

An Approach for Resource Management by Volunteering Community Cloud for an Educational Use

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Abstract : In today's (Information Technology) IT world, the service providers and the service users playing an important role. So the satisfactions at both the ends are also very important. This is a very common problem where the service user is always cost conscious about the product and in rural area there is no chance for affording these services. Also the service providers are not interested in doing so. In this paper, by making the use of underutilized resources in an optimized and efficient manner we provide the service to the user which will be in less cost. This service is in the form of web-app and it can be useful in various fields but we use this app in Education which is more needed. The community cloud is volunteered for making use of underutilized resources with the virtualization and Gale Shapley Algorithm for load balancing which is used for resource management.

Keywords : Hypervisor, Virtualization, Gale Shapley Algorithm or SMP, DPS, Thin Client, TCO

I. Introduction

With the tremendous growth in (Information Technology) IT industries and popularity of its services in the general public, every company wants to migrate toward the cloud computing because of its easy service policies and its availability to the user. But apart from these all things, Cloud computing service providers need to think about the basic things like security and resource management. We know cloud computing is all about managing resources in a proper manner to give more benefit to the customer. In this paper we try to use the existing resources to power the customers or educational institutions using underutilized computing machines.

We volunteer the cloud for educational use by using the existing underutilized resources. The user can demand and consume the required services. Our education system should take advantage of this same trend, which will both enrich our student's technology-enabled education, and importantly, reduce the budget impact in academic institutions [3]. This concept will be further elaborated in the next section. Also we are trying to integrate the load balancing with the underutilized resources. Optimized resource utilization is achieved by a well-designed underlying hardware infrastructure, a real-time resource scheduling algorithm, and a set of migrating operations of VM's [1]. We use the virtualization for resource management with the Xen which provides Para virtualization and full virtualization.

II. Existing Techniques

1. Client-Server Model

The client-server model of computing is the older but with its three building blocks i.e. client, middleware and the server gives the user a friendly environment to the user and the user feels, it is their server and they can do anything they please with it. In the big competitive world where people are overvalued by the new technologies era, the client-server model is still used for the small business and departments.

2. Grid Computing

A grid computing system can be as simple as a collection of similar computers running on the same operating system or as complex as inter-networked systems comprised of every computer platform you can think of. The connection between the application and resources are in the form of pervasive network fabric or grid, which is the heart of grid computing. Using IP-based networks, a grid links hundreds or thousands of servers and desktop computers into a supercomputing engine capable of delivering massive amounts of computational power and other IT resources. In today's world, the grid computing is used on a very large scale in some industries.

3. Software as a service (SaaS)

The cloud computing enhances itself by providing software as a service. Different from the traditional model, in SaaS the software (application) is already installed and configured. The user has the advantage of provisioning the server for an instance in the cloud and in a couple of hours they can have the application [top five advantages of cloud]. This will result in a reduction of time and with the multi-tenant behavior the reduction of cost is also achieved. Hence we make use of this technology in our proposed model. We can make use of

underutilized resources by adopting the virtualization and give service to the user in lower cost. The user who can use this service can be a school faculty or a shop owner, who are not aware about these services (software) and always cost conscious. In our model, the underutilized resources that we are going to use is from any organization or educational institution, hence we are having our volunteer community cloud which can be more useful for involving the other organizations in it for donating the processing.

4. Virtualization

Virtualization technology diverts the human's perspective for utilizing IT resources from physical to logical. The goal of virtualization is to collaboratively utilize the IT resources such as storage, processor and network to maximum level and to reduce the cost of IT resources which can be achieved by combining multiple idle resources into shared pools and creating different virtual machines to perform various tasks simultaneously [2]. There are some basic techniques include when we use virtualization. The techniques are emulation, hypervisor, full, Para and hardware assisted virtualization.

