



# CloudOpting

Migration of Open Public Services to the Cloud and Provision of Cloud Infrastructures

## Deliverable D2.4.2 Background Platforms Adaptation and Interfaces. (Prototype)

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## Reference

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v3.0	30/06/2016	Check drawings	Xavier Cases	Xavier Xicota, Gonzalo Cabezas

## Acronyms & Abbreviations

Concept	Definition
TOSCA	Topology and Orchestration Specification for Cloud Applications
UI	User Interface
API	Application Programming Interface
BPMN	Business Process Model and Notification

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## 1. Executive Summary

Deliverable *D.2.4.2* is a prototype release of the background platforms integrated in the CloudOpting Platform (release 2.0 on February 2016). This document supports and complements the prototype, delivered via Github, to present a summary of how the platforms are used and how are they configured and integrated in the CloudOpting architecture. A deeper technical description of the information described in this document can be found in *D2.1 Platform Technical Requirements*, *D2.2 Architecture of the CloudOpting platform* and *D2.3.2 Integrated CloudOpting Platform*.

This is an updated version of the deliverable D2.4. In June 2016, gathering the comments at the second year project review in Brussels, a new version of the document is released. This version of the document provides a deeper view of the technical architecture of the CloudOpting Platform and provides more detailed and precise information of the interfaces, libraries and components used.

## 2. Introduction

In September 2015 the version 1.0 of the CloudOpting Platform was released. It was a prototype version covering the basic functionality required to fulfil the core business use cases. Among them: User register, Login to the CloudOpting web catalogue, publishing services, and finally, subscribing services. This first version of the CloudOpting Platform was conveniently described in Deliverables D2.3.1 and D2.4.

According to the CloudOpting project calendar, at the end of February, it was delivered the second release of the CloudOpting Platform. This 2.0 release, as the name suggests, consolidated a release of the CloudOpting Platform capable to offer the full functionality to manage the services.

One of the first technological paradigms of the project was based on the use of pre-existing platforms and libraries already existing in the market. Deliverable D2.4.2, Background Platforms Adaptation and Interfaces, presents a detailed description of how are these platforms used and how are they configured and integrated in the architecture.

In June 2016, gathering the comments at the second year project review in Brussels, a new version of the document is released. This version provides a deeper insight of the architecture of the CloudOpting Platform by means of diagrams of components. It also emphasizes some key technical aspects of these components and how they have been adapted and integrated in the CloudOpting Platform.

The present document is structured in 3 sections describing:

- **The CloudOpting Platform** release version.
- **The Architecture** at physical level.
- **The Background platforms** being used.

This Deliverable D2.4.2 is also complementary of Deliverable *D2.3.2 Integrated CloudOpting Platform* because D2.4.2 offers a technical summary of this CloudOpting release, whereas D.2.3.2 is more focused in the usability and functionality of the release.

### 3. Architecture

#### 3.1. Diagram

The following diagram shows the physical architecture of the CloudOpting Platform.

