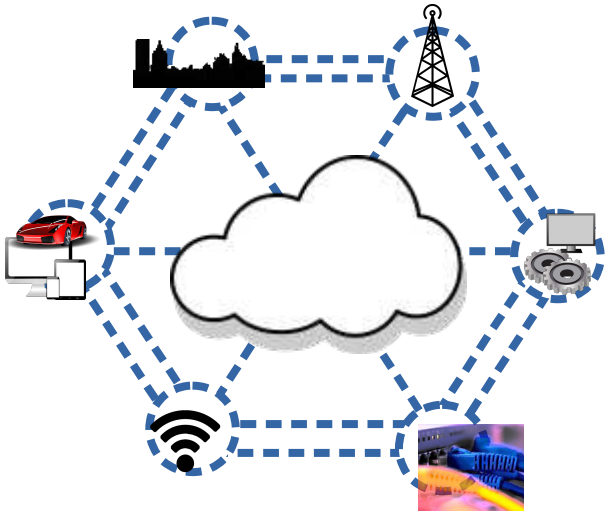
Virtual Open Systems

# Virtualized Infrastructure Managers for edge computing: OpenVIM and OpenStack comparison
# IEEE BMSB2018, Valencia, 2018-06-08



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# Authorship and sponsorship

**Teodora Sechkova**, Software Engineer at Virtual Open Systems.

**Virtual Open Systems** is a high-tech software company active in open source virtualization solutions and custom services for complex mixed-criticality automotive systems, NFV infrastructures and consumer electronics.

This work is done as a part of the H2020 “Distributed Cloud & Radio Platform for 5G Neural Hosts” project (**www.5gcity.eu**).

# Introduction

- **Introduction**
  - Edge computing and multimedia
  - Objectives
- Virtualized Infrastructure Managers
  - OpenStack
  - OpenVIM
- Cloud Benchmarking
  - Extending CloudBench
  - Benchmark Configuration
  - Benchmark Results
- Conclusion

# Edge computing and multimedia

- Technologies pushing the traditional centralized cloud computing architectures to the edge:
  - ✔ Software-Defined Networking (**SDN**)
  - ✔ Network Functions Virtualization (**NFV**)
  - ✔ Multi-access Edge Computing (**MEC**)
  - ✔ Fifth Generation (**5G**) wireless systems
- Multimedia benefits:
  - ✔ **Offloading** computing power to the edge
  - ✔ Network traffic offloading
  - ✔ Local **caching**
  - ✔ Minimized latency and flexibility

# Objectives

This work focuses on **comparing and evaluating open-source implementations of Virtualized Infrastructure Managers in an edge computing environment.**

- Edge virtualized infrastructure management
- Virtual machines provisioning time overhead
- Benchmarking tools extensions development
- OpenStack and OpenVIM benchmark