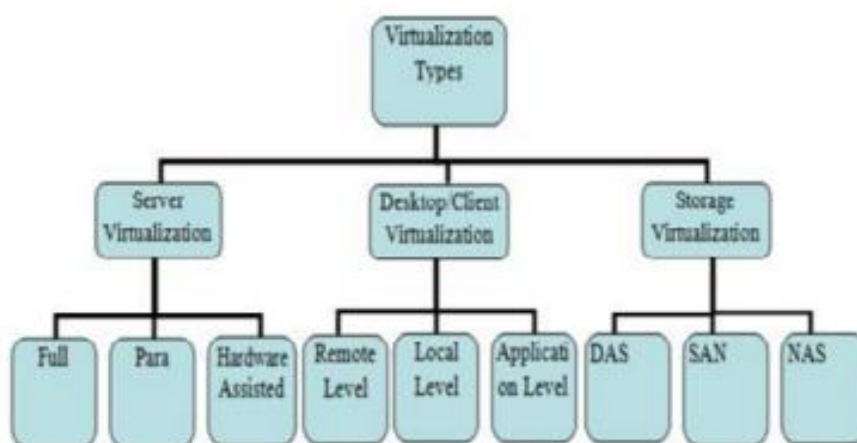
There are three types of virtualization i.e. Server, Desktop Client and Storage. The server virtualization consist of full, Para, hardware assisted virtualization.

4.1 Para virtualization

It provides the special hyper call that substitute the instruction set architecture of host machine. It connects the hypervisor and operating system to improve efficiency and performance. It is more preferred over the full virtualization.

4.2 Full Virtualization

The Hypervisor creates isolated environment between the guest or virtual server and the host or server hardware. Operating system directly access the hardware controllers and its peripheral devices without cognizant of virtualized environment and requirement modification [2].



Fig(1). Virtualization type

5. The Community Cloud Storage

“Cloud infrastructure [that] is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises[according to NIST].” The similar needs of organization can achieve by community storage, hence it is beneficial to use when we have to perform the collaborative work.

III. Why Cloud Computing?

This question can be better answered by the today's IT industry. Nowadays in IT world we even cannot imagine the service without the cloud. The cloud computing is mostly focused on use of services rather than the use of collaborative sharing of resources like grid computing. Also it gives the great scalability and transparency which cannot achieve by the others. It provides the real time services and it can be centralized or decentralized as well as distributed also. These facilities are not offered by the other technologies. By using cloud we can handle multiple OS with the hypervisor and the most important feature of cloud is that it can reduce the cost and time as well, also there is no limitation of space, place and time i.e. you can access your data from anywhere and anytime. These facilities of cloud are more than sufficient for adopting cloud in our model.

IV. Current Scenario Of Software Industry

Nowadays, a software industry integrated with the 'cloud' and creating a new vision of providing services to the customers. The cloud integrates your data in a centralized manner. In our software industry the customers are now called as 'cloud customers'. They manage their data integrated with the cloud. There are many companies who are always ready to provide these services. Earlier, managing your data is quite a difficult task with the big databases which are located on your disk and also it will help to increase the cost of memory space. But 'cloud' brings this situation in very interesting and easy way. The 'Smart Cloud Customer' having there all data in cloud. So they do not worry about the memory space or losing their data. The best benefit of cloud is you can access your data from anywhere and anytime; this tremendous facility attracts the customers for integrating with the cloud.

The IT industry having lots of companies who are always ready to provide you services, only the condition is that you have to pay for this. No matter what your requirement is and what your business is about, they provide service according to your wish. Also the cost is increased with your increasing requirement. The service provider companies give the service to the stand alone application and others also. As Software Industry grows towards the great success by providing services integrated with the cloud to the big cities and socially connected area. In India, especially there is a very big population and most of the people live in rural area, where the big companies cannot reach easily_towards_them. Also there are lots of people who want to do business in a smart way and the schools who want to make their work easy but the 'cost' factor will be the attention seeker for them. Hence they have to compromise with the situation.

V. Proposed Model

Using the existing technologies and resources, in this paper we proposed a model which will be more useful for the people who are deprived from the services provided by the big companies and cannot afford the rental charge of these services.