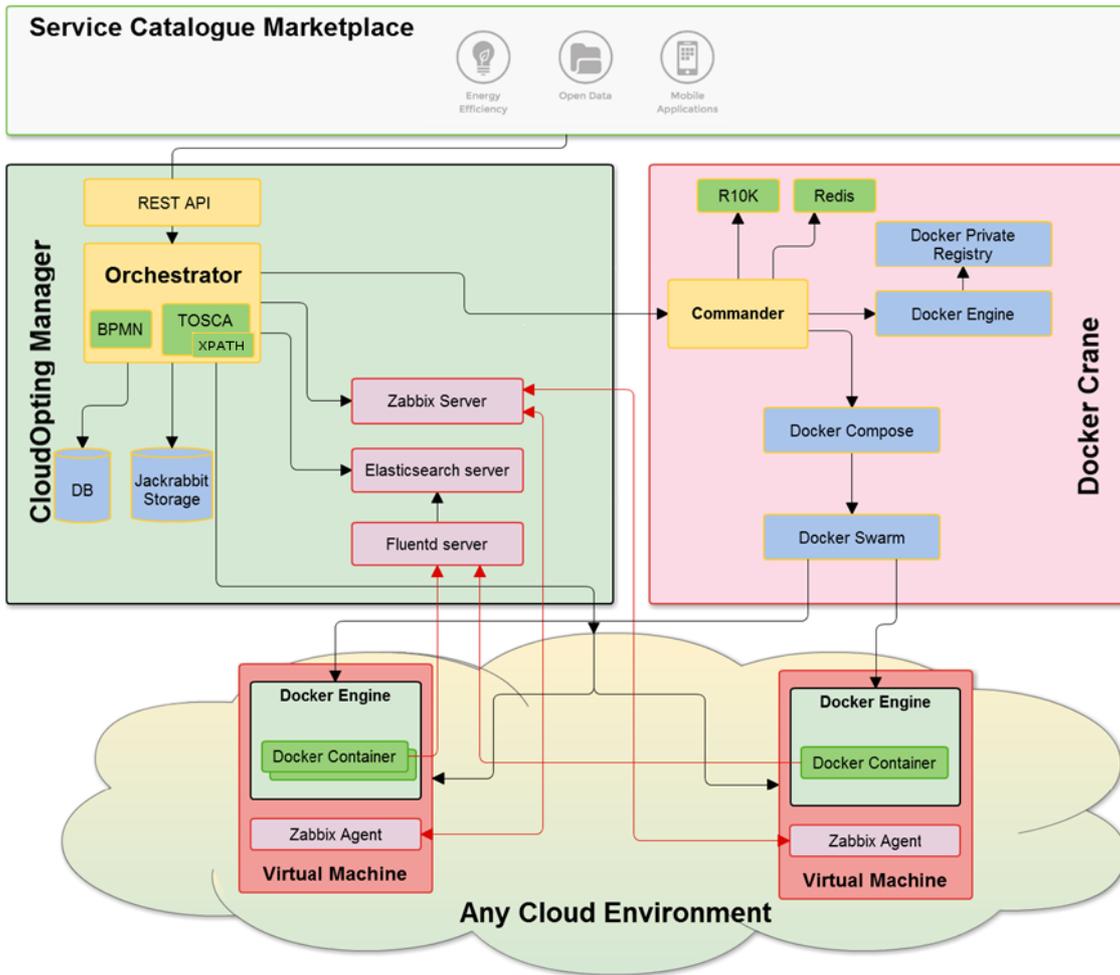


Figure 1: CloudOpting Platform Architecture

The next sections provide further information on these components.

### 3.2. CloudOpting Manager

CloudOpting Manager is the core component of the CloudOpting Platform and manages all the business logic. According to the diagram above it can distinguished the following elements grouped by their functionality.

#### Interface Layer

The User Interface layer provides functionality to end users and is composed by the following elements:

- **User Interface<sup>1</sup>**. A web based tool that provides the access to the CloudOpting catalogue of services and the basic backoffice functionality to manage the service operations.
- **Rest Component**. Element in charge of the Web User Interface and representing the API umbrella for all other services.

#### Persistency Layer

The Persistency layer provides storage functionalities. This layer is composed by the following elements:

- **File System**. The file system provides storage for environment parameters and ISO images. Implemented in Jack Rabbit.
- **DB**. The persistency layer is implemented in PostgreSQL. The DB stores the business data, and persistent data needed to configure the CloudOpting environment.

The following image shows the *Entity Relationship* diagram of the CloudOpting Manager DB

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<sup>1</sup> See Deliverable D2.3.2 for more information on the CloudOpting User Interface



## Orchestrator Layer

The Orchestrator layer provides the functionality to deploy and manage services on the CloudOpting Platform. This layer is composed by the following elements:

- **Orchestration.** Takes control of the process, controlling each step and commanding the other modules.
- **Tosca.** The TOSCA file contains the topology service information necessary to manage the automation of the deployment. The Tosca component is able to take a TOSCA description of a service and obtain the proper inputs for Docker Crane and JClouds.
- **Xpath.** XPath is used to navigate through elements and attributes in an XML document in order to extract all needed information.
- **JClouds.** Connects to a cloud provider, manage the VM creation, provision and configuration.
- **Docker Manager.** Invokes Docker Crane and provides services and basic functionality to manage Docker instances and container related operations.

