Version
IP Address
Size
Status
Actions
No items to display.
Displaying 0 items

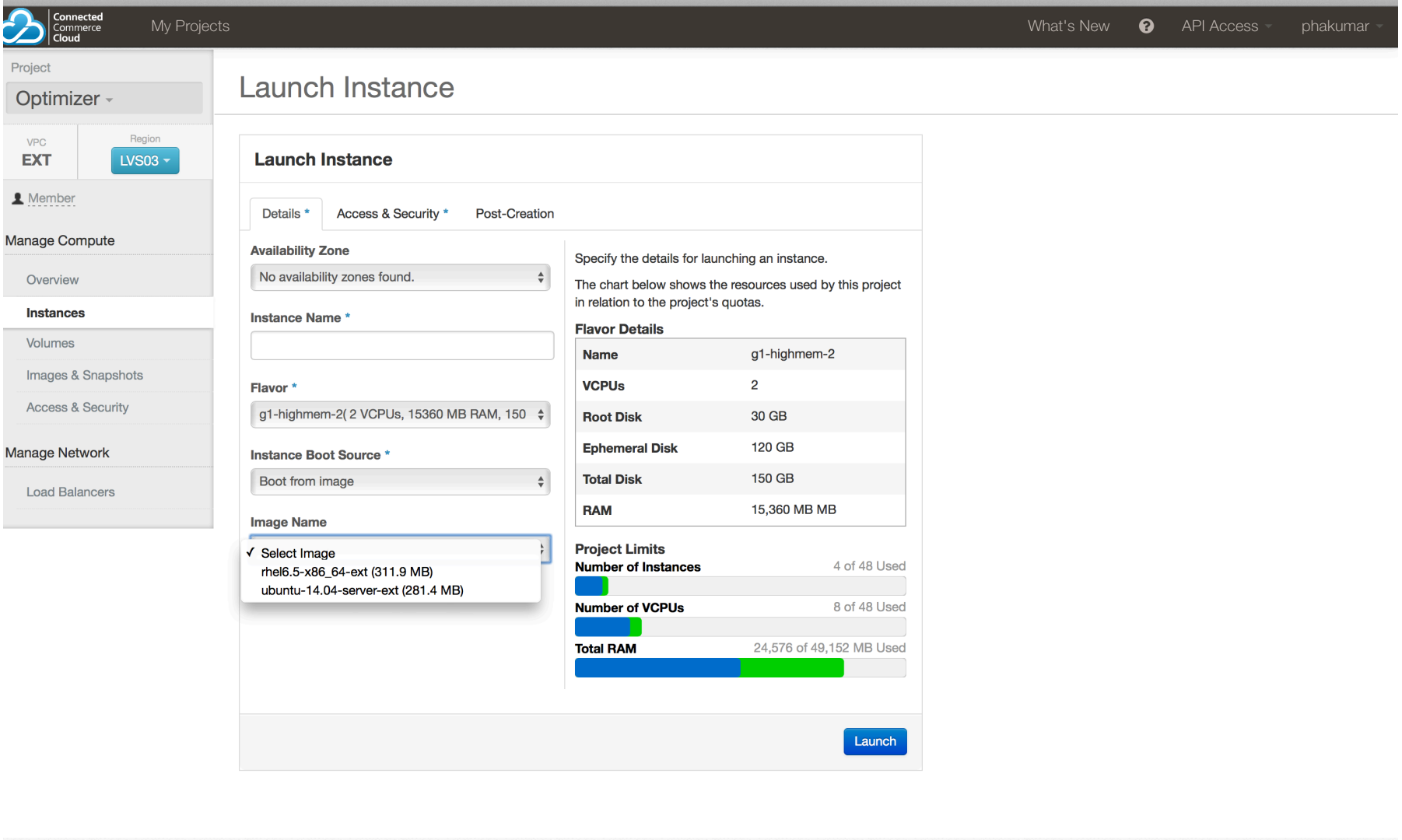

VPC
EXT
Region
LVS03
Member
Manage Compute
Overview
Instances
Volumes
Instances
Filter
Filter
Launch Instance
Soft Reboot Instances
Terminate Instance
Instance Name
Image Name
IP Address
CPU Usage
Memory Usage
Size
Keypair
DNS Name
Status
Task
Power State
Uptime
Actions
Optimize
(not found)
-
-
g2-standard-2 | 6GB RAM | 2 VCPU | 30.0GB Disk
migration-key
.com
Error
None
Running
5 months
Edit Instance
More

