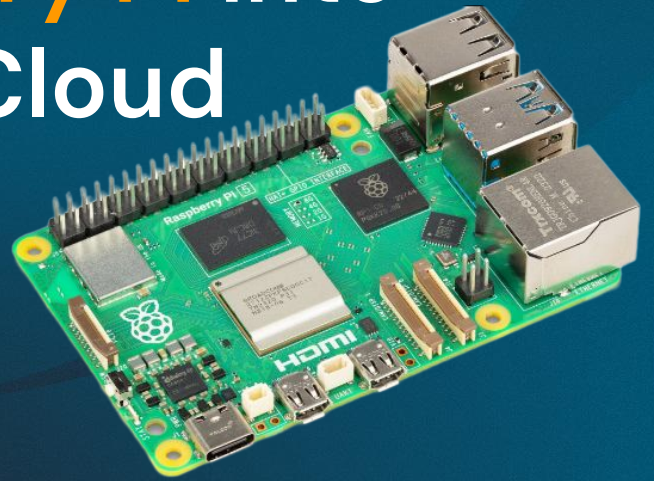
OpenNebula

FOSDEM

How I Turned a Raspberry Pi into an Open-Source Edge Cloud



Pablo del Arco
Cloud-Edge Innovation Engineer @ OpenNebula Systems

OpenNebula.io

Hello, FOSDEM!

Pablo del Arco | **Cloud-Edge Innovation Engineer** at OpenNebula Systems

Pablo del Arco

Cloud-Edge Innovation Engineer
@ OpenNebula Systems

➔ **My Journey**

- **Spain** 🇪🇸: Born in Murcia, now based in **Valencia** ☀️
- **France** 🇫🇷: MSc @ **EURECOM**, Sophia Antipolis 🏖️
- **Finland** 🇫🇮: MSc @ **Aalto University**, Helsinki ❄️

➔ **Main Focus**

- Cloud computing
- Internet of Things
- **Homelab** (K8s cluster👽)
- I write **tech blog posts** in **Medium!**

Medium

Follow me!

➔ **Current focus**

- I develop **new features** and **applications** for OpenNebula as part of the **Innovation** Unit.

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1 What is OpenNebula?

OpenNebula: Open-Source Cloud Platform

OpenNebula

The **open source platform** for the cloud-edge continuum

OpenNebula is an **open-source cloud management platform** that unifies **VMs, containers, and Kubernetes** under a **single pane of glass**. From data centers to edge nodes, it orchestrates workloads across the entire cloud-edge continuum.

Multi-Hypervisor
KVM & LXC containers

Hybrid & Multi-Cloud
Integration with AWS, **Scaleway**, **OVH cloud**, and more!

ARM64 Native
Full support since v7.0

Kubernetes Ready
Cluster API, OneKE, **RKE2**

AI-ready platform
OneDRS + **MCP** integration

Enterprise Features
Multi-tenancy, **federation**, HA

Why OpenNebula for Edge Computing?

OpenNebula

Feature / Platform	OpenNebula 7.0	Proxmox	VMware / CloudStack
ARM Support	✓ **Yes** (Native)	✗ Unofficial / Experimental	✗ No (x86 only)
Marketplace **ARM** Images	✓ **Yes** (Native)	✗ No official ARM templates	✗ No
Installation Simplicity	✓ **Simple** (MiniONE/OneDeploy)	Complex / Unsupported	✗ Unsupported on ARM
Resource Efficiency	✓ **Very High**	High (x86 only)	Low (x86 only)
Edge / IoT Use Cases	✓ **Native Support**	Limited	✗ Not designed for Edge

OpenNebula leads in ARM and edge deployments — the clear choice for edge computing and IoT.