The following image shows the main process executed by the Orchestrator to automatize the deployment of services on the CloudOpting Platform

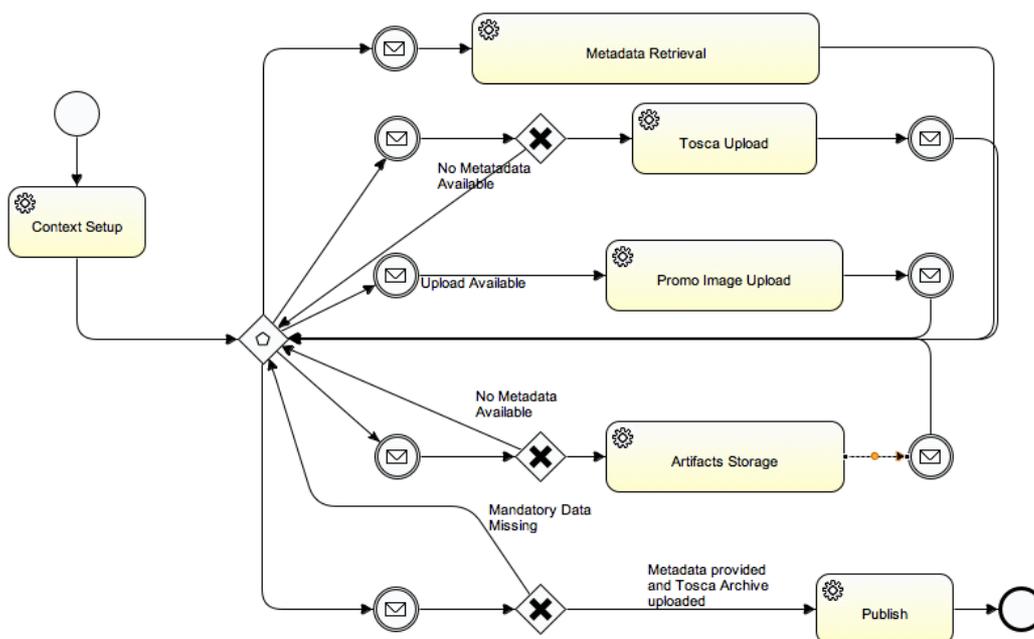
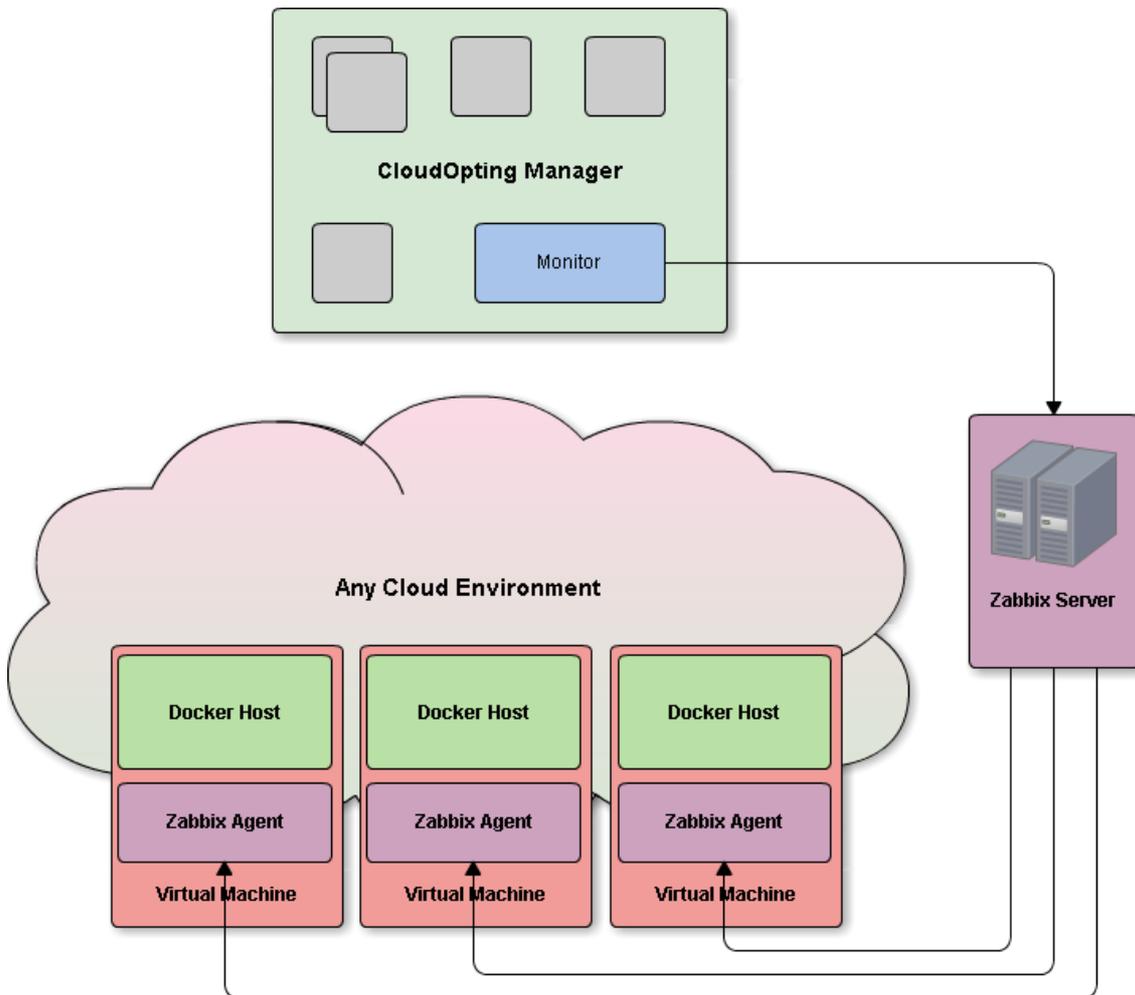


