The Design Of Private Cloud Platform For Colleges And Universities Education Resources Based On Openstack

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Abstract. There are some problems in using and managing the educational resources of colleges and universities, such as uneven distribution of resources, Inconvenient to use, data redundancy, more maintenance personnel and low efficiency. There is often a branch in colleges and universities; there are plenty of hardware and equipment. In view of the above situation, A scheme of building the private cloud platform of educational resources in colleges and universities is given and a user management system using the private cloud is designed in this paper.

1 Problems of the use and management in Colleges and Universities educational resources

Education resources in colleges and universities mainly has the following several aspects:

Software resources: all kinds of office online system, department website, online courses, excellent courses, library system, etc.

Hardware resources: in the office, there are some computers, wireless router, printer, copier, etc. used for daily work; In the laboratory room, there are many computers, switchs,routers,etc. used for learning ; In the classroom,there are some multimedia equipments .

However,there are some problems in using the software and hardware resources.

1.1 In Software Resources

Software from different developers, due to the use of web technology, supported by the browser also there is a difference, so that teachers and students in the use of the software, may need to meet the needs of the software, to switch back and forth the browser or a new browser installed.

Update of office software and software development, training rooms of experimental environment, temporary, cyclical is stronger, the different curriculum requires that difference is very big, the environment is preparing a more time-consuming thing, need the teacher complete software per semester, each training rooms because of changes in the curriculum arrangement all teachers need to collect the software she'll need, then according to the needs of teachers looking for software to install. This process will be requires a lot of manpower.

1.2 In Hardware Resources

Resource allocation imbalance, some departments configuration of computer is new, and some departments configuration of computer due to reasons such as renewal, older, or the quantity is not enough to use, or cannot be used due to the software requirement is higher.

Data redundancy and waste of resources, the teacher teaching in different classrooms or offices or office, need to copy the relevant teaching courseware or other software resources to the U disk, to the venue, copied or installed on the computer used in class, again have the same teacher allows multiple multimedia classroom computer duplicate data and software, data redundancy and waste of resources.

Repeated investment, the relatively independent research, when computing resources is not enough, often need to purchase a server, on the one hand, the server whether in time or in efficiency, utilization rate is very low; On the other hand, the server cannot be Shared between the various research, eventually led to the school.

To sum up, in the current college information resources on the use and management of the main contradictions are: 1) insufficient resources and waste of resources; 2) use inconvenience and data

redundancy; 3) low maintenance personnel with more efficiency. The essential reason is resource utilization efficiency is low. Cloud computing is a good way to solve these contradictions, one of the aims of cloud computing is the flexible configuration and make full use of resources.

2 Introduction of OPENSTACK

Cloud computing is a style of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet。 Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

2.1 Cloud Computing Services

Cloud computing services provided by the resource type is divided into three categories: infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS)[1-2].

 IaaS: hardware equipment basic resources in service for users. In IaaS environment, the user is equivalent to in the use of bare-metal and disk, can let it run Windows, also can let it run Linux. IaaS biggest advantage is that it allows the user to dynamic application or release the node, charged according to usage. The IaaS is Shared by the public, thus has higher efficiency of resource use.

PaaS: provide the operation of the user application environment. PaaS itself is responsible for the resources of the dynamic extension and fault-tolerance management, user applications need not too much to consider cooperation between the nodes. But at the same time, the user's autonomy, must use a certain programming environment and follow specific programming model, applies only to resolve the calculation problem of certain.

SaaS: targeted stronger, it will be some specific application software functions encapsulated into service. It only provides some specialized service supply with calls.

2.2 The Components of OPENSTACK

OPENSTACK is an open source cloud computing project management platform, composed of several main components to complete the specific work. Through a variety of complementary services provide the infrastructure as a service (IaaS) solution, each service provides the API for integration.

