Green Computing and Eco-Friendly Computing System

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Abstract

Nowadays, computer and Application of Computer systems are being used by almost every person and every level of organization in different sectors (Education, Health care, ICT, Agriculture, and Automobile Etc.). And by using it, data growth has been also growing very speedily. In 21st century data is very vital. [1] In the digital age, data is king and a precious asset for any organization. It is the foundation of information and the basis on which people make decisions. Data also brings following benefits to the organization: Improved Customer Relation, Reduced cost, Effective Marketing. To store data, nowadays IT industries provide a service called DATA CENTER. Today, there are reportedly more than 7 million data centers worldwide. Nowadays cloud computing is emerging Technology and spreading within all over the world in every sector .Cloud Technology provides Data Center Microsoft Azure , Amazon Cloud ,Google cloud. As we know the growing demand for cloud technology and computational gadgets has been increasing, so the power and energy consumption of Data centres and Gadget also has been increasing. Power and energy consumption of Data centres affects the environment in the form of its carbon emission which is released from organizations because Data service providers are establishing a number of data centers very speedily. So, in order to make cloud computing as Green computing technology some new energy efficient methods are necessary to save the environment.

Keyword: - Green Computing, Cloud Computing, Data Center, carbon emission, environment.

Introduction

"When I went to school, I had physical books and issued books from the library and we played on the ground. But my children go to school with laptops, access to the Internet and read digital books and play games on Laptop, Tablet or from Mobile phone by internet resources. Favourite line I use to demonstrate the effect of the 'Digital Revolution'. [2] The population of the world in January-2022, 7.9 Billion (Figure-01). And nowadays almost every person has at least one or more than one compute device. And almost 65 to75 percent of the world's life depends on the internet. [3] I am sharing statistical data of Global spending on devices (PCs, tablets, mobile phones, and printers) from 2012 to 2023. (Figure – 02)

They book tickets, purchase things, and transaction Money from web Application .Even without any purpose they have been surfing the internet. But sometimes they get so lost in the excitement of using new technologies that they are not aware of its effects on the world around us. Billions of Mobile and internet users share photos and Documents through some web applications which are useful for the analytical operations of personal or business work. Even emerging computing technology has been very fastly spreading in almost every sector Ex.-Health care, Agriculture, Auto Mobile, Education, civil engineering and building construction. For these kinds of operations it is very important to have a platform which provides accelerated access to flexible and low cost IT resources. In order to provide this platform, the novel service model called cloud Computing has been introduced to the world (Figure-03).

WORLD INTERNET USAGE AND POPULATION STATISTICS 2023 Year Estimates						
World Regions	**Population (2022 Est.)**	**Population % of World**	**Internet Users 31 Dec 2021**	**Penetration Rate (% Pop.)**	**Growth 2000-2023**	**Internet World %**
Africa	1,394,588,547	17.6 %	601,940,784	43.2 %	13,233 %	11.2 %
Asia	4,352,169,960	54.9 %	2,916,890,209	67.0 %	2,452 %	54.2 %
Europe	837,472,045	10.6 %	747,214,734	89.2 %	611 %	13.9 %
Latin America / Carib.	664,099,841	8.4 %	534,526,057	80.5 %	2,858 %	9.9 %
North America	372,555,585	4.7 %	347,916,694	93.4 %	222 %	6.5 %
Middle East	268,302,801	3.4 %	206,760,743	77.1 %	6,194 %	3.8 %
Oceania / Australia	43,602,955	0.5 %	30,549,185	70.1 %	301 %	0.6 %
WORLD TOTAL	7,932,791,734	100.0 %	5,385,798,406	67.9 %	1,392 %	100.0 %

Figure-01 World Internet Uses and Population

Cloud computing is the delivery of computing services including servers, storage, database, networking, software, analytics, and intelligence over the Internet. Apart from this, Cloud service provider also offers Artificial Intelligence and machine learning and Dataset on cloud technology. Cloud Technology is a highly scalable and cost-effective infrastructure, And Pay according to electricity bill, water bill on monthly basis and running High performance computing and Web application. However, the growing demand of Cloud Technology has drastically climbing and energy consumption of data centers also has been climbing, which has become a critical issue .Data centers hosting cloud computing applications consume huge amounts of energy, contributing to high operational costs and carbon footprints to the environment.
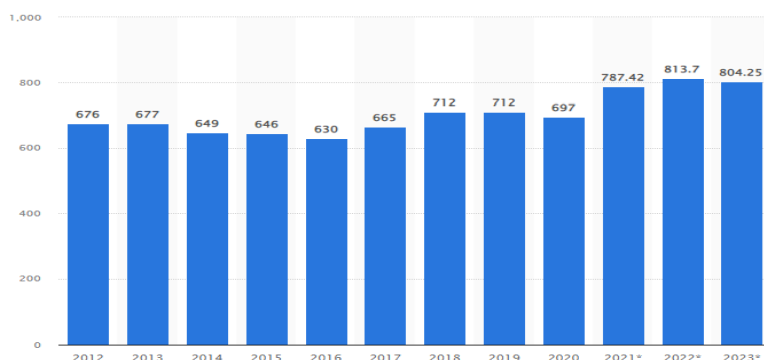

