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CLOUD COMPUTING FOR RURAL DEVELOPMENT

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ABSTRACT
The majority of the population in Chhattisgarh lives in villages. Rural areas has been ignored since several decades and the Cloud will bring the change that is required to bridge the divide between rural and urban areas; and will improve the rural economy. This new information technology model is called "cloud computing," a network based computing model for enabling 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. In this paper we analyze the study and application of Cloud Computing on education, agriculture, healthcare and business in rural areas of Chhattisgarh. The Cloud enables non English speaking literate individuals to join the information revolution and the future of the country by transacting on the web in the Indian language of their choice. It also enables people of rural areas to access the web based application of cloud computing with the help of tablets and mobile phones

1. INTRODUCTION

Cloud computing is used by IT Services companies for the delivery of computing requirements as a service to a heterogeneous community of end-recipients. The vision of computing utilities based on a service provisioning model anticipated the massive transformation of the entire computing industry in the 21st century whereby computing services will be readily available on demand, like other utility services available in today's society. Similarly, users need to pay providers only when they access the computing services. In addition, consumers no longer need to invest heavily or encounter difficulties in building and maintaining complex IT infrastructure.

In such a model, users access services based on their requirements without regard to where the services are hosted. This model has been referred to as utility computing, or as Cloud computing. The latter term denotes the infrastructure as a "Cloud" from which businesses and users can access applications as services from anywhere in the world on demand. Hence, Cloud computing can be classified as a new paradigm for the dynamic provisioning of computing services supported by state-of-the-art data centers that usually employ Virtual Machine (VM) technologies for consolidation and environment isolation purposes .

Cloud computing delivers infrastructure, platform, and software (applications) as

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services, which are made available to consumers as subscription-based services under the pay-as-you-go model. In industry these services are referred to as

- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS), and
- Software as a Service (SaaS)

Clouds aim to drive the design of the next generation data centers by architecting them as networks of virtual services (hardware, database, user-interface, application logic) so that users can access and deploy applications from anywhere in the world on demand at competitive costs depending on their QoS (Quality of Service) requirements

Clouds are virtualized datacenters and applications offered as services on a subscription basis. They require high energy usage for its operation. Today, a typical datacenter with 1000 racks need 10 Megawatt of power to operate, which results in higher operational cost. Thus, for a datacenter, the energy cost is a significant component of its operating and up-front costs. According to a report published by the European Union, a decrease in emission volume of 15%–30% is required before year 2020 to keep the global temperature increase below 2 C. Thus, energy consumption and carbon emission by Cloud infrastructures has become a key environmental concern

2. GREEN COMPUTING

Green computing is the eco-friendly use of computers and related resources. Such practices include the implementation of energy-efficient central processing units, servers, peripherals as well as reduced resource consumption and proper disposal of electronic waste.Green computing is a study and practice of designing , manufacturing, using, and disposing of computers, servers, and associated subsystems—such as monitors, printers, storage devices, and networking and communications systems—efficiently and effectively with minimal or no impact on the environment." The goals of green computing are similar to green chemistry; reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of defunct products and factory waste. Research continues into key areas such as making the use of computers as energy-efficient as possible, and designing algorithms and systems for efficiency-related computer technologies.

There are several approaches to green computing namely

- Algorithmic efficiency
- Resource allocation
- Virtualization
- Power management

Need of green computing in clouds

Modern data centers, operating under the Cloud computing model are hosting a variety of applications ranging from those that run for a few seconds to those that run for longer periods of time on shared hardware platforms. The need to manage multiple applications in a data center creates the challenge of on-demand resource provisioning and allocation in response to time-varying workloads. Normally, data center resources are statically allocated to applications, based on peak load

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characteristics, in order to maintain isolation and provide performance guarantees. Recently, high performance has been the sole concern in data center deployments and this demand has been fulfilled without paying much attention to energy consumption. The average data center consumes as much energy as 25,000 households. As energy costs are increasing while availability dwindles, there is a need to shift focus from optimizing data center resource management for pure performance to optimizing for energy efficiency while maintaining high service level performance. According to certain reports, the total estimated energy bill for data centers in 2010 is $11.5 billion and energy costs in a typical data center double every five years.

Data centers are not only expensive to maintain, but also unfriendly to the environment. Data centers now drive more in carbon emissions than both Argentina and the Netherlands. High energy costs and huge carbon footprints are incurred due to massive amounts of electricity needed to power and cool numerous servers hosted in these data centers. Cloud service providers need to adopt measures to ensure that their profit margin is not dramatically reduced due to high energy costs. For instance, Google, Microsoft, and Yahoo are building large data centers in barren desert land surrounding the Columbia River, USA to exploit cheap and reliable hydroelectric power.

Lowering the energy usage of data centers is a challenging and complex issue because computing applications and data are growing so quickly that increasingly larger servers and disks are needed to process them fast enough within the required time period. Green Cloud computing is envisioned to achieve not only efficient processing and utilization of computing infrastructure, but also minimize energy consumption. This is essential for ensuring that the future growth of Cloud computing is sustainable. Otherwise, Cloud computing with increasingly pervasive front-end client devices interacting with back-end data centers will cause an enormous escalation of energy usage. To address this problem, data center resources need to be managed in an energy-efficient manner to drive Green Cloud computing. In particular, Cloud resources need to be allocated not only to satisfy QoS requirements specified by users via Service Level Agreements (SLA), but also to reduce energy usage.

