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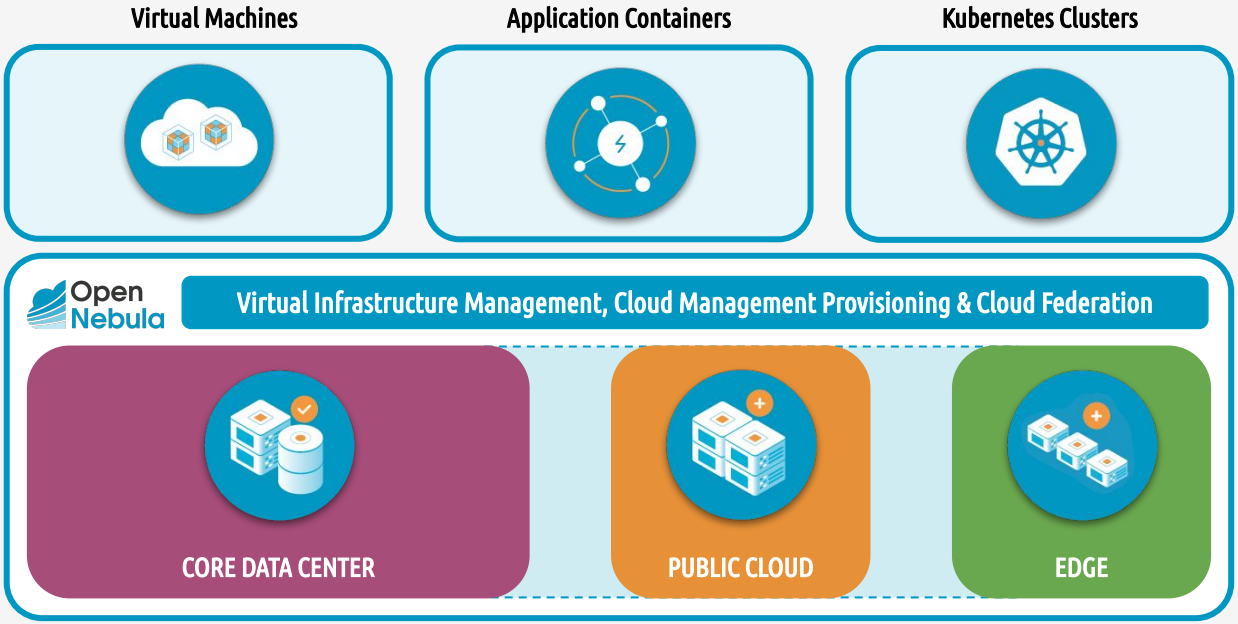
Deploying Kubernetes across Hybrid and Multi-Cloud Environments Using OpenNebula

Dr Marco Mancini
Senior Cloud Solutions Architect

What is OpenNebula?

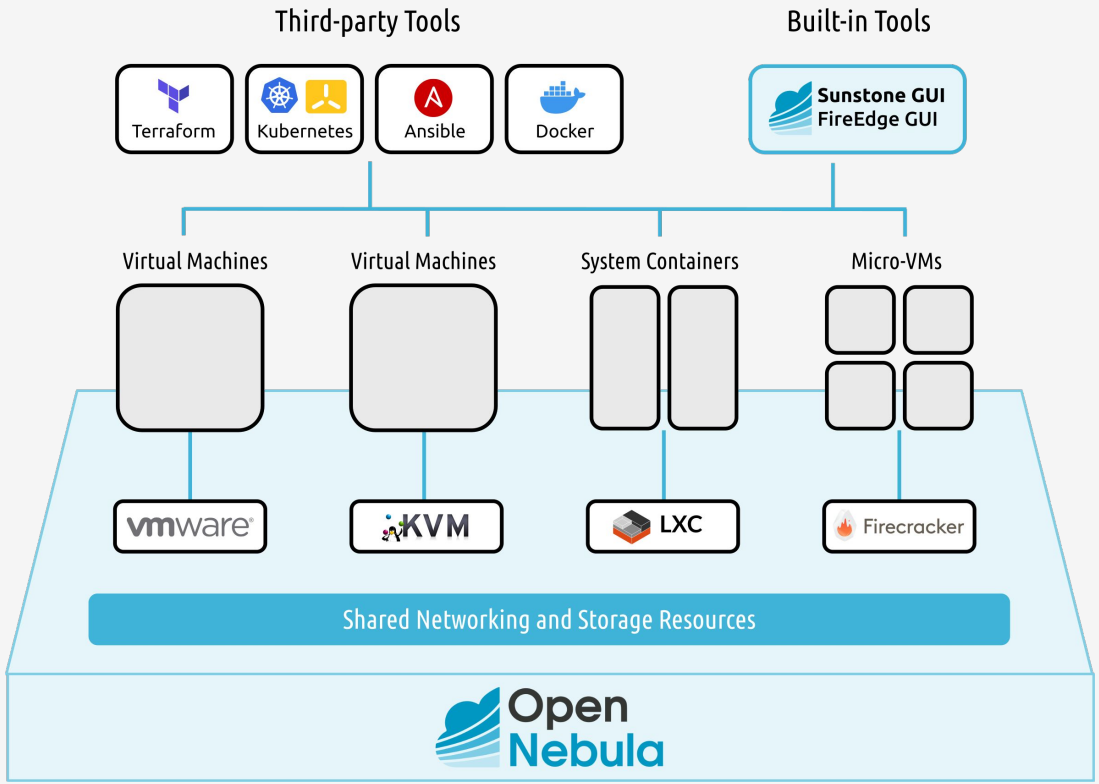
The open source **Cloud & Edge Computing Platform** bringing real freedom to your **Enterprise Cloud** 🚀



