Open Nebula

FOSDEM – 03/02/2024

AI-Driven Observability and Operations in Cloud-Edge Systems

Victor Palma
Cloud Engineer

~$ **whoami**

CARD_ID @vickmp

Victor Palma
Cloud Engineer

vpalma@opennebula.io

📍 Madrid (Spain)

Open Nebula

Let's Start with some Initial Context 🤓

Why is **Observability** so important?

Transforming data into information 📈

*"The ability to **understand** and **analyze** the internal behavior of a system by collecting and analyzing relevant data."*

🐛 Anomaly Detection

We can identify anomalous patterns or trends that could indicate potential system failure or degradation.
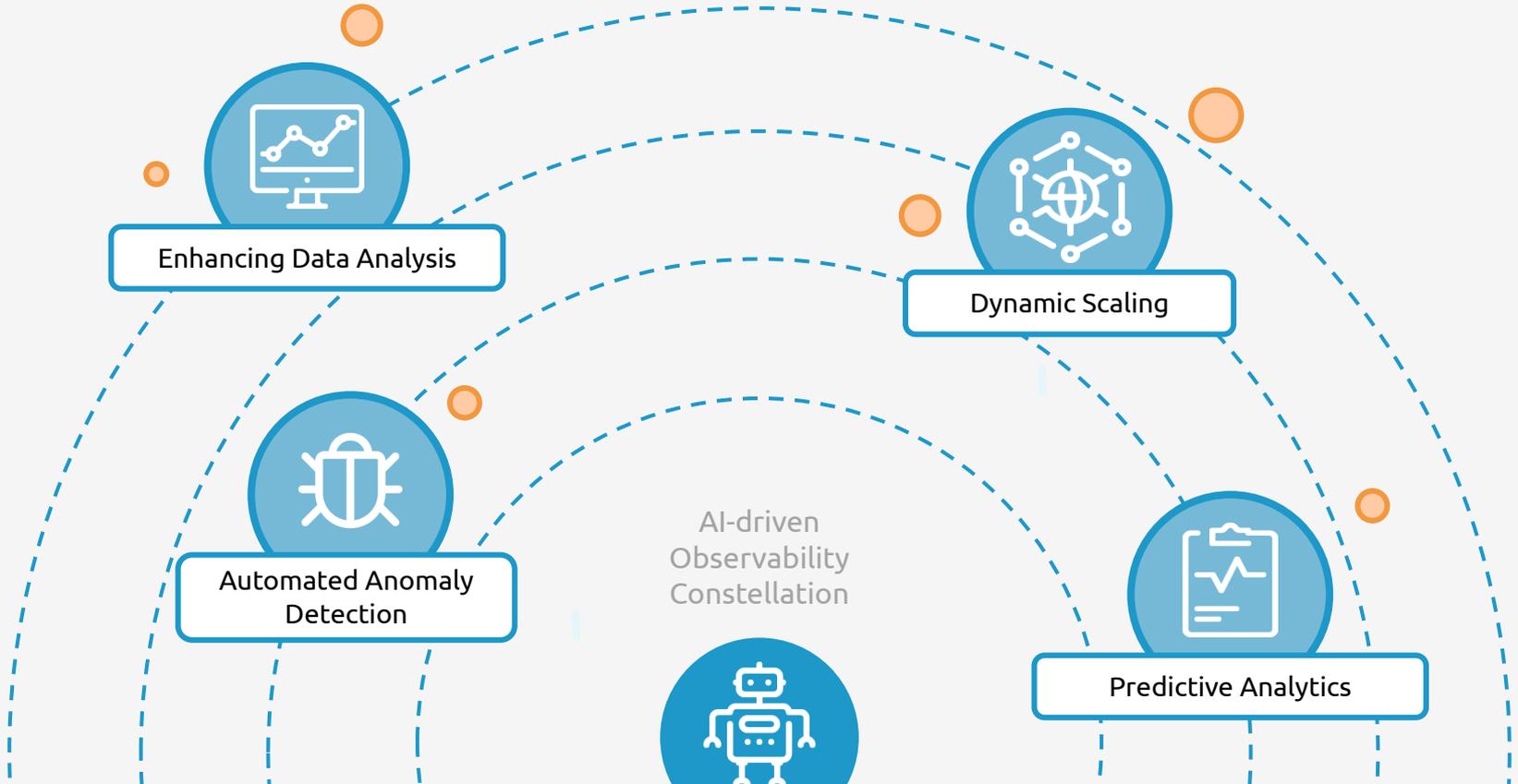
⚙️ Performance Analysis

We can identify areas for improvement and make adjustments to optimize operating efficiency

🔍 Decision Making

We can measure the impact of changes, plan improvements and allocate resources more effectively

IA for Observability

IA is everywhere nowadays, but is it really useful in Observability?