Basically, in this model we are trying to build our community cloud which will be used for providing services. Nowadays in India, there are many institutes who are having rich computer network. This will help the student to explore their knowledge. Suppose we consider a single institute in which the computers are get used but at the same time some of them are not used by the students i.e. they are still underutilized. By using these underutilized resources we are trying to volunteer our private cloud and it will be used for providing services to the educational institutes. Also because we are using the underutilized resources it will be result in lower cost[8]. Hence instead of using the other applications or software which increase cost and involve lot more complications, you can use this service with its benefits.

1. Use Of Underutilized Resources

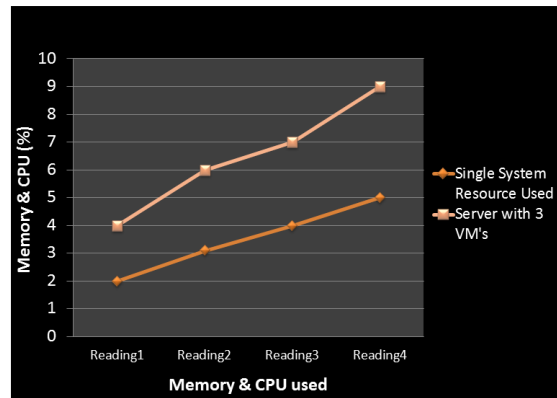
When we are using any system, at that time the memory and CPU power are not get completely utilized. Also in many educational institutions, there are many computer labs for the students, but in this lab all the pc or systems are not used by the student at a time. So these underutilized resources can be used in an efficient manner. For implementing this idea we use virtualization concept.

1.1 Citrix Xen Server

Over the years, the Citrix Xen Server has been labelled as the strongest and fastest virtualization software available in the industry. It's a complete, managed server virtualization platform that has been in the business since 2009. This allows the IT staff to closely monitor, administer, and manage several VMs coming from a centralized management console of Xen. Also it takes very less time for starting VM's. Hence it is more efficient than others. Citrix Xen server is designed to optimize the private data centre and clouds today and in the future.

1.2 Use of Citrix Xen Server

In this model we use Citrix Xen server .By installing Citrix Xen server, we create the four virtual machines, two of them are 32-bit and other two are of 64-bit. By using this virtualization concept we can monitor the memory and processor uses of the various system and we can use the unutilized memory and processor for processing the data of the other user.



Fig(2). Use of underutilized resources by virtualization

1.3 Web App for Educational Use

The results of a survey that have been completed in 2009 by Gartner analysts (Fig.3) about the IT trends (especially cloud computing) show that it is being used more in the areas of finance and business when compared to other sectors (Gartner, 2009). Results are shown as a pie chart and the labels on each different slice represent different industrial sectors and services. The “/” is used to separate different sectors with the same percentage [3]. This is the older statistics of cloud in education. The cloud has an indefinite power and we can use this power in our education for enhancing it more. So for this we are creating a web app and deploy it on a Citrix Xen server.

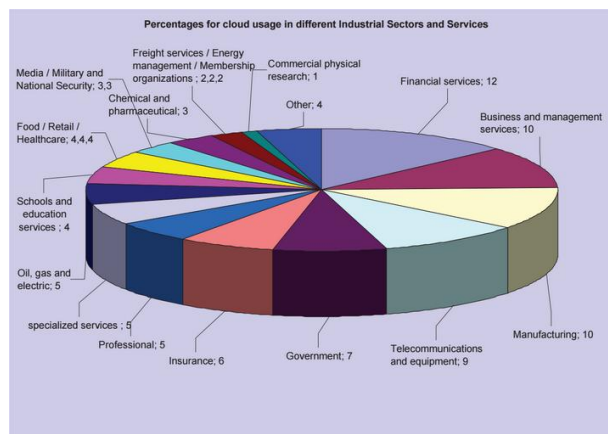


Fig (3). Cloud Usage

This app is basically used for the schools and the colleges in the rural areas. By using this application the user or we can say a school authority can manage their school activities without expending more. The best advantage of using this app is that the user do not have to worry about his/her data or information and its storage with its maintenance. In our proposed model, the resource utilization is done through this app. Because we are using the underutilized resources ,the cost required for this type of application is get reduced and also the user can manage their data very easily.

