Green Cloud Computing

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Abstract: - This Paper Discusses The Carbon Footprint Caused By Computer Resources, Cloud Computing And The Damage It Causes To Nature. The Growing Need Of Data Centers And The Resulting Environmental Problems Like Emission Of Harmful Gases And Production Of Heat Are A Relevant Field Of Study. Efficient Use Of Computing Resources Without Harming The Nature On Pay-As-You-Go Basis Is A Concern. This Paper Discusses How To Improve The Above With Green Computing.

Keywords – Cloud Computing, Green Cloud Computing, Carbon Emission, Sustainable Energy, Eco-Friendly;

Introduction:

In Today's World, Computers And The Internet Become Indispensable. This Use Causes A Large Number Of Carbon Emissions.

- A Computer That Is On For Eight Hours A Day Uses Almost 600 Kwh And Emits 175 Kg Of CO_2 Per Year.
- A Laptop That Is On For Eight Hours A Day Uses Between 150 And 300 Kwh And Emits Between 44 And 88 Kg Of CO_2 Per Year.
- As Of 20 October 2020, The Earth Had 7,796,949,710 Inhabitants, 63.2% Of Whom Were Internet Users. Between 2000 And 2020, The Number Of Internet Users Multiplied By 6 In Europe, By 21 In Asia And By 139 In Africa. [3]

A Fast Growth Of Demand For Cloud Based Services Results Into Establishment Of Enormous Data Centers Consuming High Amount Of Electrical Power. Green Cloud Computing Techniques Is Used To Reduce The Energy Consumed By Physical Resources In Data Center And Save Energy And Also Increases The Performance Of The System. [2]

I. Cloud Computing

Cloud Computing Is A Model For Enabling Ubiquitous, Convenient, On-Demand Network Access To A Shared Pool Of Configurable Computing Resources (E.G., Networks, Servers, Storage, Applications, And Services) That Can Be Rapidly Provisioned And Released With Minimal Management Effort Or Service Provider Interaction. Virtualization Is A Technique, Which Allows To Share A Single Physical Instance Of A Resource Or An Application Among Multiple Customers And Organizations. It Does By Assigning A Logical Name To A Physical Storage And Providing A Pointer To That Physical Resource When Demanded.

There Are 3 Major Services

1. Iaas [Infrastructure-As-A-Service]
2. Paas [Platform-As-A-Service]
3. Saas[Software-As-A-Service]

1. Infrastructure-As-A-Service (Iaas) Iaas Is The Most Basic Category Of Cloud Computing Services That Allows You Rent It Infrastructure (Servers Or Vm's) From A Cloud Provider On A Pay-As-You-Go Basis.

2. Platform As A Service (Paas) Platform-As-A-Service (Paas) Refers To The Supply An On-Demand Environment For Developing, Testing, Delivering And Managing Software Applications. It Is Designed To Quickly Create Web Or Mobile Apps, Without Worrying About Setting Up Or Managing The Underlying Infrastructure Of Servers, Storage,

Network And Databases Needed For Development.

3. Software As A Service (Saas) Software-As-A-Service (Saas) Is A Method For Delivering Software Applications Over The Internet As Per The Demand And On A Subscription Basis. Saas Helps You Host And Manage The Software Application And Underlying Infrastructure And Handle Any Maintenance (Software Upgrades And Security Patching).

Four Areas Where Cloud Computing Have Power Efficiency Advantages:

1. Diversity: Spreading Computing Loads Across Many Users And Time Zones Can Improve Hardware Utilization.

2. Economies Of Scale: Computation Is Cheaper In A Large Shop Than Small Shop, As Fixed Costs Can Be Spread Over More Servers And Users.

3. Flexibility: The Management Of Virtual Servers In Cloud Apps Is Easier And Cheaper Than Managing Physical Servers. It Also Has Reliability Advantage That Can Create Savings In The Data Center. If You Can Void Outages Using Software To Route Around Problems, You Don't Need To Buy Two Power Supplies For Each Server.

