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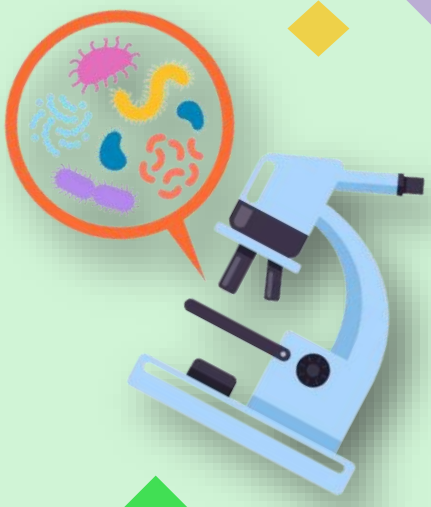
Yuri Morales López



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UNA UNIVERSIDAD NACIONAL COSTA RICA

Implementation of a Mini-cloud E-learning Supplementary Tool by Using free Tier AWS

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Resumen

Las técnicas de e-learning han mejorado el rendimiento en el sistema educativo moderno. Falta un sistema de gestión de e-learning efectivo y de bajo costo, y las herramientas podría tener un impacto negativo en el rendimiento educativo. La incorporación de tecnologías en línea en el proceso de aprendizaje puede cubrir esta desventaja. El sistema de nube de Amazon Web Service es una de las últimas tecnologías que ofrecen grandes volúmenes de servicios en las plataformas de aprendizaje electrónico. Accesando la capa gratuita de AWS, el sistema de gestión de aprendizaje (un Moodle con MYSQL), el alojamiento de archivos y los servicios de gestión de contenido se consideran herramientas complementarias que son viables mediante el uso de la plataforma AWS. Una explicación concisa relacionada con el diseño de la metodología se presenta en el documento junto con las ventajas del sistema que se detallan en la sección de conclusión. A pesar de que todavía existen varios riesgos asociados con la implantación de la nube, debido a las potenciales ventajas, como el costo bajo o gratuito, el alto rendimiento en tiempo real y el diseño seguro superan los riesgos y desafíos.

***Palabras claves*: Amazon Web Service (AWS); Moodle; e-learning; Cloud; Educación;**

Abstract

E-learning techniques have enhanced the performance in the modern education system. Missing an effective & low cost e-learning management system, and tool, could have the negative impacts on the educational performance. Incorporating the online technologies in the learning process can cover this disadvantage. Amazon Web Service cloud system is one of the latest technologies which offer large volumes of the services in the e-learning platforms. Service such as Free Tier account, the Learning Management System (a Moodle with MySQL), File-hosting and content management services are considered as the supplementary tools which are feasible by using AWS platform. A concise explanation related to the methodology design is presented in the paper along with related advantages which are detailed in the conclusion section. Even though, there are several risks associated with cloud implantation, the potential profits such as the low or free cost, real time high performance & secure design outweigh the possible risks and challenges.

***Keywords:* Amazon Web Service (AWS); Moodle; e-learning; Cloud; Education;**

Tema: Desarrollo y aplicaciones científicas y tecnológicas.
Principal área: Informática

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Introduction

Cloud computing is an Internet-based service that offer shared online computing & processing as well as the resources, applications, storage and data sharing to the users. It is using different tools and services such as high performance servers, storage and application services, enabling the ubiquitous and 24/7 of time access to resources. Also, it is a type of scalable sharing online resources through the Internet connection includes the process of delivering software and platform services (Saini et al., 2017). Providing the online self service security and authentication with a low IT service cost are some essential features of cloud systems (Kaur et al. 2019; Arora,2012; Wadhawan and Ahuja, 2012).
The cloud system also is considered as a set of services, applications and technologies which can be accessed and controlled by a large number of customers in real time from any locations (Alshamaila et al., 2013).The cloud structures is being adopted by various purposes and applications through the Internet because of its robust structure, various online services (Soft & Hardware), and scalable source sharing and storage features. Education is one of these plenty of spots (Gomita, 2017;Arora et al.,2012). Now a day, education have a vital role in the human life and using communication technology such as Internet is essential to run the e-learning systems (Saluja et al. 2019).The cloud can support the educational systems and related smart chain of learning such as learners, teachers and staff to get access to the online information from anywhere and anytime in a low cost price and sometimes free of charge (Yadav, 2014).
There are several papers that discussed the role of cloud systems in the educational and e-learning systems (Saini et. al, 2017; Gomita,2017; Kiran, 2014; Saluja et al.,2019; Vishwanath, et al ,2012). Some of them argued impact of cloud on the education system such as (Sateesh, 2018; Kale and Mente, 2017; Sing, et al. ,2012).There are plenty of investigations on “the relationship between the cloud services and e-learning” (Jain, et al ,2013; Pund, et al. ,2012; Dinoopet al. 2013; Faten et al. 2013; Darak et al. ,2014; Fernández et al.,2012; Riahi, 2015; Alajmi et al. ,2017; Hamidi and Rouhani,2018).