# Virtualized Infrastructure Managers

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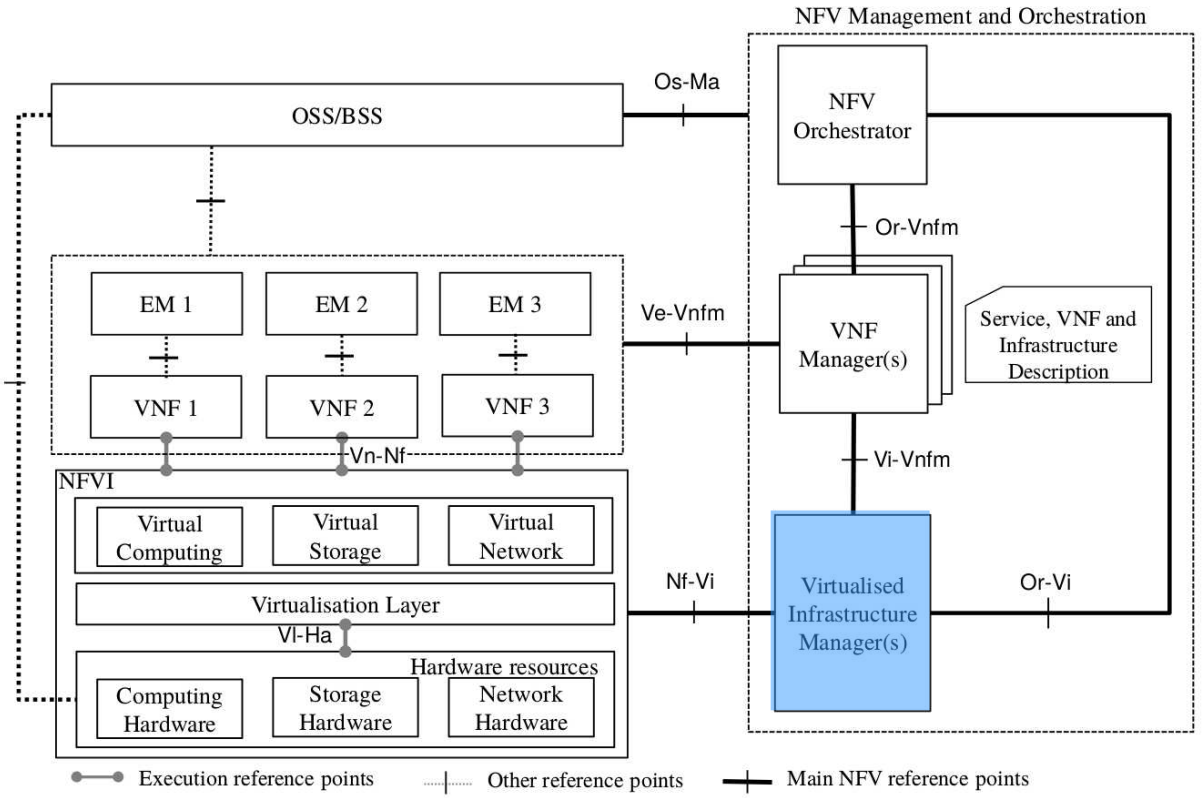
# Virtualized Infrastructure Managers

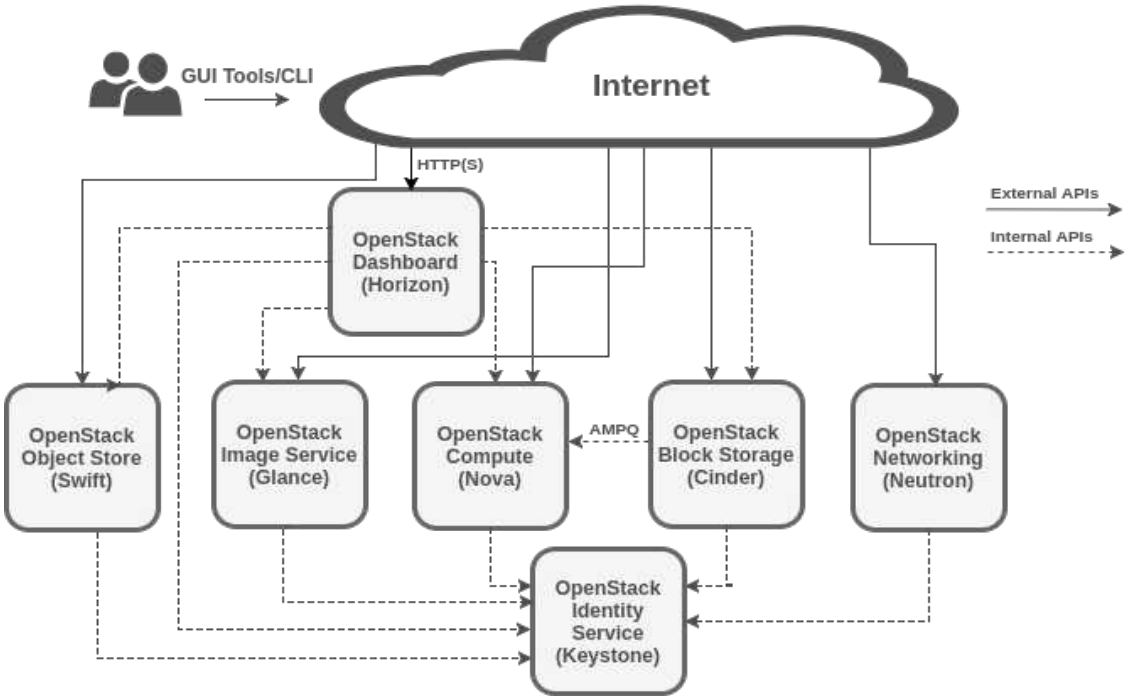
- **ETSI NFV** framework
- VIMs: *"Control and manage the compute, storage, and network resources as well as their virtualization"*



# OpenStack

An open-source project with the goal of being a cloud operating system managing large-scale compute, storage and networking resources.

