SURVEY ON GREEN CLOUD COMPUTING DATA CENTERS

[1]ONKAR ASWALE, [2]YAHSAVANT JADHAV, [3]PAYAL KALE, [4]NISHA TIWATANE

[1,2,3,4]Dept. of Computer Sci. & Engg, Rajarambapu Institute of Technology, Islampur
E-mail: [1]onkaraswale, [2]jadhavyashavant428, [3]kale.payal68, [4]tiwatane.nisha57}@gmail.com

Abstract- Energy efficiency is an important aspect of Green Cloud and the Cloud data centers have huge impacts on it. New ways need to be found out to make data centers, reduce power consumption while keeping the desired quality of service. Several governmental, industrial, and academic surveys indicate that the energy utilized by computing and communication units within a data center contributes to a considerable amount of the data center operational costs. Cloud computing is emerging that would have an impact on the future aspects. We systematically analyze its energy consumption and obtain the conditions to facilitate green cloud computing to save overall energy consumption in the related information communication systems. This paper is for anyone who may have recently heard the term "Green Cloud Computing" for the first time and needs to know what is and how it helps them.

Keywords- Data Centers, Load Balancing Algorithms, Cloud Computing, Power Module

I. INTRODUCTION

Data Center is a large group of networked computer servers typically used by organizations for the remote storage, processing, or distribution of large amounts of data. Green cloud is a label that describes the potential environmental benefits that information technology services delivered over the Internet can offer society.

An operating expense, operating expenditure, operational expense, operational expenditure or OPEX is an ongoing cost for running a product, business, or system. Its counterpart, a capital expenditure (CAPEX), is the cost of developing or providing non-consumable parts for the product or system. Ns-2 is a discrete event simulator targeted at network research and focused on modeling network protocols wired, wireless, satellite TCP, UDP, multicast, unicast web, telnet, ftp ad hoc routing, sensor networks.

The cloud computing data centers have a great importance in provisioning computing resources. The cost and operating expenses of data centers have grown on a very large scale. There have been many surveys that underlined the fact that the energy utilized by computing and communication units within a data center contributes to a considerable slice of the data center operational costs.

Thus if the data center fails due to temperature issues it may decrease the hardware reliability drastically and may potentially violate the Service Level Agreement (SLA) with the customers. A major portion (over 70%) of the heat is generated by the data center infrastructure.

II. COMPONENTS OF DATA CENTERS

A data center is a facility used to house computer systems and associated components, such as telecommunications and storage systems. It generally includes redundant power supplies, data communications connections, environmental controls (e.g., air conditioning, fire suppression, etc.) and security devices. For our purposes we will focus on the Servers, Storage, Hypervisors, Networking, Firewalls and connectivity elements of the data center.

Servers
It is a computer program that accepts requests from number of clients and it responds to the requests accordingly.

Thus, the server provides services to the client by performing different tasks for the client. There are various types of servers as:

1. Application Server.
2. Proxy Server.
3. Web Server.
4. Name Server
5. Blade Server etc

Switches
It is a networking device used for connecting number of devices available on the network. It forwards message in form of packets to the devices only for which the message is intended. There are types of switches in a data center:

1. Core Switch:
2. Aggregation Switch
3. Access Switch

Internetworking
It provides the connectivity to the data center i.e connection between all the components of a data center.

The linking of the components can be created by any of the following cables that have different characteristics of their own. These are:

1. Coaxial
2. Twisted Pair
3. Fiber Optic.

III. LITERATURE SURVEY

In this field of green cloud computing there is lot of work had done before. So just take a look on those papers.

In D. Kliazovich, P. Bouvry, and S. U. Khan presented A packet-level simulation environment for energy-aware cloud computing data centers. Along with the workload distribution, the simulator is designed to capture details of the energy consumed by data center components (servers, switches, and links) as well as packet-level communication patterns in realistic setups.

In D. Kliazovich, P. Bouvry, and S. U. Khan presented these under-lines the role of communication fabric in data center energy consumption and presents a scheduling approach that combines energy efficiency and network awareness, named DENS. The DENS methodology balances the energy consumption of a data center, individual job performance, and traffic demands.

The proposed approach optimizes the trade-off between job consolidation (to minimize the amount of computing servers) and distribution of traffic patterns (to avoid hotspots in the data center network).

In Anusuya, Krishnapriya presented system uses simulator to capture the details of energy consumed by Cloud data center components as well as packet-level communication patterns in realistic setups. The protocol AODV is to improve the energy efficiency of both data center and the user node performance as well as the performance of Cloud data centers. Here, the Ad-Hoc protocol emphasize the aggregation method in order to reduce message replies in the network to lead the traffic reduction while transformation of packets. It improves the energy efficiency, increases the accuracy of packet delivery, reducing the communication-related delays and congestion related packet losses. The results confirm that the discovery success rate and the message reduction to increase the performance of Cloud data centers and improve the energy efficiency.

