

Chapter 2

The OpenNebula Cloud Toolkit

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ABSTRACT

This chapter aims to describe the OpenNebula Cloud Toolkit, a framework born as a result of many years of research and development that intends to provide an efficient and scalable solution for the large-scale distributed management of Virtual Machines running on a pool of physical resources. A description of the history of the project is presented, along with a detailed explanation of the characteristics of the Toolkit, including directions on how to install and configure the software, enumeration of the interfaces exposed, and information on how to use and configure the three types of clouds (private, hybrid, and public) that can be built with the framework. The chapter ends with a practical use case that shows how to deploy a service composed of Virtual Machines on top of an OpenNebula cloud, and with the lessons learned during the project and the future work planned for the Toolkit.

INTRODUCTION

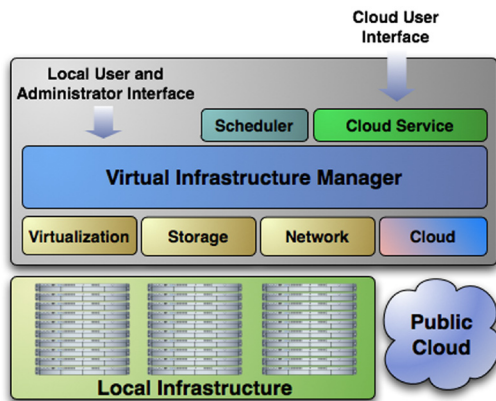
OpenNebula is a fully open-source toolkit to build any type of Infrastructure as a Service (IaaS) cloud: private, public and hybrid. It orchestrates storage, network, virtualization, monitoring, and security technologies to enable the dynamic placement of multi-tier services (groups of interconnected

virtual machines) on distributed infrastructures, combining both data center resources and remote cloud resources, according to allocation policies (Sotomayor, et al., 2010) (see Figure 1).

OpenNebula holds unique capabilities for either private, public, and hybrid cloud management. It provides the following features and benefits, grouped by the different user roles:

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Figure 1. Overview of the OpenNebula architecture



For the Infrastructure Manager:

- Faster respond to infrastructure needs for services with dynamic resizing of the physical infrastructure by adding new hosts, and dynamic cluster partitioning to meet capacity requirements of services.
- Centralized, efficient and scalable management of the network, computing and storage capacity in highly distributed and large-scale physical infrastructures to enable the dynamic placement of virtualized multi-tier services.
- Higher utilization of existing resources with the creation of a infrastructure incorporating the heterogeneous resources in the data center, and infrastructure sharing between different departments managing their own production clusters, so removing application silos.
- Operational saving with server consolidation to a reduced number of physical systems, so reducing space, administration effort, power and cooling requirements.
- Advanced scheduling policies for the placement of virtual machines in the physical hosts, such as consolidating virtual machines to reduce power consumption or

advanced reservation of capacity to meet predictable service workloads.

- Lower infrastructure expenses with the combination of local and remote Cloud resources (i.e. hybrid cloud computing), so eliminating the over-purchase of systems to meet peaks demands.
- Secure management of multi-tenant environments, guaranteeing that resources are used only by users with the relevant authorizations and full isolation between workloads.

For the Infrastructure User:

- Faster delivery and scalability of services to meet dynamic demands of service end-users.
- Support for heterogeneous execution environments with multiple, even conflicting, software requirements on the same shared infrastructure.
- Support for multi-tier services consisting of groups or interrelated components (e.g. web interface or database back-ends) that are instantiated and automatically configured in several virtual machines.
- Full control of the life-cycle of virtualized services management.

For System Integrators:

- Fits into any existing data center thanks to its open, flexible and extensible interfaces, architecture and components.
- Builds any type of Cloud deployment.
- Open source software, Apache license
- Seamless integration with any product and service in the virtualization/cloud ecosystem and management tool in the data center, such as cloud providers, virtual machine managers, virtual image managers, service managers, management tools, security solutions and schedulers.

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