Figure-02 Statistical data of Global spending on devices.

Figure-03 (Cloud Technology)

Address Of Clouds Technology.

Types Of Cloud Computing Model

The growing popularity of cloud computing an n-number of Data center servers and storage devices has given rise. Cloud technology has different types of cloud service deployment models based upon their location and can be categorized as follows:

Private Cloud

Private cloud infrastructure is usually protected behind a firewall, which is a security system that tracks and controls network traffic. This means only authorized people can use these computing resources. Companies that have strict regulatory standards will prefer private clouds to protect their information and data.

Public Cloud

Companies, such as Amazon and Google, are known for their public clouds. This type of cloud is known for providing large storage space. Business teams will typically use a public cloud for collaborative projects or software development.

Hybrid Cloud

Hybrid clouds are a combination of public and private clouds. They are engineered to allow people to use and store data on both platforms seamlessly.

Types Of Cloud Computing Services

Infrastructure as a Service (IaaS)

This is a service model that builds the foundation for a business's cloud technology. Infrastructure as a Service is considered the most flexible and all-inclusive cloud application because it provides a multitude of resources. This includes on-demand networking, data storage, and processing power. IaaS also does not require hardware investments since these resources are provided by the platform. People that want a cost-efficient and scalable cloud solution will often turn to IaaS.

Platform as a Service (PaaS)

Platform as Service is considered to be the advanced version of Infrastructure as a Service. PaaS provides an IT structure, computing platform, and solution stack. It also helps non-expert users with creating custom apps on the web without any concern for data storage and management. Additionally, PaaS offers hosting solutions, network access, and server software.

Software as a Service (SaaS)

The computing service, SaaS, consolidates the different services that IaaS and PaaS provide. Software as a Service caters to diverse business functions, such as business analytics, automation, and customer management. SaaS also offers browser-based software apps that are user-friendly, reducing the need for IT specialists, laborious set-up, and maintenance. This is the most common cloud computing service, in which people often use SaaS apps, like Gmail and Slack.

HISTORY OF GREEN COMPUTING

Green computing is started in the 90's when US environment protection energy launched the Energy Star Program. Energy star is a program of label awarded to computers and other electronic devices. It is basically used to minimize the use of the energy and maximize the efficiency of the product/device. This labeling program is basically designed to promote and recognize the energy efficiency in monitors, climate control equipment and other technologies. This technique basically increases the adoption of "sleep mode" among consumer's electronics."The low magnetic and electrical emission program was first launched by the Swedish organization TCO. It issues the certification from cathode ray tube (CRT) based computer displays. This program was later extends to include criteria on energy consumption and use of hazardous material in construction. High energy consumption not only translates to high operational cost, also reduces the profit margin of cloud users. High carbon emissions which are not environment friendly, hence energy-efficient solutions are required to minimize the impact of cloud computing on the environment .In order to design such solutions, deep analysis of cloud technology is required with respect to their power efficiency. To prevent carbon footprints in the environment, we need green cloud computing solutions, with this solution we can not only save energy, we can also reduce operational costs.

Benefits of Green Computing

1)   Green Computing can save energy.
2)   Green Computing can save money in the long run.
3)   More sophisticated recycling process.
4)   West Reduction.
5)   Less Pollution.
6)   Less Green house gas emission.
7)   More efficient Hardware use.
8)   Sustainable IT practices.
9)   Increases Pressure to go green in the IT Industry.
10)   Positive impact on flora and Fauna.
11)   Reduction of health risks for customer.

As global warming has been increase becomes a more pressing issue for our climate, So data centers provider can use some best practice which can help data center go greener ,which can benefits both for our business and environment. Developing becomes a priority for companies across industries and geographic locations. Consider few steps you can take to make your data center more sustainable -- an essential task from both a business perspective and an environmental one.

1)   Virtual Server

You can also replace physical servers with virtual ones or move certain resources to the cloud to cut down on the number of physical technologies you use.