Figure 3: CloudOpting Manager. Orchestrator Deployment process

## Monitor Layer

The Monitor layer provides functionality to monitor the VM's and the performance of the services deployed on the CloudOpting Platform. The image below shows the main components:



**Figure 4: CloudOpting Manager. Monitoring Component**

This layer is composed by the following elements:

- **Zabbix Agent.** Deployed at VM level, allows the system to monitor the Docker host.
- **Zabbix Server.** Collects data from all Zabbix agents.
- **Monitor.** Dashboard panel that allows the user to monitor the performance of any service deployed on the CloudOpting Platform.

## Logging Layer

The Logging layer provides functionality to log the operations of the services deployed on the CloudOpting Platform. The image below shows the main components.

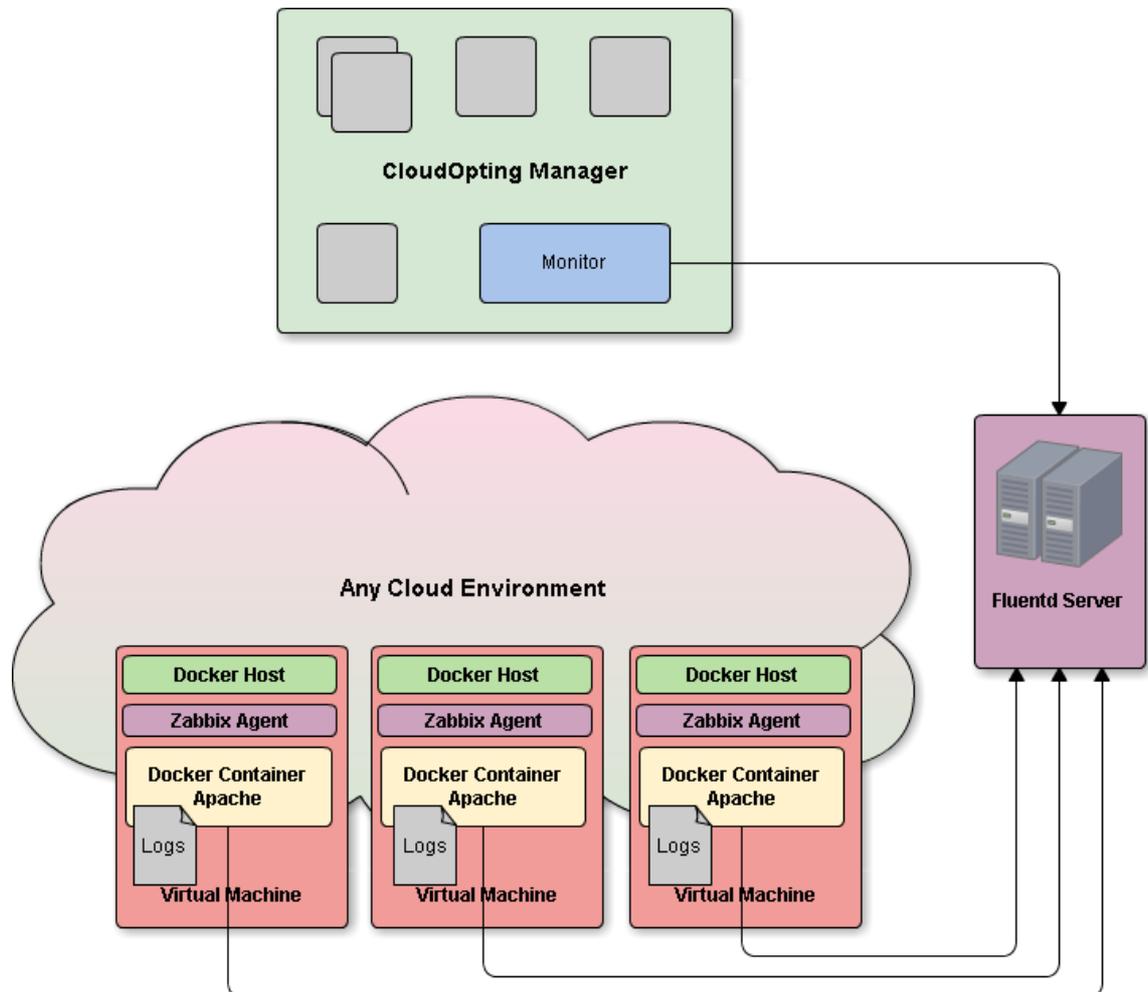


Figure 5: CloudOpting Manager. Monitoring

This layer is composed by the following elements:

- **Logs Container.** Storage of logs at Docker level Container
- **Fluentd Server.** Collects data from all Docker Containers
- **Elastic Search.** Allows the user to retrieve data from the log storage
- **Monitor.** Dashboard panel that allows the user to measure service KPI's of the services deployed on the CloudOpting Platform.





- **REST Component.** Provides the Spring Boot REST endpoint for all the platform features. It's consumed by the user interface.
- **Docker-manager interface.** Wraps the Crane REST API with Java classes and methods.
- **Crane Interface.** Crane provides a REST API (commander) which is the interface for all the Docker related operations. There are methods related with base images construction, service image construction with puppet manifests, connect with Docker hosts, Docker swarm clusters, and container orchestration.
- **JackRabbit interface.** Set of Java classes and method to talk with the JackRabbit service.

