




FOSDEM – 03/02/2024


Deploying a **hyper-converged** infrastructure with **Ceph** across the **Cloud-Edge** Continuum

Victor Palma
Cloud Engineer

~\$ whoami




CARD_ID  @vickmp



Victor Palma
Cloud Engineer

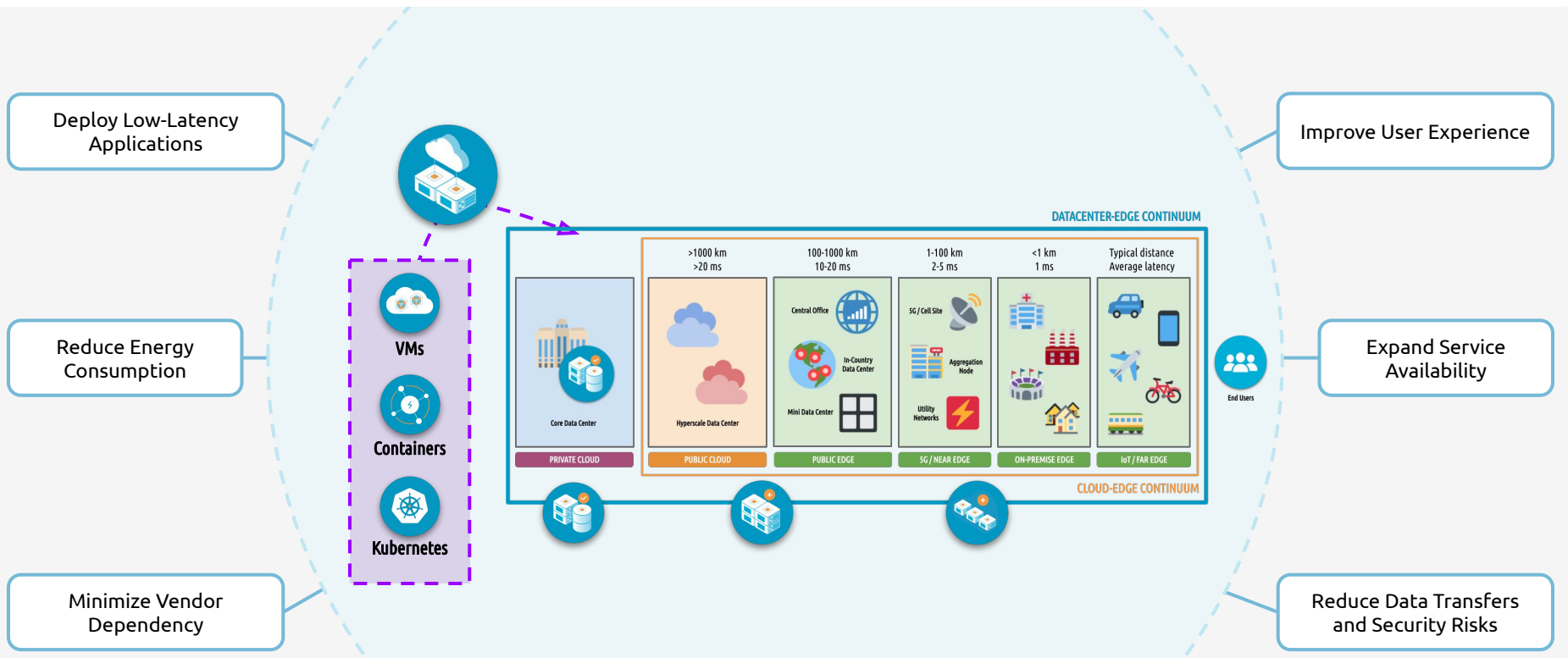
vpalma@opennebula.io



Let's Start with some Theory 🧐

What is the Cloud-Edge Continuum?

How to manage the emerging Datacenter-Cloud-Edge continuum?



Edge Computing

How to manage the emerging Datacenter-Cloud-Edge continuum?