- ✓ Avoids “Vendor Lock-in”
- ✓ Minimizes complexity
- ✓ Reduces resource consumption
- ✓ Slashes operating costs

Building Your Enterprise 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**

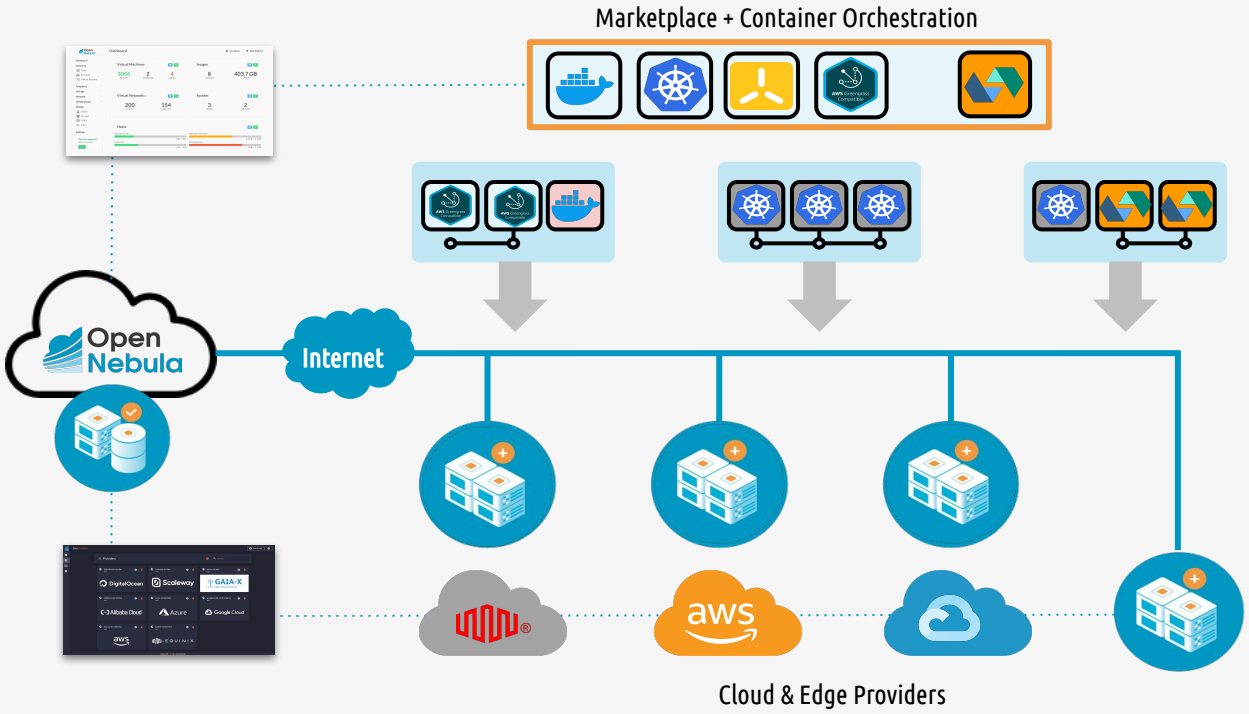
VMs, multi-VM services, **containers**, and **k8s clusters** on a shared environment