It the latest version of the Grizzly suites with a total of seven different function, respectively is operational suite Nova, object storage, Cinder block storage suite, suite Swift netcom suite Quantum, and identity identification suite Keystone, image file management suite Glance dashboard suite Horizon. The main components of OPENSTACK is shown in Fig. 1[3-6].

Nova:It create an abstraction layer, let the CPU, memory, network adapter and server virtualization resources goods such as hard disk drives, and have the ability to improve the efficiency and automation.

Neutron/Quantum:Known as Quantum before Neutron, it provides the ability to manage local area network (LAN), have applied to virtual local area network (VLAN), dynamic host configuration Protocol and Internet Protocol version 6 features. User can define network, subnet, and routers to configure its internal topology, then assigned to the network IP address and VLAN. Floating IP address allows the user to the VM allocation fixed external IP address.

Keystone:It Management user directory, and users can access it service catalog. it exposed a central authentication mechanisms. Keystone itself does not provide Authentication, it can integrate various other Directory service, such as Pluggable Authentication Module, Lightweight Directory Access Protocol (LDAP) or request.

Swift: it is the ideal redundant Storage systems. It ensures that all equipment in the pool of data replication and distribution, let users can take advantage of the commercial hard disk and the server, rather than the more expensive the equipment. If a component fails, the contents of a system from other activities, so it can be added to the new cluster member. The architecture also supports the horizontal extension, because it is easy to use other server according to need to extend the storage cluster.

Swift is a distributed storage system, mainly for the static data, such as the VM image, backup and archive. The software to write documents and other objects into the possible distribution in one or more multiple servers within the data center of a set of disk drives, to ensure the data replication and integrity within the entire cluster.

Cinder:Cooperate with Cinder storage is the most common used Linux server storage. The system provides the additional piece of equipment used to create a piece of equipment, to the server and separation from the server block device interface. In addition, Cinder volumes can be used to backup system.

Glance:It supports the VM images ,Glance mirror can serve as a template, quickly and consistently to deploy a new server, users can use it to list and get assigned to a set of extensible back-end Storage of the virtual disk image.
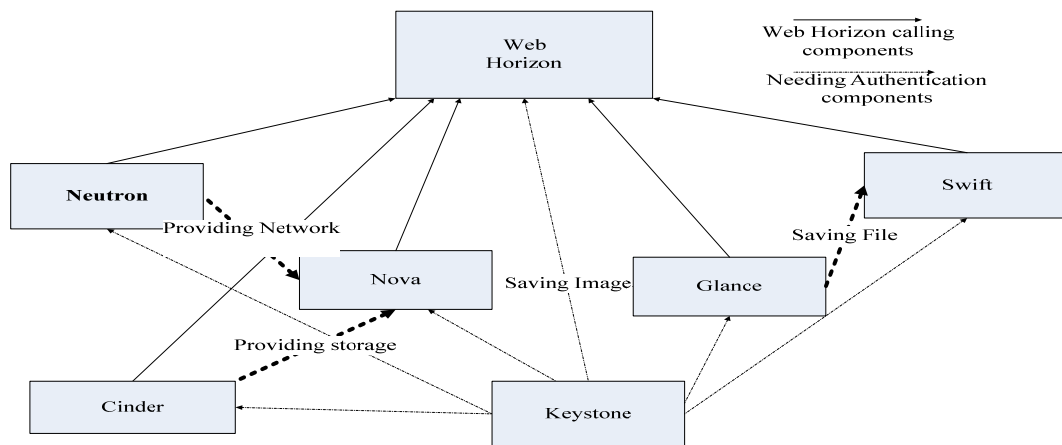

Fig.1 The Main Components Of OPENSTACK

3 The Design of Private Cloud Platform For Colleges And Universities Education Resources

Private Cloud Platform For Colleges And Universities Education Resources includes two parts of hardware and software.The hardware part mainly use OPENSTACK to build iaas, All hardware in school will be connected together as a whole through the network and openstack. Software part is based on the IAAs platform, it realized remote login authentication, after the user authentication successed, user can access to the corresponding resources and has corresponding operating rights.