Enhancing Data Analysis

Dynamic Scaling

Automated Anomaly Detection

AI-driven Observability Constellation

Predictive Analytics

Data Sovereignty and Open Source

Growing concerns about data processing at external providers

CHALLENGES

Concerns with Third-Party Solutions
Many organizations currently entrust sensitive data to external observability providers, raising concerns about data ownership and privacy.

Open Source as a Solution
Provide transparency, allowing organizations to scrutinize code, address customization needs, and maintain control over their data.

Vendor Lock-In Risks
Organizations may find themselves tied to a specific vendor, limiting flexibility and potentially increasing costs.

So... What's Next? 🤔
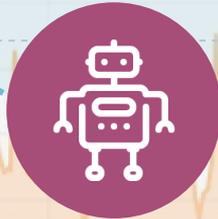
What is OpenNebula?

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

Virtual Machines

Application Containers

Kubernetes Clusters

Open Nebula

Virtual Infrastructure Management, Cloud Management Provisioning & Cloud Federation

CORE DATA CENTER

PUBLIC CLOUD

EDGE

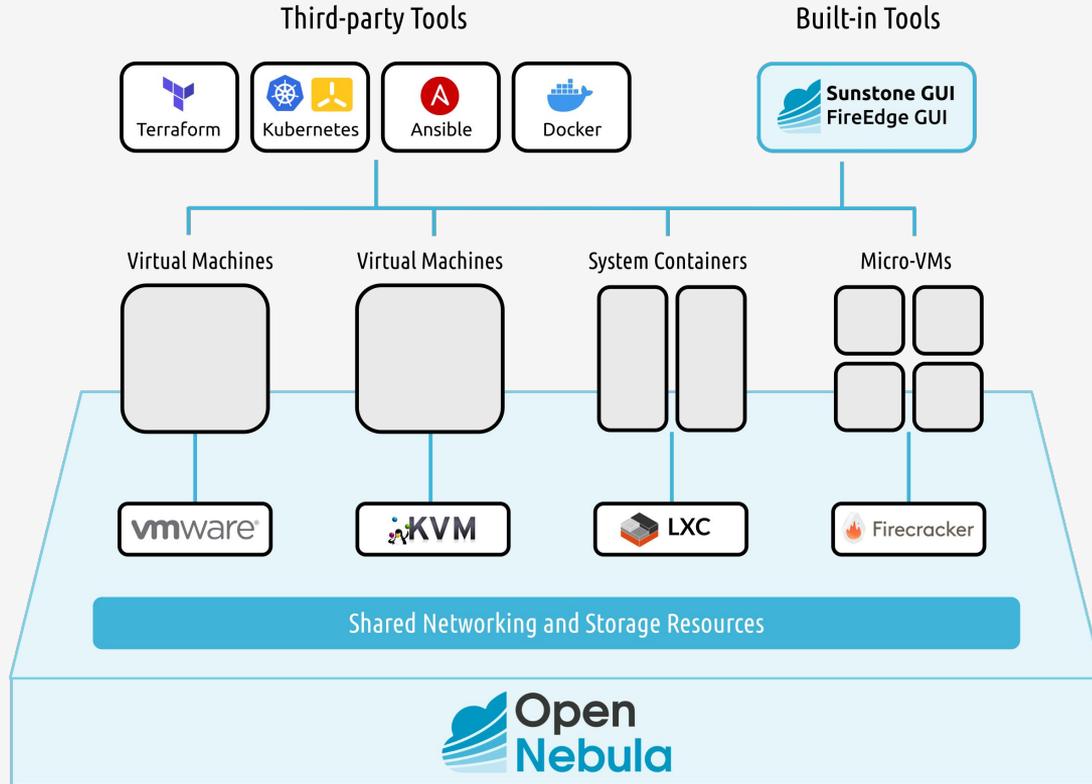✔ **Avoids "Vendor Lock-in"**

✔ **Reduces resource consumption**

✔ **Minimizes complexity**

✔ **Slashes operating costs**

Building Your Cloud

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

Third-party Tools
- Terraform
- Kubernetes
- Ansible
- Docker

Built-in Tools
- Sunstone GUI
- FireEdge GUI

- Virtual Machines — vmware
- Virtual Machines — KVM
- System Containers — LXC
- Micro-VMs — Firecracker

Shared Networking and Storage Resources

OpenNebula

✓ **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

Marketplace + Container Orchestration

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**

Internet

Cloud & Edge Providers

https://opennebula.io/multi-cloud/
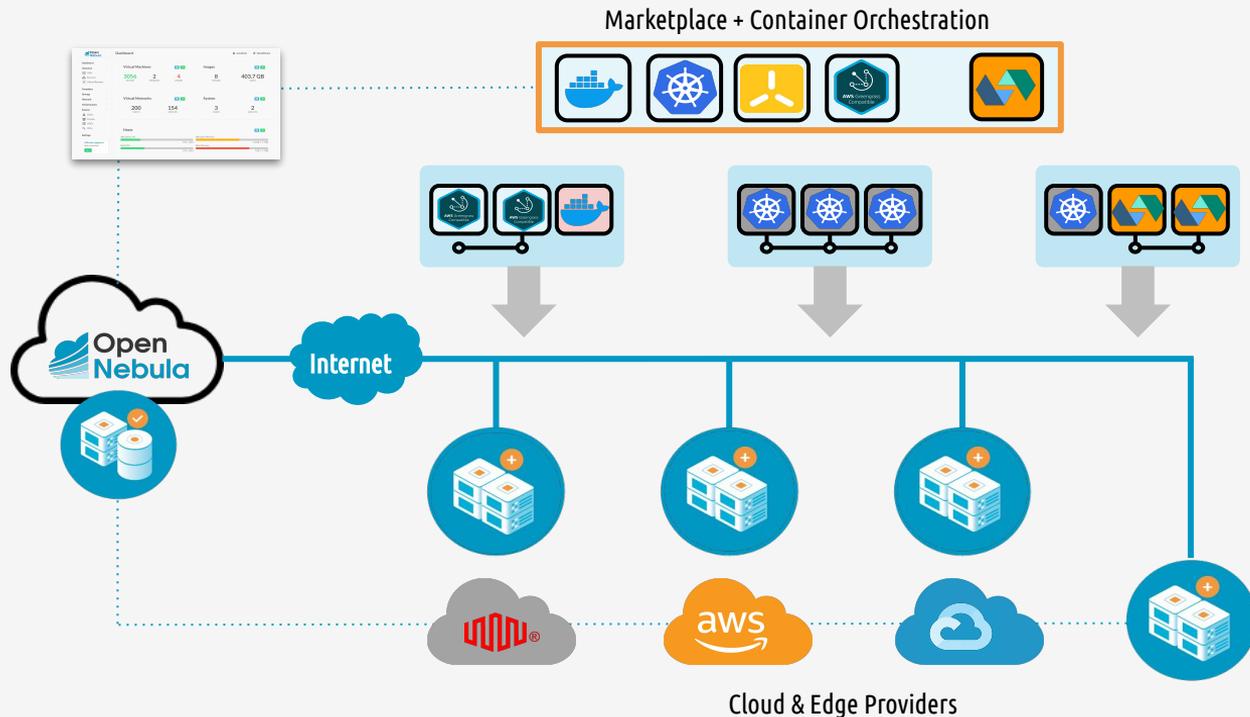
OpenNebula and Prometheus Integration