## 4. CloudOpting Platform Release

### Release Version

Current release can be found and executed following the link below:

<http://lab1.cloudopting.org:8080/cloudopting/>

The release of the CloudOpting Platform described in this document is composed by the following GitHub projects:

- **CloudOpting/cloudopting-crane** Tag:v2.0 released on February the 15<sup>th</sup>, 2016

<https://github.com/CloudOpting/cloudopting-crane>

- **CloudOpting/cloudopting-manager** Tag:v2.0.0 released on February the 29<sup>th</sup>, 2016

<https://github.com/CloudOpting/cloudopting-manager>

- **CloudOpting/cloudopting-fluentd** Tag:v2.0 released on February the 17<sup>th</sup>, 2016

<https://github.com/CloudOpting/cloudopting-fluentd>

### Installation

A guide to install the full CloudOpting Platform on a local server can be found in the CloudOpting's Github account:

<https://github.com/CloudOpting/deploy-cloudopting>

## 5. Background Platforms

As seen in section 3.4, figure 7 shows the architecture of software platforms and libraries that have been used to build the CloudOpting Architecture. The list below is the full list of libraries and the description of the key technical features to adapt them to the CloudOpting Platform. It also includes links to the software library page and version used.

### 5.1. Cloudstack

Apache CloudStack is open source software designed to deploy and manage large networks of virtual machines, as a highly available, highly scalable Infrastructure as a Service (IaaS) cloud computing platform. Used in CloudOpting as a cloud platform in Torino. It contains a selected set of services and works as a production environment for the WP4 Pilots.

- **Version used: 4.4.1**
- **Link/path to the software library**

<https://cloudstack.apache.org/>  
<https://cloudstack.apache.org/archives.html>

### 5.2. Azure

Microsoft Azure is widely considered both a Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Used in CloudOpting as a cloud platform in Barcelona. It contains a selected set of services as a production environment for the WP4 Pilots.

- **Version used. Software as a Service**
- **Link/path to the software library**

<https://azure.microsoft.com/es-es/>  
<https://azure.microsoft.com/en-us/pricing/free-trial/?b=15.21>

### 5.3. Jack Rabbit

Jackrabbit Oak is a complementary implementation of the JCR specification. It is an effort to implement a scalable and performant hierarchical content repository for use as the foundation of modern world-class web sites and other demanding content applications.

CloudOpting uses it to store all kinds of files, from media to database bulks or configuration files.

- **Version used: 2.10.1**
- **Link/path to the software library**  
<https://jackrabbit.apache.org/jcr/index.html>  
<https://jackrabbit.apache.org/jcr/downloads.html>

## 5.4. JClouds

Apache jclouds® is an open source multi-cloud toolkit for the Java platform that provides the freedom to create applications that are portable across clouds while giving full control to use cloud-specific features.

It's been used by the CloudOpting platform to implement a common API to grant compatibility for all cloud types. (ie. Cloudstack and Azure).

- **Version used: 1.9.0**
- **Link/path to the software library**

<https://jclouds.apache.org/>

<https://jclouds.apache.org/releasesnotes/1.9.0/>

## 5.5. R10K

R10k is a code management tool to manage environment configurations (such as production, testing, and development) in a source control repository. Based on the code in control repo branches, r10k creates environments on the master and installs and updates the modules required in each environment.

It's been used by the CloudOpting Platform to manage puppet dependencies.

- **Version used: 2.0.3**
- **Link/path to the software library**

<https://github.com/puppetlabs/r10k>

<https://docs.puppetlabs.com/pe/latest/r10k.html>

## 5.6. BPMN Activiti

Activiti is a light-weight workflow and Business Process Management (BPM) Platform targeted at business people, developers and system admins. Its core is a BPMN 2 process engine for Java. Activiti is open source and runs in any Java application, and integrates perfectly with Spring. It is extremely lightweight and based on simple concepts.

CloudOpting uses it to define and manage all the critic flows of the platform.

- **Version used: 5.18.0**
- **Link/path to the software library**

<http://activiti.org/>

<http://www.activiti.org/download.html>

## 5.7. Tosca

OASIS Topology and Orchestration Specification for Cloud Applications (TOSCA).

Used by CloudOpting as a standard to define the service topologies and the technical features and components of each service. The CloudOpting Platform processes the TOSCA files to publish and replicate the services easily.