In Chen G, He W, Liu J, Nath S, Rigas L, Xiao L, Zhao F Presented A simulation environment for energy-aware cloud computing data centers. Green Cloud is designed to capture details of the energy consumed by data center components as well as packet-level communication patterns between them. The simulation results obtained for two-tier, three-tier, and three-tier high-speed data center architectures demonstrate applicability and impact from the application of different power management schemes like voltage scaling or dynamic shutdown applied on the computing as well as on the networking components.

In Chen Y, Das A, Qin W, Sivasubramaniam A, Wang Q, Gautam N Presented The cost and operating expenses of data centers are becoming a growing concern as cloud computing industry is booming. The challenge of energy efficiency allows maintaining the same data center performance while the level of energy consumption is reduced. This can not only significantly reduce costs of operating the IT equipment and cooling but also increase server density enlarging the capacity of existing data center facilities. To understand the optimization space we surveyed energy consumption models of computing servers, network switches, and communication links. Thereafter, main techniques for energy efficiency, like DVFS or dynamic shut-down, are studied at both the component and system levels. It is demonstrated that approaches for centralized coordination and scheduling are required to achieve satisfactory optimization levels.

In Manasa H.B, Anirban Basu Presented the Cloud computing field in two ways. First, it plays a significant role in the reduction of data center energy consumption costs, and thus helps to develop a strong and competitive Cloud computing industry. Second, consumers are increasingly becoming conscious about the environment. In this paper, proposed an organization theory model for resource management of Green Clouds and demonstrated that the proposed solution delivers both reliability and sustainability, contributing to our goals of optimizing energy utilization and reducing carbon emission. Concepts related to cloud computing and green cloud computing were presented. We also described the simulator employed in the practical part of the experiments and

detailed improvements undertaken on it to validate the green cloud computing approach. The simulator we used is called CloudSim and was developed at the University of Melbourne in Australia.

In Anton Beloglazov a, Jemal Abawajy b, Rajkumar Buyya Presented paper we conduct a survey of research in energy-efficient computing and propose: (a) architectural principles for energy-efficient management of Clouds; (b) energy-efficient resource allocation policies and scheduling algorithms considering QoS expectations and power usage characteristics of the devices; and (c) a number of open research challenges, addressing which can bring substantial benefits to both resource providers and consumers. We have validated our approach by conducting a performance evaluation study using the CloudSim toolkit. The results demonstrate that Cloud computing model has immense potential as it offers significant cost savings and demonstrates high potential for the improvement of energy efficiency under dynamic workload scenarios.

IV. OVERVIEW OF DATA CENTER ARCHITECTURES

There are various existing data center architectures some of them are mentioned below. This is the tiered architecture of the Data Center:

a) Two-Tier Data Center Architecture

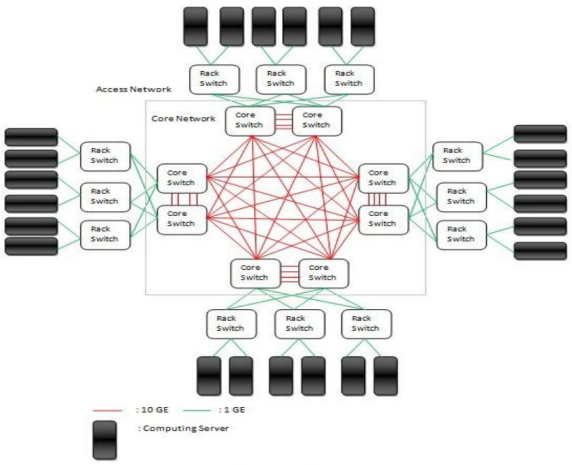

Figure 1

In Two-Tier Data Center Architecture computing server(s) physically arranged into racks form the tier-one network At the tier-two network, Layer-3 (L3) switches provide full mesh connectivity using 10 GE links.The two-tier architecture worked well for early data centers with a limited number of computing servers. Depending on the type of switches used in the access network, the two-tier data centers may support up to 5500 nodes. The number of core switches and capacity of the core links defines the maximum network bandwidth allocated per computing server.