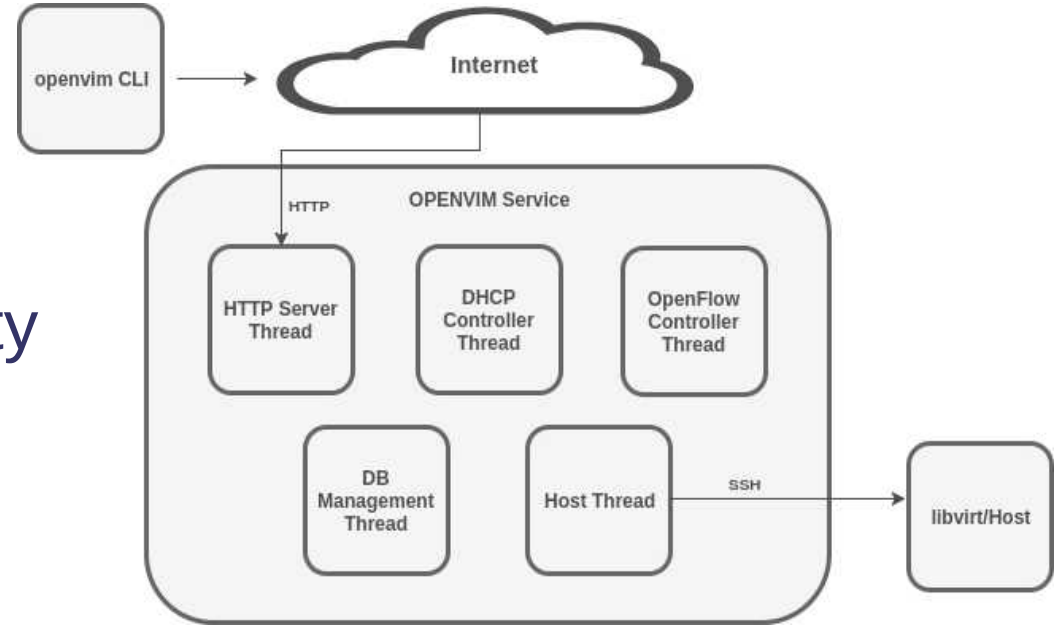
- Open-source
- Flexible and expandable architecture
- Public APIs
- Intra-communication through messaging
- Horizontal and vertical scalability



# OpenVIM

A lightweight VIM part of ETSI Open Source MANO (ETSI OSM), the practical implementation of an ETSI MANO stack.

- Open-source
- Simple architecture
- Minimalistic VIM functionality
- Lightweight
- Public API
- Horizontal scalability



# Cloud Benchmarking

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# Cloud Benchmarking

- Metrics
  - **VM provisioning** - the process of deploying virtual machines
  - Provisioning latency and provisioning throughput
- Open-source tools
  - PerfKitBenchmarker – captures traditional cloud performance metrics
  - Rally – OpenStack benchmarking tool
  - **Rapid Experimentation and Analysis Tool (CloudBench) – captures cloud performance and management metrics**
  - **All tools already support OpenStack, none supports OpenVIM**

# Extending CloudBench

**CloudBench framework:** written in Python, extensible

- **New cloud adapter for OpenVIM needed**
- New class OvimCmds: `vmccleanup(), vmcregister(), vmcunregister(), vmcreate(), vmdestory()`
- New configuration template file with OpenVIM specific parameters

```
[USER-DEFINED : CLOUDOPTION_MYOPENVIM]
OVIM_ACCESS = http://localhost:9080/openvim
OVIM_TENANT = tenant_uuid
OVIM_NETNAME = mgmt
OVIM_LOGIN = cbuser
```

# Benchmark configuration

- Processor: Intel(R) Xeon(R) CPU E5-2623 v4 @ 2.60GHz
- Memory: 32GB
- Storage: 4TB
- OS: Ubuntu 16.04.1 Server operating system with KVM-enabled 4.4.0-31-generic Linux kernel
- Hypervisor: KVM
- OpenStack: deployed through DevStack, one host configuration
- OpenVIM: “host only” mode