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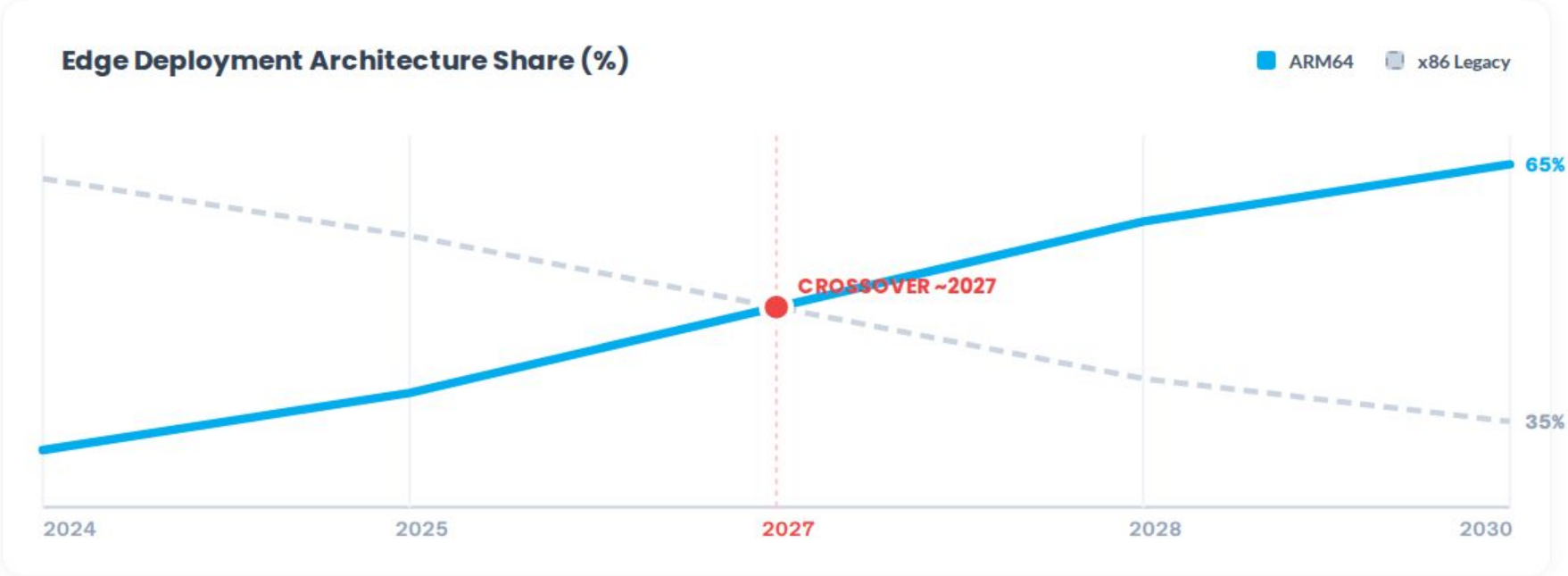
ARM64 vs x86 Architecture Shift

Market Transition and Future Outlook in Edge Computing

2024 BASE
18% ARM64
Initial penetration in edge deployments.

2025 SURGE
+70% YoY
Growth in ARMv9 server shipments.

2030 TARGET
65% Share
Projected dominant edge architecture.



The Challenge of Traditional Clouds

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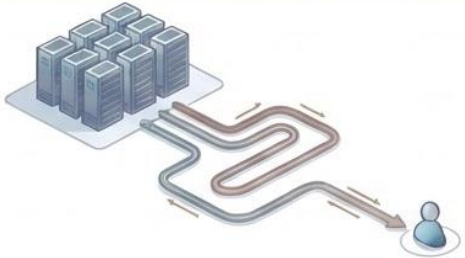
Traditional Clouds



- **Far from data** is generated
- Latency-sensitive apps **suffer**
- **Bandwidth costs** for data transfer

Edge Computing Needs

- **Process data locally**
- Sub-**millisecond** response times
- **Work offline** or with limited connectivity

The Gap

- Enterprise platforms **too heavy**
- DIY solutions **lack features**
- **ARM support** historically **poor**

What if you could run an **enterprise-grade cloud on a $50 device**?
With OpenNebula 7.0 and native ARM64 support, now you can.

