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Implementing and Managing framework for PaaS in

Cloud Computing

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**ABSTRACT**

With the rapid development of Internet and

Cloud computing, there are more and more

network resources. Sharing, management and

on-demand allocation of network resources are

particularly important in Cloud computing.

Platform as a Service (PaaS) is one of the key

services in Cloud computing. PaaS is very

attractive for schools, research institutions and

enterprises which need reducing IT costs,

improving computing platform sharing and

meeting license constraints. However, nearly all

current available cloud computing platforms are

either proprietary or their software infrastructure

is invisible to the research community except

technologies. Cloud computing provides both

platforms and applications on-demand through

Internet

or

intranet

[1][2][7][13].

Some

examples

of

emerging

Cloud

computing

platforms are Google App Engine [14], IBM

blue Cloud [16], Amazon EC2 [17] and

Microsoft Azure [18]. The Cloud allows

sharing, allocation and aggregation of software,

computational and storage network resources

on-demand. Some of the key benefits of Cloud

computing include hiding and abstraction of

complexity, virtualized resources and efficient

use

of

distributed

resources

[2];

Cloud

computing is still considered in its infancy, there

are many challenging issues waiting for tackling

[1][2][5][6][7][13]. Platform as a Service (PaaS)

is one of the key services in Cloud computing.

“PaaS is the delivery of a computing platform

and solution stack as a service without software

downloads or installation for developers, IT

managers or end-users,… It's also known as

Cloudware.” [14] It is very important to develop

an on-demand resource management system for

PaaS in Cloud environments. In this paper, a

framework for platform as a service is

developed. It is also possible to apply the

proposed solution to real and vitual Cloud

for

a

few

open-source

platforms.

For

universities and research institutes, more open

and testable experimental platforms are needed

in a lab-level with PCs. In this paper, a

framework for managing PaaS in a virtual

Cloud computing lab is developed. The

framework implements the user management,

resource management and access management.

The system has good expandability and can

improve resource’s sharing and utilization.

**1. INTRODUCTION**

Cloud computing is developing based on years’

achievement on virtualization, Grid computing,

Web computing, utility computing and related

computing

environment.

The

system

implements the user management, resource

management and remote access. For schools,

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research institutes and small/medium size

enterprises, reducing the IT cost is especially

important. For example, in the traditional school

lab, because of software license and hardware

constraints, many useful application software

and platforms are not accessible to students

“anytime and anywhere”. This problem may be

solved using PaaS in Cloud computing. Through

development of several conceptions such like

virtualization, utility computing, IaaS, PaaS and

SaaS.

**2.1 SaaS (Software as-a-Service)**

SaaS is the supreme, first appeared and the most

common type of cloud computing. It includes a

complete application provided to a service

through multitenancy demand. The software

instances are used as providers' infrastructure

and provide services for several end-users or

customer organizations. The basic idea of SaaS

is to put software on providers' servers and let

the operators in charge of the management of

maintenance and upgrades. Users who purchase

the software only buy the network's permission

to use the software instead of installing the

software locally. As for the users, they will save

the expenses of server and software license. As

for the suppliers, they only need to maintain a

program so they will reduce the cost.

virtualization

and

other

resource

sharing

mechanisms, Cloud computing can dramatically

reduces user costs and meet large-scale

applications’ demands. Using virtualization

techniques, it is possible to open a few

platforms

in

a

single

physical

machine

(Windows, Linux or others) so that resources

can be shared better and more users can be

served. Most of Cloud computing platform is

based on virtualized environments. In a

virtualized Cloud computing lab, there are four

major parts: software and hardware platforms

provided from real and virtualized servers

(narrowly speaking, PaaS resources); resource

management node; database servers and users

who access resources through Internet or

Intranet. Generally speaking, above mentioned

platforms and users can all be called resources

in the Cloud. In the following sections, we

**2.2 PaaS (Platform as-a-Service)**

PaaS is not only abstract packages of

development environment and also packages of

effective service load. PaaS productions can

execute the software development and testing of

various stages or be used for a certain field.

PaaS service can provide great flexibility, but

might be affected by the suppliers' ability. Users

can develop their own program by middlemen's

infrastructure equipments and deliver it through

Internet and their server to other users.

consider

a

framework

of

design

and

implementation of PaaS in the Cloud, especially

focusing on the resource management. Section 3

discusses the design architecture and major

modules in the system; section 4 introduces the

implementation technologies and operational

environment; Related work in the literature are

introduced in Section 5; finally a conclusion is

provided in section 6.

**2.3 IaaS (Infrastructure as-a-Service)**

IaaS is in the lowest level and is a mean of

providing basic storage and computing ability

on line as a standardize service. Servers, storage

systems, switches and routers and other systems

are operable and can be used to handle workload

from application components to the high

performance computing applications.

**2. CLOUD COMPUTING**

**HIERARCHICAL STRUCTURE**

The

present

study

achievements

haven't

achieved an agreement on the definition of

"cloud"

computing

and

is

"cloud

generally

computing". Could

viewed as the

development of Parallel Computing, Distributed

Computing and Grid Computing or the

commercial realization of these computer

science conceptions. Cloud computing is a

production of the mixing, evolution and

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module and connection management module.

These three modules can be divided into the

corresponding sub-modules. User Management

module includes basic information management

and user access management. Basic information

management is mainly concerned with users’

information changes to database records; user

login management is mainly responsible for the

user login and authentication, as well as the user

interface. Resource allocation subsystem is the

core of the management system, including

resource usage, resource status and resource

renewal subsystem. Resource usage manages

the immediate users and books resources for

future users; resources status management

maintenances status of all resources; resources

renewal management lets user renew the use of

resources if possible. Connection management

module is to deal with users’ accessing

resources, including remote access management

and remote connection management. These can

be done in the remote servers together with

management node. PaaS resources can be

controlled by one management node or many

nodes in the Cloud.

