International Journal of Advanced Scientific Technologies, Engineering and Management Sciences (IJASTEMS-ISSN: 2454-356X) Volume.3,Special Issue.1,March.2017

ISSUES ON GREEN CLOUD COMPUTING TOWARDS ENERGY SAVING

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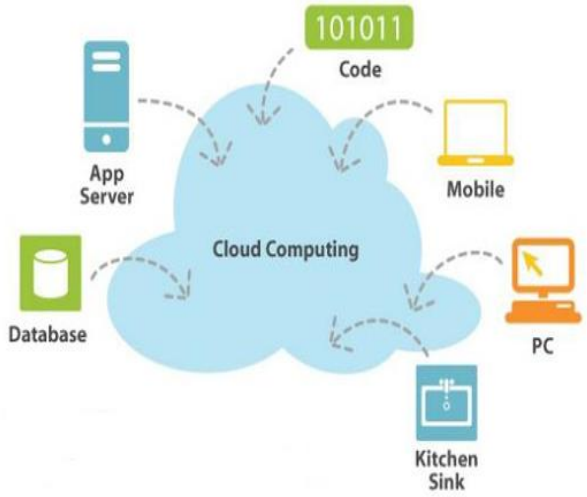
Abstract:-Cloud computing is offering utility-oriented IT services to users worldwide. Based on a pay-as-you-go model, it enables hosting of pervasive applications from consumer, scientific, and business domains. .The services provided by remote data centre as Software application and other services migrated on the remote data centre ,The major issue of green cloud computing is managing data centre with respect to power consumption and Co2 emission. The reason for this is that servers don't have a good quality cooling system. Green computing is more effective and enables more energy efficient use of computing power .This survey paper shows the requirement of green computing and Issues and technologies to save the energy.

Keywords — Green computing, Cloud Computing, power consumption, Virtualization, Co2 emission, Moors Law.

I Introduction

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources like networks, servers, storage, applications, and services.



II Clouds offer Subscription-Oriented IT Services: {compute, apps, data,..} as a Service

III Benefits of cloud Computing

- ✓ information with minimal cost.
- ✓ Workforce through internet: worldwide can access the cloud, with internet connection.
- ✓ Performance: More work done in less time with less people.

- ✓ Minimize capital costs. No need to spend much money on hardware, software or licensing fees.
- ✓ Improve flexibility. You can change direction without serious financial issues at stake.

IV Clouds Impact on the Environment

Data centres are not only expensive to maintain, but also unfriendly to the environment.

Carbon emission due to Data Centres worldwide is now more than both Argentina and the Netherlands emission.

High energy costs and huge carbon footprints are incurred due to the massive amount of electricity needed to power and cool the numerous servers hosted in these data centres.

V Green Cloud Computing

Green computing is environmentally responsible and eco-friendly use of computers and their resources. It is designing, manufacturing, using computing devices in such way that it reduces impact on environment.

Green Cloud computing is to achieve not only efficient processing and utilization of computing infrastructure, but also minimize energy consumption[1]

A Powering cloud infrastructure

Modern data centres, operating under the Cloud computing model, are hosting a variety of 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).[2]

B Cloud Data Centers consume excessive amount of energy:

According to McKinsey report on *"Revolutionizing Data Centre Energy Efficiency"* :

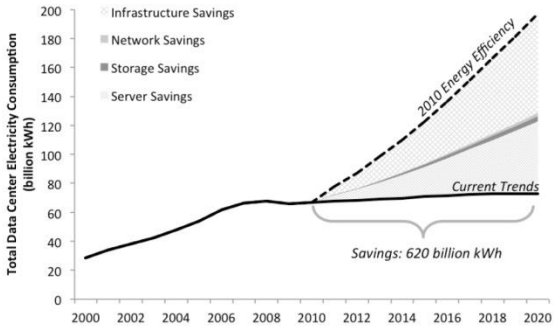
A typical data centre consumes as much energy as 25,000 households.

The total energy bill for data centres in 2010 was over $11 billion and energy costs in a typical data centre doubles every five years.[3]

C Survey Of Energy Consumption & efficiency

Efficiency improvements have played an enormous role in taming the growth rate of the data center industry's energy consumption. Without these improvements, staying at the efficiency levels of 2010, data centers would have consumed close to 40 billion kWh more than they did in 2014 to do the same amount of work, according to the study, conducted by the US Department of Energy in collaboration with researchers from Stanford University, Northwestern University, and Carnegie Mellon University.

Energy efficiency improvements will have saved 620 billion kWh between 2010 and 2020, the study forecasts. The researchers expect total US data center energy consumption to grow by 4 percent between now and 2020 – they predict the same growth rate over the next five years as it was over the last five years – reaching about 73 billion kWh.[16]



This chart shows past and projected growth rate of total US data center energy use from 2000 until 2020. It also illustrates how much faster data center energy use would grow if the industry, hypothetically, did not make any further efficiency improvements after 2010. (Source: US Department of Energy, Lawrence Berkeley National Laboratory).

Data center energy consumption started attracting a lot of public attention. The internet was developing fast and many

started asking questions about the role it was playing in the overall picture of the country's energy use.

D Power-Aware Computing

Power Aware (PA) computing communication: The objective of PA computing/communications is to improve power management and consumption using the awareness of power consumption of devices.

Power consumption is one of the most important considerations in mobile devices due to the limitation of the battery life.