The cloud has already demonstrated its impact on different industries and is now set to take over the education sector. According to survey 2012, only 6% of institution where using the cloud in past two years. Today we see the great numbers of school and colleges using server and applications provided by various companies. In March 2014, the company reported that 110 million students and faculty staff where using office 365 in cloud to support critical learning and teaching processes. According to national survey carried out in 2015, 98% of educators believe that websites perform the most important educational function and account for increased students and parental engagement [4].This information make sense in building app for educational use in cloud.

2. Load Balancing For Resource Management

In this paper we are using the Gale Shapley Algorithm which gives the explicit idea for implementing load balancing technique. The Fig.(4) Shows the actual idea about the Gale Shapley Algorithm and diagrammatic description of its working. A matching is a mapping from the elements of one set to the elements

of the other set. Given n men and n women, where each person has ranked all members of the opposite sex in order of preference, marry the men and women together such that there are no two people of opposite sex who would both rather have each other than their current partners. When there are no such pairs of people, the set of marriages is deemed stable. A SMP (Stable Matching Problem) give the two equal sized sets of elements where the orders of preferences are selected. A matching is stable whenever it is not the case that both these two conditions hold.

There is an element A of the first matched set which prefers some given element B of the second matched set over the element to which A is already matched, and B also prefers A over the element to which B is already matched.

a matching is stable when there does not exist any match (A, B) by which both A and B are individually better off than they would be with the element to which they are currently matched. The runtime complexity of this algorithm is $O(n^2)$ where n is number of men or women. Resource management in the cloud can be naturally cast as a stable matching problem, where the overall pattern of common and conflicting interests between stakeholders can be resolved by confining our attention to outcomes that are stable. This algorithms considers the client interest and shut the machine off which is less preferred and migrate the VM to another one which is most preferred[7].For maintaining the resources with equality of load can be easy by using SMP and also it will save the time of user for accessing the service.

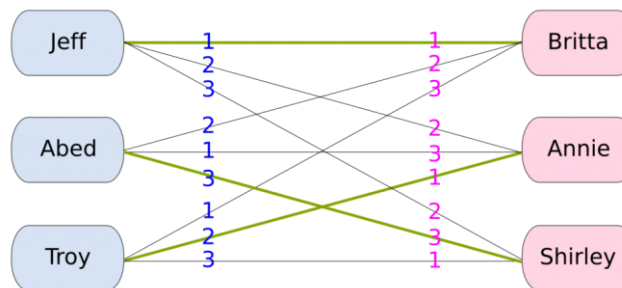


Fig (4).Gale Shapley Algorithm

2.1 Load Management of Resources

$$Load(h) = \frac{N(h)}{C(h)}$$

The ability to dynamically adjust the performance of computer components proportionally to their power consumption is called Dynamic Performance Scaling (DPS). It is possible to adjust the computer supply voltage when it is not fully utilized. Based on this idea, many techniques are adopted. In this algorithm, the nominal MIPS (N) for each host represents the maximum computing capability of the host at the maximum frequency, while the host load (c) represents the current load of the host in MIPS. The load on host h is computed using equation below, which is equal to the ratio of maximum computing

$$Load(DC) = \sum_{\forall h \in H} \frac{N(h)}{C(h)} / Size(H)$$

Capability to current load. The data-centre load is computed using below equation, which is equal to the average load on all its hosts [7].

This resultant load will be help to find the maximum load of the resource and we can manage the resources by implementing the resource management algorithm.