**3. DESIGNING PaaS SYSTEM**

***3.1 The Architecture of a Virtual Cloud***

***Computing Lab***

Figure 1 A virtual Cloud Computing Lab

A simplified Cloud computing environment is

shown in Figure 1, where users send requests

for computing platforms through Internet or

intranet (Cloud); management node which may

be physically in the same cloud as server

groups, verifies the user account, finds available

real and virtual servers with requested platforms

and allocates them to the user for some periods

of

time;

database

servers

keeps

users

***3.2 Communication Among Core Modules***

authentication, resource availability and other

information; after some time, the user finishes

the service and leaves the system or chooses to

renew. This paper discusses how to design and

implement

the

lab

with

focus

on

the

management system.

Management System of On-demand Resource

Allocation.

The management system includes a user

Figure 3 Communication Among Core Modules

management

module,

resource

allocation

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In Figure 3, Web Portal is users Web access

interface; Manager refers the resource allocation

manager; Server refers to a group of real or

virtual servers. From the figure we can see that

the

major

communications

among

core

modules: users access Web servers and

resources list, and selects resources; Web server

forwards

the

user

request

to

resource

management node for processing; then, resource

management node sends back Web server the

resources information by IP address and users

account; Finally, users get access to resources in

real or virtual servers. The management system

of PaaS needs to coordinate among these four

parts to efficiently manage users, platforms

resource and remote connections.

Figure 4 Database Management System

***3.5 Virtualization in Operating System Level***

Virtualization is one of key technology in Cloud

computing.

virtualization such as operating system level,

hardware location level and network level.

There

are

many

levels

of

***3.3 User Management***

There may be four kinds of users in PaaS: end

users, personnel who manage access to the

resources and allocate resources, creators of the

PaaS service and PaaS framework developers.

In this paper users refer the end-user only, who

accesses PaaS service through a web portal. The

user can select from a menu list of a

combination of applications and operating

systems. The user can request for immediate use

or for sometime in the future (reservation).

There are time windows for user to choose.

Once authenticated, user can access remote

PaaS service use security remote connection

such as openSSH.

Operating

system

level

virtualization

is

considered only in this paper. Using VMware

workstation and other related virtualization

software, it is possible to open a few platforms

in a single physical machine (Windows, Linux

or others) so that resources can be shared

Efficiently and more users can be served.

**4. IMPLEMENTATIONAL AND**

**OPERATIONAL ENVIRONMENT**

The system is developed using open resources

including Apache web server, MySQL database

server, OpenSSH remote access tools; also

VMWare workstation 5.5 is used to create

virtual platforms.The user can select appropriate

operating platforms with application software.

There are two kinds of choices: immediate

(now) application and reservation for future use.

The user should choose amount of time for his

application.

***3.4 Database Management***

Authentication, resource availability and other

information is kept in a database server.

Therefore, database server has to maintain and

manage four kinds of information: user

information (UserInfo), platform information

(resourceInfo),

platform

state

information

(stateInfo) and user connection information

(connectionInfo).

Their

contents

and

relationship are shown in Figure 4 MySQL is

used for this purpose to keep information of

authentication, resource availability and other

information.

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[7] is among one of a few an open-source

systems for implementing on-premise private

and hybrid clouds using the hardware and

software

infrastructure.

Eucalyptus

adds

capabilities such as end-user customization,

self-service provisioning, and legacy application

support to data center virtualization features,

making IT customer service easier, more fully

featured, and less expensive. To understand

Cloud computing better and quantify the

performance of scheduling and allocation policy

on a Cloud infrastructure, simulation tool

CloudSim is proposed [3]. Approaches of

dimensioning a virtual computing lab with job

priorities and QoS constraints is discussed in

[9]. Three techniques to improve the efficiency

of virtual Cloud computing lab based on

queuing model are introduced in [10]; some of

these techniques are applied in this paper.

Adaptive dimensioning approaches of Cloud

datacenters are introduced in [11]. There are

many other related work and many more to

come in Cloud computing.

Figure 5 Web Interface for PaaS

The system will be open source in the near

future under Eclipse open source license.

Theoretically it is possible to provide and

manage hundreds of real and virtual platforms;

more test and evaluation results are conducting

in the following work.

**5. RELATED WORK**

There may be no consistent definition for Cloud

computing yet, however, practitioners are

designing and implementing some application

examples such as Google App Engine, IBM

blue Cloud, Amazon EC2 and Microsoft Azure.

There are many pioneering work in this area,

many people think that Cloud computing

becomes popular after IBM and Google jointly

announced Cloud computing plan in 2007. IBM

introduces its blue Cloud in [2][16], Google’s

App Engine[15] and related Google file system

[8], BigTable [4] and MapReduce [6] are

considered to have laid foundation for Cloud

computing. A virtual computing lab (and then

Cloud computing) was built since 2004 [12].

Cloud implementation and research related

issues are discussed in [2][7][12][13]. As this

writing, more than 30,000 teachers and students

use VCL [12] at NCSU each year. Eucalyptus

**6. CONCLUSION**

In this paper, a framework implementing and

managing platform as a service in a virtual

Cloud computing lab is developed. The system

has good expandability and can improve

resource’s sharing and utilization. In the future

we will extend the framework to include

imaging of software and hardware platforms,

load

balancing

and

complete

automatic

provisioning of resources so that the system can

be applied in large-scale and distributed

environment.

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