

# Energy Saving using Cloud Computing

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## Abstract

This paper describes cloud computing, a platform for next generation internet computing and various layers comprising a cloud. The paper defines green computing, how energy can be saved using cloud. It proposes novel ideas to reduce costs and conserve energy at an infrastructural level while setting up resources for implementing cloud computing. The paper also highlights some of the key benefits of implementation of cloud computing paradigm that can help make earth a greener planet. It discusses how cloud can be used to provide highly efficient and optimum computational paradigm to provide for both cost and energy effectiveness using virtualization. The paper concludes with the need for inter convergence of various clouds and taking product development to a new and a higher level where not only costs but energy efficiency is also considered.

**Keywords:** Cloud, Green computers, Green grid, Data centre

## 1. Introduction

Cloud computing has emerged as a recent trend in IT, Research and Development industry which focuses on utilizing the computational resources using internet. Cloud computing is a new and promising paradigm delivering IT services as computing utilities which is our vision for 21<sup>st</sup> century. It introduces a pay-as-you go economic policy which gives way to the new pricing models that are necessary to address the high variable demand for cloud resources.

### 1.2. Definition

“A cloud is a type of parallel and distributed systems consisting of a collection of inter connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service level agreements established through negotiation between the service provider and consumers.”



## 2. Layers Comprising Cloud: Cloud Computing Stack

A cloud comprises processing, network and storage elements and its architecture consists of three abstract layers as –

<b>Clients</b>
<b>Application</b>
<b>Platform</b>
<b>Infrastructure</b>
<b>Servers</b>

Layer 1 – Infrastructure and Servers.

Layer 2 – Platform.

Layer 3 – Clients and Application.

## 3. Energy efficient computing

The energy used on computing worldwide is tremendous. Since the target area for energy consumption in the implementation of a cloud is known, steps can be taken to make the process more energy efficient.

### 3.1 Green Computing

The study and practice of designing, manufacturing, using and disposing of computers, servers and associated subsystems efficiently and effectively with minimal or no impact on the environment is Green Computing. The combination of green data centers along with efficient computing techniques gives rise to green computing. It is estimated that the use of such techniques may help reduce the energy usage by about 10 times.

Data centers are places where most of the websites are hosted. The resources are contractually used by client from the service provider. The client needs to pay for floor space, bandwidth and power. He gets a facility that has

connectivity, uninterrupted power supply to all the data systems and a cooling system to tone down the rising temperature of computers and they bear the data of various sizes and types and thus are knitted using several computing units and storage devices.

### 3.2 Green Data Centers

So, how to address the energy consumption in the data centers and try to make them green? Well, a novel low cost technique is used by data center builders who are on the cutting edge of sustainability to cut cooling cost and energy consumption; **Outside Air.**

The Green Grid, a trade Group dedicated to reducing energy consumption in data centers has released free online tools to help data centers operators determine how cost-effective and useful outside cooling is at their location.

The operators at the data centers don't want dust and outside elements floating in and mucking with all that sensitive gear. But, as concerns over energy consumption of data centers raises – particularly the large amount of energy needed for cooling- companies from Google to IBM to Sun, are adding in more ways to naturally cool down equipment using outside air.

A recent innovative idea is 'mounting of solar panels' on the roof of data centers have evolved by Intel. Intel has installed solar panels in a facility near Rio Rancho, New Mexico to test the potential of photovoltaic [PV] solar energy to provide power for data centers. An array of 64 sharp solar panels will generate 10 KW of electricity. The solar array will be used with data center containers, which require less total power than traditional data centers.



Other ways such as utilization of wind power are being explored to reduce the consumption of power off the grid. A data center facility at Woodstock, IL – based **OWC** (Other World Computing) is the first to have 100% onsite wind power to run its operations. The 39 m (128 foot) diameter, 500 KW turbines is expected to generate an estimated 1,250,000 KWh per year. This is more than twice as much electricity as is used by all of OWC's operations. The facility is grid – tied and will sell the excess power back to the local utility, as well as being able to utilize grid power as backup during slack wind periods.



### 3.3 Green Computers

Now a days we also find the computers, too are getting eco friendly and are consuming far less power for the same processing power. One of the systems from silicon machines that reports using only 122 Watts. There has been a global initiative by various chip developers to give way to power efficient processing systems which require lesser power for same processing speed.

### 3.4 Power – Saver Modes

Other techniques involved make use of power saver modes built into various operating systems which puts down the system into a low power state when it is in idle state. This reduces the consumption of power to a greater extent. It is found that US college students could save more than 2.3 billion KWh per year electricity by enabling power saving features on their PCs. That equals an annual saving of more than \$200 millions in energy cost and 1.8 million ton reduction of carbon-di-oxide emission from the operation of computers – equivalent to taking more than 3,50,000 cars off the road !.

The real matter of concern is under utilization of computing resources which are designed to cater heavy demands. For example, most websites hold their data on more than a single server and sometimes they have a backup server running in case of failure that one server goes of so that the website does not shutdown as it may cause great loss of not only data but revenue also. For such systems, it is not always that they need to work at their full potential and as a result mostly it is found that they work at about ¼ to 1/8<sup>th</sup> of their total capacity. This in total a lot of power is being wasted all together. Cloud computing can provide break way solution that can help in reduction of loss of resources due to under consumption during non-peak hours. It involves provisioning of data and computing resources which is based on demands of clients as per a pre-defined agreement or dynamically scalable as the needs vary with time.

## 4. Benefits of Cloud computing

### 4.1 Benefits of enormous infrastructure

One of the advantages of cloud computing is that both small and medium sized business can instantly obtain the benefits of the enormous infrastructure without having to implement and administer it directly. This also permits accessibility to multiple data centers anywhere on the globe. It also means that as the need for resources increases, companies can add additional services as and when needed from cloud computing vendor without having to pay for additional hardware.

### 4.2 Eco friendly incentives

Of course another incentive to opt for cloud computing is that it is more environmental friendly. Reducing the no of hardware components and replacing them with cloud computing system reduces energy costs for running hardware and cooling as well as reducing carbon di oxide emission and conserve energy.



## 5. Conclusion

Cloud computing could allow us to have a small and inexpensive computer system. We don't need any hard disk or drive. Instead we need only a connection that would work as hook with central supercomputer that host all programs and files. This present an advantage to both storage and security issues. It is a new emerging trend and a promising paradigm delivering IT services as computing utilities in the modern generation of cost effective and energy efficiency.

The paper discusses how the cloud works and how dynamic scalability is provided with the help of virtualization. Cloud computing provides a perfect solution and it hence helps us to achieve our 21<sup>st</sup> century dream of moving away from traditional desktop to next generation gadgets which are not only more portable but also more energy efficient.

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