2

Raspberry Pi + OpenNebula

Raspberry Pi + OpenNebula: It's a match!

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Raspberry Pi meets OpenNebula

Hardware

Device:	Raspberry Pi 5 (BCM2712)
RAM:	**4GB / 8GB Recommended**
Storage:	NVMe SSD (PCIe) preferred
Network:	Gigabit Ethernet / PoE+
Cost:	**50€ - 100€** (8GB)

Software Stack

OS:	**Ubuntu** Server 24.04 LTS
Hypervisor:	KVM with ARM
Platform:	OpenNebula 7.0 "Phoenix"
Web UI:	FireEdge Sunstone
Marketplace:	**Pre-built ARM64 Appliances**

Two deployment paths:

MiniONE — Quick single-command setup for testing & development

OneDeploy — Ansible-based IaC for production deployments

Option 1: MiniONE

From zero to cloud in less than **2 minutes**

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MiniONE is a **single-script installer** designed to deploy a full OpenNebula stack on a single machine. Optimized for Edge nodes, labs, and PoC environments.

1 Flash Ubuntu

Flash Ubuntu Server 24.04 LTS (**ARM64**) to your microSD or SSD.

2 Update System

Ensure the **local package** is updated.

3 Execute the MiniONE script

Download and run the MiniONE script with default or custom parameters.

BASH — DEPLOY-CLOUD.SH

```
$ sudo apt update && sudo apt upgrade -y
$ wget \
    'https://github.com/OpenNebula/minione/
     releases/latest/download/minione'
$ chmod +x minione
$ sudo ./minione
# Initializing OpenNebula "Phoenix" 7.0 ...
```

✓ **After ~90 seconds: Full OpenNebula cloud with Sunstone UI, Alpine VM template, and KVM hypervisor!**

Option 2: OneDeploy

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Infrastructure as Code for production edge deployments

OneDeploy is a **set of Ansible playbooks** for automated, repeatable deployments. Ideal for multi-node clusters and production environments.

When to Use OneDeploy

- **Multi-node** ARM64 **edge** clusters
- **Production**-ready deployments
- **Repeatable infrastructure** setup
- **Custom network**/storage configs
- **High-availability** requirements

