A Highly Distributed Cloud Architecture for Telco NFV Deployments

Madalin Neag

Product Manager 5G & Edge

Agenda

- Introducing OpenNebula
- Virtualizing Infrastructure for the Most Complex Telecom Use Cases
- Features Validation
- Backup Slides

Introducing OpenNebula

OpenNebula Systems

Developing & Supporting OpenNebula since 2010

- European open source technology vendor.
- HQ in Madrid (Spain), with offices in Brussels (BE), Brno (CZ) & USA.
- The only European open source IaaS solution, born in 2008.
- A success story emerged from EU innovation programs.
- Leader of several innovation projects in Cognitive Cloud and Advanced 5G.
- Playing a key role at the NexusForum CSA.
- Chairing the EU Cloud Alliance and the IPCEI-CIS Industry Facilitation Group.

LINUX FOUNDATION SILVER MEMBER

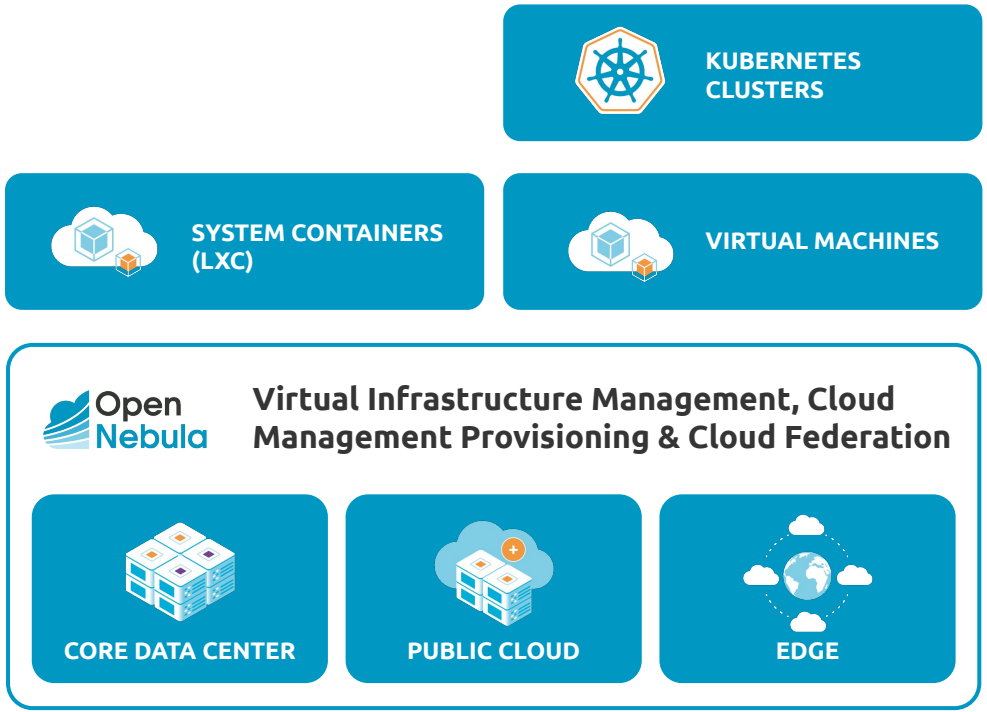
CLOUD NATIVE COMPUTING FOUNDATION SILVER MEMBER

LF EDGE GENERAL MEMBER

Sylva

What is OpenNebula?

The Open Source Cloud & Edge Computing Platform



- ✓ **Virtualization layer**
  - Simplicity and light profile
  - Extensible architecture
  - Multi-tenancy & Multi-VM
  - DevOps friendly
- ✓ **OneKE (Kubernetes)**
  - Virtual appliances CaaS
  - Different “add-ons”
- ✓ **Cloud-Edge Continuum Apps**

Enterprise Cloud OpenNebula Benefits

Simplicity and Agility of Public Cloud + Performance and Security of Private Cloud

Power of Simplicity
A single control panel that unifies management across the hybrid multi-cloud continuum

Lightweight and Easy to Maintain
Single enterprise-ready product, with small footprint, and a one-stop long-term commercial support

Elastic and Fully Automated
Automated operations with deployment of clusters on-prem and on-cloud in < 5 minutes