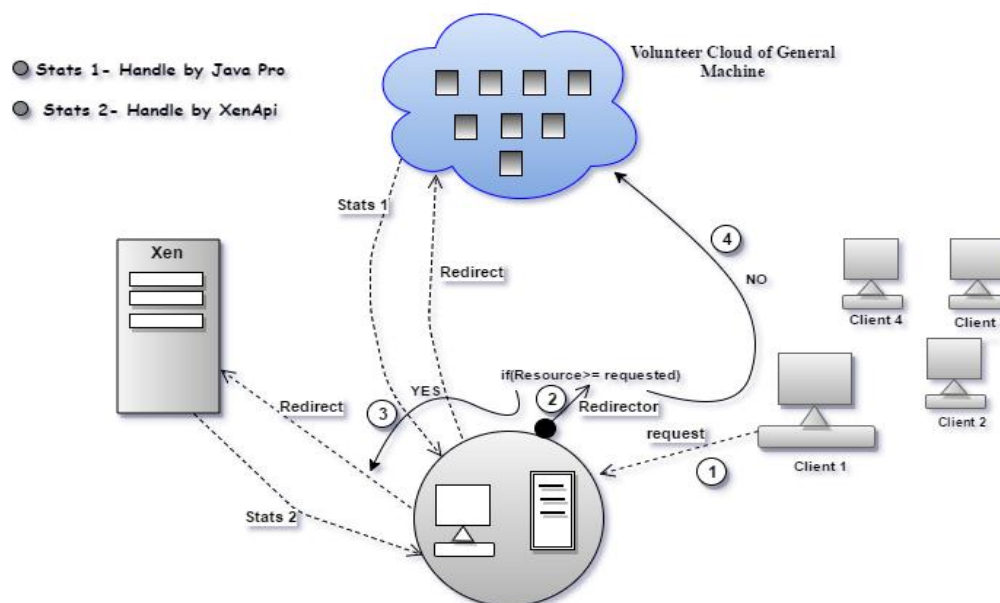


Fig (5).Complete Architecture of Proposed Model

VI. Benefits Over Introduced Model

Factors	Benefits
Community Cloud	Can take benefits of both public and private cloud, Multitenant platform(i.e. presence can be either on site or offsite), Cost can be cheaper due to division of cost among all participants.
Server Virtualization	Reduce number of servers, Reduce TCO (Total Cost of Ownership), Improve availability, availability of your virtual environment.
Saas, IaaS	Automatic updates and patch management, Global accessibility, Scalability, No investment in hardware, Physical security of data centres locations for servers
Educational App	Browser based access-Teachers, students and staff can access educational tools from anywhere with any device. Allows software standardization, a shared pool of applications for use school or district-wide, and easier maintenance through centralized licensing and update Provides a flexible, scalable, cost- effective model that does not tie schools to out-of-date infrastructure or application investments. Thin Client - The thinnest platforms are hardware that receives most or all of their applications and operating systems from the server. With thin platforms, some applications and operating systems are installed and some are delivered through the cloud [5]. All or nothing - Schools can determine how much and what gets served over the cloud [5].
Load Balancing	Redundancy, Scalability, Flexibility, Ease to manage resources

VII. Security Over Proposed Model

In this model, we are encrypting the user's data and there information for the security purpose. This will provide the following advantages.

1. Transmit Securely

Just as data security is ensured on all devices, encrypting data also provides security benefits during transmission.

2. Guarantee data integrity

Targeted data theft is one high but another way to misuse data is through manipulation.

3. Ensure Compliance

These may involve archiving banking data or providing special protections for customer information. Main advantage relates to the overarching theme of theft. Given that data is encrypted before it is written to the server, a hacker would need to have access to the database contents as well as the applications that were used to encrypt and decrypt the contents of the database in order to decrypt sensitive data. [6]

VIII. Conclusion

In this paper we come to the conclusion that using the existing resources will tend to the reusability of the resources in a better way. We know the core of cloud computing is the auto-provisioned of the resources and the resources which are available on demand. Here we try to do the same using existing resources and doing volunteer for the processes and the storage. In section V, we are providing the service to the user in the form of web-app and also in subsections A & B, the use of underutilized resources with virtualization and load balancing for resource management. These all are concluded with our proposed model with its benefits and security given in section VI & VII. By implementing this idea we can solve the problems of many cost-conscious users and also the organizations who want to tie up with the other organization by involving their resources. By this way we can say that we can use underutilized resources to power education and give a boost to normal users to use high-end resources.

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