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/

Kubernetes on OpenNebula

Deployment, management and scaling of Kubernetes clusters on OpenNebula

Simplified Lifecycle Management
Offer abstraction from physical hardware, with easy deployment, resize and overprovision if necessary

Central Management for All Workloads
Encompass k8s clusters with other virtualized workloads using a single control layer to reduce complexity, consumption and operating costs

Kubernetes as a Service
Build a multi-tenant self-service environment for the execution of k8s clusters on a shared physical infrastructure

Enhanced Security
Enhance security thanks to the additional layer provided by hardware virtualization to isolate resources pools on the same host

Fast Deployment on any Infrastructure
Automatically deploy and manage multiple k8s clusters across on-premises, edge and cloud locations to enable large-scale container orchestration

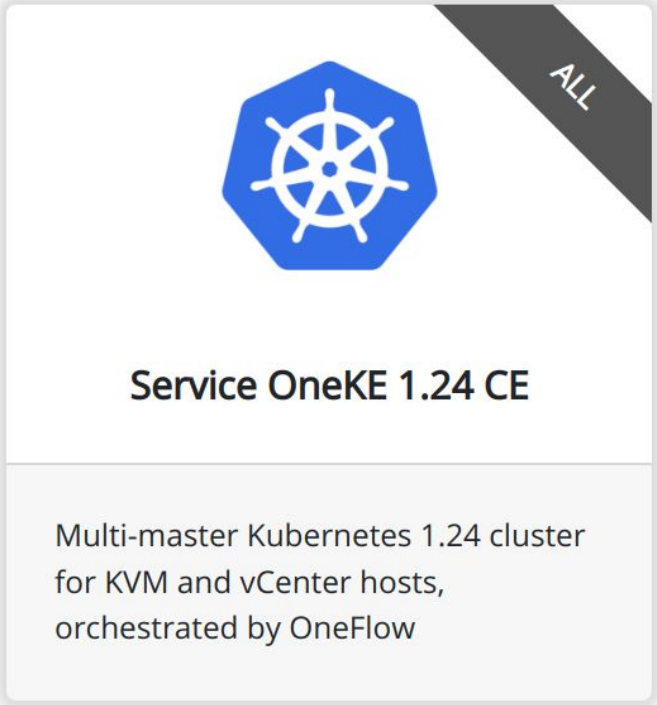
No Provider Lock-in
Deploy k8s anywhere, with the configuration you want and following the same process

OneKE Appliance

A minimal out of the box hyperconverged Kubernetes platform in OpenNebula 🚀

Features:

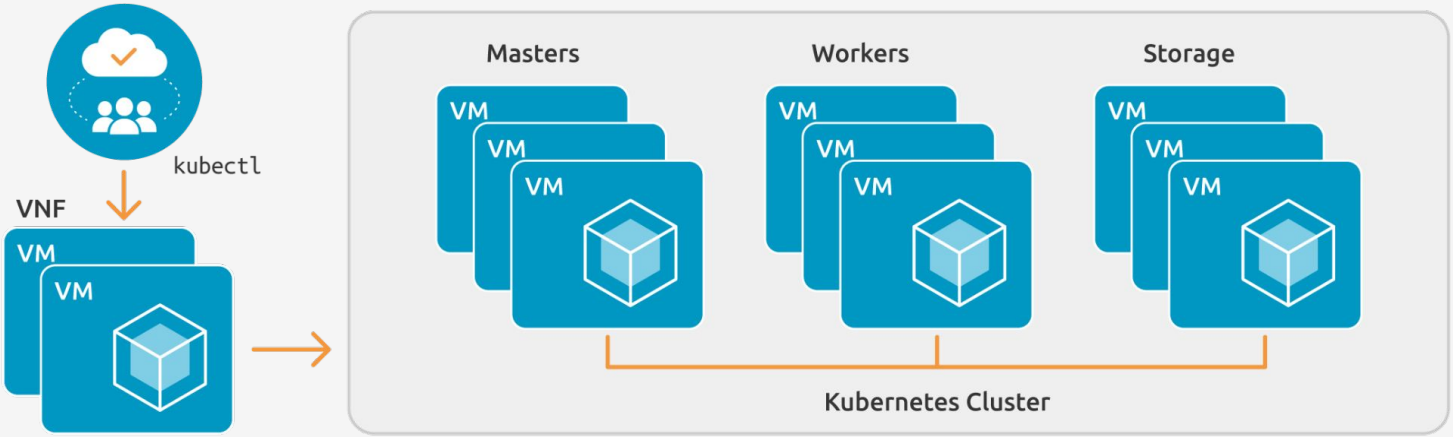
- ❑ Kubernetes version 1.24
- ❑ Based on RKE2
- ❑ Multi-master ready
- ❑ Canal CNI networking
- ❑ CNCF Longhorn distributed storage
- ❑ Traefik Ingress Controller
- ❑ MetalLB load balancer



