[Berlin Institute of Technology](https://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&cad=rja&uact=8&sqi=2&ved=0ahUKEwiVgpy4r4rRAhWKMVAKHSe5BKwQFghQMAY&url=https%3A%2F%2Fwww.linkedin.com%2Fcompany%2Ftu-berlin&usg=AFQjCNExBiMP72-gp2IK1_t3_OM98p1GWA&sig2=qqzI7wU5CpNwIhkSjZZstQ)

Faculty IV – Electrical Engineering and Computer Science

Department of Telecommunication Systems

**Service-centric Networking**

**Using modern deployment methods to provide a cloud based learning platform**

Master thesis proposal

presented by:

**BURCIN BAYKAN**

Matriculation number: 358882

Course of study: Computer Engineering

E-mail: [burcin@mailbox.tu-berlin.de](mailto:burcin@mailbox.tu-berlin.de)

Date of delivery: 25 January 2017

1. Supervisor: Axel Küpper

2. Supervisor: N.N

1. Advisor: Mathias Slawik

2. Advisor: Dirk Thatmann

3. Advisor: André Krüger (eLeDia GmbH)

1. **Introduction**

The topic of this master thesis is defined in cooperation with the company eLeDia GmbH. The company is hosting Moodle systems on virtual machines. The virtualization is done using Xen. Xen is a hypervisor (also known as a Virtual Machine Monitor (VMM)) that runs directly on hardware. Xen allows running multiple virtual machines on a physical computer. eLeDia GmbH installs and manages Moodle systems on these virtual machines for different customers. Moodle is a Learning Management System[[1]](#footnote-2).The software supports cooperative teaching and learning methods and in some cases requires a lot of memory and computing power. Since the company uses Xen for the virtualization, the final thesis will deal with using modern deployment methods to provide a learning platform on the cloud using the CYCLONE stack.

1. **Problem definition**

As described above, eLeDia GmbH uses Xen for virtualization. When using Xen several problems can arise:

* 1. **Deployment effort**

Each virtual machine has its own operating system. Thus it needs a lot of resources and memory. Hence, the virtual systems are slower than real hardware. Thereby slowing down the deployment process of any application.

* 1. **Maintenance effort**

Virtual machines are always dependent on operating system of the physical computer. All virtual machines are automatically rebooted if the physical computer has to be restarted due to updates, reconfiguration, etc. This increases the downtime. More number of virtual machines extend the reboot time.

* 1. **No redundancy**

The Xen virtualization cannot guarantee high availability or even fault tolerance of resources. The installed applications no longer work if the server fails.

* 1. **Elasticity**

Virtual machines are not elastic. The resources are not distributed among the virtual machines dynamically based on the priority or load.

1. **State of the art :**

Google launched “Kubernetes” which is a system that enables deployment, scaling, and administration of containers. OpenStack will be able to run in container on Kubernetes.

**3.1 OpenStack**

OpenStack includes a variety of components, including virtualization and the provision of storage. Users can also package and manage OpenStack in a container.

**3.2 Docker&Docker Compose**

Docker is a tool for automated provisioning of applications. This simplifies the provisioning of applications because containers contain all necessary packages and containers can be easily transported and installed. On the other hand, containers ensure the separation of the resources used on a machine, so that a container does not have access to the resources of other containers. Docker Compose allows you to manage easily and link multiple Docker containers.

**3.3 CYCLONE**

CYCLONE is an innovation action and was established by the European Commission.

CYCLONE enables the deployment and management of cloud-based applications. CYCLONE consists of production-quality tools and software. CYCLONE has several main components like SlipStream and C[YCLONE Federation Provider](http://www.cyclone-project.eu/software.html#cyclone-federation-provider). Slipstream is offered via the Nuv.la Online Application Deployment platform.

**3.4 Nuv.la**

Nuv.la is a deployment tool and offers to package the application components in containers and to define the application.

1. **Approach**

**4.1 Moodle Docker&Docker Compose**

The solution to deployment effort is using docker containers when deploying the application. [Docker provides automated deployment of moodle application](https://www.google.de/search?espv=2&biw=1354&bih=638&q=docker+provides+automated+deployment+of+moodle+application&spell=1&sa=X&ved=0ahUKEwjaua7gldTRAhVBDywKHbPbAeoQBQgYKAA). Docker Compose allows running multi-container Applications. Creation of multiple servers is very simple using Docker Compose.

**4.2 Nuv.la Online Application Deployment Platform**

The maintenance effort is solved by using Nuv.la. Nuv.la enables deployment, scaling and management of moodle apps on all cloud from a single platform.

**4.3 Criteria of ELeDia GmbH**

A high-availability system is to be provided. The system should include 1 load balancer, 2 webserver and 2 databaseserver. We also need memcache servers and a fileserver for the Moodledata directory. The database server should be configured as master-slave configuration. An automatic switch must occur when the server crashes. A new webserver is to be started automatically from a template when the CPU utilization of two web servers would rise above 78 %.

**4.4 Analysis of Work**

The goal of this thesis is to analyze and test the CYCLONE Federation provider based Moodle hosting. It is necessary to examine the advantages and disadvantages of Moodle Docker in terms of high availability and scalability. The evaluation takes place by comparing the hypervisor-based virtualization and container-based virtualization for providing the learning platform

1. **Task/Time scheduling**

|  |  |
| --- | --- |
| **Tasks** | **Time** |
| Design and Implementation  Analysis | February 2017 – 30 May 2017  April 2017 – May 2017 |
| Documentation | February 2017 –May 2017 |
| Writing and Finalizing | June 2017 – July 2017 |

1. More information can be found on https://moodle.org [↑](#footnote-ref-2)