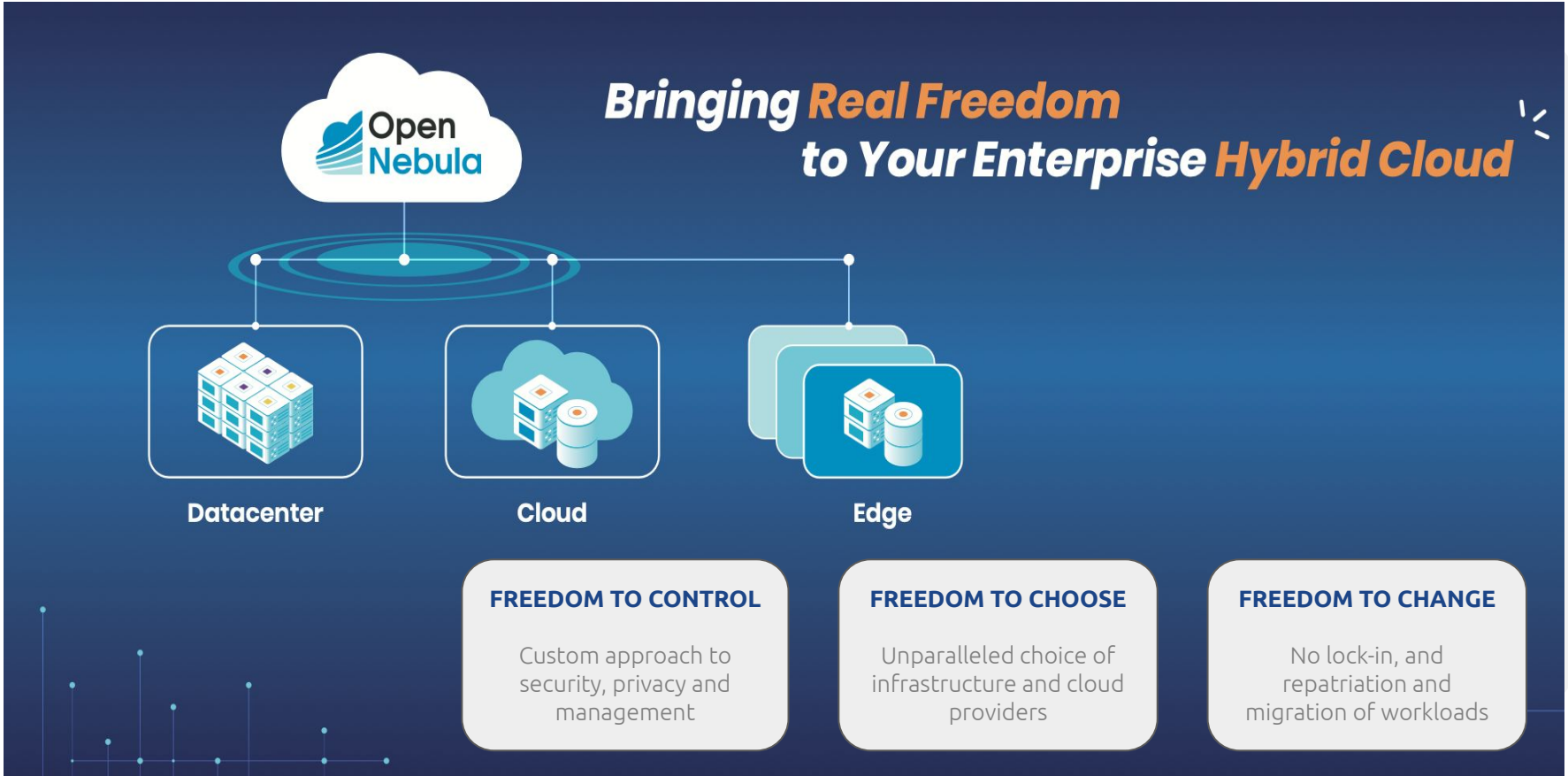
Vendor Neutral Flexibility
Infrastructure agnostic to build an enterprise cloud that meets your needs on-prem and on-cloud

Proven and Scalable
Many large scale production deployments with thousands of distributed nodes

Cost-effective
In 10-node cloud, reduce TCO by up to 75% compared to VMware and Red Hat OpenStack

