AI-Driven Observability and Operations in Cloud-Edge Systems
Let’s Start with some Initial Context 😎
Why is Observability so important?

Transforming data into information

“We can identify anomalous patterns or trends that could indicate potential system failure or degradation.

Anomaly Detection

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

Performance Analysis

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

Decision Making

“The ability to understand and analyze the internal behavior of a system by collecting and analyzing relevant data.”
IA for Observability

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

- Enhancing Data Analysis
- Dynamic Scaling
- Automated Anomaly Detection
- Predictive Analytics
- AI-driven Observability Constellation
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? 🤔
One AIOps Framework
The Open Source Solution for AI-Driven Observability

One platform to rule them all

Collects and Visualizes Data

One AIOps Framework

AI & ML techniques
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 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

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

Built-in Tools:
- Sunstone GUI
- FireEdge GUI

Virtual Machines:
- vmware
- KVM

System Containers:
- LXC

Micro-VMs:
- Firecracker

Shared Networking and Storage Resources

Open Nebula
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/)
OpenNebula and Prometheus Integration

Make the most of OpenNebula’s monitoring and alerting system

Prometheus Server

- Prometheus official exporters
- OpenNebula exporter

- opennebula-server
- oned daemon
- opennebula-libvirt
- opennebula-probes

Front-end

OpenNebula own monitor system

Pull metrics (http)
Adding **AI** to the Formula

AI-generative text based are not the only one!

1. **Machine Learning**
   Predict VM CPU, memory or network traffic usage

2. **Decision Algorithms**
   Allocate recursively based on the current context and some predefined criteria
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** \(\frac{\text{last day real usage}}{\text{last day predicted usage}}\)

- **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
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.
Closing Thoughts and Next Steps
Join the Huge OpenNebula Community where Exploration and Collaboration Unite!

👉 forum.opennebula.io

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**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](http://www.opennebula.io)

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#### Development

Any aspect related to development and integration of OpenNebula and its add-ons and ecosystem:

- Network
- General
- Upgrade
- GUI - Sunstone
- CLI / API
- VM Configuration / Contextualization
- Storage
- HA / Federation
- vCenter

#### 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
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**Latest Topics**

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<td>Sinatra doesn’t know this ditty trying to access OneFlow</td>
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<td>1h</td>
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<td>Change user password in Fireedge</td>
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<td>1h</td>
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<td>Not able to attach Network as an alias to existing private network attached to Virtual Machine</td>
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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
Thank you very much for your attention!

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