Make the most of OpenNebula's monitoring and alerting system
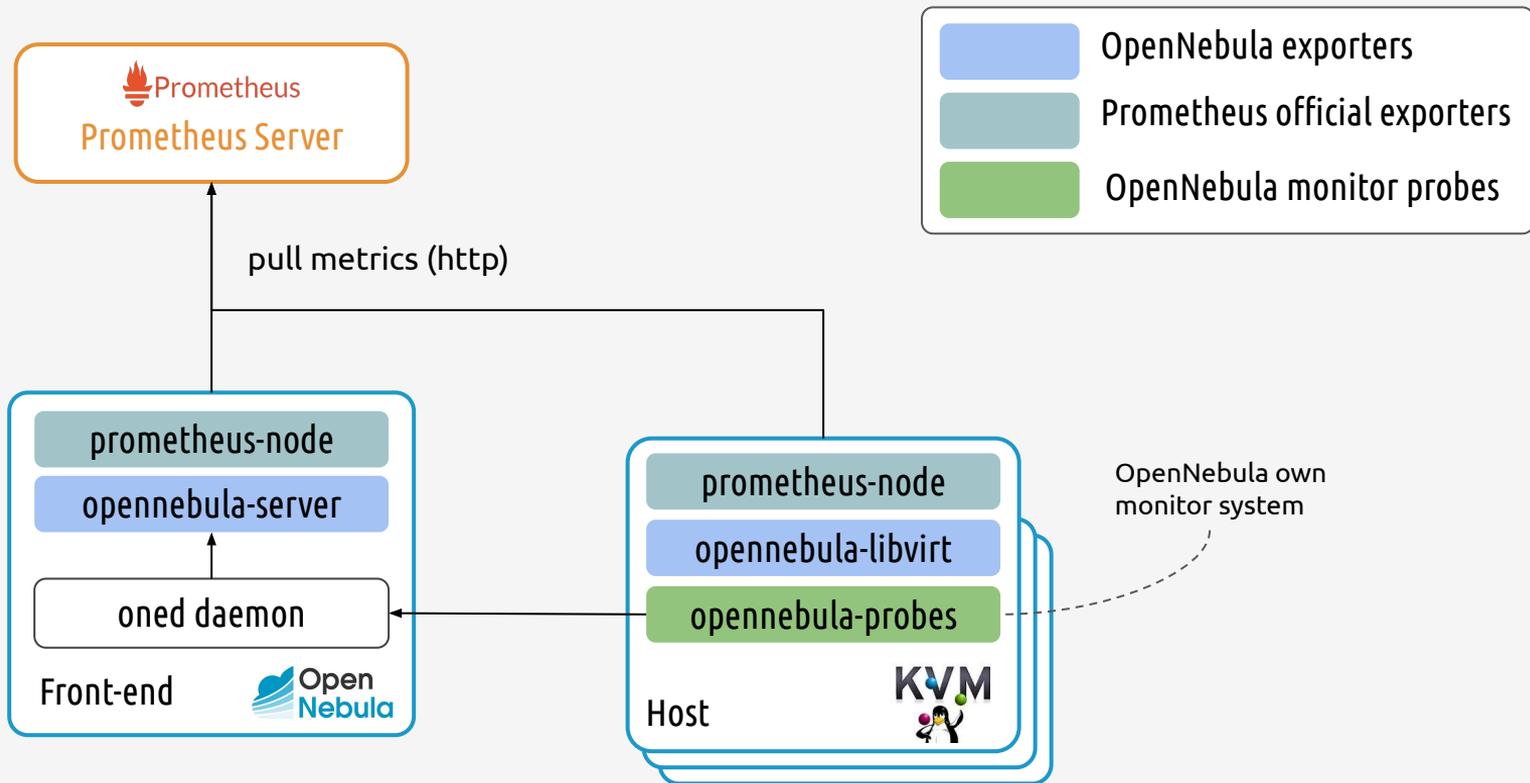
Adding AI to the Formula

AI-generative text based are not the only one!