The abundances of the researches in this area indicate the high value and tendency of employing the cloud structure in the educational environment. Nevertheless, in this paper a novel practical model of a min-cloud e-learning tool is presented by using the free Tier Amazon Web Service (AWS) platform in which covers a particular portion of the educational and administrative needs of the learners and lectures. Three supplementary blocks which are integrated in one module, are: Learning Management System: Moodle with MySQL, File-hosting Software System. Seafile with PostgreSQL and Content Management System. Alfresco with MySQL. A short theoretical framework, Methodology of Implementation and analysis together with a concise conclusion will be discussed in the following sections.

Short Literature Review

AWS Cloud Computing

Cloud Computing is the fifth generation of computing era which provides to developers, designers and users capacity of sharing the electronic resources through the communication platforms (Qadri and Qadri, 2017). Amazon as the leader in the cloud industry (Chiregi &

Navimipour, 2018), has defined “Cloud computing is the on-demand delivery of compute power, database storage, applications, and other IT resources through a cloud services platform via the internet with pay-as-you-go pricing”(Amazon Web Services, Inc.,2019). Also, based on the Amazon, cloud computing offers a basic method to access to the farm of servers, applications, databases, storage spaces and a wide range of online services over the Internet, globally. One of the cloud service infrastructures which Amazon offers is Amazon “Amazon Web Services” or “AWS” which provides the online network-connected hardware required for its application services through the web applications. (Amazon Web Services, Inc.,2019).

AWS Cloud Computing Models

Basically, there exits three models for cloud computing as Figure 1 is demonstrates. AWS also, follows the same concept. Each model represents a singular component of the cloud computing stack.

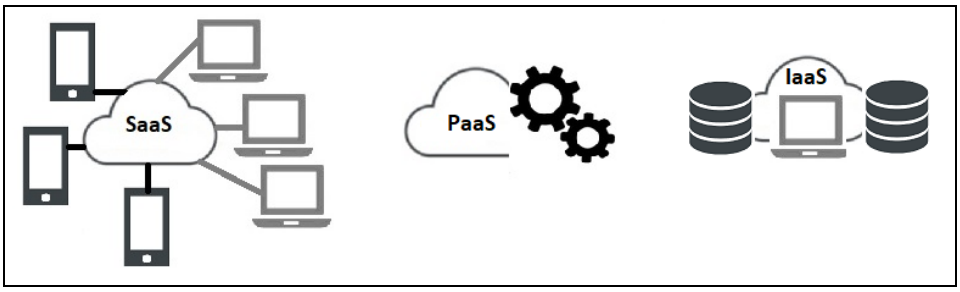

Figure 1. Three models of cloud computing (SaaS, PaaS and IaaS)

Saas, PaaS and IaaS are three models which AWS infrastructure, platform and software services have been built based on them.

Infrastructure as a Service (IaaS):

Iaas stands for Infrastructure as a Service, includes the basic building blocks for cloud IT which provides access to the networking nodes such as host, workstations, data storage and other computing resource. IaaS also provides to the clients with the highest level of processing: networking, storage and capability of management control over application and other resources.

Platform as a Service (PaaS):

PaaS or Platforms as a service provide the capability of deploying onto the platform to the client allowing them to develop, run and administrate the service applications without underlying to the infrastructure. This can help the users to focus on the development functions and eliminate the developer´s wariness related to the maintenance of the environment and resource procurement (Chang et al., 2010; AWS Inc., 2019).