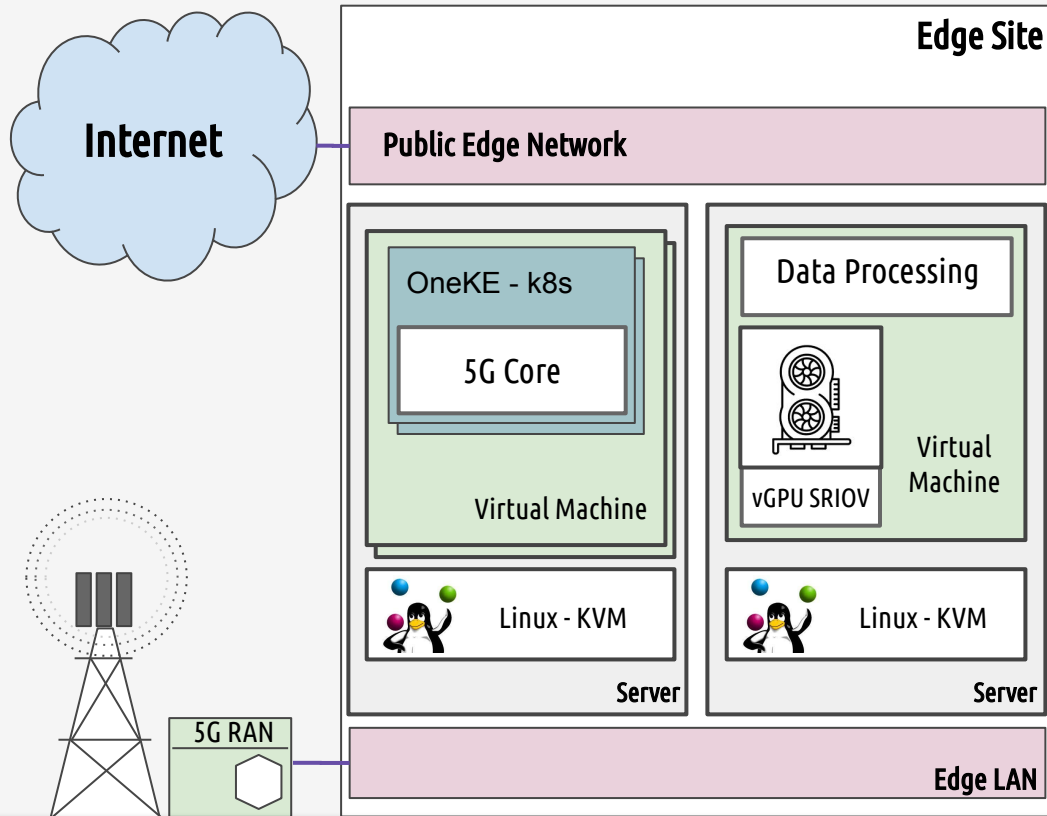
- Clusters (PoPs) of bare-metal servers running KVM hypervisor.
- Uniform management layer for multiple locations and private clouds.
- Interconnected through high latency links.
- **Multi-tenancy** environment.



Looking Inside a Cloud-Edge site

An example deployment of 5G networks

- Small number of servers
- Runs virtualized services to consolidate workloads (e.g. virtual k8s clusters)
- Sites as autonomous as possible
- Simple network model (e.g. VLAN)
- Run some specialized workloads (e.g. VNF) that requires SR IOV



Bringing these Ideas to Life 🤔

Deploying a Cloud-Edge Node

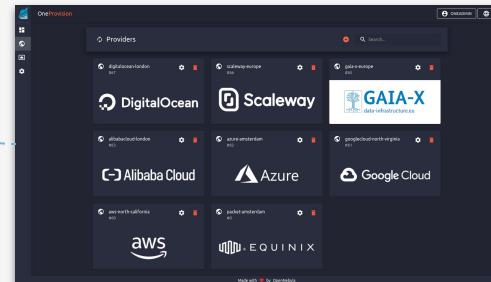
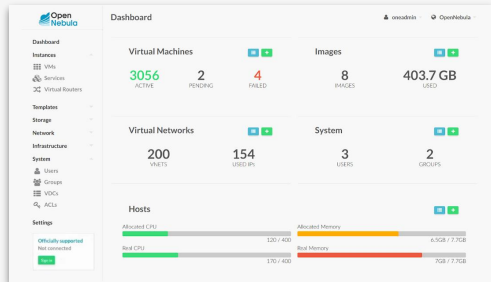
The Open Source Join Forces 🤝

