

## Cloud TAC: OpenStack and Technology Learning and Knowledge for teaching IT Infrastructure

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**Abstract.** In today's university environment, most students are digital natives. Therefore, it is difficult to imagine their academic life without relating it to the various cloud tools for communication and collaborative work. In this context, university professors work in new scenarios of communication and collaborative work in the classroom. This represents a transformation in the teaching-learning process assisted by new ICTs in the cloud. Working in the cloud offers the opportunity to transmit new knowledge when using pedagogical strategies supported by computer technologies. With the combination of ICTs and modern teaching-learning processes, the concept of Learning and Knowledge Technologies (TAC) is valuable. This work exposes the academic experience of researching and developing Cloud Computing using an OpenStack configuration so that students can empower themselves with the knowledge and use of cloud technologies. Thus, to be able to teach concepts and practices on IT Infrastructure including activities such as: design, configuration, implementation and administration of a private cloud for academic uses.

**Key words:** TAC, OpenStack, IT Infrastructure, private clouds.

### 1 Introduction

Systems and technological tools currently going to the Cloud Computing paradigm, which is constantly growing. More and more companies and research groups are working together to take advantage of the opportunities offered by Cloud tools [1]. These they consume resources as services: SaaS (Software as a Service), PaaS (Platform as a Service) or IaaS (Infrastructure as a service).

Students generally need computing infrastructure resources to carry out academic software development professorships or workshops. To satisfy this need, virtual machines with different operating systems are offered, specific tools that have a network (VPN), among others.

In this way, we support learning processes on IT infrastructure management [2], giving space for teachers to guide students to manage and configure IaaS requests. These resources could be obtained simply, quickly and easily by means of Cloud Computing

through the IaaS services. Virtual machines, computing, storage, among others, can be ordered and managed by the same student upon request from the private cloud itself. The management and use of these technologies allow the student to be trained with the necessary technical-technological knowledge such as the analysis, design and development of software systems [3].

The main objective of this work is to facilitate the academic community teaching-learning process for these since students are active participants in the private cloud. Also show the theory in a practical way, so that the student can get closer to new technologies through practical contact.

## 2 Technologies used: OpenStack for academic cloud

OpenStack is a free and scalable software platform designed to offer public or private clouds, enabling IaaS. It has different components with specific functions and can be installed separately or together, depending on the distribution. This integration is through API, which each service offers and consumes. Thanks to these APIs, the services can communicate with each other and allow one service to be replaced by another with similar characteristics as long as the way of communication is respected. In other words, OpenStack is extensible and meets the needs of those who want to implement it [4]. The main components are [5]:

**Compute (Nova):** OpenStack core, designed to manage and automate groups of equipment resources, being able to work with virtualization technologies.

**Object Storage (Swift)** - Module responsible for redundant, scalable, and fault-tolerant storage of objects and files.

**Networks (Neutron):** In charge of network management.

**Block Storage (Cinder)** - Provides persistent block-level storage devices, allowing search and recovery of virtual machines.

**Identity service (Keystone):** Service that offers user authentication and security policies.

**Image Service (Glance):** Provides virtual machine creation, search and recovery service. Manages all images of operating systems.

**Dashboard (Horizon)** - Provides administrators and users with a graphical interface to access, provision, and automate cloud resources.

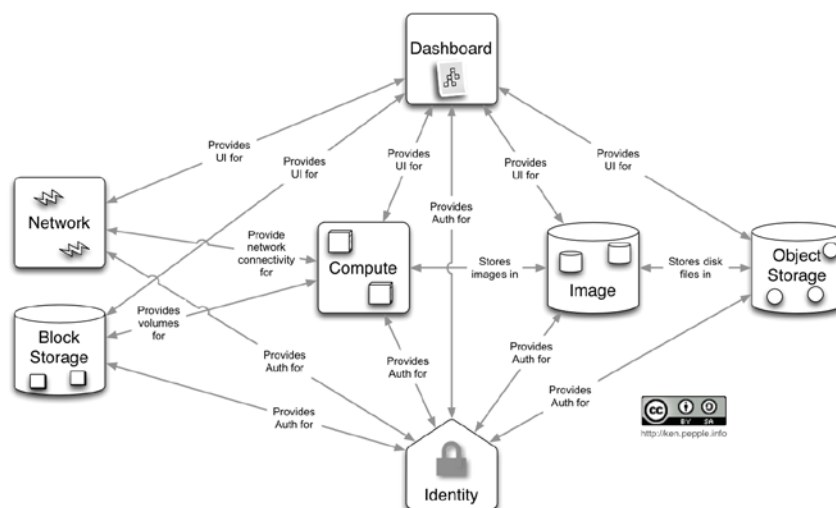


Fig. 1. Representative image of the intercommunication of modules in OpenStack [5]

### 3 Proposal

This work proposes to implement an IaaS platform based on OpenStack, which allows us to offer Cloud Computing resources to professors and students of the academic community of the UTN-FRLP. This promotes the use of free and open source software, as services such as Amazon Web Service, Microsoft Azure and Google Cloud are difficult to access due to their high licensing costs.

It seeks to implement and provide services through a private cloud, as part of the initiatives of the research area "Computer Science in Education and the 21st Century Classroom" of GIDAS. This technological experimentation is part of the Project approved by the UTN Secretariat for Science and Technology called "Computer innovation in learning and knowledge technologies applied to the improvement of educational processes". This work allows us to bring the use of OpenStack closer, not only providing the possibility of using virtual instances to the rest of the academic community, but also promoting its use and seeking to generate knowledge in students about the advantages of using this type of technology.

On the other hand, we consider that we are bringing a tool to centralize the deployment of software projects and execute them on different platforms. We simplify this task by giving all students the possibility of implementing their own virtual servers as part of a private cloud within the Faculty. During the 2019 academic year, the first experimentation experience with OpenStack was carried out in the subject of Resource

Management (hardware-software) of the 4th year in the Information Systems Engineering degree at UTN-FRLP. For this activity in the classroom, a workshop the OpenStack was designed with an installation and configuration guide so that students in the computing cabinet can deploy a Cloud and experience its use and administration. What allowed training in a practical way on the operation and resources that can be obtained from an IaaS. From this experience, it was possible to obtain feedback from the students for the use of these resources in various subjects and to improve the teaching mechanisms, being able to have virtual machines, computing, storage, among others, in a centralized way and that could be ordered and managed by the same student on demand from the private cloud itself. In addition, he provided us with initial information on the types of resources that will be consumed and those necessary to deploy Cloud Computing.

#### **4 Conclusions and Future Work**

From the design of these cloud technologies in the scope of the Faculty, it is expected to achieve an effective use of the use of TIC, putting not only knowledge but also tools from the perspective of usability, implementation and maintenance. This Project originates from the need to train researchers and thematic areas related to the management, deployment and manipulation of hardware technologies, within the scope of their use in the different professorships of the Career. In this aspect, the use of Openstack has been chosen as a starting point since its versatility and use allow activities to be carried out in such a way as to achieve an adequate transfer of knowledge in the research group, and its opportunity to transfer knowledge to different Chairs. . As future work, this project hopes to continue advancing in the implementation of a Private Cloud using its own technological resources. At the same time, incorporate new teaching-learning strategies through interaction with students and specific needs.

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