Challenges and Importance of Green Data Center on Virtualization Environment

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Abstract-Green Data center on virtualization environment is a concept that plays an important role on data center energy efficiency and data server. Green data center not only includes storage, server and networking but also include storage specific power, cooling system and energy efficiency of data centers. This paper present the green data center on virtualization environment. Firstly, we present modified architecture of green data center on virtualization environment and compare with existing architecture, after that what are the different type of advantages are obtained by making data center green. Then we investigate the different factor's effecting green data center. Furthermore, we explain opportunities and challenges of green data center energy saving proportional hardware design, power management in virtualization and virtualization technologies in high performance green computing.

Keywords –Energy efficiency, green energy, cloud computing.

I. INTRODUCTION

Data center virtualization focuses on several virtualization activities aimed at creating a virtualized environment for computing such that resource utilization can be maximized for use in cloud computing in a data center. Data center virtualization helps us to minimize costs on services, energy or power, cooling the components of hardware and also to help in the simplification of maintenance and administration for achieving a much more green IT. Data Centers are the major consumers of energy and emit huge amount of CO_2, which is harmful in global warming.
A data center takes the power that can be used to power thousands of homes. A data center consumes the power that can be utilized to power thousands of homes. The large levels of power consumption dwells data centers to opt for ways reducing the power consumption and make them a green energy data centre. A Green data center computing is an environmentally imperishable computing which employs virtualization computing effectively with a little effect on the environment Green data center also tries to improving the system performance, achieve economic viability and its various usage, while following our social and virtuous responsibilities. Thus, green data center includes the aspects of environmental imperishability, the statistical economics of energy efficiency, and the overall cost of ownership involved which includes the cost of disposing and recycling. It is the study and practice of using computing resources with maximum efficiency [3].

II. GREEN DATA CENTER ARCHITECTURE ON VIRTUALIZATION ENVIRONMENT

In this section, we discuss architecture of green data center on virtualization environment and comparison between energy efficient data center architecture and green data center architecture. Virtualization environment changes the way that IT resources used and consumed. Green data center on virtualization environment is designed with high processor core count and with high density of virtual machine. A Green data center would be implemented with visibility and protection aspects across all building blocks.

In figure 1 the architecture consist of consolidate computing resources, reduced management complexity and increasing the response time to business dynamics. The architecture is consisted by four main modules: Management Module, Virtualization Module, Monitoring Module and Cloud Service Module [1].
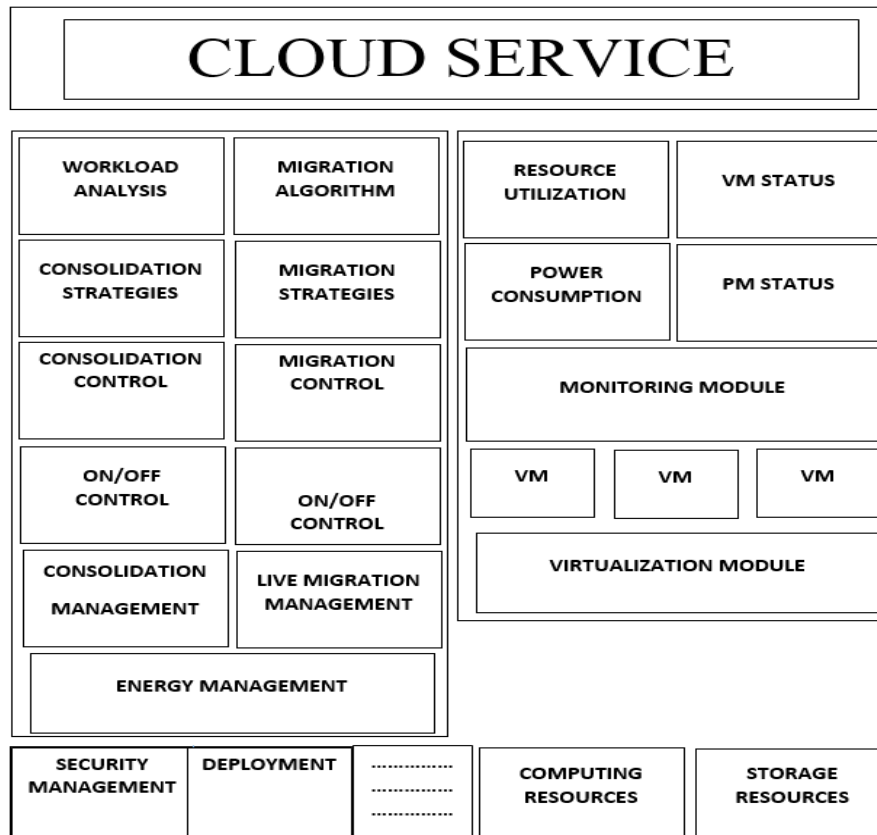
Figure 1.   Energy efficient Data center architecture for cloud computing based on virtual machine [1].

In Figure 2 the proposed architecture also consisted of four main modules: Virtualization Environment service delivery module, Virtualization Environment Energy Efficient Management Module, Virtualization Environment Data center Protection Module and Virtualization Environment Service orchestration Module.