One platform to rule them all 🚀



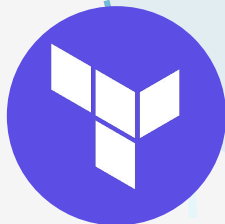
+ OneProvision

Cloud-Edge Deployment in an Instant ⚡



Cloud-Edge Deployment

Automated Resources
Deployment



HashiCorp
Terraform



ANSIBLE

Automated Host
Configuration

What is OpenNebula?

The open source Cloud & Edge Computing Platform bringing real freedom to your Enterprise Cloud 🚀

Virtual Machines



Application Containers



Kubernetes Clusters



Virtual Infrastructure Management, Cloud Management Provisioning & Cloud Federation



CORE DATA CENTER



PUBLIC CLOUD



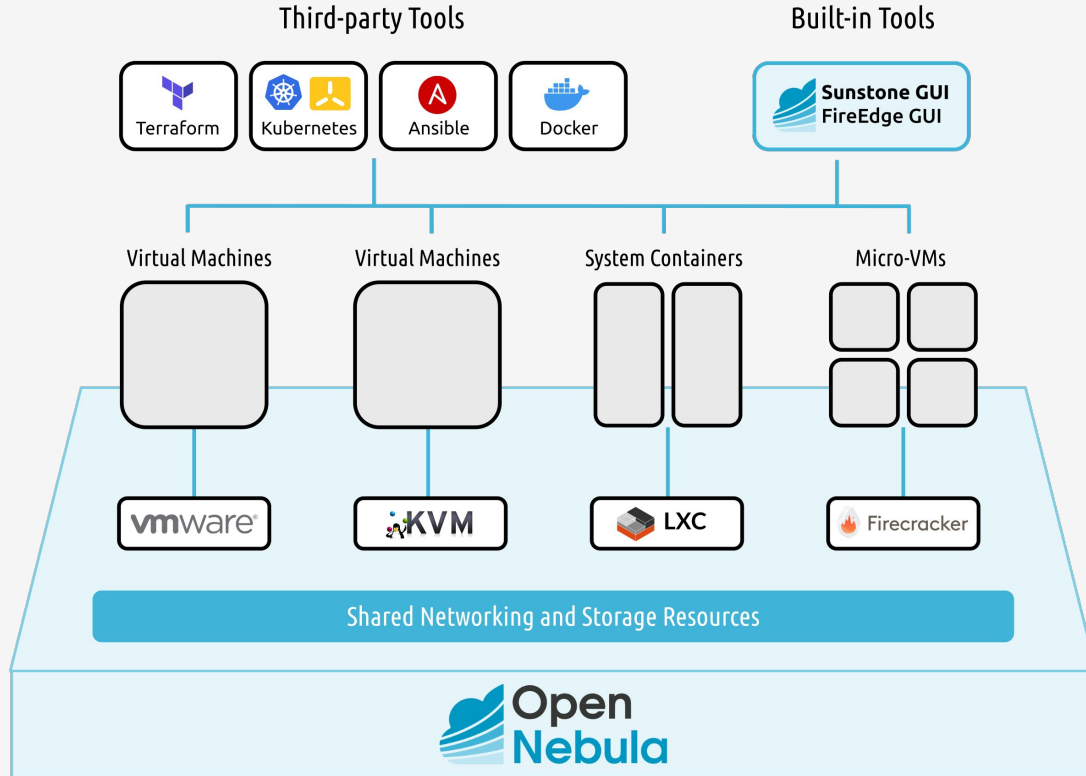
EDGE

- ✓ Avoids “Vendor Lock-in”
- ✓ Minimizes complexity

- ✓ Reduces resource consumption
- ✓ Slashes operating costs

Building Your Cloud

A comprehensive solution offering flexibility, scalability, simplicity, and vendor independence