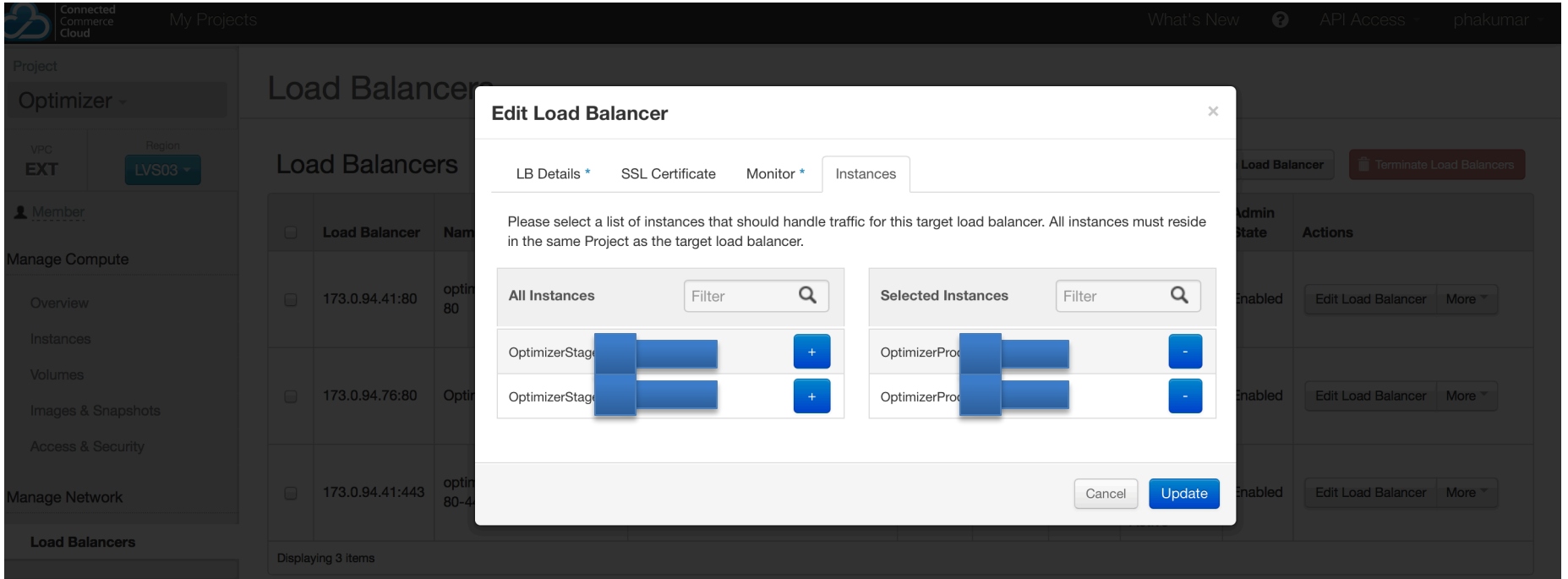

Project
Optimizer
VPC
EXT
Region
LVS03
Member
Manage Compute
Volumes
Volumes
Filter
Filter
Create Volume
Delete Volumes
Name
Description
Size
Status
Type
Attached To
Actions
Stage1Data
30GB
In-Use
-
Attached to OptimizerStageExt1
Edit Attachments


Project
Optimizer
VPC
EXT
Region
LVS03
Member
Manage Compute
Overview
Images & Snapshots
Images
Project (0)
Shared with Me (0)
Supported (2)
Community (0)
Delete Images
OS
Provider
Image Name
Type
Status
Public
Protected
Login User
Actions
redhat
admin
rhel6.5-x86_64-ext
Image
Active
Yes
No
-
Launch
More
ubuntu
admin
ubuntu-14.04-server-ext
Image
Active
Yes
No
-
Launch
More