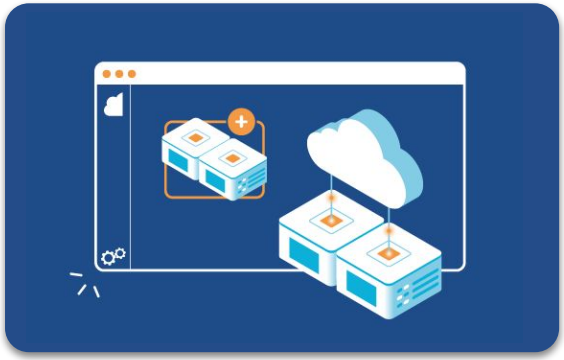
Your Cloud Your Rules

Our Mission is to Bring Real Freedom to your Enterprise Cloud 🚀



Enterprise Hybrid OpenNebula Features

OpenNebula Solves the Toughest Cloud Challenges



Any Application

Deploy, manage and provision Kubernetes and Virtual Machines

Any Infrastructure

Compute, storage and networking are virtualized and driven by software

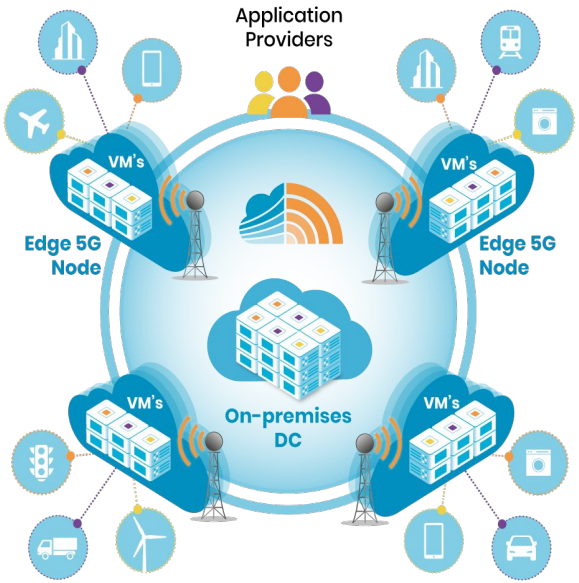
Any Cloud

From on-premises and hybrid cloud to the multi-cloud edge

Virtualizing Infrastructure for the Most Complex Telecom Use Cases

OpenNebula Top Priorities

"Intelligence and Automation for the Operation of Distributed Edge Systems on B5G Infrastructures"



ONEedge5G

Satisfying the demand for open European tech for B5G Telco Cloud

Integrating the functionality of B5G to improve the cloud-continuum

Making use of open solutions to manage the deployment of private B5G

Expanding the cloud-edge continuum through new B5G infrastructures

Facilitating the distributed management of the cloud-edge continuum for businesses and users

Creating an ecosystem of research and innovation in B5G for next generation cloud-edge

Project Coordinator: OpenNebula Systems | More Information: ONEedge5G.EU

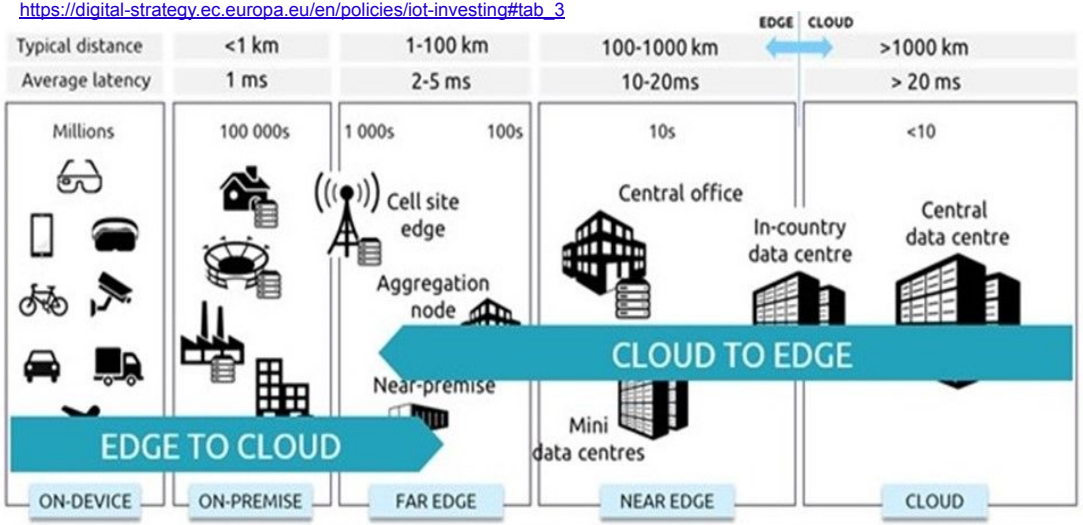
ONEedge5G (TSI-064200-2023-1) is supported by the Spanish Ministry for Digital Transformation and Civil Service through the UNICO I+D 6G Program, co-funded by the European Union – NextGenerationEU through the Recovery and Resilience Facility (RRF).

UNICO I+D 6G | Gobierno de España, Ministerio para la Transformación Digital y de la Función Pública | Plan de Recuperación, Transformación y Resiliencia | Financiado por la Unión Europea NextGenerationEU

OpenNebula Top Priorities

Enabling EU's target to have 10,000 climate-neutral highly secure edge nodes

https://digital-strategy.ec.europa.eu/en/policies/iot-investing#tab_3



https://sovereignedge.eu/

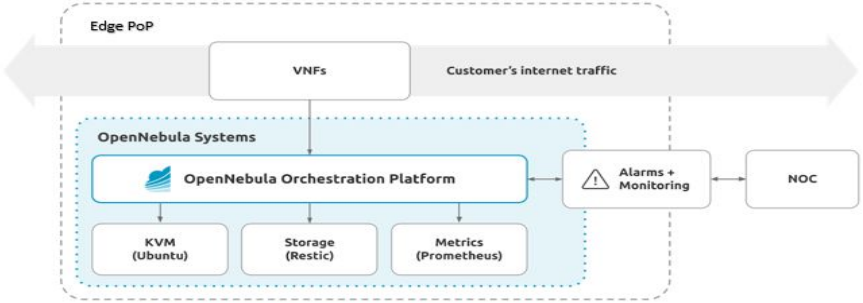
- **Multi-country large-scale projects**
  - Data infrastructure
  - B5G communications
  - High-performance computing
  - AI Farms
  - Public administration
  - Digital innovation hubs
- **75% of cloud uptake by EU enterprises in 2030**
- **Support for European SMEs willing to explore innovative business models**