OneKE Service Components

OneFlow Service Components

VNF: Load Balancer for Control-Plane
Master: Control-Plane nodes
Worker: Nodes to run your workloads on
Storage: Dedicated storage nodes for Persistent Volumes



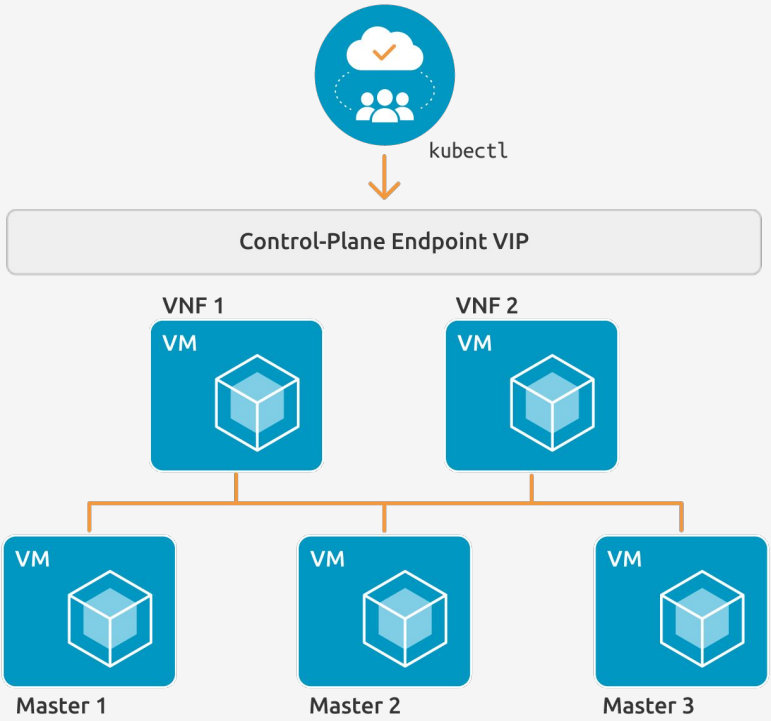
High Available Kubernetes Cluster

High Availability Multi-Master

VNF provides a **load-balancer for HA Multi-Master** control-plane

VNF is based on keepalived and can be scaled up to run on multiple VMs

Control-Plane Endpoint VIP is provided by *ONEAPP_VNF_LB0_IP* context parameter



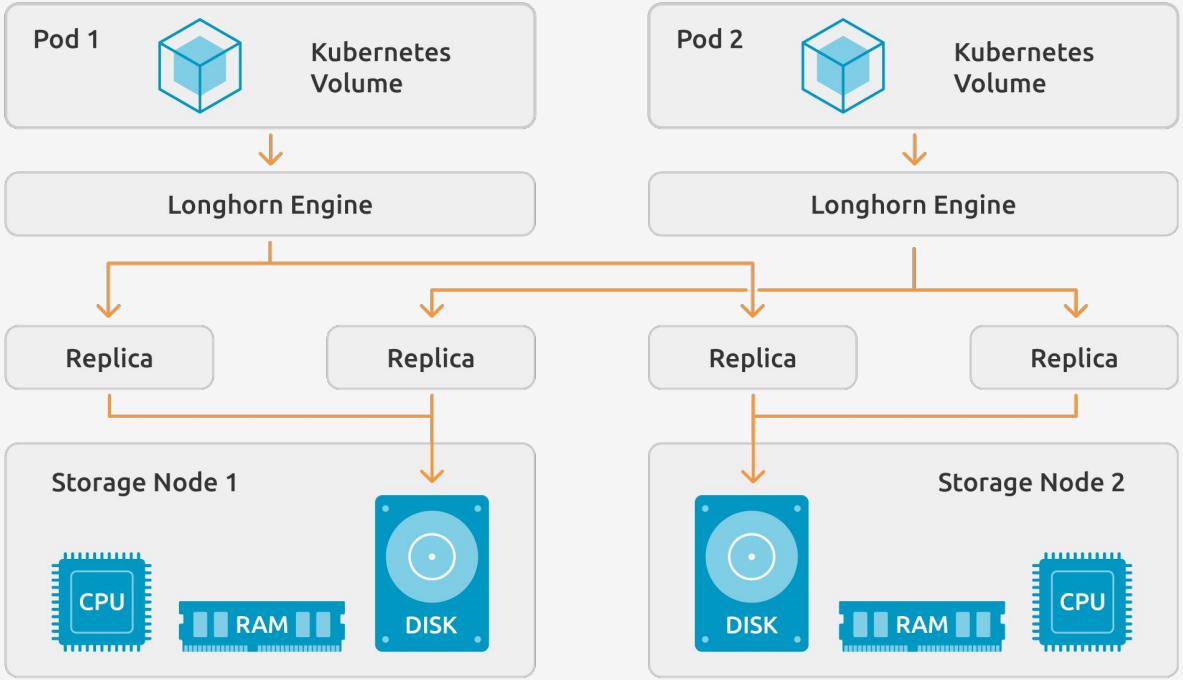
Persistent Volumes

Longhorn-based solution for your Persistent Volume Needs

Persistent volume data are hold on Storage Nodes

