RESEARCH ARTICLE OPEN ACCESS

# A Survey on the Power and Energy Consumption of Cloud Computing

Harmanpreet Kaur [1], Jasmeet Singh Gurm [2]
Department of Computer Science and Engineering [1] & [2]
PTU/RIMT Institute of Engineering and Technology
Mandi Gobindgarh
Punjab – India

**ABSTRACT**
Cloud computing is dilating regularly over few years in the technology commerce. It is a multitenant habitat pledge the services and resources distracted from IT infrastructure which are served "on demand" and "at scale" in the cloud domain. In this survey paper various components assesses cloud, deployment models and various cloud service models are discussed. Many analysts have proposed discrete techniques to improve energy efficiency and reducing power consumption. This paper represents the survey on existing power consumption and energy efficiency in cloud computing.

***Keywords:-*** Cloud Computing, Deployment models, Cloud, Cloud Service Models, Power consumption.

## I. INTRODUCTION

Cloud Computing is an appearing paradigm in the computer industry where the computing is moved to a cloud of computers. Cloud Computing is appraised as one of the transpiring arena which incorporates technologies, concepts and generates a platform for IT framework and cost-effective business applications. The embracing of Cloud computing is growing steadily for prior few years in the technology market. Some main benefits of cloud computing includes: elasticity, self-service provisioning and pay per use.

### *A. Component*

Cloud computing system is made of three components that are clients, datacenter and distributed servers

*1)* ***Client***: End users communicate with the clouds to direct information associated to the cloud. Clients mainly categories in three:

• Mobile: windows mobile smart phone such as blackberry or an I Phone.

• Thin client: These clients do not do computation work. Thin clients only show the information.

All the work is done by servers for them. This type of clients does not have internal memory. Examples of thin clients are Cherry pal, Zonbu.

• Thick client: Thin client use various browsers such as internet explorer or Mozilla Firefox or Apple Safari to connect to the different cloud.

*2)* ***Datacenter***: Datacenter is collection of servers hosting various applications. End user connects to the datacenter to subscribe various applications.

*3)* ***Distributed Servers***: Distributed servers are those which actively check the services of their hosts. Distributed servers is a part of a cloud which present throughout the internet hosting various applications.

### *B. Deployment Models*

- Public Cloud

The resources of public cloud are being obtainable to the public by the provider itself. Public clouds are those which are mainly stand-alone clouds and are present off premises and run by third party organizations.

- Private Cloud

Resources those are only obtainable for limited group of customers. This cloud infrastructure executes in the organization's physical data center or it might be third party co-location. It is formed generally to provide internal services to an organization. Private clouds are formulated and organized by an IT segment within an organization.

- Hybrid Cloud

Hybrid cloud may be described as a cloud which incorporates of both private and public cloud. It may considered as private cloud for carrying out day to day operations and it may be considered as the public cloud when need to scale out.

- Community Cloud

The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns. It can be organized by the organizations or a third party and may exist on premise or off premise.

### *C. Cloud Service Models*

- Software as a Service (SaaS)

SaaS is a model where applications are managed by a vendor or service provider and build obtainable to clients across a network, typically the Internet.

- Platform as a Service (PaaS)

It is a way for renting hardware, operating system, storage and network capacity over the Internet. The service delivery model allows the client to rent virtualized servers and associated services for running prevailing applications or developing and testing new ones.

- Infrastructure as a Service (IaaS)

IaaS is a model in where an organization outsources the equipment used to support operations, including storage, servers and hardware and networking components. The service provider owns the equipment and service provider is also responsible for housing, running and conserving it. The client pays on a per-use basis.

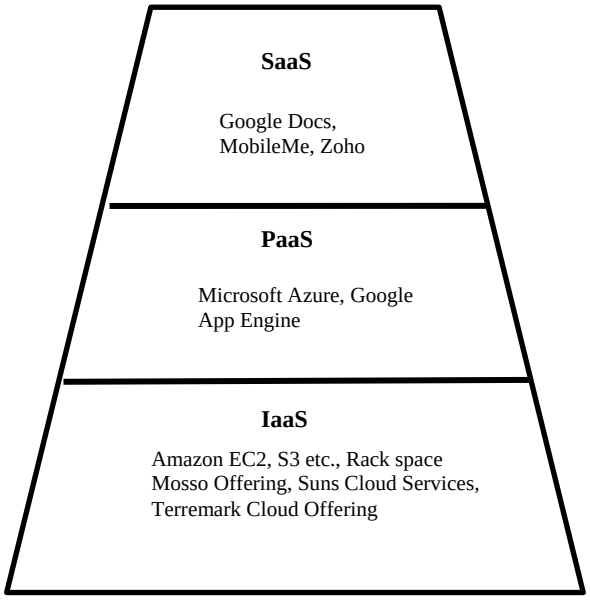


Fig. 1. Examples of Cloud Service Models.