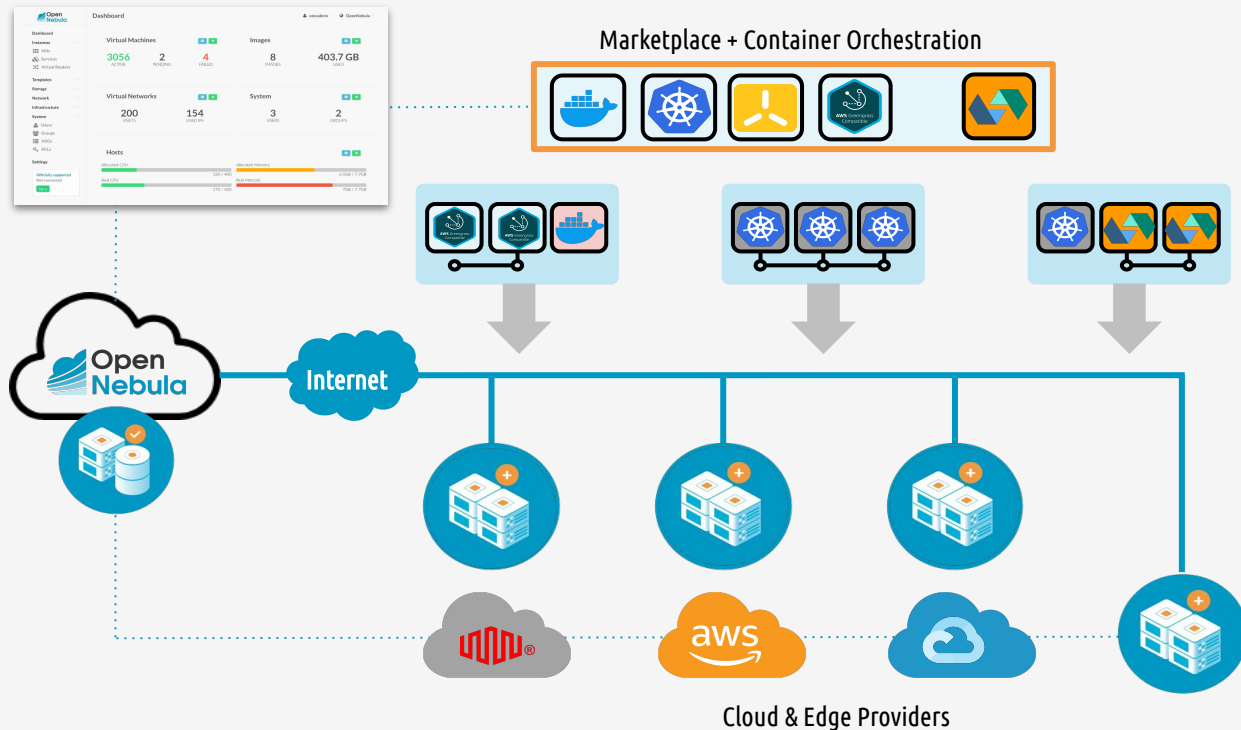


- ✓ Multi-Tenancy
- ✓ Self-Service
- ✓ Elasticity
- ✓ Multi-Tier Apps
- ✓ High Availability
- ✓ Federation
- ✓ Provisioning
- ✓ Multi-Cloud
- ✓ VMs + Containers

Expanding to the Multi-Cloud

Single control panel to avoid vendor lock-in, reduce costs, and ensure workload portability