Multiple Storage Nodes can be instantiated for Replicas

Deployment of regular pods onto the Storage nodes is prevented (tainted with *NoSchedule*)



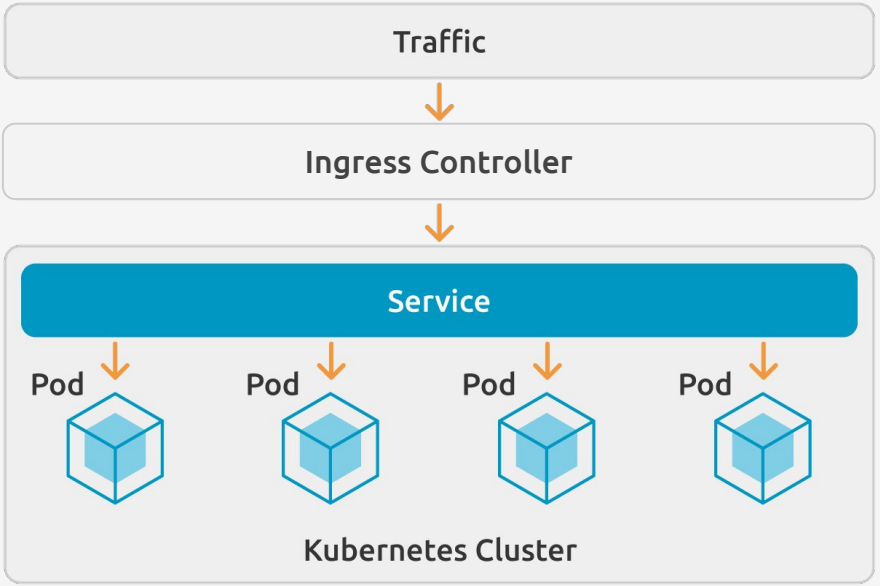
Ingress Controller Service

Exposing Kubernetes Pods and Services through Traefik

Ingress Controller based on **Traefik** in order to expose HTTP and HTTPS routes from outside the K8s cluster

Traffic routing is controlled by rules defined on the Ingress resource. Traefik is exposed on a NodePort type of the Kubernetes Service.

An Ingress does not expose arbitrary ports or protocols; exposing services other than HTTP and HTTPS to the internet typically uses a LoadBalancer service.