Virtualization Environment service delivery module is an important module in which application services are delivered over the network through internet.

Virtualization Environment Data center Protection Module is responsible for security and confidence related reflection in the infrastructure models of virtualization environment. This module consists of several components like security, control, compliance and service level agreement.

Virtualization Environment Service orchestration Module this module provides service catalogue, asset account, and source-to-sink plan [6]. This module is of main concern as it maps the technology module to the service section and also serves as an indication point while the service provisioning. The Service orchestration module creates a service for Delivery. by integrating the lower layers.

Virtualization Environment Energy Efficient Management Module is main concerned module it include power and cooling component, Data center physical construction component, racking and cabling component.
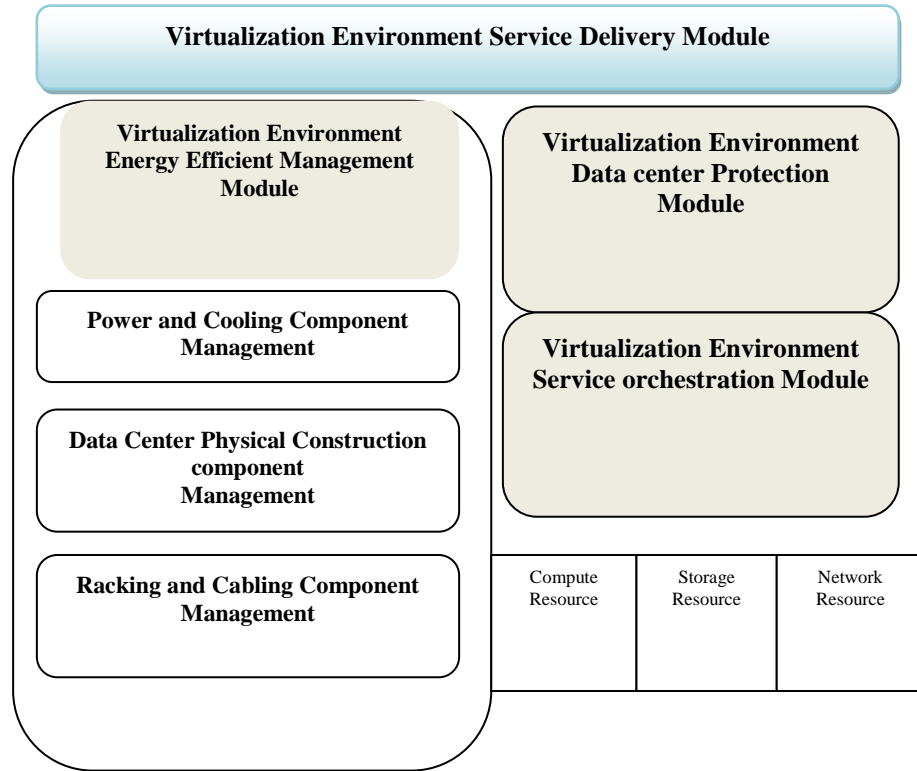
Figure 2. Modified Virtual Machine Based Energy Efficient Green Data center Architecture on Virtualization Environment

In Table 1 comparison between virtual machine energy-efficient data center architecture and virtual machine energy based energy-efficient green data center architecture. The given table present different module of both architecture and their sub-modules.

Table -1 Comparison between Energy-Efficient Data center and Energy Efficient Green Data center architecture on Virtualization Environment

MODULE'S ↓	*VM Energy Efficient Data centre Architecture*	*VM Green Data center Architecture*
1	*Cloud Service Module*	*Service Delivery Module*
2	*Management Module* (Energy management, Deployment Management)	*Energy Efficient Management Module*(Power and cooling Management, physical construction management)
3	*Monitoring Module* (for monitoring physical and virtual machine)	*Data center Protection Module* (Security and Compliance)
4	*Virtualization Module*	*Service orchestration Module*

There are many complex domains within virtualization environment infrastructure; it includes Network, Storage, Computing, software application and resources service management and there are several area of complexity including integration, interoperability, function, scalability, and conformity so to avoid these complexities green data center architecture is adopted.

III. ADVANTAGES OF MAKING DATA CENTER GREEN

The primary functionality of any data center is data processing which is achieved through servers, storage and networking, but modern data center operating in virtualization environment hosting a Varity of applications and to manage multiple applications in data center creates the challenges of providing resources and allocation in response. The main advantages of making data center green is to achieve not only efficient processing and utilization of resources but also include minimizing energy consumption, resource management, power saving on virtualization environment, cloud computing services with performance management and IT security.

Efficient Resource Management in virtualization Environment provide more computing power to end user's, it enhances the QoS, (well designed data center give better services), providing a enhanced flexibility in perspective of cost since user is paying for the needed infrastructure.

Efficient Performance on virtualization Environment It talks about how efficient the services run on your environment. It depends on the services used by the end user's and the connection between the data center and your computing environment.

Virtualization Environment Service Management Service management includes many disciplines like efficient work load management, network management, capacity management and asset management.