# Benchmark configuration

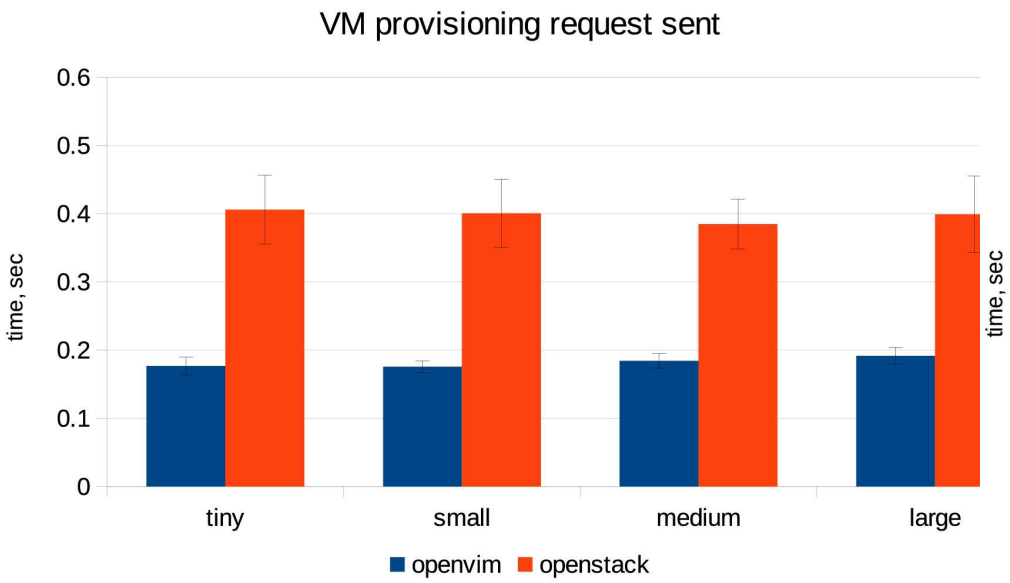
- **Flavor**: defines the compute, memory, and storage capacity of a VM.
- Flavors created for the experiments:

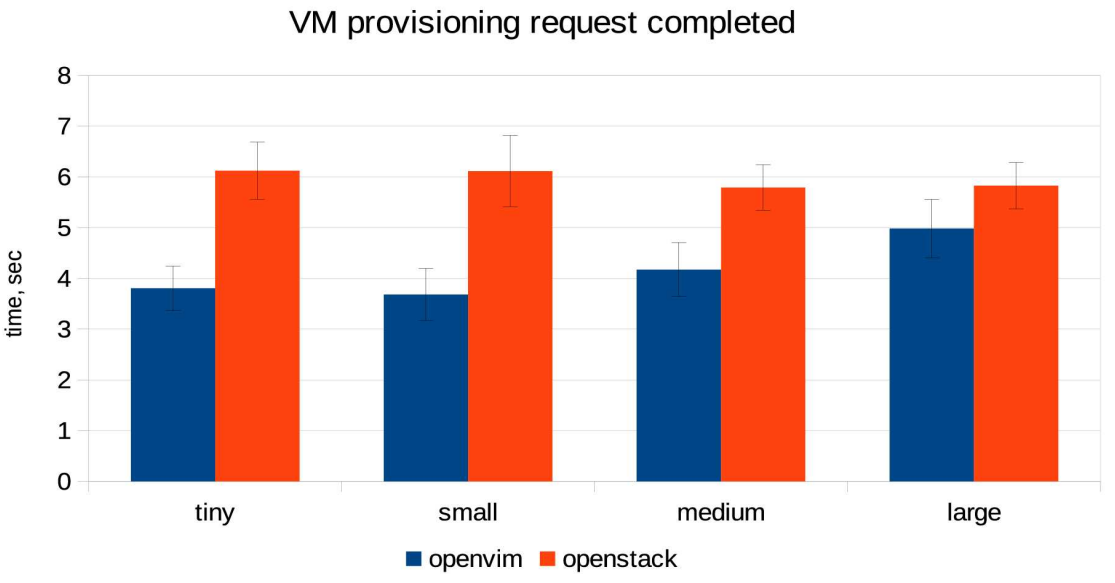
| Name | RAM, MB | Disk, GB | VCPUs |
|---|---|---|---|
| tiny | 1024 | 1 | 1 |
| small | 2048 | 20 | 1 |
| medium | 4096 | 40 | 2 |
| large | 8192 | 80 | 4 |

# Benchmark results

**VM provisioning request sent** - the time overhead while collecting pre-provisioning data for images, flavors and existing VMs.