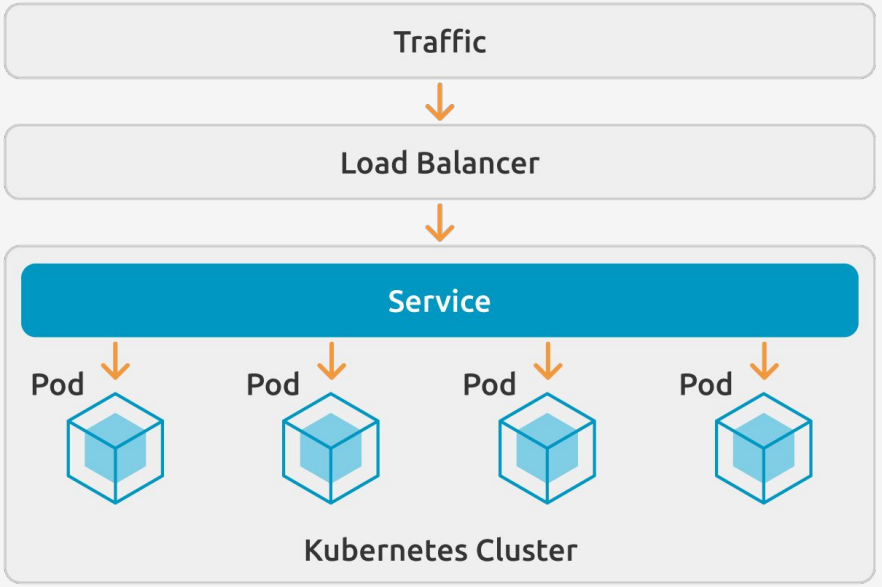
Load Balancer Service

Exposing Kubernetes Pods and Services through MetalLB

MetalLB allows pods or deployments to be exposed as a service of the type LoadBalancer.

MetalLB by default is configured as ARP Layer2 LoadBalancer.

MetalLB supports also BGP Layer3 loadbalancing. The user can provide the proper configuration via the contextualization parameter *ONEAPP_K8S_LOADBALANCER_CONFIG*



Today's Demo

A View From the Eagle's Eye

1 Create Multi-Cloud

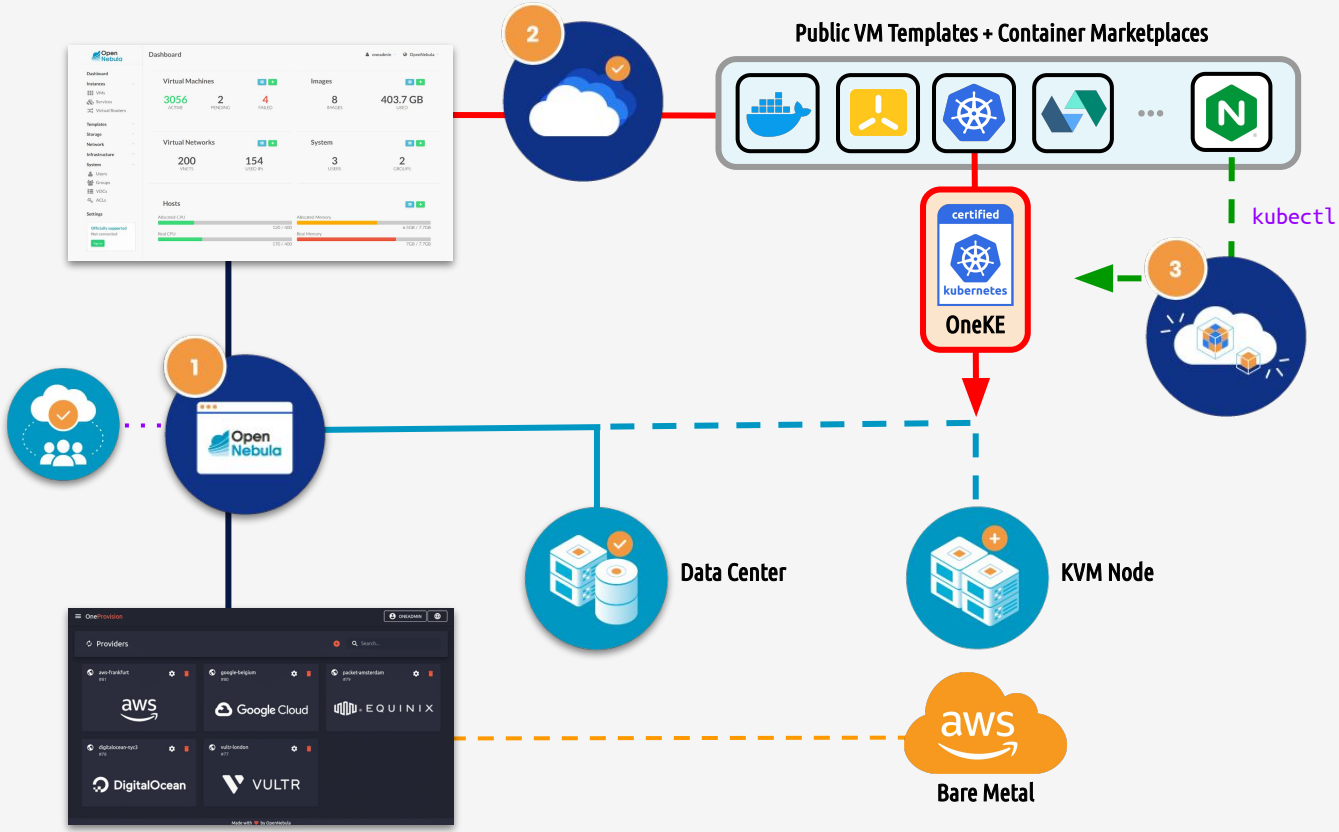
Use OpenNebula to expand your on-premise infrastructure with **bare-metal resources** from public cloud/edge providers.