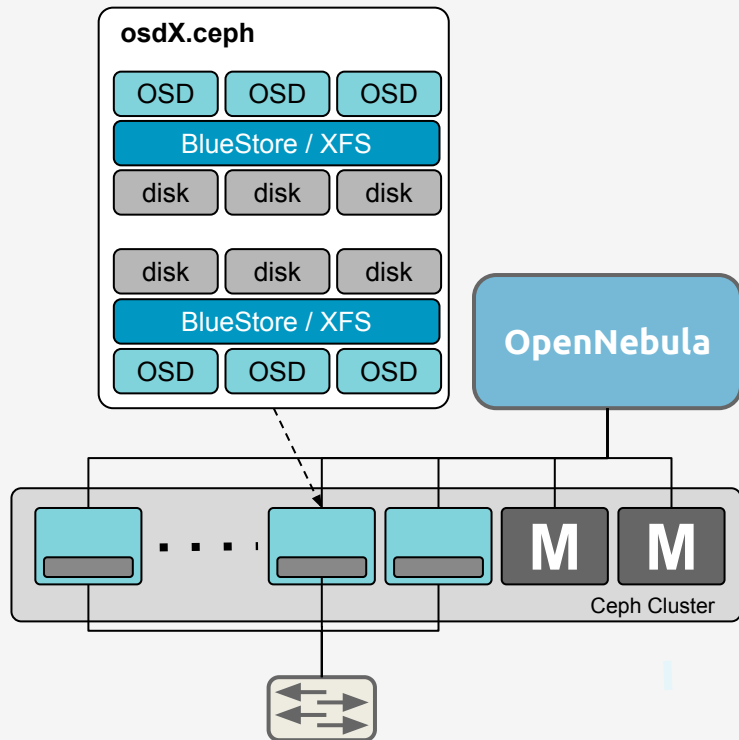
- 3 Any Application**
VMs, multi-VM services, containers, and k8s clusters on a shared environment
- 2 Uniform Management**
Homogeneous layer for user and workload management and operation
- 1 Any Infrastructure**
Automatic provision of resources from cloud providers



<https://opennebula.io/multi-cloud/>

Ceph as Storage Solution

Hyper-converged Infrastructure Architecture Based on Ceph Open Source Storage Solution



Ceph at OpenNebula

- Ceph based Datastores: simple configuration & multiple Ceph clusters / pools.
- Shared storage with consistency & replication
- Features: Thin provisioning, snapshot, clone, compression, encryption...

Ceph at the Edge

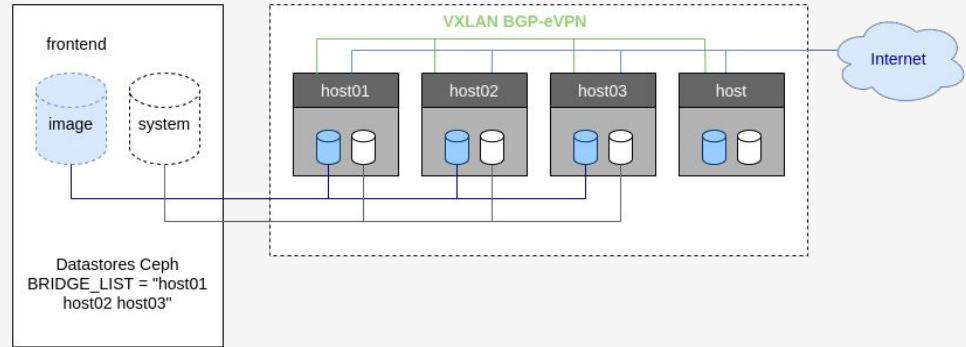
- Small number of nodes (~3)
- Dedicated to store VM disk images
- Low storage requirements & density of OSD
- Run in a HCI configuration