3. BENEFITS OF CLOUD COMPUTING IN E-HEALTH

a) Better treatment**:** a unified medical record for patients available anytime and anywhere would helpdoctors to have all of the patient's medical history and treat them to the best.

b) Reduced Cost**:** due to the property of resource sharing of cloud computing, the cost of establishing theIT infrastructure is reduced as such that the client only need to bear a minimum cost of sharedinfrastructure with the flexibility of paying only for actual resource utilization. This property is veryadvantageous for small and medium sized healthcare providers.

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***c) No scarcity of resources*:** both scarcities of IT infrastructure and of healthcare professionals are meteffectively as by using cloud computing would provide unlimited resource at a very cheap cost as wellas good medical professional would be available in remote rural part of the country.

***d) Improved quality*:** as all the medical data are stored at one place, it would be quite easy to provide it toMinistry of Health or the World Health Organisation with patient's safety and the quality of treatmentgiven.

***e) Support research*:** as all the data are available at a single repository, it would be easy for carrying outmedical research to provide new medical facts, enhance medications, medical treatments andhealthcare services.

***f) Support national security*:** e-health cloud would help in checking the spread of contagious diseases, itscause for spread, spreading pattern and infection area.

4.Results

For the benchmark experimental results a Non Power Aware (NPA) policy has been used. It does not apply any power aware optimizations and means that all hosts run at 100% CPU utilization and use maximum power. The second policy applies DVFS, but does not perform any adaptation of allocation of VMs in run-time. The NPA policy leads to the total energy consumption of 9.15 KWh, whereas DVFS allows decreasing this value to 4.4 KWh for simulation setup.

Energy Consumption and SLA violation of ST policy

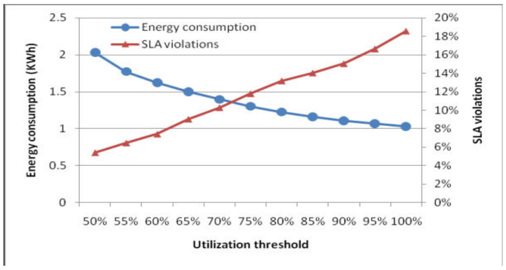

Fig 4: simulation results of ST policy

The simulation results are presented in Figure 4. The energy consumption can be significantly reduced with respect to NPA and DVFS policies by 77% and 53% respectively with 5.4% of SLA violations as show in figure. The growth of the utilization threshold energy consumption decreases, SLA violations increases. This is due to the fact that higher utilization threshold allows more aggressive consolidation of VMs, by the cost of the increased risk of SLA violations.

Energy consumption and SLA violations of other policies

MM policy is compared with HPG and RC policies varying exact values of the thresholds. These types of policies allow the achievement of nearly the same values of energy consumption and SLA violations. But the number of VM migrations produced by MM policy is reduced in comparison to HPG policy by maximum of 57% and 40% on average and in comparison to RC policy by maximum of 49% and 27% on average.

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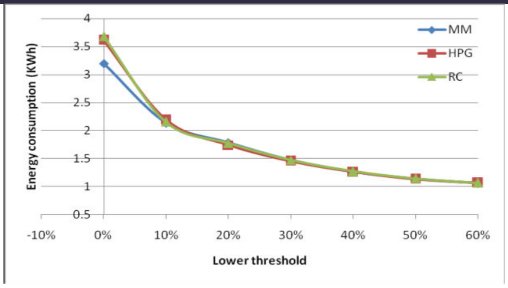

Fig 5: energy consumption of different policies

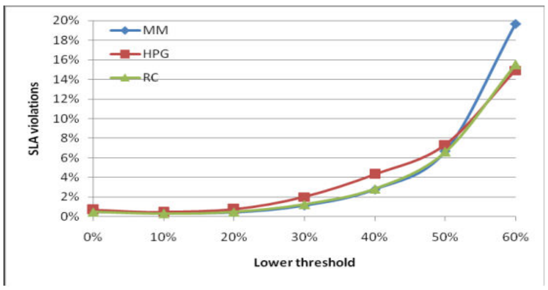

Fig6: SLA violations of different policies under different thresholds

CONCLUSION

Cloud computing is emerging as a significant shift as today's organizations which are facing extreme data overload and skyrocketing energy costs. Green Cloud architecture, which can help consolidate workload and achieve significant energy saving for cloud computing environment, at the same time, guarantees the real-time performance for many performance-sensitive applications. In the future, there are still a number of research activities that we plan to carry out, which could improve the performance of Green Cloud and bring solid value to users to achieve their business goals and their social responsibility in Green IT Applying green technologies is highly essential for the sustainable development of cloud computing. Of the various green methodologies enquired, the DVFS technology is a highly hardware oriented approach and hence less flexible. Green scheduling algorithms based on neural predictors can lead to a 70% power savings. These policies also enable us to cut down data Centre energy costs, thus leading to a strong, competitive cloud computing industry. End users will also benefit from the decreased energy bills.As a conclusion, GreenCloud effectively saves energy by dynamically adapting to workload leveraging live VM migrations, at the same time meeting system SLAs.

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