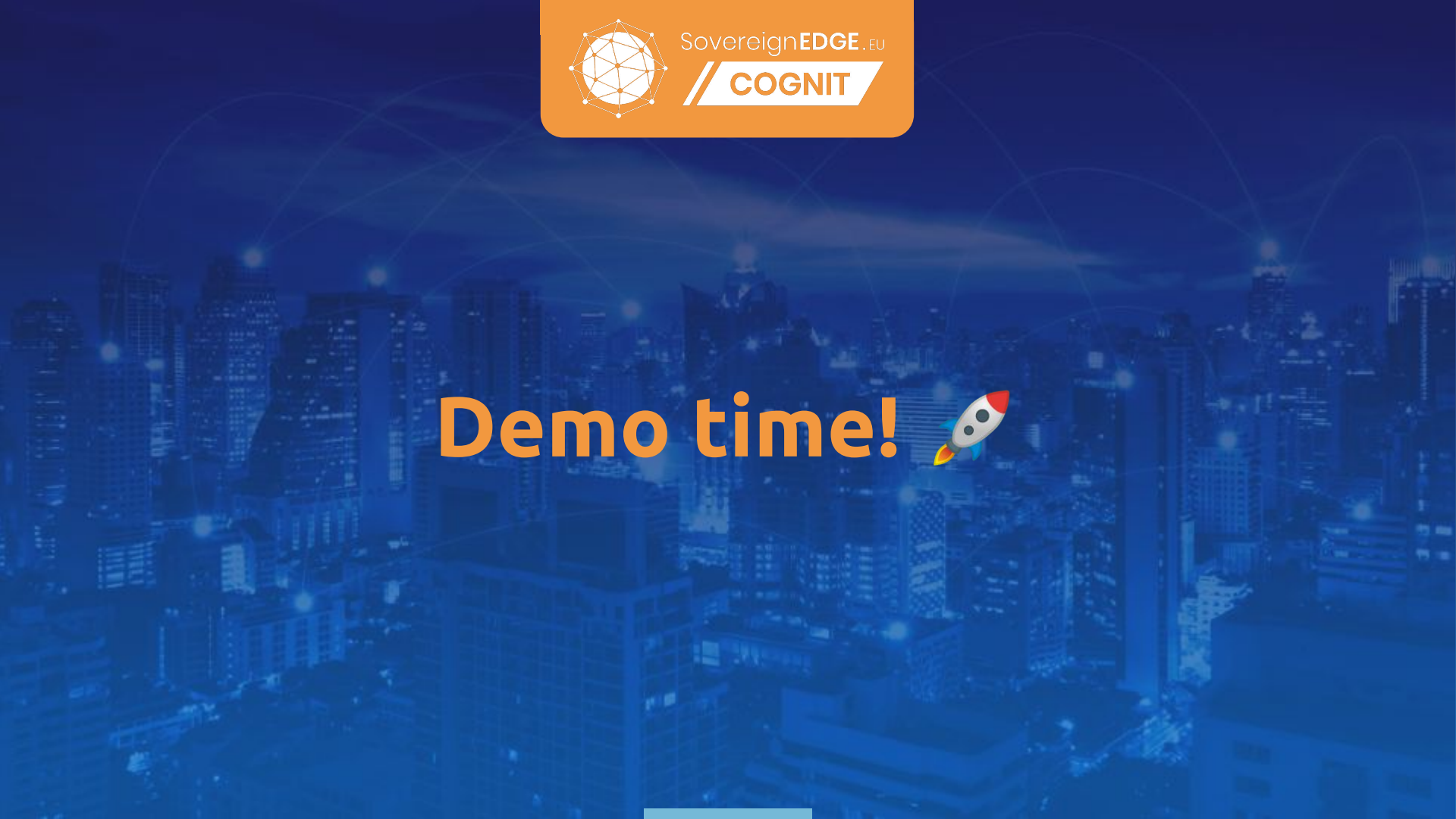
2 Deploy K8s Cluster

Import the **OneKE Appliance** from the OpenNebula Public Marketplace and instantiate a Kubernetes cluster.