### *D. Green Cloud Computing*

Green computing is an art in which efficient utilization of computing resources is advocated. The main goal of green computing is to promote the utilization of eco cordial products which are facilely recycled and reused. It is of utmost paramount for Information Technology sector due to the sprawling and extensive utilization of IT accommodations these days. It will be a revolution if it is laid efficaciously and used efficiently. It is not only confined to research studies but withal to be adopted by organizations depending largely upon IT products. Green computing is utilizing computing resources proficiently. . The goals are analogous to green chemistry; reducing the utilization of harmful materials, maximizing energy efficiency during the product's lifetime. The IT function of business is motivating an exponential increase in demand for energy, and, along with it, it is bearing the related cost increases.

In this survey paper, SectionII presents power consumption in cloud computing. SectionIII presents literature review of the existing methods for reducing power consumption and to use energy efficiently are discussed.Section1V presents the conclusion.

## II. POWER CONSUMPTION IN CLOUD COMPUTING

Modern data centers, operating under the Cloud computing model, are hosting a various applications ranging from those that run for a few seconds (e.g. serving requests of web applications such as e-commerce and social networks portals) to those that run for longer periods of time (e.g. simulations or large dataset processing). Cloud Data Centers consume excessive amount of energy. It is accountable for global increase in energy consumption, and energy cost additionally as a proportion of IT costs. Now days the incipient software which are being used are devouring more and more power per year. Some of them require virtually steady access to the hard drive which drains power more rapidly than precedent software did.

### POWER AND ENERGY MANAGEMENT FOR SERVER SYSTEM

Power and energy consumption are key concerns for data centers. These centers abode thousands of server and support infrastructures for cooling as well. Researchers have now made resultant tread in making their effort to conserve energy in servers because they have been given these benefits, By calculating the greatest power utilizing HP's power calculator the power consumption for each server can be found. Then we can follow the convention which average power usage either for midrange or for high-end servers which is around 66% of the utmost potency. Hard disk arrays comprise fortifying the functions like cache recollections, disk array controllers, disk enclosures and redundant power supplies. When we verbalize about cloud computing data centers the storage spaces which have in the data center is consolidated and hard disk utilization is centrally harmonized. Multiple number of users can share a single server through server virtualization, which ultimately increases resource utilization and in turn reduces the total number of server's desideratum. Users do not need to aware the operations being performed by other users and can facilely utilize the server cerebrating themselves to be the only utilize on that server. Wherein some servers enter into a sleep mode, when they are not in demand, which ultimately reduces energy consumption.

- Jonathan Koomey, suggested his viewpoint after his research that the cloud is responsible for 2% of the world's electricity used .A report by the CDP has found that a company that accepts cloud computing can

reduce its energy consumption and carbon emissions and additionally can reduce its principal outlay on their resources hence ameliorating efficiency of operations being performed.

- Prioritization of energy-savings in lieu of operating on a more diminutive solar PV system utilizing energy vigilant cloud computing lets us manage the computing load even in extreme weather conditions by shutting off the activities which are not essential. This will lead to Energy Cognizant Cloud Computing.
- Cloud Computing Futures (CCF) is one of the organizational divisions of Microsoft Research which focuses on the reduction in the costs of the operation of the data centers. It also increases the adaptability to failure.
- Power Usage Effectiveness (PUE) is the metric that is used to calculate the energy efficiency of a data center.
- **Workload diversification:** Since many diverse users will avail themselves of different resources which are there on cloud – different applications and different usage volumes different feature preferences set – this will get better hardware use and consequently make worthy usage of power that is used to keep a server up and running.
- **Power-management flexibility:** Virtual servers are not difficult to manage though physical servers are if we think from a power perspective. The load can automatically be deployed somewhere else if hardware failure occurs. Likewise theoretically all virtual loads could be relocated to certain servers when they are under loaded or power-down and idle.
- **Usage of solar PV array:** Solar Photovoltaic (PV) is a process that transforms sunlight into electricity. Solar PV modules can be merge together as parallel connected modules and an array of series to facilitate any level of power requirements from watts to kilowatt and megawatt size.