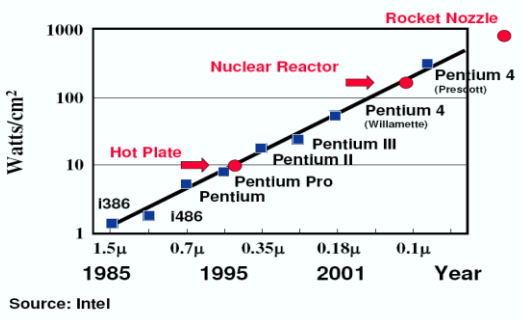
System level power management

Recent devices (CPU, disk, communication links, etc.) support multiple power modes.

Traditionally, HPC (commodity clusters) & Data center community has focused on performance (speed).

At the same time, microprocessor vendors have not only doubled the number of transistors (and speed) every 18-24 months, but they have also doubled the power densities. [16]

Moore's Law for Power Consumption:



E Research Motivations of Power Aware/Energy Efficient Computing

- Rapid uptake of Cloud Data Centers for hosting industrial applications
- Reducing the operational costs of powering and cooling Data Centers:
- The tremendous increase in computer performance has come with an even grater increase in power usage.
- According to Eric Schmit, CEO of Google, what matter most to Google is "not speed but power, because data centers can consume as much electricity as a city."[5]

F Improving reliability

As a rule of thumb, for every 10°C increase in temperature, the failure rate of a system doubles.

Computing environment affected the correctness of the results. [6]

The 18-node Linux cluster produced an answer outside the residual (i.e., a silent error) when running in dusty 85°F warehouse but produced the correct answer when running in a 65°F machine-cooled room.

VI Resource Management and Scheduling Systems can use these multiple power modes to reduce the power consumption.

A DVS (Dynamic Voltage Scaling) technique[16]

Reducing the dynamic energy consumption by lowering the supply voltage at the cost of performance degradation

Recent processors support such ability to adjust the supply voltage dynamically.

The dynamic energy consumption = $\alpha * Vdd^2 * Ncycle$

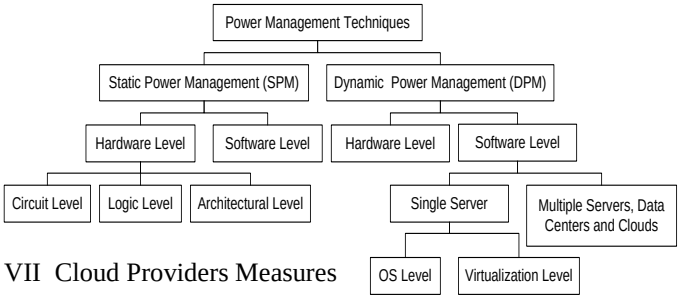
Vdd : the supply voltage

Ncycle : the number of clock cycle

An example:

B DVS (Dynamic Voltage Scaling)

C Taxonomy of Power Management Techniques [8]



VII Cloud Providers Measures

- Cloud service providers need to adopt measures to ensure that their profit margin is not dramatically reduced due to high energy costs.
- Amazon.com's estimate the energy-related costs of its data centers amount to 42% of the total budget that

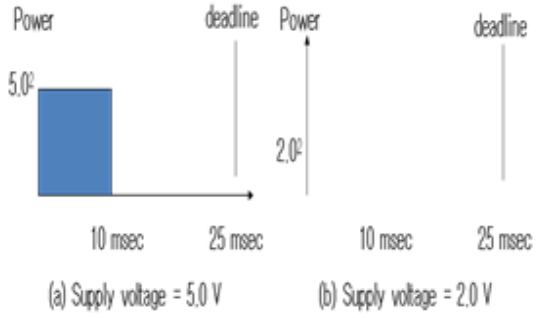
include both direct power consumption and the cooling infrastructure amortized over a 15-year period.

- Google, Microsoft, and Yahoo are building large data centers in barren desert land surrounding the Columbia River, USA to exploit cheap hydroelectric power.
- There is also increasing pressure from Governments worldwide to reduce carbon footprints, which have a significant impact on climate change. [7]

A Green Cloud: "performance" → "energy efficiency

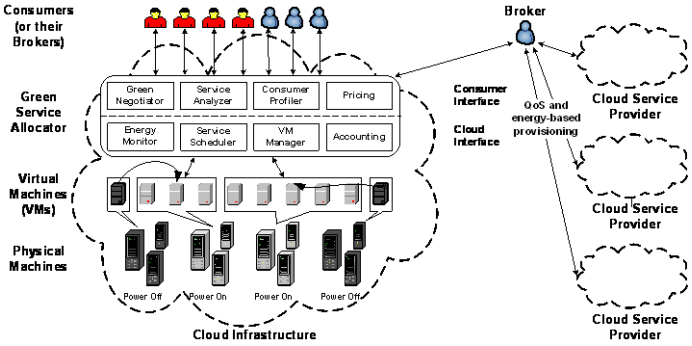
- As energy costs are increasing while availability dwindles, there is a need to shift focus from optimising data center resource management for pure performance alone to optimising for energy efficiency while maintaining high service level performance.
- We propose Green Cloud computing model that achieves not only efficient processing and utilisation of computing infrastructure, but also minimise energy consumption. [3]

B Green Cloud Computing



C Green Cloud Computing Architecture

Energy-Efficient Resource Management



VIII CONCLUSION

Clouds are essentially data centers hosting application services offered, consume high energy to maintain their operations which is directly proportional to environmental impact. Here is a survey of some of the solutions given by research scholars.

we have to take measures like H/w components usage which consume less power, Virtualization ,Power Aware computing ,Dynamic Voltage scaling, Green cloud Framework & environment to save energy and reduce the emission of CO2.

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