Review of Simulation & Modelling of Cloud Data Centre Energy Utilization

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***Abstract* - Due to the growth of the internet and internet-based software applications, cloud data centres' demand has increased. Modern cloud data centres typically contain up to thousands of servers and working 24×7 for users. It is witnessed a considerable increase in power consumption. Server utilization is not the same all the time. Generally, it remains between 10% to 50% of maximum possible utilization. From the economic point of view, power management is also essential to save energy overheads. There are several constraints to model cloud energy efficiency. In the present paper, we study the resource scheduling effect on energy utilization in the cloud data centre.**

***Index Terms* –Cloud, Data Center, Energy optimization**

I. INTRODUCTION

Cloud computing purpose of reducing the expenses of operation, maintenance, and management of software, hardware and network resources by replacing the location over the internet. The computing resources are available for cloud customers on-demand over the internet as a flexible form of service. The cloud environment has four basic deployment models, three primary service models and ten major key attributes. The type of access and contact defines the cloud deployment model to cloud resources, i.e., its location and access mechanism. Cloud access models are Public access, Private access, Hybrid access, and Community access. The cloud service model is to be arranged into three primary classes, i.e., SaaS, PaaS, and IaaS. The resources pooling, on-demand self-service, easy maintenance, scalability and rapid elasticity, economical, measured and reporting service, security, automation, resiliency and availability, extensive network access are primary attributes of the cloud environment [1], [2], [3], [4].

Due to the growth of the internet and internet-based software applications, cloud data centres' demand has increased. Modern cloud data centres typically contain up to thousands of servers and working 24×7 for users. It is witnessed a considerable increase in power consumption. From the economic point of view, power management is also essential to save energy overheads. Sparsh Mittal (2014) [others]classified the power management techniques in the five types.

1. DVFS (dynamic voltage and frequency scaling) technique.
2. Dynamic Power Management
3. Workload management or Task Scheduling based techniques
4. Thermal-aware or thermal-management techniques which take into account the thermal properties
5. Virtualization

DVFS, DPM, Task Scheduling based techniques

DVFS is a power-management technique in this technique, the clock frequency of a processor is dynamically adjusted to reduce the supply voltage to achieve power saving. The power consumption P of a CMOS (Complementary metal-oxide-semiconductor) circuit is given by equation 1.

$$P = P_{static} + CFV^2 \tag{1}$$

Here C is the transistor gates' capacitance, F is operating frequency, and V is the supply voltage.

Dynamic power management is a basis that dynamically powers on/off electronic devices after predicting the future workloads. In workload-scheduling techniques, work will be assigned intelligently among available special servers to save power, reducing the temperature and cooling requirements. Thermal-aware power management techniques are several techniques that work in a thermal-unaware manner. Virtualization is a technique that allows the sharing of one physical server among multiple virtual machines (VM). It reduces energy consumptions in data centres.

II. RELATED WORK

Kyong Hoon Kim et al. (2009), Anton Beloglazov et al. (2012) described Datacentre consumes 10 to 100 times more energy than a typical office or even consumes as much electricity as a city. The major part of power consumption in a datacentre comes from processing units, storage, network, and cooling infrastructure. Lee, Y.C et al. (2012) described an energy model for the cloud. That model has a linear relationship of processor utilization with energy consumption. Shuja, J. (2012) explained that a data centre consumes a large amount of electricity due to redundantly built architecture.

Rajkumar Buyya et al. (2010), Anton Beloglazov et al. (2012), and Heena Kaushar et al. (2014) used the power model as

$$P(u) = k.P_{max} + (1-k).P_{max}.u \tag{2}$$

$$E = \int_t P\big(u(t)\big) \tag{3}$$

Where Pmax is the maximum power consumption of a server when the server is fully utilized, k is the fraction of power consumption by the ideal server, u is CPU utilization, u(t) is

CPU utilization function, and E is the energy consumption of the server.

Ferdaus M (2014) states that physical servers' power consumption increases linearly and dominated by CPU utilization.

$$E = \begin{cases} (E_{max} - E_{idle}).U^{CPU} + E_{idle} & if U^{CPU} > 0 \\ 0 & otherwise \end{cases} \quad (4)$$

Emax and Eidle are the average electrical power drawn when the server is fully utilized and idle.

Tafani, D et al. (2014) data centre energy consumption. One of the most popular is the Power Usage Effectiveness (PUE), defined as

$$PUE = \frac{E_{TOT}}{E_{IT}} = \frac{E_C + E_L + E_P + E_{IT}}{E_{IT}} \quad (5)$$

Lee, Y.C. et al. (2012) provided an energy model for cloud

$$u_i = \sum_{j=1}^{n} u_{i,j} \quad (6)$$

$$E_i = (P_{max} - P_{min}).u_i + P_{min} \quad (7)$$

III. Conclusion

Growth in use of internet and internet-based software applications has increased the demand of cloud data centres. These days even 1 cloud data centre normally has thousands of servers and are live 24×7 for users. This use of too much of Cloud space, has lead to increase in power consumption, though the server utilization is not the same all the time. Thus, from the economic point of view, power management is an essential to save energy overheads. Researchers are working on models to optimize the energy cost in such 24X7 live scenario of world of data and network

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