Power saving on virtualization environment Power saving for data center includes cooling limitations and power delivery that results increasing the scalability and performance of application running on the cloud environment.

IT security on virtualization environment Virtualization services has its own IT security procedures which protect user from external threats and ensure that individual users environment isolates from others so that no one can access the other areas.

IV. FACTOR'S AFFECTING GREEN DATA CENTER IN VIRTUALIZATION ENVIRONMENT

4.1 Air Management in Green Data Centre

The air management is important for the functionality of the green data center therefore the temperature and the humidity should be continuously monitored Adequate air management with in data center has increase energy efficiency and advance temperature control of the cooling system of the data centre. The major elements are temperature and air mass flow rates which are basically used to express the quality and quantity of the energy supplied to the server and The others important parameters bypass air and recirculation air. Air cooling involves placement of air conditioner through out data centers.

Constant temperature of the IT equipment in green data centers is essential the managers should implement efficient resources solutions for the air management of the facilities such as advanced cooling systems. Total Cost of Operating (TOC) managers should take into consideration which improvement of the cooling systems of their facilities since the cooling system can consume 30% or more of the total power. One way this can be achieved is by having a well-designed green data center which will not allow the combination of cold and hot air into the system by eliminating the hot spots at the exact time.

There are some methods which cause better and more efficient air management in green data center

- Close gaps with foam pillows and brushes at the discharge side of the green data center.
- Remove floor grills from the areas where the cooling is not required so that efficient air management take place.
- Make sure air velocity is not very high at the floor.
- Remove obstacle below the floor that limit cold air to supply in the server.

4.2 Efficient Energy Saving in Green Data center attainable through Liquid Cooling

Liquid cooling basically talked about a matter of late and liquids being distant more efficient at fatiguing heat than air. This comes up to require more changes of the data server so that it can be submerged in the liquid, but researches have shown positive results. Now a day microprocessor density increases very rapidly and water has nearly 3500 times the volumetric sensible heat capacity as air, so   Liquid cooling involved the cooling of microprocessor with the use of micro heat exchanger. Liquid cooling is obtained by chilled water, glycol loop and condensed water. For energy efficient liquid cooling system, electric power required for both fan and pump [5].

V. CHALLENGES OF GREEN DATA CENTER IN VIRTUALIZATION ENVIRONMENT

Green data center on virtualization environment has been effective research area and the major challenges to achieve green data center on virtualization includes design, manufacturing of hardware design, power in virtualization environment and efficient resource management.

5.1 Energy Proposed Hardware Design

Efficiency of the Green Data center has become one of the important design goal. Currently different researches are in progress in the IT industry which use low-power design methodology to help improve the energy-efficiency of green data server. The design of green data centers is considered to be more efficient in respect to energy and power management.

5.2 Power Management in Virtualization

Virtualization adoption has rapidly increased in recent few years. Power and energy management has become increasingly necessary in very high scale energy data centers to reduce costs and limitations in cooling or energy power delivery system. Centralization is a one of the technology for minimizing data center energy and power consumption by improving the server utilization rates. Centralization is an energy and power management computational   tool, where applications used to run in a physical data server are now virtualized and squished into a single physical host. Profiling might be done to make sure they could exist, as a priori, static exercise with the VMs instances treated as black boxes. There is no attempt taken to look at the workload profiles inside each of the virtualized instance. Power and energy savings come from an almost all the side effect of repackaging of different applications formerly running in a dedicated energy based server into virtualized instances.

5.3 Energy Efficient Resource Management

The enormous growth of power computation by the sectors such as business, scientific labs and data servers has revolutionized the demand of computational power. The Green energy resource management system designed for virtualized environment data centers reduces the amount of cost and provides better Quality of Service (QoS) [4]. Energy savings are maintained by continuous centralization of VMs by utilizing resources and technologies established between Virtual machine and thermal state of external nodes. Dynamic reallocation of VM's using live and appropriate migration according to current requirements of CPU's performance [7].

IV.CONCLUSION

Virtualization environment is a new standard which is used to provide dynamically scalable and virtualized source as a service over the Internet. In this paper we present why Virtualization environments are important and necessary challenges for developing green energy efficient resource management and techniques for Green Cloud Computing. We have presented a modified virtual green energy efficient data center architecture model.
The Green Data server Center was completed for a reserved sum relative to the efficient energy savings achieved. This paper also highlights the growth of Green IT, challenges and importance of green data center. It also discussed increasing trends in power consumption; Power management; Energy proposed hardware design and factor's effecting the green data center and discussed a number of measures for efficiency improvements.

II. FUTURE WORK

In this paper, we propose the Modified Virtual Machine Based Energy Efficient Green Data center Architecture on Virtualization Environment and challenges in green data center on virtualization environment. Future work includes design and implementation live migration mechanism to this architecture which improves the energy efficiency.

Based on the migration data center become green and maintain energy efficient automatically. In future we will also evaluate the energy consumption of different type's application which is running on virtualization environment. In addition to that we will combine energy cost rates and try to propose new model which reduces the total energy cost of data center.

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