Software as a Service (SaaS):

SaaS refers to the Software as a Service, or sometimes end-user application which provides to users access to the software & applications over the Internet. It is generally run by the service providers which can eliminate thinking about the service maintaining focusing on the application layer. One of the general cases of a SaaS is using the web-based

applications such as email or hosting the cloud-applications such as a basic webpage html file, etc.

Cloud system for Education

Cloud computing technology can provide solutions for main users such as the students, teachers and administrative staff in an educational system. The connected users to the Internet can connect the private mini-cloud for the institute. The student will have the opportunity of free access to a variety of the platforms, didactic resources via the WebPages on-demand. Teachers as other users will be connected to the cloud uploading assignments, tutorials, students´ evaluations and all prepared didactic resources into the farm-servers of the mini-cloud. Staff also, can almost administrate all transactions, correspondences, formalities, admission process and electronic procedures. They will be capable of the downloading/uploading all type of electronic files to the cloud system (Mannir and Getso, 2014; Jain, et al., 2013; Saini et al., 2017; Kiran, 2014).

Methodology and Analysis

In this section, a concise explanation related to the design and implementation of an AWS module includes three blocks (Moodle, Alfresco and SeaFile) in a mini-cloud AWS system.

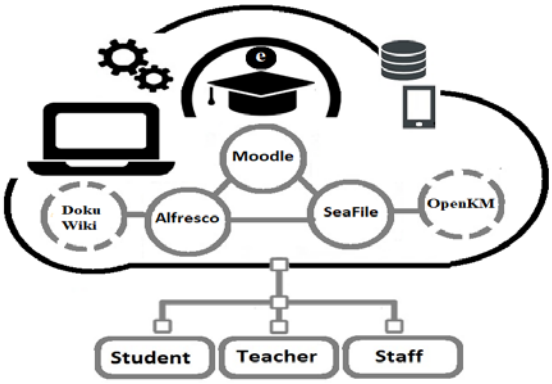

Figure 2. AWS supplementary E-learning tool system

In order to develop the mentioned module (see Figure 2) by using AWS is required to open a free Tire account for 12 months.

Opening the free Tire AWS account

Figure 3 shows an overview of the opening account process:

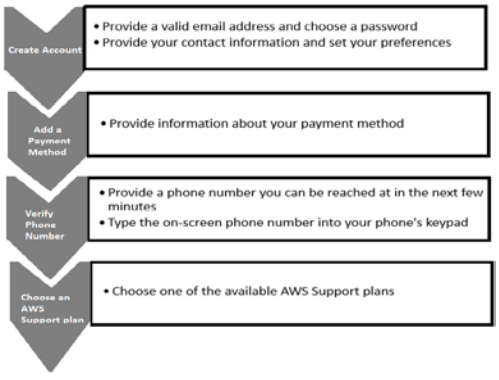

Figure 3. Account opening process (Amazon Inc. (a), 2019)

As Figure 3 demonstrates, four stages of opening an account are detailed. The AWS free Tier will be automatically activated for each AWS account and it ends after one year. The user can try all free AWS services for free while the AWS is active during this period of time. Table 1 summarizes a free Trier in AWS.

Table 1. Summary of a free Tier details (Amzon Inc(b),2019).

COMPUTE	**STORAGE**	**DATABASE**
Amazon EC2 750 Hours per month	Amazon S3 5GB of standard storage	Amazon RDS 750 Hours per month
DATABASE	**MACHINE LEARNING**	**COMPUTE**
Amazon Dynamo DB 25GB of storage	Amazon SageMaker 250 Hours for the first two months	AWS Lambda 1MILLION free requests per month
COMPUTE	**MACHINE LEARNING**	**ROBOTICS**
Amazon Lightsail 750 Hours one month free Trial	Amazon SageMaker Ground Truth Two months free Trial	AWS RoboMaker 25 SU-hours free

In Table 2, three AWS service tools which support e-leaning are selected to put into practice.