**VM provisioning request completed** – the time elapsed between submitting the VM provisioning request and the VM status changed to ”running”.

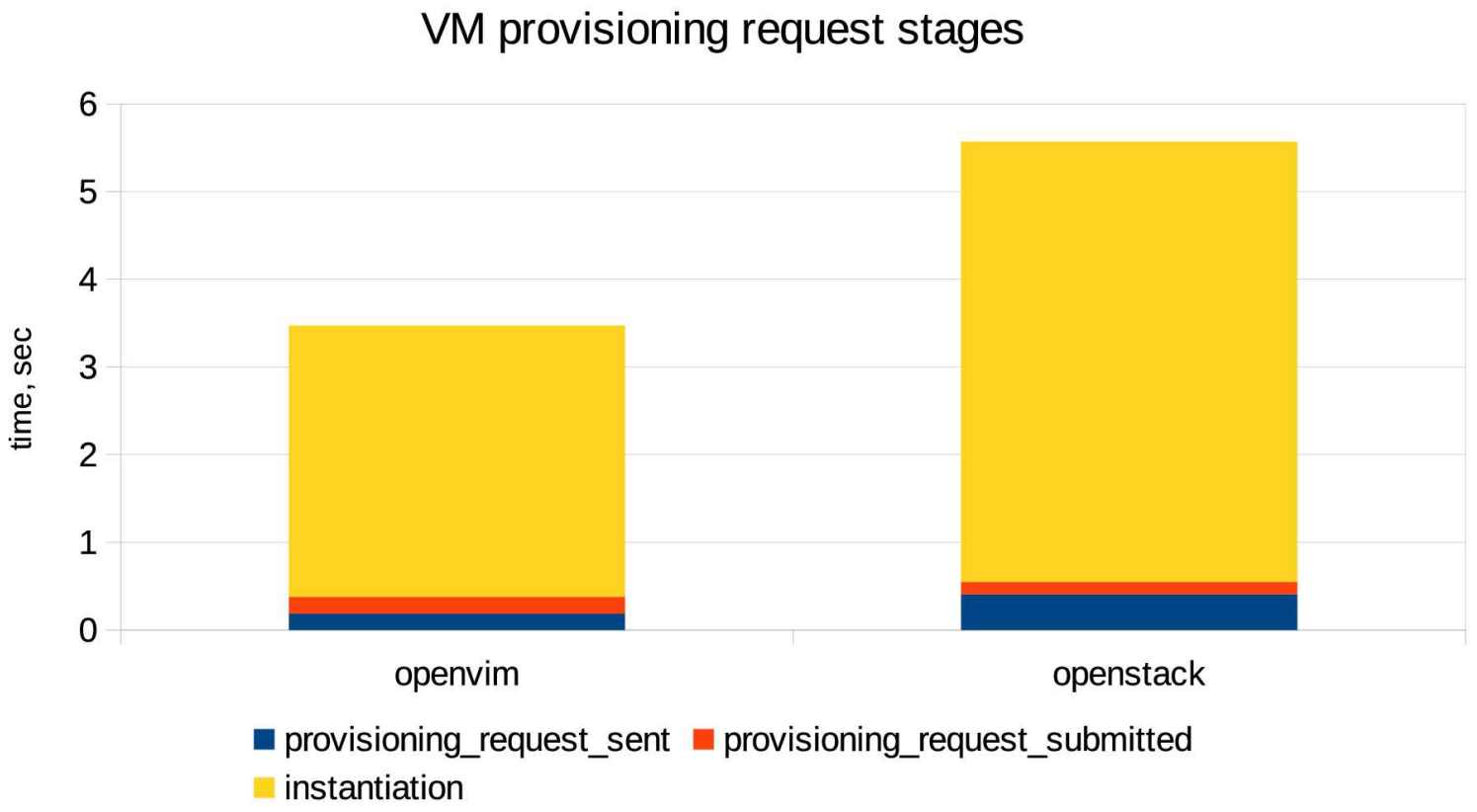


# Benchmark results

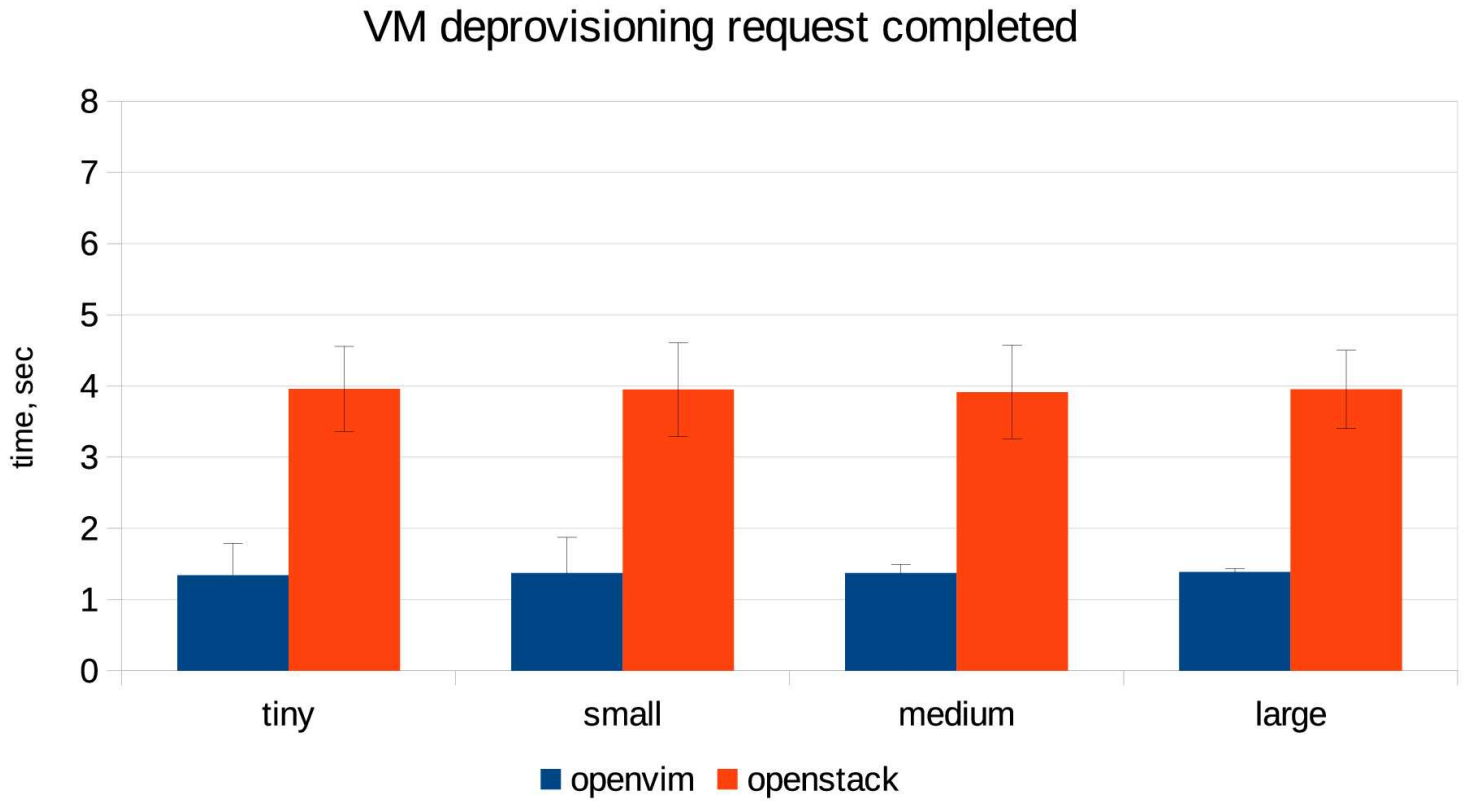
**VM provisioning stages:**

1) request sending 2) request submission 3) VM instantiation



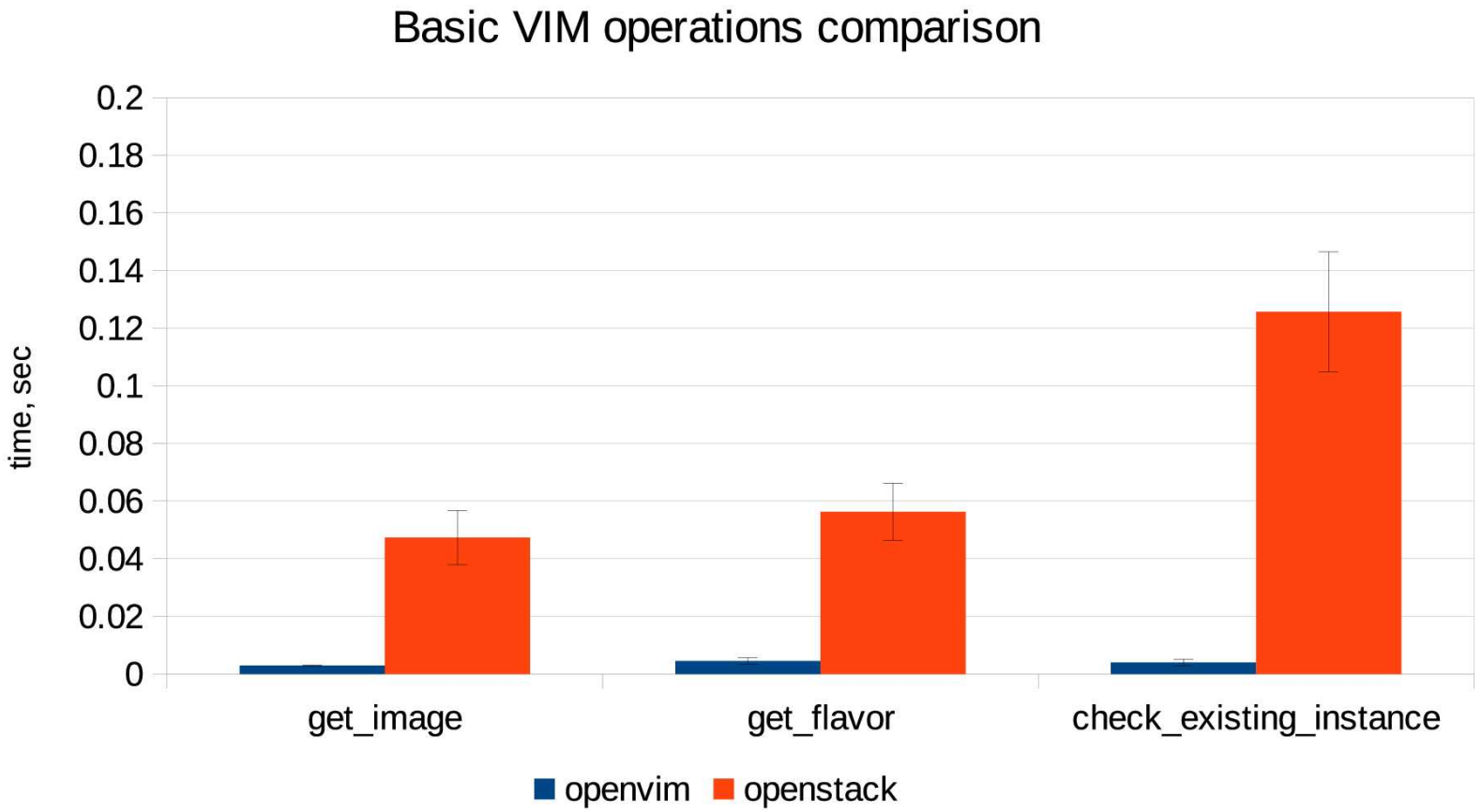
# Benchmark results

**VM deprovisioning request completed** - the time elapsed between submitting the VM deprovisioning request and the actual VM removal.



# Benchmark results

## Responding to basic requests



# Conclusion

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# Conclusion

## OpenVIM

- ✔ Better performance
- ✔ Horizontally scalable
- ✗ Lack of functionality
- ✗ Worse support and development activities

## OpenStack

- ✗ Worse performance
- ✗ Complex, general purpose
- ✔ Well supported, regularly updated
- ✔ Flexible, allowing for custom solutions
- ✔ Horizontally and vertically scalable

# Conclusion

## Outcome:

In a rapidly changing environment, with hardware processing capabilities constantly growing, regular maintenance, flexibility and scalability are more valuable software qualities than performance. Having such characteristics, OpenStack allows for the creation of custom solutions for the needs of the edge computing realm.

## Future work:

This benchmark can serve as a reference for further internal analysis of both solutions as well as a comparison with other available products.

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# THANK YOU!

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