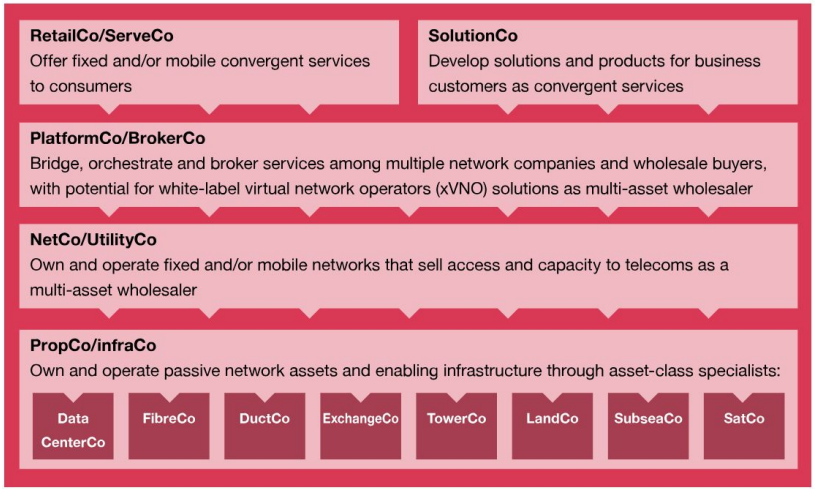
Highly Distributed Cloud Architecture

An exercise with one of the global services providers

https://globalsolutions.telefonica.com/en/coverage/

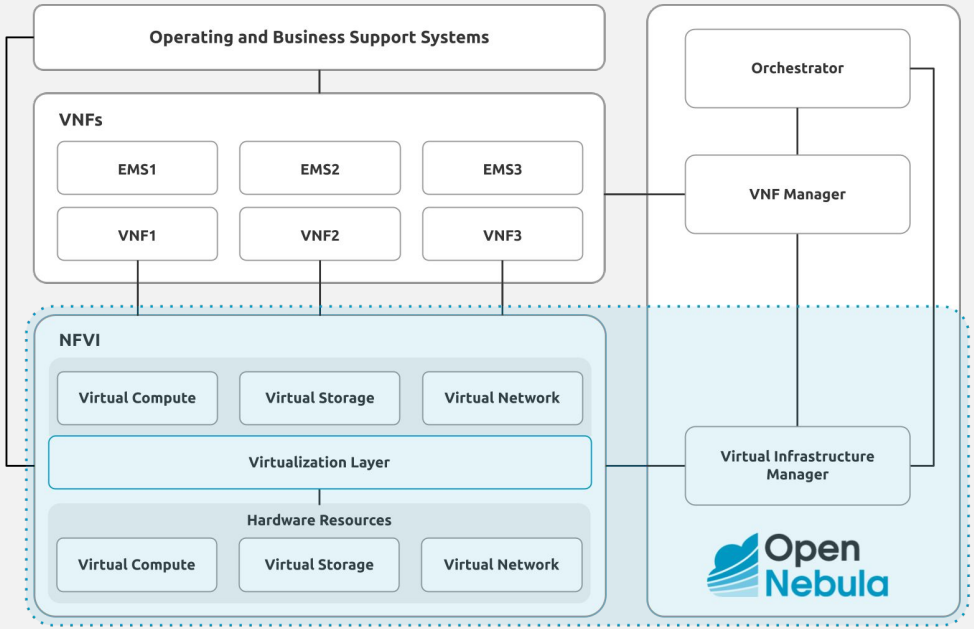
- It delivers world-class services and platforms to wholesalers, carriers, fixed and mobile operators, OTTs, service providers, aggregators and multinational companies
- Target architecture should support the most challenging VM-based workloads such as firewalls, load balancers, routers and other non-generic compute services