Ceph Storage Based HCI Architecture

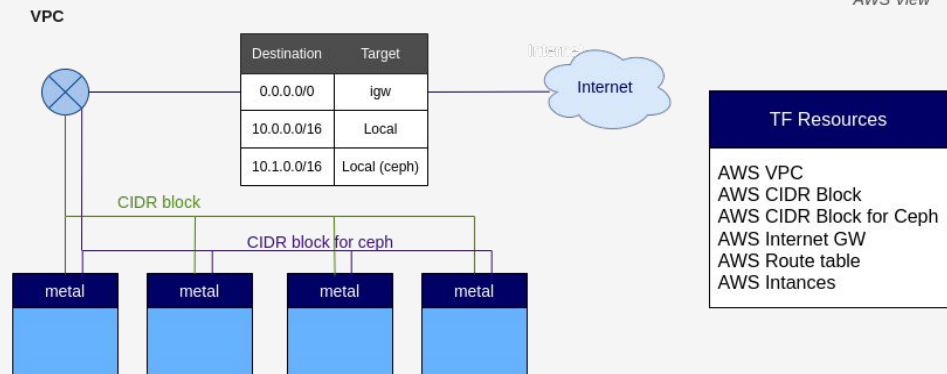
Hyper-converged Infrastructure Architecture Based on Ceph Open Source Storage Solution

The HCI cluster consists of three different type of servers:

- **Full nodes**, run Ceph OSD and Monitor daemons as well as KVM. In order to get a fault tolerant cluster a number of 3 nodes of this type is recommended.
- **OSD nodes**, run Ceph OSD daemon.
- **Hypervisor-only nodes**, run the KVM and the Ceph client tools.



OpenNebula View
AWS View



Demo Time! 🚀

Demo Environment

Deploying a Cloud-Edge Ceph Cluster

4 Deploy Applications

Instantiate new VMs in the remote cloud/edge locations.

3 Access Marketplace

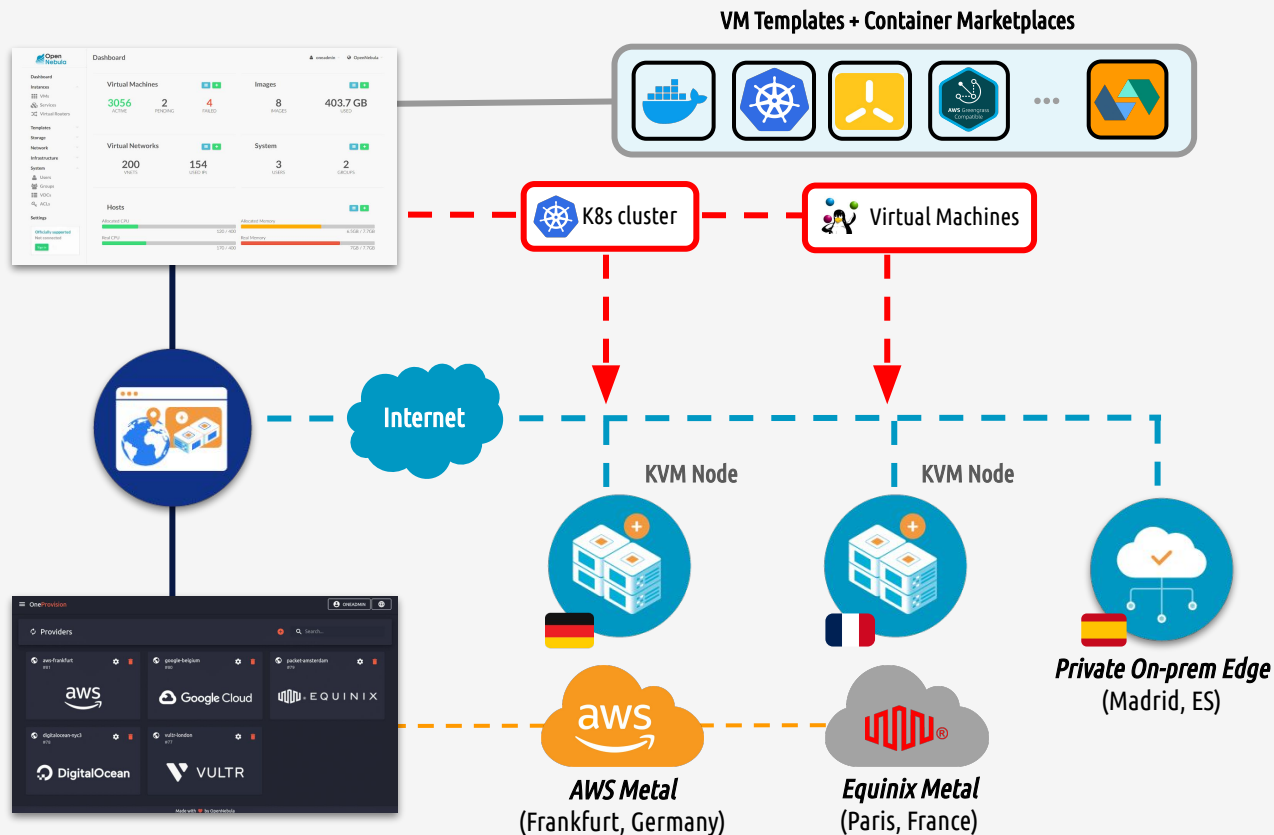
Download the VM templates or Docker images for the services to deploy.

