Cloud Computing and Energy Efficiency Cloud as an Alternative to Green Computing

Puru Agrawal

Student, CSE 5th Semester, Shri Shankracharya Institute of Professional Management & Technology
Raipur, Chhattisgarh, India

Abstract: ***With the growing use of computing and emerging it as transformative trends in business and society, it is necessary to consider its energy efficiency and its effects. Most consumers are already heavy users of cloud-enabled services, including email, social media, online gaming, and many mobile applications. But with growing use of clouds should we really consider it as an alternate to conventional computing. The efficiency model gives the wastage of energy in conventional systems and how it can be avoided by using clod computing.***

Keywords: Cloud Computing, Energy Efficiency, Cloud Efficiency Model, BCloud, Cloud consideration

1. Introduction

The increasing availability of high-speed Internet and corporate IP connections is enabling the delivery of new network-based services .While Internet-based mail services have been operating for many years, service offerings have recently expanded to include network-based storage and network-based computing. These new services are being offered both to corporate and individual end users. Services of this type have been generically called Bcloud computing services. The cloud computing service model involves the provision, by a service provider, of large pools of high performance computing resources and high-capacity storage devices that are shared among end users as required. There are many cloud service models, but generally, end users subscribing to the service have their data hosted by the service, and have computing resources allocated on demand from the pool. The service provider's offering may also extend to the software applications required by the end user. To be successful, the cloud service model also requires a high-speed network to provide connection between the end user and the service provider's infrastructure. Cloud computing potentially offers an overall financial benefit, in that end users share a large, centrally managed pool of storage and computing resources, rather than owning and managing their own systems.

Its financial benefits have been widely discussed, the shift in energy usage in a cloud computing model has received little attention. Through the use of large shared servers and storage units, cloud computing can offer energy savings in the provision of computing and storage services, particularly if the end user migrates toward the use of a computer or a terminal of lower capability and lower energy consumption [2]. At the same time, cloud computing leads to increases in network traffic and the associated network energy consumption. It is estimated that data centers accounted for approximately 1.2% of total United States electricity consumption in 2005 [3]. The transmission and switching networks in the Internet account for another 0.4% of total electricity consumption in broadband-enabled countries [3]. In addition to the obvious need to reduce the greenhouse impact of the ICT sector, this need to reduce energy consumption is also driven by the engineering challenges and cost of managing the power consumption of large data centers and associated cooling. Against this, cloud computing will involve increasing size and capacity of data centers and of networks, but if properly managed, cloud computing can potentially lead to overall energy savings.

2. Why Cloud Should be Considered?

In today's internet world where the speed of the connection is continuously increasing with technologies like 3G, 4G and the LTE, the speeds match up with the real world speed that one requires for smooth loading of files. This is quite useful when we talk about the mobility and hardware. This is also helpful when we are talking about a huge amount of data and we cannot have sufficient data storage in one place. This is also useful because companies and organizations do need to store huge amounts of data but do not want all the data to be used at once. For example if we consider a mobile service provider, it will have data of millions of subscribers, but at a time it might need data of only a particular costumer. Also it might need the data of any customer anywhere in the country. So instead of physically storing and accessing data from its data center, the company can use the cloud. This would enable to access the data any time anywhere over machines.

3. Why is it Efficient?

The gains that we get in energy efficiency from moving business and personal software on the cloud is achieved from the fact that data centers which hosts these cloud servers are far more energy efficient than the IT infrastructure that the small companies deploy and also the fact that the servers of data centers are much more efficient. The energy savings are significant, particularly for small companies which deploy inefficient IT services [1], [3].

4. Efficiency Model

When it comes to deploying cloud for business software there are a numerous factors which come to consideration. Also these factors are interdependent and have a cumulative effect on the energy use. Here the cycle shows the nodes at

which the energy is wasted at independent companies who are not using cloud.

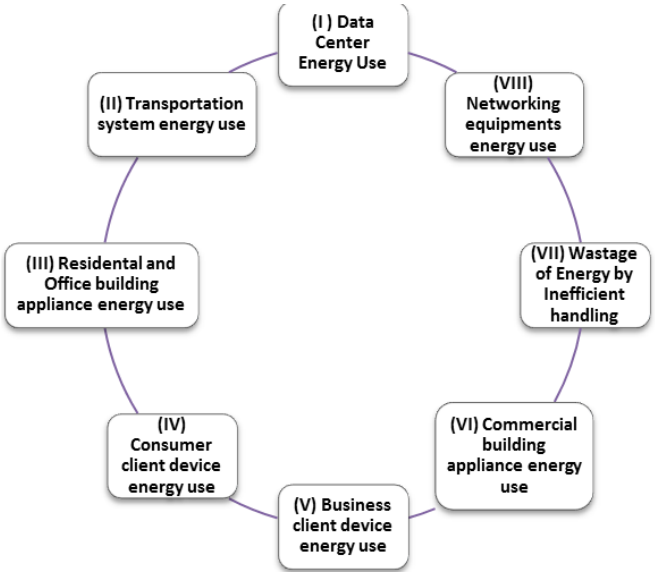

Figure 1: Cloud Efficiency Model

In this model all the factors are interdependent. These are explained as follows:

1) Data Center Energy Use: When companies use their dedicated data centers they need to have a lot of resources which primarily invloves:

   a) Air Conditioning unit.
   b) Dedicated Hardware.
   c) Resourse Person
   d) Power Backup
   e) Security

2) These all resources are used by all indivisual data centers in all corporations. This leads to energy wastage. Wheras when the cloud is implemented there is only one server at one data center which is maintained by the datacenter and this server is used by many corporations which leads to a lot of enrgy saving as there is only nodes at the client side.

3) Transportation System Enrgy Use: This involves the data transfer from client system to main server and back to the client. Moreover if data transfer needs to take place between the nodes itself, there is sepearate data transfer. Wheras in case of cloud there is direct transfer from client to server thus saving energy that was wasted in transport.

4) Residential and Office Building appliance energy use: The indivisual electrical appliances furthur used leads to wastage of energy which is alltogether no use of any extra appliances on the client side.

5) Consumer Client device Enrgy Use: This is related to the fact that if data transfer needs to be done from client to any other device the entire data is transferred. Wheras in cloud the data can be easily accessed thorough any device.

6) Business Client Device Energy Use: In corporations there is a lot of redundancy of data which leads to memory and energy wastage. The cloud architecture takes care of it and energy efficiency is maintained.

7) Commercial Building & Appliance Energy use: The large cooling systems that are used for maintaing the server is not needed in cloud systems thus leading to energy efficiency as only small node computers are required to access the data.

8) Network Equipment Energy Use:There is a lot of networking components involved when there is a network of computers in a building. As we see in Fig 1, we find that all these resources are interdeendent on each other. Thus a network euipment is dependent on all other factors as well such as commercial building appliance energy use and also to the wastage of energy due to inefiifcient hndling. Instead if we go for intenet connection and cloud architecture the energy can be saved.

9) Energy wastage by inefficient handling: The cost involved in maintaining the servers and also the inefficient use of resources by indivisuals. This could be reduced by cloud architecture as all the maintainence is done by datacenters with efficient resources.

5. Data to Show Cloud Efficiency

The following research from Microsoft [4] shows the efficient use of energy when the clients use the cloud compared to the use of conventional software on individual systems.

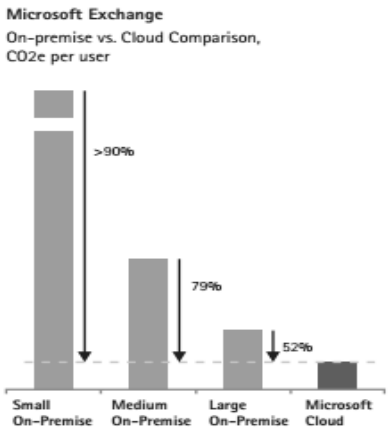

Figure 2: Graph showing the comparison of emission of CO2 levels when clod is deployed and when it is not.

The analysis suggests that, on average across the different applications, typical carbon emission reductions by deployment size are:

- More than 90 percent for small deployments of about 100 users
- 60 to 90 percent for medium-sized deployments of about 1,000 users
- 30 to 60 percent for large deployments of about 10,000 users

6. Conclusion and Future Scope

The power consumption in cloud computing is comparitively low as compared to the conventional computing systems that are currently in use at data centers around the world as we see it in Fig 2. As the need of the hour is to save our energy resources it would be beneficial if more organizations swith to Cloud Computing as their primary computing model. This will save them energy as well as financial resources. With the easier avability of internet connection at an economical rate and as fast speeds will futhur ease the use of Cloud Computing. Also in the world of portable computers which are comparitively less powerful in terms of computing power and battery backup, the use of cloud could be beneficial as all processing part is done at the data centers and the user side hardware is used only for input and output operations.

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Author Profile

Puru Agrawal is a Computer Science and Engineering student currently pursuing his Engineering degree from Shri Shankracharya Institute of Professional Management & Technology, Raipur. His areas of interests and research include Cloud Computing, Data Base Management and Android Software development