Machine Learning

Predict VM CPU, memory or network traffic usage

Decision Algorithms

Allocate recursed based on the current context and some predefined criterias

One AIOps Features and Capabilities

AI for Cost Optimization in Edge Cloud Infrastructure

- **CPU usage prediction**:
  - Individual VM CPU prediction per hour
  - General CPU usage
  - Accuracy *(last day real usage / last day predicted usage)*
- **VM allocation suggestion**:
  - Load Balancing
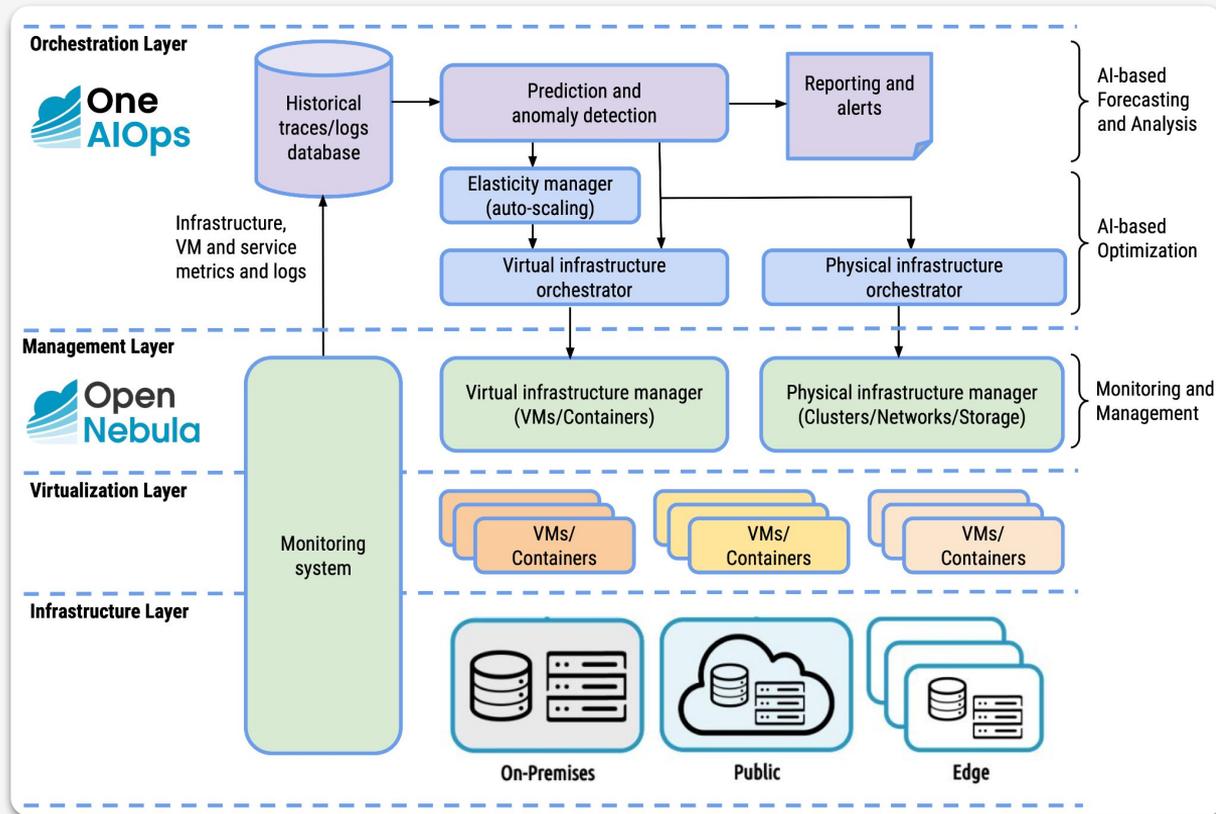 - Resource Contention
  - Reduce Migrations
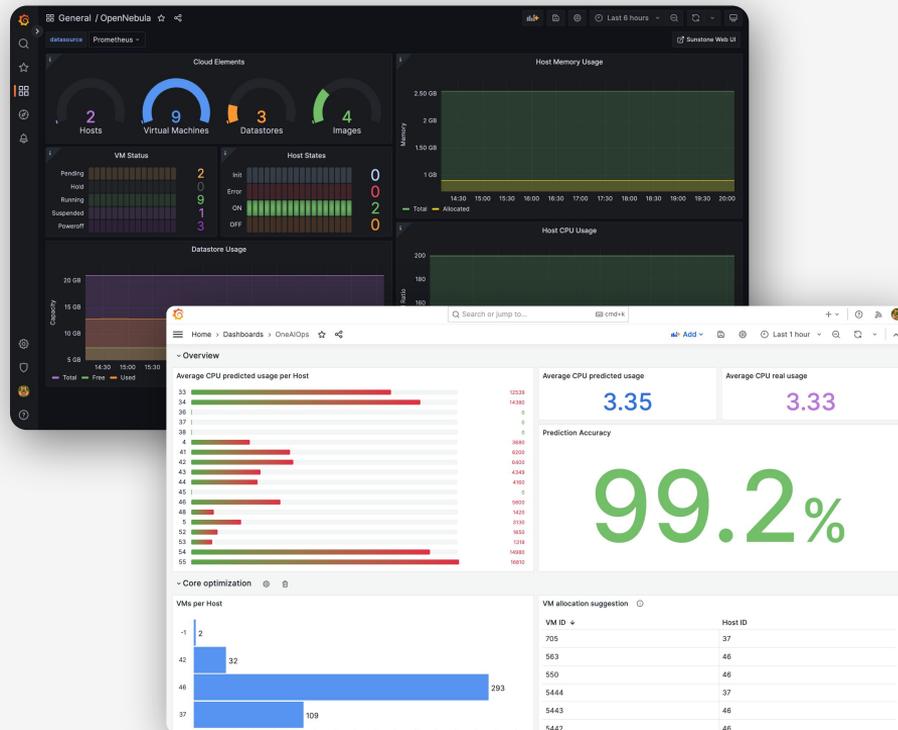
One AIOps Architecture