OpenNebula as VIM

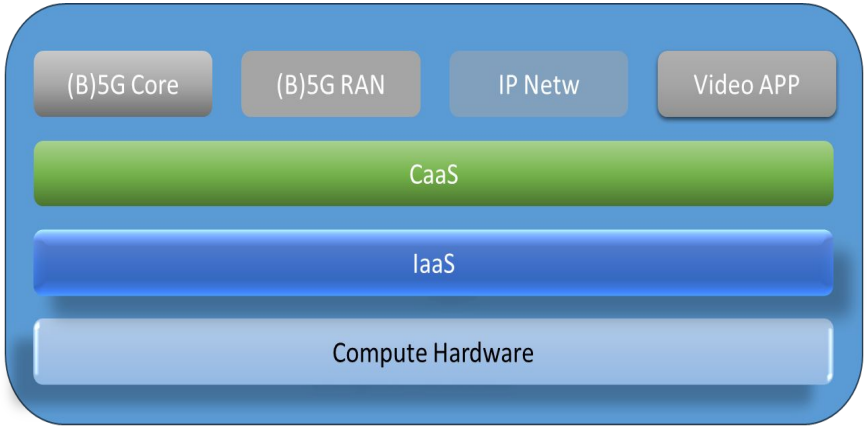
Efficiently using and managing the physical assets

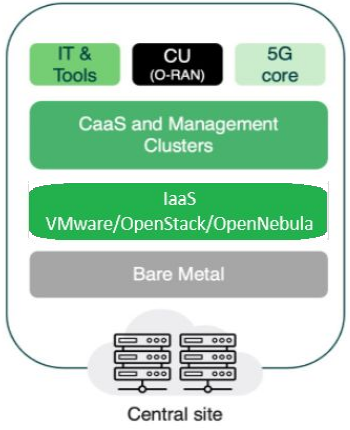


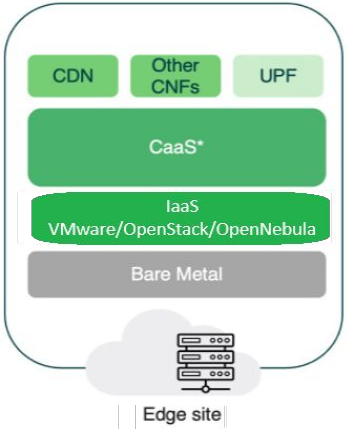
- VIM Functionalities
  - Robust, flexible and widely used
  - Designed for heterogeneous infrastructure
  - Software image management
  - Virtualized resources allocation and management
  - Infrastructure resource fault and performance management
  - NFV acceleration capabilities management
  - Orchestration of usage and provisioning of the virtual infrastructure
- NBI towards VNFM and NFVO
- SBI to the NFVI's elements
- WAN Infrastructure Manager

OpenNebula from VIM to IaaS

OpenNebula Systems is a general sponsor of LFE Sylva



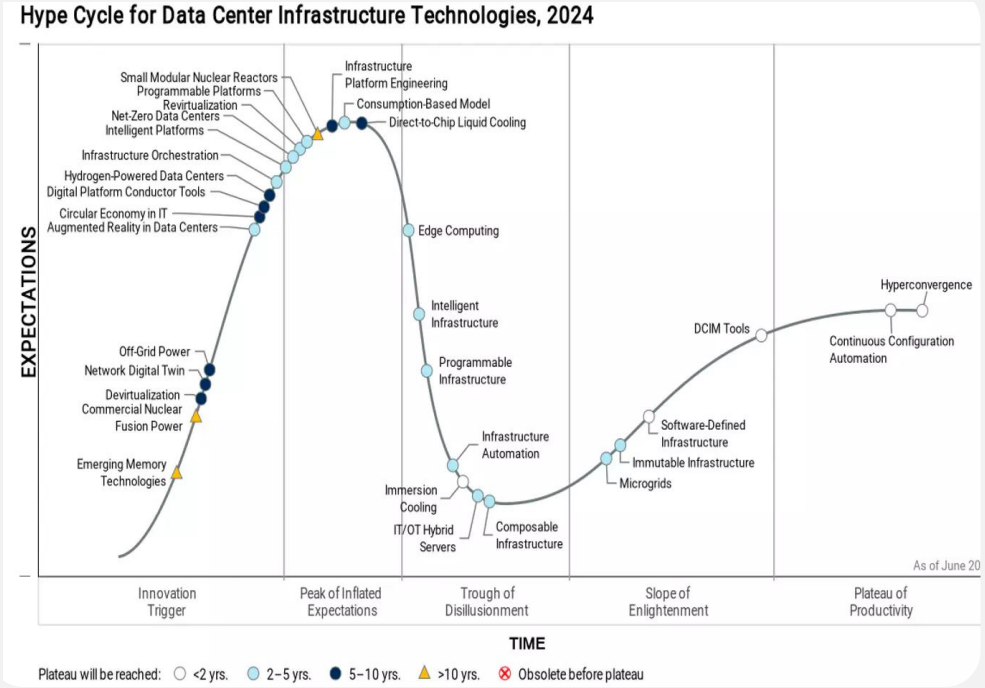




- **Unified IaaS**
  - support the deployment of 5G networks over cloud-edge continuum
  - easily and efficiently scale the networking, computing capacity, servers and/or storage resources to their cloud tailored for every specific use case
  - bridge the cloud-edge continuum to the Container-as-a-Service (CaaS) platform
  - deliver optimal performance for the services built on top
- **OneKE, as CaaS,** is offered to the telecom actors, benefiting from the control and orchestration done via CAPI