2)   AI Powered monitoring Tools

AI-powered monitoring tools can use machine learning to analyze facility data to create a power usage effectiveness forecasting model. Some data centers also use AI-powered tools to autonomously manage HVAC functions at their facilities, in partnership with IoT sensors that feed continuous temperature data to the system. The software then analyzes the data and automatically changes the HVAC system to ensure that temperatures remain at optimal levels at all times. Google has used this technology to reduce energy consumption by 40% in its data center cooling systems.

3)   Track your base usage

First, Data center provider should know how much power and how many resources our data center currently uses. Start by tracking overall electrical usage. Then you can dive deeper into the numbers to forecast future use. For example, break your electrical use down into HVAC (Heating, Ventilation, and Air Conditioning, control the temperature), server, infrastructure, and network and storage consumption. Once you have a sense of your baseline, you can start looking at ways to improve efficiency.

4)   Right-size your servers

Running servers 24/7 might actually lead you to underutilize them. Some servers might only process requests during certain times of the day, while others might run applications infrequently or simply no longer serve a purpose. Server monitoring tools like Zabbix, Netreo and PRTG Network Monitor can help admins track server utilization to determine which server functions you can consolidate onto fewer machines, which you can virtualizes and which you can decommission altogether.

5)   Modify the temperature

Data center HVAC systems tend to be designed to use more air conditioning than the data center really requires. Newer data center assets can safely run at higher temperatures, so data center facilities can keep the overall temperature a little warmer in order to reduce the load on HVAC.

6)   Rearrange your data center

You can increase the efficiency of your data center by rearranging it based on energy consumption and temperature. Use smart layouts such as hot and cold aisle configurations to group warmer assets together and take advantage of HVAC vent placement.

7)   Replace older assets with more efficient ones

Many legacy assets use more power, generate more heat and have lower physical tolerances than newer ones. Newer servers, switches, racks and HVAC technologies have higher-efficiency processors and components.

Include these new assets when appropriate for your data center, such as during end-of-life or sunset processes or during replacement maintenance processes. Invest in smart facilities management

IT service management requires you to gather and store a lot of information about your data centers, including power consumption and data loads. By analyzing that data, you give your environmental control systems the insights it requires to optimize your asset usage, thus reducing power consumption and HVAC loads.

8) Investigate alternate green technologies

Organizations seeking to reduce their carbon footprints can consider many green alternatives, such as geothermal cooling, wind power and hydroelectric power. For example, Verne Global uses geothermal and hydroelectric technologies in their Keflavik, Iceland, data center to naturally cool their facility, Tier Point's data center in Spokane, Wash., combines internal geothermal cooling technology with Washington's green electricity generation options to reduce their footprint, and Iron Mountain's underground data centers take advantage of natural cooling. Check which green options are available to your organization, because the development of new green technologies means you can always find new ways to reduce your carbon footprint.

9) Partner with green vendors and organizations

Develop green partnerships with vendors and organizations that offer more sustainable options. U.S.-based data centers can partner with the EPA to identify the best green power products for their locations. You can check for a vendor's or provider's sustainability level through the Carbon Disclosure Project, the RE100 and Sustainalytics to see their commitment to renewable energy.

Proposed Approaches Of Green Computing

[4] According to Report May-2020, if we think compute device and data center are non-polluting and consume very little energy, in fact the use of compute device plays a big role in environment pollution. It is estimated that out of \$250 billion per year spent on powering computers worldwide only about 15% of that power is spent computing, the rest is wasted idling (i.e. consumed by computers or compute device which are not in use but still turned ON). That consumed energy is the main reason of CO2 emission, thus, energy saved on computer hardware and computing will equate tonnes of carbon emissions saved per year.

Conclusions

It can be observed that Global warming is a gradual increase in the temperature near the earth's surface earth's surface. This phenomenon has been observed over the past one or two centuries. To overcome the temperature we should follow Green Computing Technology is needed to protect environment.

[5] Compute gadget has also established its share to contribute to saving the environment under the concept "Green Computing". Green computing is the environmentally responsible and eco-friendly use of computers and their resources.

As more and more time passes the need of computers as a dependable machine increases and so does its use. So computer penetration is increasing globally at an amazing rate. This makes it all the more necessary to maintain green computing procedures throughout the life cycle of a computer from manufacturing through day-to-day operation till the end of its operating stage. Thus, it can be safely concluded that in order to have a healthy and clean environment all stake holders must work collaboratively for a healthier and greener environment for our future generations.

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