Table 2. Summary list & covering map of mini-cloud project

MINI-CLOUD PROJECTS	**STUDENT**	**TEACHER**	**STAFF**
Learning Management System: Moodle with MySQL	✓	✓	
File-hosting Software System. Seafile with PostgreSQL	✓	✓	✓
Content Management System. Alfresco with MySQL	✓	✓	✓

Learning Management System: Moodle with MySQL

In Moodle infrastructure, all functions are developed in modules which provide site, course & use. Also, it includes the logging, task, resource, forum modules, etc.

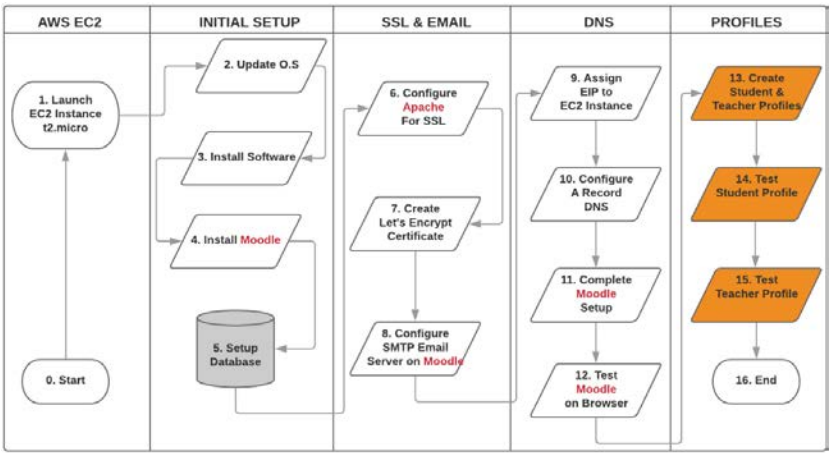

Figure 4. Configuration steps of the Moodle with MySQL

Based on the Flow chart in Figure 4, there are five steps to launch the Moodle block and

related process. They are AWS EC2, INITIAL SET UP, SSL & EMAIL, DNS and Profiles. In order to install the Moodle (version 3.6) it should run the following steps:

Installing Moodle 3.6 version on Ubuntu:
sudo git clone git://git.moodle.org/moodle.git
cd moodle
sudo git branch -a
sudo git branch --track MOODLE_36_STABLE origin/MOODLE_36_STABLE
sudo git checkout MOODLE_36_STABLE
Creating the database and de user for moodle conection:
mysql -u root -p
CREATE DATABASE moodle DEFAULT CHARACTER SET utf8 COLLATE utf8_unicode_ci;
create user 'usuariomod'@'localhost' IDENTIFIED BY 'SetYourePassword';
GRANT SELECT,INSERT,UPDATE,DELETE,CREATE,CREATE TEMPORARY TABLES,DROP,INDEX,ALTER ON moodle. TO usuariomod@localhost IDENTIFIED BY ' SetYourePassword ';*
The process in the PROFILES step ***will end*** with the Test Teacher Profile phase.

File-hosting Software System: Seafile with PostgreSQL

In SeaFile infrastructure, each client can obtain a specific storage quota, backup and shared files. Figure 5 demonstrates five configurations steps of the File-hosting Software System.

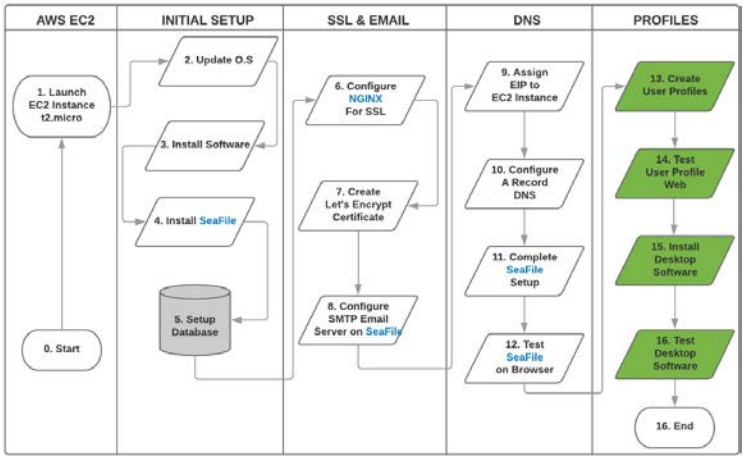

Figure 5. Five configuration steps of the SeaFile

Based on the Figure 5, there are five steps to install Seafile blocs considering some blocks in this graphical representation are common with the processes of the Moodle with MySQL (Compare Figure 4 vs. Figure 5). The own steps of the SeaFile configuration are highlighted in other colors.