OpenNebula facilitating the re-virtualization

A concept at its peak, being applicable to 5-20% of companies



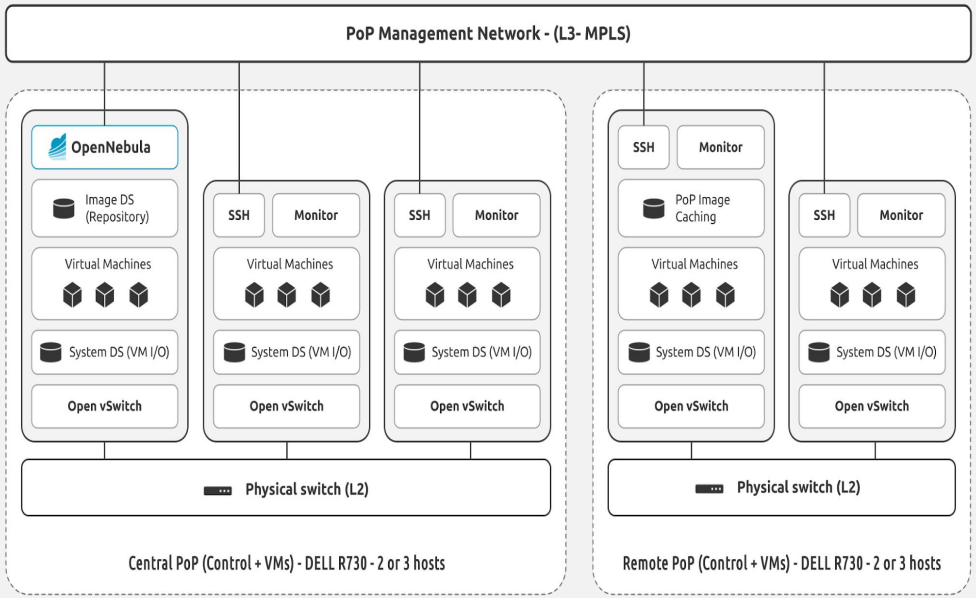
- Re-virtualization
  - virtual-to-virtual migration
  - to address a viability or commercial risk
- OpenNebula's approach
  - Unified Management through a single control pane.
  - Easy migration from VMware (including dedicated features and workflows)
  - Enhanced security using open-source solutions for both VMs and containers.
  - Scalability, helping to adapt VM/container workloads to meet dynamic network demands.
  - Coexistence and seamless integration with other platforms.
- Devirtualization

https://www.gartner.com/en/documents/554059

Features Validation

Testing configuration

Re-virtualize and expand the e2e architecture



- Focus on the functionality of VNFs
- Avoid putting too much effort into the underlying layer
- Coexistence of VM and containers
- Multi-tenancy in resource-constrained environments
- Main components
  - PoPs
  - Central PoP included the OpenNebula control daemons
  - Storage
  - Networking
  - Management plane
  - APIs and WebGUI
- Long Fat Networks (100-1000 Mbps, latencies over 200 ms)

VIM features

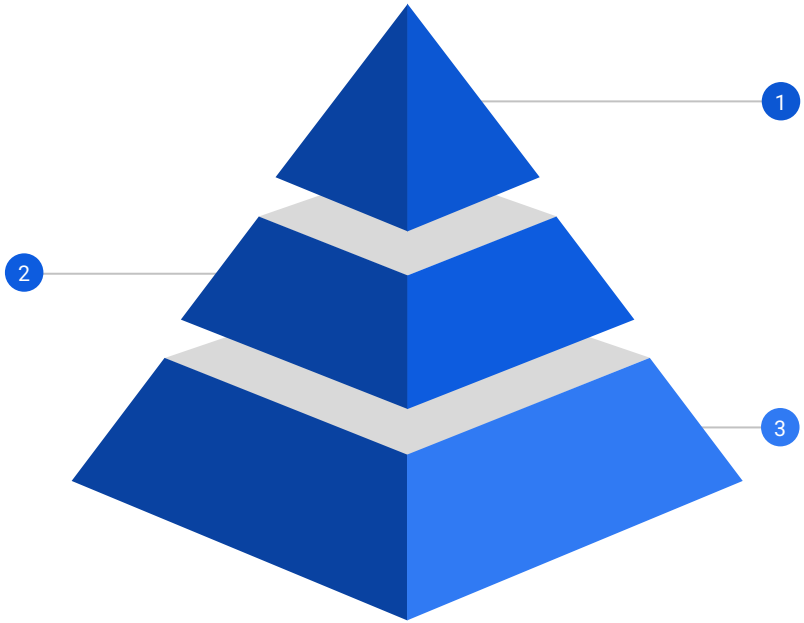
Tailored test scenario to showcase OpenNebula's advantages