## III. LITERATURE SURVEY

| Author's | Year | Topic | Explanation |
|---|---|---|---|
| J. Baliga et.al [1] | 2011 | SLA-based Optimization of Power and Migration Cost in Cloud Computing | Emphasize on the managing in the data centers the utilization of power has prompted various remarkable improvement of energy efficiency. Introduced an outline of use of energy in cloud computing and contrast it with consumption of energy in the traditional computing. |
| H. Goudarzi et.al [2] | 2013 | Novel resource allocation algorithms to performance and energy effiiciency in cloud computing | Lessen the total cost of energy of cloud computing administration. . Efficient heuristic algorithm used to resolve the quandary based on dynamic programming and convex optimization. Virtualization mechanics assist in improving the power efficiency of datacenters consolidation. |
| D. Kliazovich et.al [4] | 2010 | GreenCloud: a packet-level simulator of energy-aware | Simulation is efficiency of the simulator acquired for two tiers and three tiers with high speed data centers in employing the scheme of power management applied to networking and computing components with the help of simulator. |
| A. Horri et.al [3] | 2014 | Energy-Efficient Cloud Computing | Proposed algorithm lessens the number of VM migration, SLAV and total data transmitted in contrast to current algorithm. |
| Y. Tian et.al [6] | 2014 | Managing performance and power consumption tradeoff | DVFS lowers processor voltage and frequency while the load is light, rates of feasible service are distinct and bounded and 50% power cost can be saved compared to the servers without DVFS. Without DVFS, service rate is a constant. |
| Verma et.al [9] | 2011 | Power aware scheduling of virtual machines in DVSF enabled cluster | Worked upon live migration to move VMs to their new frame but did not work upon SLA. Static VM consolidation focused on Semi static VM consolidation. |

## IV. CONCLUSION

Cloud computing have several benefits over traditional (non-cloud) environment and have capability to handle most immediate, temporary peaks in application demand on cloud infrastructures. Increasing power consumption by cloud computing is one of the largest issues. Various techniques and algorithms are used to solve the problem. In this paper we survey various existing energy efficient techniques in cloud environment. In future large number of parameters and different types of soft computing techniques can be included for better energy efficiency.

## ACKNOWLEDGMENT

This research paper is made possible through the constant encouragement and helps from my parents and guide. I am extremely thankful and indebted to them for sharing expertise, and sincere and valuable guidance extended to me.

## REFERENCES

[1] Jayant Baliga, Robert W. A. Ayre, Kerry Hinton, andRodney S. Tucker, “Green Cloud Computing:Balancing:Energy in Processing,Storage, and Transport”,IEEE Vol. 99, No. 1, January 2011

[2] Hadi Goudarzi, Mohammad Ghasemazar, and Massoud Pedram, "SLA-based Optimization of Power and Migration Cost in Cloud Computing," supported in part by a grant from National Science, p. NA, NA..

[3] Abbas Horri, Mohammad Sadegh Mozafari, Gholamhossein Dastghaibyfard·, "Novel resource allocation algorithms to performance and energy effiiciency in cloud computing," Springer Science+Business Media New York, 24 june 2014..

[4] Dzmitry Kliazovich, Pascal Bouvry, Samee Ullah Khan,"GreenCloud: a packet-level simulator of energy-aware cloud computing data centers," Springer Science+Business Media, LLC 2010, 9 November 2010.

[5] Erol Gelenbe, Marco Di Girolama, Giovanni Giuliani, Andreas Beri, "Energy-Efficient Cloud Computing," Oxford University Press on behalf of The British Computer Society, 28 july 2009

[6] Yuan Tian, Chuang Lin, Keqin Li, "Managing performance and power consumption tradeoff," Springer Science+Business Media New York 2014, 26 March 2014.

[7] Gregor von Laszewski "Power aware scheduling of virtual machines in DVSF enabled cluster," Springer Science+ Business Media New York 2014, 24 June 2014.

[8] Mohsen Sharifi, Hadi Salimi, Mahsa Najafzadeh, "Power-efficient distributed scheduling of virtual machinesusing workload-aware consolidation techniques," Springer Science+Business Media LLC(2011), 2011.

[9] Akshat Verma ,Gargi Dasgupta, Tapan Kumar Nayak ,Pradipta De ,Ravi Kothari, "Server workload analysis for power minimization using consolidation," in USENIX annual technical conference, San Diego, USA, 2009.