3 Launch Application

Deploy an application on the new Kubernetes cluster using **kubectl** and the official image from Docker Hub.

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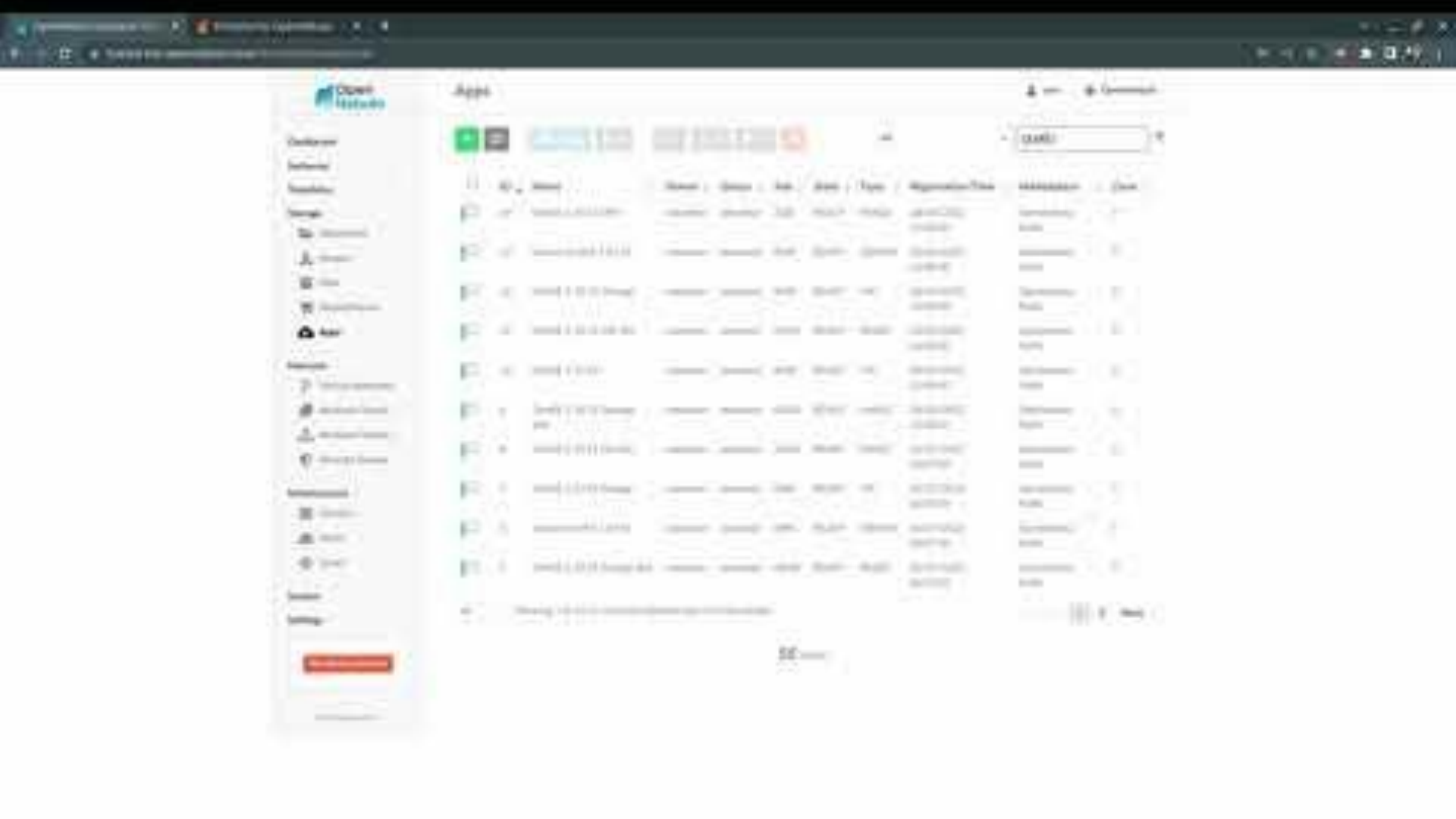
Demo time!



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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)