Networking and EPA Features

OVS-DPDK
SR-IOV
PCI-Passthrough
NUMA Awareness
IO-based NUMA Scheduling and NUMA IO Affinity
CPU and NUMA Pinning
CPU Threading Policies
Hugepages Support

VIM Advanced Features

Tenant Management
Image Datastore exposure
Automatic Host Placement
Manual Host Placement
Hosts Classification and Organization
Snapshotting
Manual Initiation of VM Movement and Relocation
Infrastructure Usage/Consumption



VIM Basic Features

Host Aggregation
Capacity Planning and Optimal Resource Usage
Redundancy, Resiliency, Fault Tolerance and Recovery
Backup and Recovery
Long Fat Networks support
Capacity planning (30 API requests per second)
Authentication
Access Control Mechanism

- **Automatic on-demand** deployment of PoPs on bare-metal servers running KVM hypervisor
- Use **local storage,** DPDK and SR-IOV for **high performance**
- Central **multi-tenant, AI-driven** NOC management
- **Minimal hardware** infrastructure at NOC and PoPs
- Avoid lock-in, increase **flexibility** and **minimize costs**

ONEedge5G

Intelligence and Automation for the Operation of Distributed Edge Systems on 5G Advanced Infrastructures

Initiative funded by the Spanish *Ministerio para la Transformación Digital y de la Función Pública* through the **ONEedge5G Project: Intelligence and Automation for the Operation of Distributed Edge Systems on 5G Advanced Infrastructures** (TSI-064200-2023-1) and through the UNICO I+D 6G Program, co-funded by the European Union's NextGenerationEU instrument through the Recovery and Resilience Facility (RRF).