- **Version used: 1.0**
- **Link/path to the software library**

<https://www.oasis-open.org/committees/tosca/faq.php>  
<http://docs.oasis-open.org/tosca/TOSCA/v1.0/os/TOSCA-v1.0-os.html>

## 5.8. Puppet

Puppet Enterprise is the leading platform for delivering and operating constantly modern software – no matter where it runs. It allows the CloudOpting Platform to automate the deployment of services.

It's been used to install and manage the software needed inside the Docker containers.

- **Version used: 3.8**
- **Link/path to the software library:**

<https://puppetlabs.com/blog/introducing-puppet-enterprise-3.8>  
<https://puppetlabs.com/blog/puppet-enterprise-3.8-now-available>

## 5.9. Docker

Docker is the a software containerization platform used for having a cross platform environment no matter the OS used and grant the portability of services. As the CloudOpting Platform follows a micro services approach, each Docker container has a single piece of software (service) inside.

- **Version used: 1.8.1**
- **Link/path to the software library**

<https://docs.docker.com/>  
<https://github.com/docker/docker/releases>  
<https://github.com/docker/docker-py>

## 5.10. Bootstrap

Bootstrap is the most popular HTML, CSS, and JS framework for developing responsive, mobile first projects on the web.

CloudOpting uses it to style the user interface among other custom styles.

- **Version used: 3.3.5**
- **Link/path to the software library**

<http://getbootstrap.com/>

<http://blog.getbootstrap.com/2015/06/15/bootstrap-3-3-5-released/>

## 5.11. Angular JS

AngularJS (commonly referred to as "Angular" or "Angular.js") is a complete JavaScript-based open-source client and server-side web application framework mainly maintained by Google and by a community of individuals and corporations to address many of the challenges encountered in developing single-page applications.

It's been used by the CloudOpting Platform to create the user interface, together with Bootstrap.

- **Version used: 1.3.11**
- **Link/path to the software library**

<https://angularjs.org/>

<https://code.angularjs.org/1.3.11/>

## 5.12. Elastic Search

Elasticsearch is a distributed, open source search and analytics engine, designed for horizontal scalability, reliability, and easy management. It combines the speed of search with the power of analytics via a sophisticated, developer-friendly query language covering structured, unstructured, and time-series data. CloudOpting uses it to query the logs from different servers.

- **Version used: 1.7.2**
- **Link/path to the software library**

<https://www.elastic.co/>

<https://www.elastic.co/blog/elasticsearch-1-7-2-released>

### 5.13. ZABBIX

Zabbix is an open-source enterprise-level software designed for real-time monitoring of millions of metrics collected from tens of thousands of servers, virtual machines and network devices.

It's been used by the CloudOpting Platform to monitor all installed services in order to have metrics for the end user.

- **Version used: 2.4**
- **Link/path to the software library**

<http://www.zabbix.com/>  
<http://www.zabbix.com/rn2.4.0.php>

### 5.14. JGRAPH T

JGraphT is a free Java class library that provides mathematical graph-theory objects and algorithms. It runs on Java 2 Platform (requires JDK 1.8 or later starting with JGraphT 1.0.0).

It's been used to create the graphs for the metrics generated for Zabbix and Elasticsearch.

- **Version used: 0.9.1**
- **Link/path to the software library**

<http://jgrapht.org/>  
<http://mvnrepository.com/artifact/org.javabits.jgrapht/jgrapht-core/0.9.1>

### 5.15. FLUENTD

Fluentd is an open source data collector for unified logging layer. It is set in the creation of the docker-compose in order to have automatic logging for the selected docker containers.

- **Version used: Integrated in Docker > 1.8**
- **Link/path to the software library**

<https://github.com/CloudOpting/cloudopting-fluentd>  
<http://www.fluentd.org/>  
<http://www.fluentd.org/guides/recipes/docker-logging>

### 5.16. Postgres

PostgreSQL is a powerful, open source object-relational database system. It is used for the platform to save information such as activities flows, the users, the organizations and the services.

- **Version used: 9.1**
- **Link/path to the software library**

<https://www.postgresql.org/>