In order to configure the **SeaFile** email, following steps are required to be installed:

Configure SMTL Email Server on SeaFile (Ubuntu):
--edit this file
sudo nano /home/sfadmin/sfroot/conf/seahub_settings.py
--Add to then end of file similar like this
EMAIL_USE_TLS = True
EMAIL_HOST = 'smtp.gmail.com'
EMAIL_HOST_USER = 'youraccount@gmail.com'

EMAIL_HOST_PASSWORD = 'your_password'
EMAIL_PORT = 587
DEFAULT_FROM_EMAIL = EMAIL_HOST_USER
SERVER_EMAIL = EMAIL_HOST_USER

Content Management System: Alfresco with MySQL

In Alfresco infrastructure, staff, students and teachers can define and share content for projects, tasks with collaborative options.

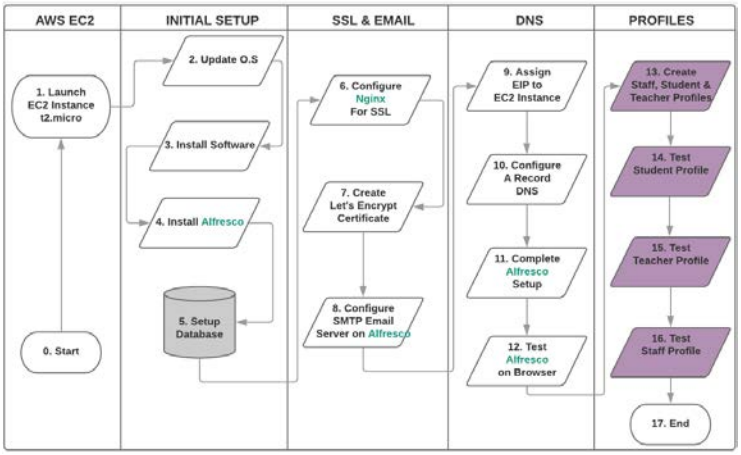

Figure 6. Configuration steps of the Alfresco

Figure 6 is a graphical presentation of configuration steps for Alresco service. There are some common blocks with Moodle MySQL & SeaFile. The highlighted blocks are particularly, belonging to the Alfresco Configuration process. In order to configure a DNS Record is required following this steps:

Configure a Recod DNS (AWS Route 53):
Login into AWS Account
Select Route 53 Service
*Select "Hosted zones" option and select the specific zone example "**mydomain.com**"*
Press "Create Record Set" Button
*Set a name example: alfresco (remember this record is on **mydomain.com**)*
Type: Select A-IPV4 or AAAA – IPV6 address
Define TTL in seconds (The default is 300)
Set the value (IP Address), for example: 52.52.52.52
Press "Create" Button
And ready!

Conclusion and Future work

Actually, cloud computing is becoming practical more and more for various organizations and institutes such as educational entities. As cloud systems provide online services, they are converting to a big supporting tool in the e-learning process. In the present study, a list of tools which support academic tasks & management has been prepared. With the support of free Tier of AWS, it can be guaranteed that teachers, students and staff can obtain benefits from the use of these platforms for a year at no cost. The free Tier of AWS application and services are the attractive opportunity for the students to take advantages of

an instance cloud-based Moodle system. Access to the prepared materials, share the experiences with others through chatting & forum spaces, sending homework, taking exam and lots of more benefits. The instructor as the central of e-learning process can prepare and present didactic materials, design exam, realizing the online exams and evaluating them in real time, register records of the students and doing all type of the electronic transactions & academic tasks in a secure platform. Staff as the educational support department can implement all kind of electronic interactions and activities as well as teachers through the AWS free Tier services. They can accomplish many administrative functions such as realizing the correspondence process, admission procedure, academic evaluations, collecting data related to the teacher & student performance and course scheduling.
In order to complete the AWS e-learning supplementary module design, two more components such as DokuWiki and OpenKM, which can be practical in the implementation of collaborative academic tasks, will be developed as a future work.

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