3.1 The Overall Architecture

Users login system by PC or mobile or iPad, After the user passed the system certification, System according to the user's role, let the user to enter different private cloud. The overall architecture is shown in figure 2
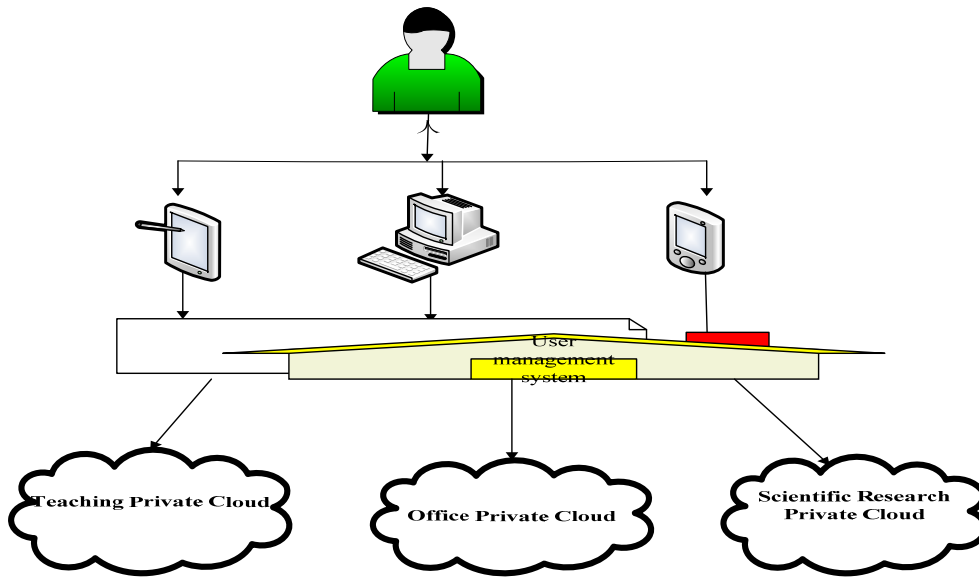
Fig.2 The Overall Architecture of Private Cloud Platform

3.2 Private Cloud Deployment

According to the component of openstack, PC servers install one of the openstack components, then all the servers can work together.Each node in Figure 3 will have a lot of servers.
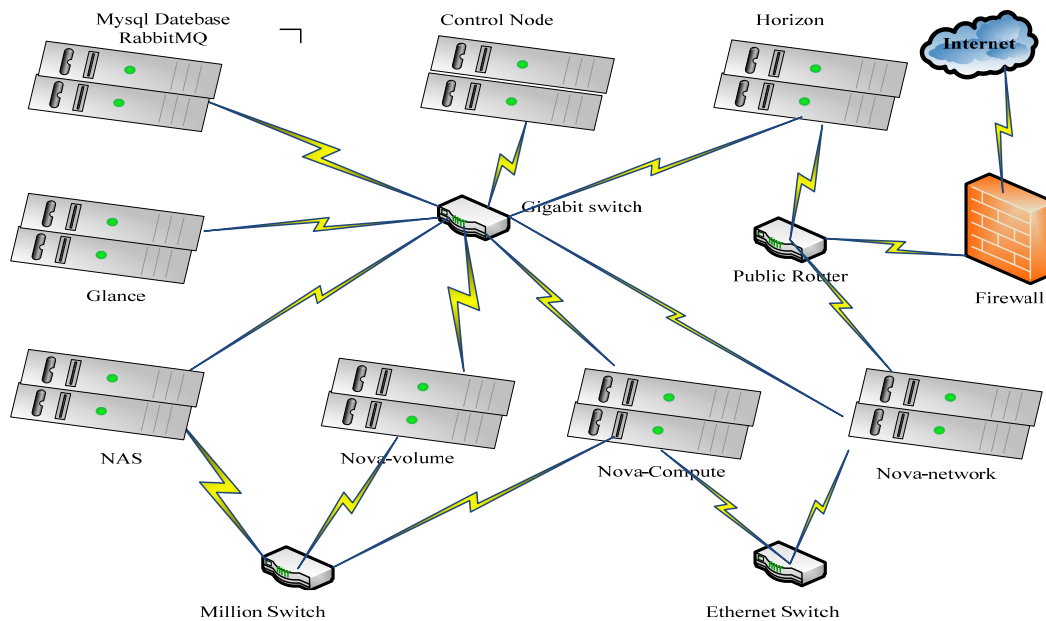