AI for Cost Optimization in Edge Cloud Infrastructure

New **One AIOps** architecture layer

Current **OpenNebula** architecture

Orchestration Layer

One AIOps

Historical traces/logs database

Prediction and anomaly detection

Reporting and alerts

AI-based Forecasting and Analysis

Infrastructure, VM and service metrics and logs

Elasticity manager (auto-scaling)

Virtual infrastructure orchestrator

Physical infrastructure orchestrator

AI-based Optimization

Management Layer

Open Nebula

Monitoring system

Virtual infrastructure manager (VMs/Containers)

Physical infrastructure manager (Clusters/Networks/Storage)

Monitoring and Management

Virtualization Layer

VMs/ Containers

VMs/ Containers

VMs/ Containers

Infrastructure Layer

On-Premises

Public

Edge

Demo Time! 🚀

One AIOps Demo Environment

AI for Cost Optimization in Edge Cloud Infrastructure

1 **OpenNebula Exporter**

Provides general information about the status of OpenNebula.

2 **Libvirt Exporter**

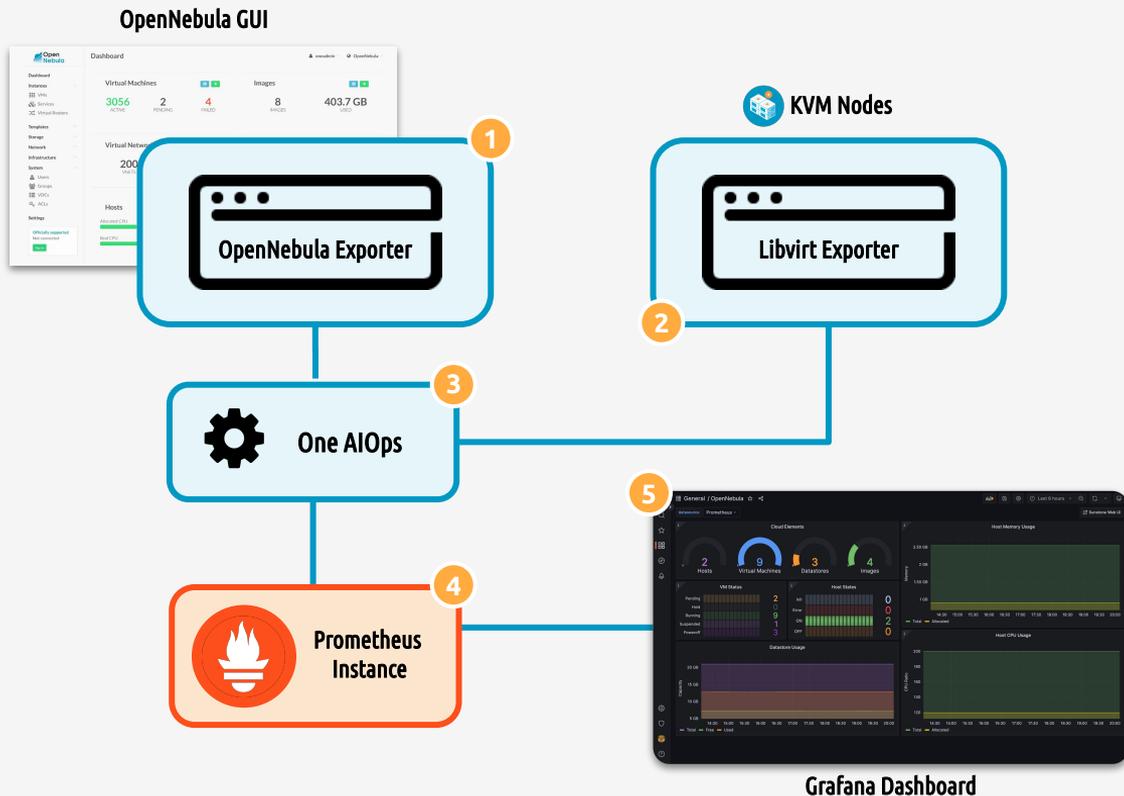Provides information about the VMs running on the Hosts.

