Deploying Kubernetes across Hybrid and Multi-Cloud Environments Using OpenNebula
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 **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

1. **Any Infrastructure**
   - Automatic provision of resources from cloud providers

2. **Uniform Management**
   - Homogeneous layer for user and workload management and operation

3. **Any Application**
   - VMs, multi-VM services, containers, and k8s clusters on a shared environment

[https://opennebula.io/multi-cloud/](https://opennebula.io/multi-cloud/)
**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
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 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.
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.
Demo time!
A Cognitive Serverless Framework for the Cloud-Edge Continuum

COGNIT.SovereignEdge.EU

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