4. Enabling Structural Change: The Shift To A Cloud Model Enables Broader Efficiencies In A Business That Can Save Money Over Time

With The Growth Of Cloud Computing, Large Scale Data Centers Have Become Common In The Computing Industry, And There Has Been A Significant Increase In Energy Consumption At These Data Centers, Which Thus Becomes A Key Issue To Address. As Most Of The Time A Data Center Remains Underutilized, A Significant Amount Of Energy Can Be Conserved By Migrating Virtual Machines (Vm) Running On Underutilized Machines To Other Machines And Hibernating Such Underutilized Machines. [2]

Some Of The Ideas To Reduce Energy Consumption Is As Follows:

●The Data Centers Uses Diesel As A Backup Purpose For Energy And Using Diesel Pollutes Our Environment By Producing Various Harmful Gases Including Carbon Dioxide. To Solve This Problem, Eco-Friendly Energy Producers Should Be Used As A Backup Like Solar Energy, Wind Energy Etc [3]. So, This Will Reduce The Pollution Caused By Diesel In Data Centers.

● Data Centers Uses Refrigerators For Cooling Purpose Which Need Energy To Run And Consumes Lots Of Energy And Also Producing Heat On The Other Side. So, To Overcome This. Free Cooling Method Should Be Used Which Basically Depends On Outside Weather Condition. Although, The Equipments Are Still Required In This Process But At Least It Doesn't Produce Heat Like Mechanical Method Of Cooling. So, Free Cooling Method Is Another Way To Practice Green Computing In Cloud Computing

●By Using Processors That Are Energy Efficient, Lots Of Power Could Be Saved. In This Process, The Modification Of Clock Rate Is Done. The Frequency Can Be Minimized And Maximized According To The Need Of Software And Hardware. This Saves Lots Of Energy As The Energies Are Not Wasted Which Are Not Used. All The Energy Are Used Efficiently. [1]

II.   Practices In Green Cloud Computing

*   Eco-Friendly

Green Cloud Computing Is An Eco-Friendly Model As It Prevents Cloud Computing From Harming The Environment. It Prevents The Load On Processor And Reuse The Resources That Gives A Benefit To Use Resources Efficiently. The Heat And All Other Harmful Gases That Used To Get Emerged From Cloud Computing Is Minimized Due To This Model

*   Virtualization

Using Some Abstract Process, This Concept Of Virtualization Lets Run Several Logical Computers In Single Physical Computer. There Are Several Software That Let It Done And Process, Like Hypervisor, It Coordinates With The Underlying Hardware Components According To The Instructions Given By Virtual Machine.

*   Scheduling

The Energy Consumption Generated By Servers In Task Scheduling Is An Important Part Of The Dynamic Energy Consumption Of Cloud Computing Systems. Saving Energy And Improving Energy Efficiency Are Important Foundations For Realizing Green Cloud

Computing Systems. First Come First Service (Fcfs), Short Job First Scheduling (Sjf), Max-Min Are Some Of The Algorithms Used For This Purpose.

- Sustainable Resources

Renewable Energy Resources To Power Cloud Datacenters Instead Of Conventional Methods Reduce The Carbon Footprints.

- Free Cooling

A Lot Of Heat Is Produced By Data Centers Every Day. Cooling This Data Centers May Produce More Heat And Carbon Emission. When The Air Near Server Get Hot It Uses Cooler Air From Outside And This Will Save Energy. Also It Is Better To Keep Some Practices Like Use Of Close Coupled Cooling, Removing Unnecessary Heat Resources, Avoid Tangled Cables Etc.

III. Future Scope

Green Computing Is Especially Relevant In Current Situation Where Climate Changes Adversely Affects The World. All Steps To Reduce Carbon Footprints Will Sae The Future, So Green Cloud Computing Is For The Better. Green Computing Reduces Energy Use And Thereby Benefits Business And Nature. There Is A Green Cloud Data Center That Houses Data In Green Cloud Virtual Environment. It Has Ultimate Performance And Powered By Infrastructure Composed Of Cisco And VMware Technologies.

IV. Conclusion

Green Cloud Computing Is A Way Of Developing And Using Computing Resources Without Harming Environment. In This Paper We Have Seen That The Carbon Footprints Of Desktop, Laptop And Internet And How Sustainable Energy Resources Will Helps To Overcome The Problems. All The Leading It Giants Like Google, Ibm Etc. Are Into It And The Future Is Safer With Green Computing With Less Carbon Emission.

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