Funded by the European Union NextGenerationEU

Plan de Recuperación, Transformación y Resiliencia

GOBIERNO DE ESPAÑA · MINISTERIO PARA LA TRANSFORMACIÓN DIGITAL Y DE LA FUNCIÓN PÚBLICA

UNICO I+D 6G

OpenNebula.io/innovation/oneedge5g

Open Nebula

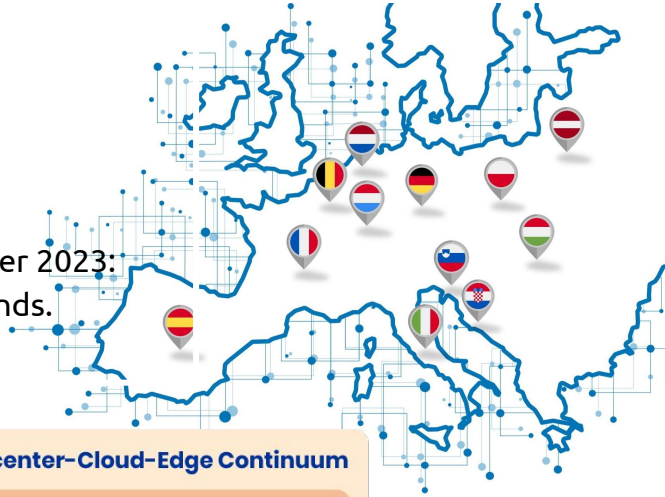
Thank you very much

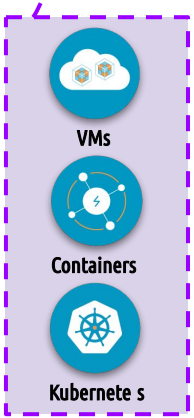
Backup slides

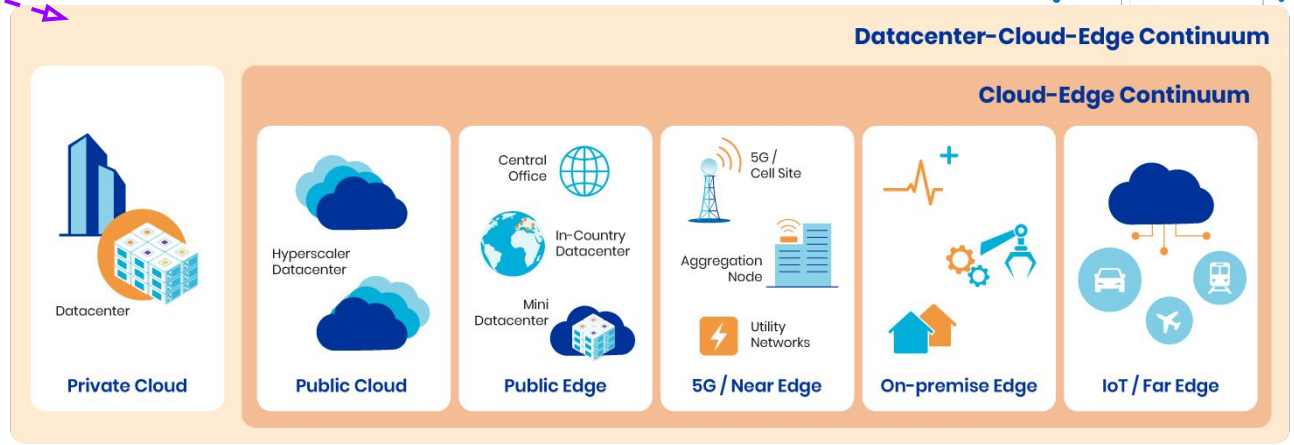
IPCEI-CIS

Fixing the EU Cloud Market

- IPCEI on Next Generation Cloud Infrastructure & Services
- Enable Multi-Provider Cloud-Edge Continuum
- Strengthening of EU digital industry
- Development of European Open-Source technologies
- The largest open source project in EU history!
  - Strategic co-investment programme approved by the EC in December 2023:
    - 1,200 million EUR in State Aid + 1,400 million EUR in private funds.
  - ~140 European companies from 12 Member States.

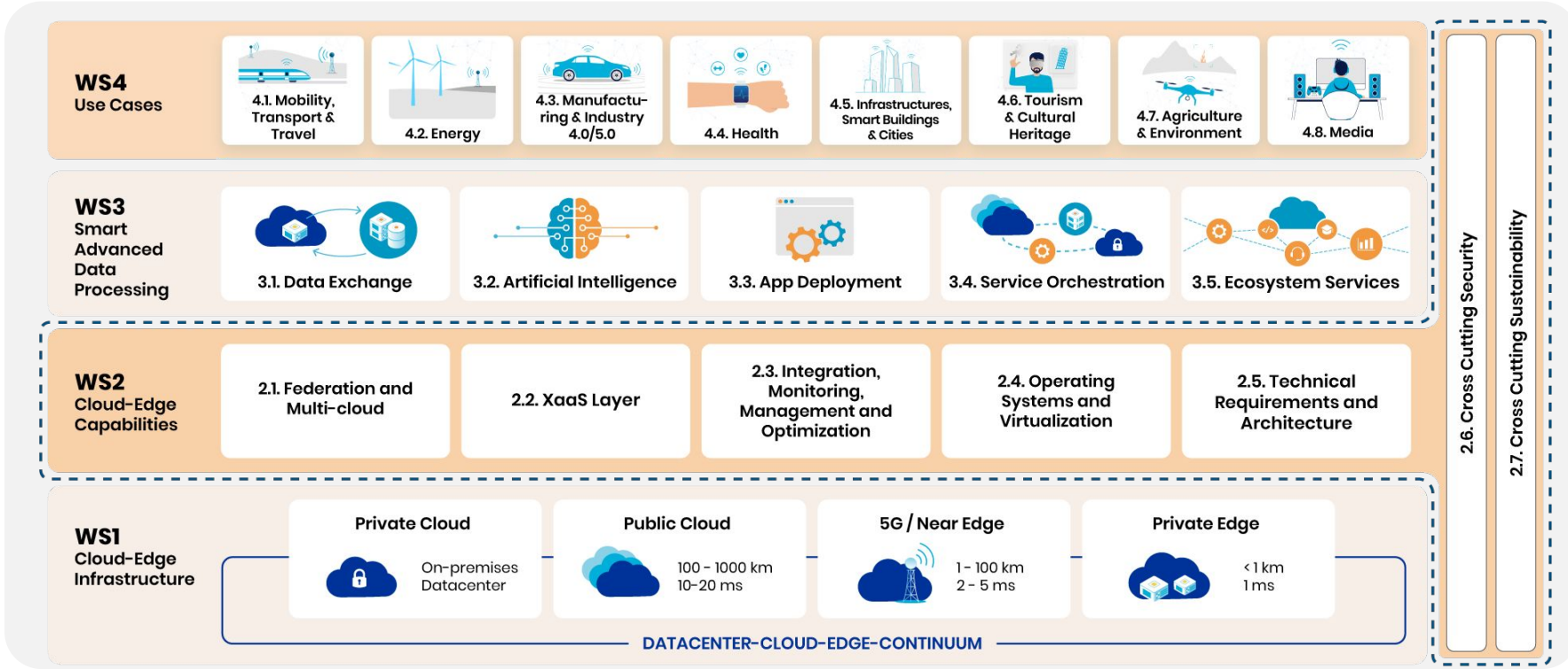






IPCEI-CIS

General Overview



OpenNebula.io

contact@opennebula.io

+34 91 297 9741 / +1 781 238 6643

OpenNebula Systems Headquarters

EMEA

La Finca Business Park, Building 13
28223 Pozuelo de Alarcón, Madrid
Spain

USA

1500 District Avenue
Burlington, MA 01803
USA

OpenNebula Labs

Czech Republic

Cyrilská 7 – Impact Hub Brno
602 00 Brno
Czech Republic

Belgium

Brussels Manhattan Center, 5th Floor
Avenue du Boulevard 21, Brussels 1210
Belgium