Fig. 3 Private Cloud Deployment

According to the deployment of Figure 3, the control nodes make the network nodes, computing nodes, storage nodes, mirror nodes work together. User application work with monitoring management platform, to realize the allocation and use of resources.

3.3 The Design of User Management System

User management platform can be accessed by different clients, When the user access platform, users need to access to different platforms according to the needs of user.There are three major categories according to the teacher's professional classification, so the platform is divided into, teaching platform, office platform, scientific research platform. Each type of platform requires user authentication, After user passed the verification,they can further visit the system. The system has different functions according to different users' roles. Details see Figure 4.

Teaching Cloud Platform Office Cloud Platform Research Cloud Platform

Customer Verification Customer Verification Customer Verification

Teacher Student Select Office Environment Project Leader Project Team Member

Create Student Users Allocate Resources To Student Users Select The Class Environment Create Project Team Members Allocate Resources To Project Team Members Select Research Environment
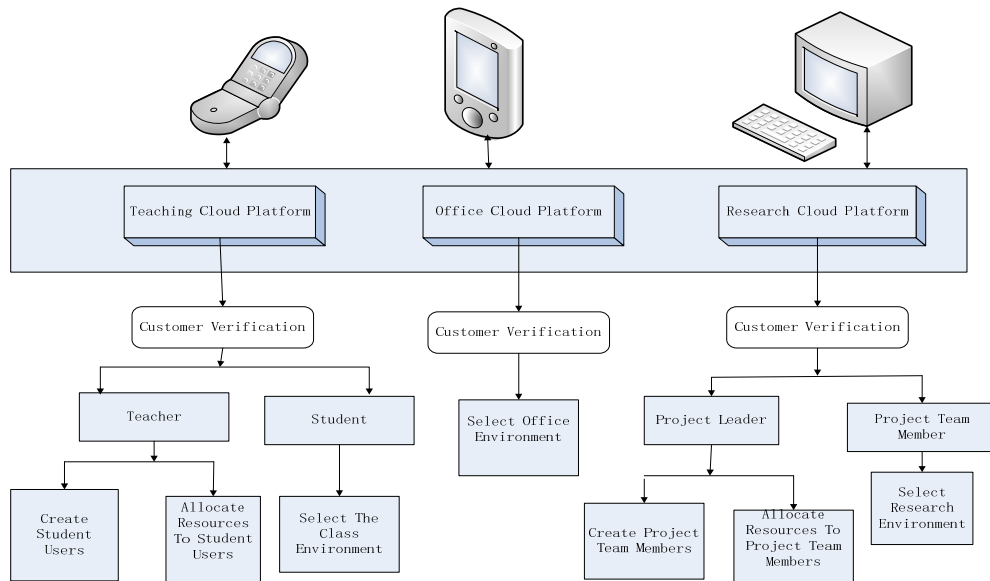
Fig. 4 Private Cloud User Management Platform

In this system, teaching cloud platform and research cloud platform has a super user roles, super users can allocate resources to other users. This user management platform needs to be closely linked with the horizon of Private cloud deployment, and need to rely on horizon to access and call the private cloud resources.

4. Summary

According to the components and functions of openstack, this paper designs the overall architecture of user access to private cloud. According to the design of the whole architecture, the private cloud platform is deployed. According to the characteristics of openstack private cloud platform, users management platform is designed. User management platform through the user access to private cloud platform.

Acknowledgment

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