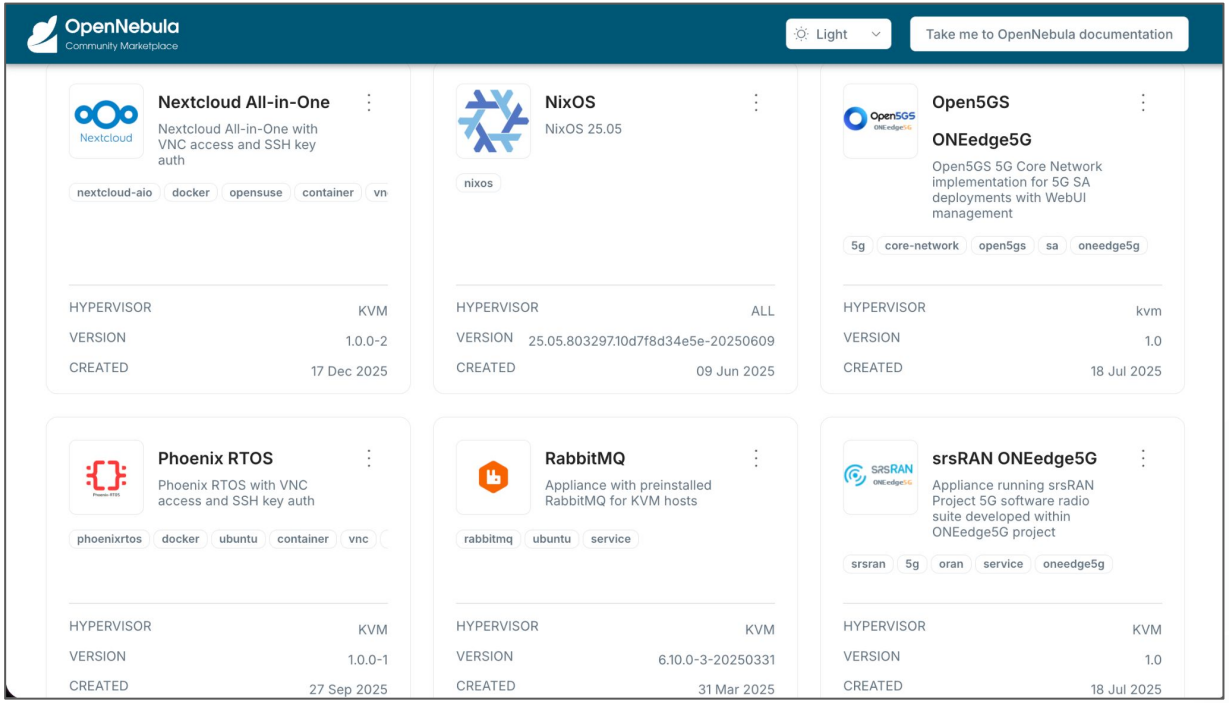
What It Configures

- **Control plane + orchestration APIs**
- **Web UI with HTTPS (Sunstone)**
- **KVM hypervisor** nodes
- **Virtual Network**: Bridge, VXLAN, EVPN
- **Storage**: Local, Shared, Ceph

BASH — ONE-DEPLOY

```
$ git clone https://github.com/OpenNebula/one-deploy && cd one-deploy
$ make requirements && hatch shell
$ ansible-playbook -i inventory.yml opennebula.deploy.main
```

Community Marketplace: x86 and ARM64



Scan Me

But how can you create a custom appliance?

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CLI-Based Wizard

A streamlined, **interactive command-line** interface that guides you **step by step** in the process..

Docker Integration

Easily convert **Docker-based images** into **production**-ready KVM V**irtual Machines** with persistent storage.

LXC System Containers

Deploy lightweight **LXC Alpine-based appliances** with pre-configured services like **MQTT**, **Node-RED**, and **PostgreSQL**.

Multi-Arch Support

Full compatibility across both **x86** and **ARM** architectures for versatile edge deployment.

3

Live Demo 🎬: Wizard & UI

4 Real-World Use Cases

Real-World Use Cases

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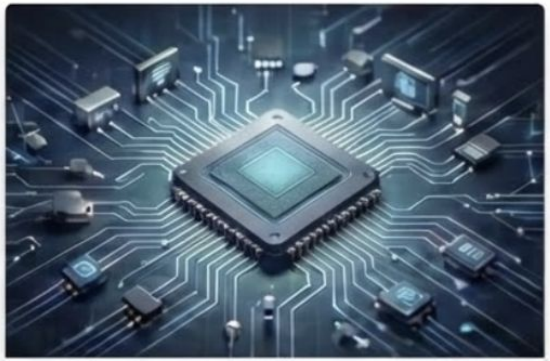
Homelab & Hosting

- Personal **private cloud** environment
- Self-hosted services (Nextcloud, GitLab)
- Home automation hub



IoT & Edge Computing

- **Real-time** sensor data processing
- Distributed edge nodes
- Industrial automation

Education & Research

- **Edge computing labs**
- Affordable virtual lab environments
- Academic research testbeds