Connected Commerce Cloud
My Projects
What's New
API Access
phakumar
Project
Optimizer
VPC
EXT
Region
LVS03
Member
Manage Compute
Overview
Instances
Volumes
Images & Snapshots
Access & Security
Manage Network
Load Balancers
Load Balancers
Load Balancers
Launch Load Balancer
Terminate Load Balancers
Load Balancer
Name
DNS Name
Method
Protocol
Monitor
Provisioning Status
Admin State
Actions
optimizerSSHloadBalancer-80
Round Robin
HTTP
TCP
Vip: Active Pool: Active Monitor: Active
Enabled
Edit Load Balancer
More
OptimizerStagePPC3
Round Robin
HTTP
TCP
Vip: Active Pool: Active Monitor: Active
Enabled
Edit Load Balancer
More
optimizerSSHloadBalancer-80-443
Round Robin
HTTPS
TCP
Vip: Active Pool: Active Monitor: Active
Enabled
Edit Load Balancer
More
Displaying 3 items


Connected Commerce Cloud
My Projects
What's New
API Access
Project
Optimizer
VPC
EXT
Region
LVS03
Member
Manage Compute
Overview
Instances
Volumes
Images & Snapshots
Access & Security
Manage Network
Load Balancers
Launch Instance
Launch Instance
Details *
Access & Security *
Post-Creation
Availability Zone
No availability zones found.
Instance Name *
Flavor *
g1-highmem-2(2 VCPUs, 15360 MB RAM, 150
Instance Boot Source *
--- Select source ---
Specify the details for launching an instance.
The chart below shows the resources used by this project in relation to the project's quotas.
Flavor Details
Name g1-highmem-2
VCPUs 2
Root Disk 30 GB
Ephemeral Disk 120 GB
Total Disk 150 GB
RAM 15,360 MB MB
Project Limits
Number of Instances 4 of 48 Used
Number of VCPUs 8 of 48 Used
Total RAM 24,576 of 49,152 MB Used
Launch


Connected Commerce Cloud
My Projects
What's New
API Access
phakumar
Project
Optimizer
VPC
EXT
Region
LVS03
Member
Manage Compute
Overview
Instances
Volumes
Images & Snapshots
Access & Security
Manage Network
Load Balancers
Launch Instance
Launch Instance
Details *
Access & Security *
Post-Creation
Availability Zone
No availability zones found.
Instance Name *
Flavor *
g1-highmem-2(2 VCPUs, 15360 MB RAM, 150
Instance Boot Source *
Boot from image
Image Name
Select Image
rhel6.5-x86_64-ext (311.9 MB)
ubuntu-14.04-server-ext (281.4 MB)
Specify the details for launching an instance.
The chart below shows the resources used by this project in relation to the project's quotas.
Flavor Details
Name g1-highmem-2
VCPUs 2
Root Disk 30 GB
Ephemeral Disk 120 GB
Total Disk 150 GB
RAM 15,360 MB MB
Project Limits
Number of Instances 4 of 48 Used
Number of VCPUs 8 of 48 Used
Total RAM 24,576 of 49,152 MB Used
Launch


Connected Commerce Cloud
My Projects
What's New
API Access
phakumar
Project
Optimizer
VPC
EXT
Region
LVS03
Member
Manage Compute
Overview
Instances
Volumes
Images & Snapshots
Access & Security
Manage Network
Load Balancers
Load Balancers
Load Balancer
Terminate Load Balancers
Load Balancer
Actions
173.0.94.41:80
173.0.94.76:80
173.0.94.41:443
Edit Load Balancer
More
Displaying 3 items
Edit Load Balancer
LB Details *
SSL Certificate
Monitor *
Instances
Please select a list of instances that should handle traffic for this target load balancer. All instances must reside in the same Project as the target load balancer.
All Instances
Filter
Selected Instances
Filter
Cancel
Update

Thank You