3 **One AIOps**

Optimizes the placement of VMs based on the usage data obtained.

4 **Prometheus**

Collects metrics

5 **Grafana**

Delivers dashboards on which to visualize the metrics generated.

OpenNebula GUI

KVM Nodes

OpenNebula Exporter

Libvirt Exporter

One AIOps

Prometheus Instance

Grafana Dashboard

Closing Thoughts and Next Steps

OpenNebula Community Forum

Join the Huge OpenNebula Community where Exploration and Collaboration Unite! 🚀

🔗 **forum.opennebula.io**

OpenNebula

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 ■ Development — 4 / 1h
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	☐ Change user password in Fireedge ■ Community Support — 1 / 1h Not able to attach Network as an alias to existing private network attached to Virtual Machine ■ Development — 0 / 5h

One AIOps Next Steps & Challenges

Contribute to the next generation of AI-Driven Operations! 🚀

- Implement VIO operations in order to apply the suggestion automatically
- Improve AIOps distribution as part of OpenNebula software
- Expand functionality:
  - Anomaly detections
  - Allocation based on memory prediction
  - Allocation based on network traffic
  - Alerts and warnings
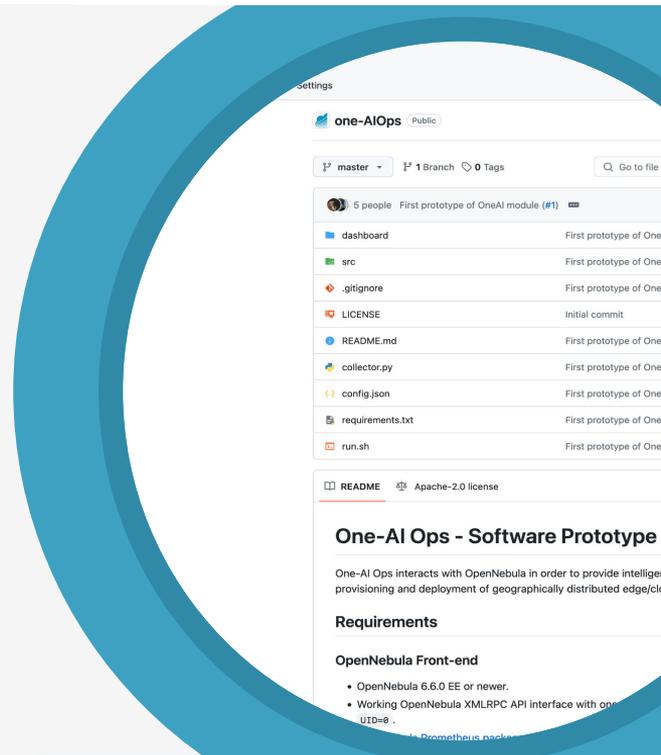
Contribute to the repo on ⬤ Github!
OpenNebula/one-AIOps

SovereignEDGE.EU

// COGNIT

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

COGNIT.SovereignEdge.EU

FOSDEM – 03/02/2024

Thank you very much for your attention!