2 Automatic provision

Provision OpenNebula Edge Ceph Clusters on the bare-metal locations of choice.

1 Provider Catalog

Add **AWS** and **Equinix Metal** as new public cloud/edge infra providers in the US.



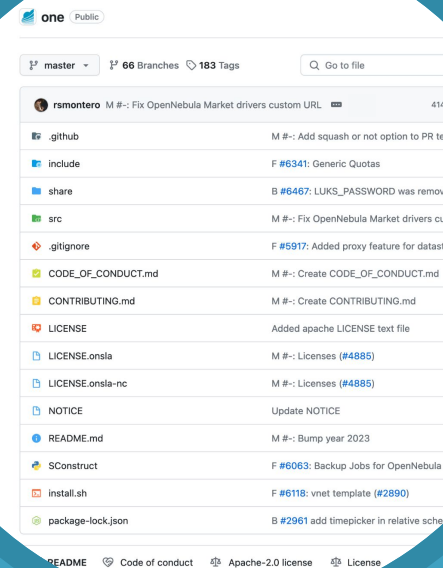
Closing Thoughts 🖋️


Next Steps & Challenges

Contribute to the next generation of Cloud-Edge Computing! 🚀

Ceph & OpenNebula Roadmap

- Support for Ceph namespaces
- Support for incremental backup in Ceph
- Adopt Ceph Image live-migration (e.g. edge import..)
- Improve HCI configurations
- Integrate with the new [one-deploy](#) project






Contribute to the repo on  [Github!](#)
OpenNebula/one

OpenNebula Community Forum

Join the OpenNebula Community where Exploration and Collaboration Unite! 🚀



 forum.opennebula.io

Sign Up Log In  

Welcome to the OpenNebula Community Forum! 🚀 ✕

This is the **Community Forum** of the **OpenNebula Project**, the open source enterprise-ready platform for building elastic Private Clouds and managing Data Center virtualization. This is the best place to join general discussions about the project, keep an eye on new features and public announcements, and ask for **community support**. For general information about OpenNebula, please visit www.opennebula.io

all categories ▾ all tags ▾ **Categories** Latest Top

Category	Topics	Latest
Development Any aspect related to development and integration of OpenNebula and its add-ons and ecosystem:	363	 Sinatra doesn't know this ditty trying to access OneFlow 4 1h ■ Development
Community Support This is the place for OpenNebula users to seek and provide support on a best-effort basis. In addition to the discussions here, there are other ways to get in touch: ■ Network ■ General ■ Upgrade ■ GUI - Sunstone ■ CLI / API ■ VM Configuration / Contextualization ■ Storage ■ HA / Federation ■ vCenter	4.1k	<input data-bbox="1045 874 1107 932" type="checkbox"/> Change user password in Fireedge 1 1h ■ Community Support
		 Not able to attach Network as an alias to existing private network attached to Virtual Machine 0 5h ■ Development



SovereignEDGE.EU

COGNIT

A **Cognitive** Serverless Framework for the **Cloud-Edge Continuum**

COGNIT.SovereignEdge.EU



A project coordinated by **OpenNebula Systems** and funded by the European Union's **Horizon Europe** Research and Innovation programme, under Grant Agreement 101092711 – SovereignEdge.Cognit (2023-2025)



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**Thank you very much
for your attention!**