Far-Edge & IoT: The O-CEI Model

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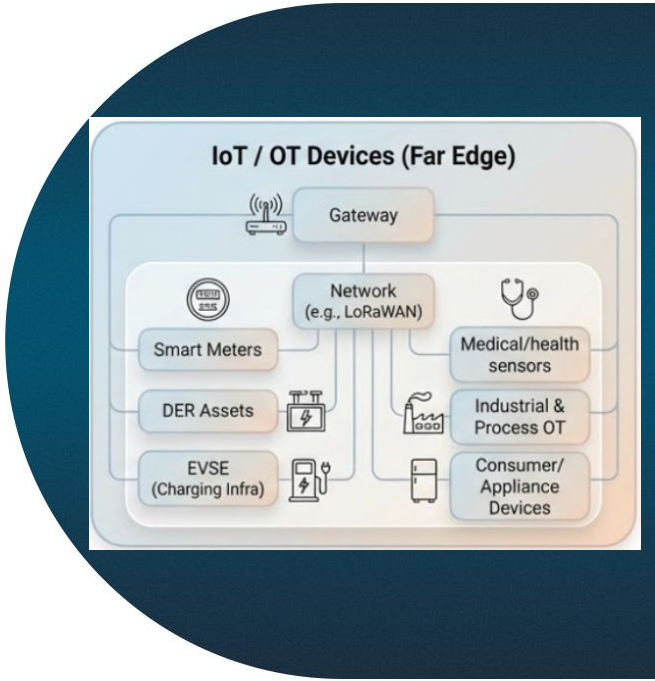
O-CEI is an EU-funded Horizon Europe project to orchestrate the **Cloud-Edge-IoT continuum**. It uses a **Blueprint-Driven Methodology** to translate high-level requirements into repeatable **technical deployments** across **8 different pilots,** such as electricity grids, agrifood or logistics, with **high technical maturity** (**TRL 7**).

O-CEI



- **Practical Extension**

In O-CEI, we have successfully extended the framework by adding a **Far-Edge / IoT** layer specifically to manage small, low-power devices and sensors at the industrial ground level.

- **Our Proposal for IPCEI v3.0**

We propose exploring the addition of this same layer to the **next ICRA version** to finally **connect** everything from the **Data Center** down to the **individual IoT device or sensor**.

5

Key Takeaways

Key Takeaways & Wrap-Up

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- **Edge computing is accessible:** Enterprise cloud is now affordable; a Raspberry Pi can run full orchestration software.
- **Native ARM64:** OpenNebula 7.0 removes the "heavy platform" barrier for edge computing.
- **Flexible Implementation:** Use *MiniONE* for rapid PoCs or *OneDeploy* for production clusters.
- **Unified Experience:** Maintain the same *Sunstone UI* and features from data center to edge.

Let’s connect!

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Medium

LinkedIn

GitHub

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Thank You!

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OpenNebula @ FOSDEM 2026

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AI Plumbers :

OneAI: An Open-Source Framework for Managing AI Models at Scale.

Network :

Building an Open Source Private 5G Network: A Practical Blueprint.

Virtualization & Cloud Infrastructure :

How I Turned a Raspberry Pi into an Open-Source Edge Cloud with OpenNebula.

Arming Cloud Computing Continuum: Hunting vulnerabilities in open source hybrid clouds.

Find our Booth in LEVEL 1 of BUILDING K

ONEnextgen

> OpenNebula.io/IPCEI-CIS

IPCEI-CIS

Next-Generation European Platform for the Datacenter-Cloud-Edge Continuum

Initiative supported by the Spanish Ministry for Digital Transformation and Civil Service through the **ONEnextgen Project: Next-Generation European Platform for the Datacenter-Cloud-Edge Continuum** (UNICO IPCEI-2023-003) and co-funded by the European Union's NextGenerationEU instrument through the Recovery and Resilience Facility (RRF).

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Plan de Recuperación, Transformación y Resiliencia

GOBIERNO DE ESPAÑA MINISTERIO PARA LA TRANSFORMACIÓN DIGITAL Y DE LA FUNCIÓN PÚBLICA SECRETARÍA DE ESTADO DE TELECOMUNICACIONES E INFRAESTRUCTURAS DIGITALES

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