a) Three-Tier Data Center Architecture

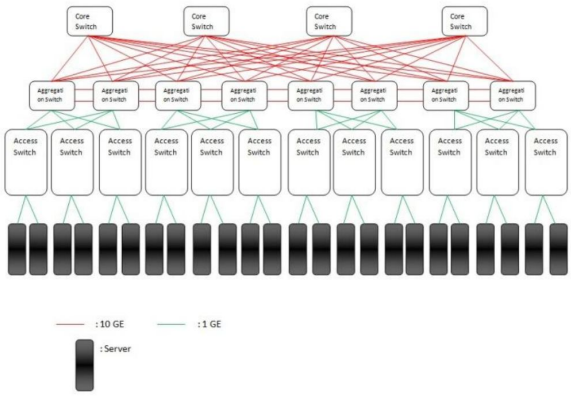

Figure 2

Three-tier data center architectures are the most common nowadays. They include: (a) access, (b) aggregation, and (c) core layers as presented in Fig. The availability of the aggregation layer facilitates the increase in the number of server nodes (to over 10,000 servers) while keeping inexpensive Layer-2 (L2) switches in the access network, which provides a loop-free topology.

b) Three-Tier High Speed Data Center Architecture

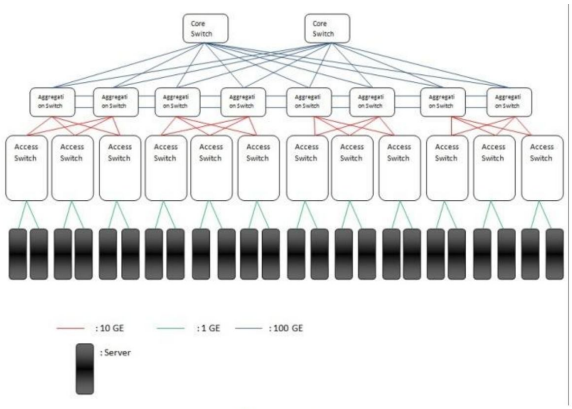

Figure 3

Three-tier high-speed data center architectures are designed to optimize the number of nodes, capacity of core, and aggregation networks that are currently a bottleneck, which limit the maximum number of nodes in a data center or a per-node bandwidth (see Fig.). While the fat-tree topology is the most widely used in modern data centers other more advanced architectures have been proposed. For example, architectures such as DCell or BCube implement

server centric approach relying on mini switches for interconnection. Both architectures do not rely on the core or aggregation D.

Kliazovich et al. layers and offer scalability to millions of servers. The routing is performed by the servers themselves, requiring a specific routing protocol to ensure fault tolerance. However, due to the fact that both architectures are only recent research proposals which have not been tested in real data centers and unveil their advantages in very large data centers, we leave their performance evaluation out of the scope of this paper, focusing on more widely used architectures.

V. EXISTING CLOUD COMPUTING SIMULATORS

CloudSim:
CloudSim is software for Simulation of data centers i.e its resources that are available on a very large-scale. It is a toolkit for cloud based services. In cloudSim users can develop their own cloud scenario that they want to evaluate.

It supports Energy model and federation policy.

- Underlying Platform: GridSim.
- Programming Language: Java.
- Availability: Open Source.

Cloud Analyst:
It overcomes the problem that CloudSim faces that is the GUI.It has a very attractive GUI and functionality of setting different parameters. It is easy to use and provides good visual results.

- Underlying Platform: CloudSim
- Programming Language: Java
- Availability: Open Source.

Green Cloud
It is a packet-level Simulator for calculating the energy consumed by data centers and its components. It actually deals with simulating how available energy can be used efficiently.

- Underlying Platform: NS2
- Programming Language: C++/OTcl.
- Availability: Open Source.

Network Cloud Sim
It is the extension of cloudSim.It can be used to implement Network layer in CloudSim.The Traffic that is available in the network can be simulated through NetworkCloudSim.

- Underlying Platform: CloudSim
- Programming Language: Java.
- Availability: Open Source.

EMUSIM
It provides Emulation along with Simulation of a cloud application. It is basically used for applications that are software as a service. These applications have intensive work as well as they have a great cost. Hence, The Simulation is performed along with Emulation that could provide with small test results.

- Underlying Platform: AEF,CloudSim
- Programming Language: Java
- Availability: Open Source.

GroudSim
It provides Simulation platform for both cloud as well as grid computing. Mainly developed for Infrastructure as a service. It is used for Simulation of scientific applications in cloud.

- Programming Language-Java
- Availability: Open Source.

DCSim
It is developed for simulation of virtualized data centers. The virtual machines are interconnected. It also allows the Migration of the virtual machines. Its system is centrally managed for simulation of data centers.

- Programming Language: Java
- Availability: Open Source.

CONCLUSION

Green Cloud is a new technology widely studied recently. In this paper we described the issue of energy efficient data center and for this some existing solutions that can be overcome through the problem of reducing energy consumption in the data centers are surveyed and described in this paper. This is done by using the tiered architecture of the data centers. This paper helps for anyone who may have recently heard the term “Green Cloud Computing” for the first time and needs to know what is and how it helps them.

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