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Deterministic Schedular Based On Parallel Processing

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ABSTRACT
The rapid growing of power consumption has critically become essential to current data centres. Presented works on reducing the power consumption of network fundamentals formulate the power optimization problem for a general network topology and require a centralized controller. There is a problem that occurs in existing HEROS is that, it is not performing well with non-uniform task size and task generation patterns, and simulations of more complex, virtualized, multi-tenant environments. HEROS could be improved by extension of the set of optimized objectives, integration of other data sources, and distribution of HEROS using a multi-agent framework to enable cooperation and exchange of information by schedulers in a single data centre, or even between multiple cloud computing systems. HEROS could also help in solving other, related problems, e.g. energy-efficient workflow scheduling. In this research paper performance of HEROS will be discussed based on different parameters.
Indexterms: *Cloud Computing, Green computing, Data Centre, Energy-Efficiency, Load balancing*

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I. INTRODUCTION

Cloud computing is a new computing model after Grid computing, Distributed computing, utility computing, cluster computing, and parallel computing and network storage [1]. It is a technique of distributed computing in which organizations do not have to be concerned about administering, configuring, purchasing, and maintaining their personal computing infrastructure and this technique is being supervised by software instead of humans. For running High Performance Computing, Web applications and for various enterprises, Cloud computing is highly scalable, cost-effective infrastructure in which users can store, share and access several amount of data in Cloud. The cloud provides application which offers a variety of benefits which include small start up, elasticity, maintenance costs and economics of scale. The disclosure of Cloud computing technique is quickly changing this control-based approach to service-oriented approach by providing a way to elasticity, scalable infrastructure and on-demand services [2]. This technique also offers huge amount of computing power to enterprises which require processing of incredible data generated approximately every day.

Day by day data is growing with a massive speed and it is very difficult to handle such pet bytes and zeta bytes of data. The main issue in managing such huge amount of data is because that the volume of data is growing rapidly in contrast to the computing resources. Big data can be categorized with different vectors such as variety, volume, velocity, variability, complexity and value .Variety of data means it not only include conventional data but also include semi-structured and unstructured data which is difficult to be handled by existing usual analytic systems. Volume defines big word in big data. Everyday social networking sites producing Terabytes of data. Velocity is another characteristic of big data deal with speed of data. Velocity refers to speed of incoming data as well as speed at which data flows. Inconsistencies of data flow consider Variability of data. Complexity means to transfer, match, link, cleanse, connect and correlate data from various sources. Value is ending of the game. Data Analytics and users can run queries beside stored data [3].

With the growth of new computing paradigms like cloud computing and big data, the energy consumption of the networks and computing resources is increasing day by day. Power Consumption is becoming severe issue at data centres. The entire energy consumed by data centre in 2011was about 120 billion KWh which is equivalent to 2.8 % electricity bill in USA. Components of data centre that consumed energy are servers, network element and cooling systems. It is expected that 55% of energy is consumed by servers, 20% of energy consumed by network elements and 25 % of energy is consumed by cooling system. By targeting servers and network elements we can minimize energy consumption in data centres as they account for 75% of whole energy

consumed [4] [5] .The regular exploitation of resources in data centre is about 30%. We must adapt energy models for network elements and server in data centres. A green routing scheme is proposed by using energy models i.e. Data centre Green routing (DCGR) which uses rate adaption, any cast transmission and dynamic voltage scaling for minimizing the combined total power consumption of servers and network elements of data centre under dynamic traffic. Integrated optimization of total combined energy of servers and network element saves higher amount of energy [6].

The foremost data centre power saving solution is based on distributed technique and determined on making data centre hardware energy efficient. DVFS (Dynamic Voltage and Frequency Scaling) and DPM (Dynamic Power Management) are two popular techniques in computing systems for energy saving. DVFS adjusts hardware energy utilization according to the functional computing load and DPM achieve energy savings by powering down machines at runtime [6].DVS (Dynamic Voltage Scaling) is another energy saving technique for minimizing the server energy utilization [4]. Nowadays severs in data centres are based on heterogeneous because homogenous servers assumed fixed static energy and energy of servers has never been fixed. Heterogeneous server helps to minimize total power consumption.

II. GREEN COMPUTING PARADIGM

Green computing is computing paradigm to achieve efficient processing and exploitation of computing infrastructure and reduce energy consumption. Green computing is required for environment sustainability and increase in growth of energy usage at data centre. Measure being taken to reduce power conservation and carbon contents apparently termed as green computing. It concentrates on reducing recourse consumption and energy efficiency. It is perform manufacturing, using, designing and abandon computer server and related sub system such as monitors, storage devices, network devices and communicate system effectively and efficiently with no impact on environment [7]. This computing concept shows how to utilize resources adequately and how to minimize the e-waste. Green computing is necessity to save power with expense. To minimize the use of venomous and hazard materials and get better energy efficiency and recycle e-waste are the main goals of cloud computing. Its purpose is to examine new computer models and applications with minimum cost and less power consumption and encourage the sustainable expansion of economy and society. Technologies associated with green computing are cloud computing, green data centre, power optimization, virtualization and grid computing [8].

Although green computing is becoming essential in IT industry but it presents many challenges to designers. During designing of system designers need to take energy consumption into account and have to find way out to reduce it. It involves all characteristics of system designing like system architectures, compilers, chips, communication network, operating system, application services and so on. All these characteristics are correlated and complex. So the consequence is to construct low cost and less energy consumption is a challenging activity. Green computing present new technical challenges to system designers. The power utilization of system is determined by hardware consumption, runtime efficiency and effectiveness of task and configuration of resources. Its aim is to build a system which is energy aware and internetworking environment. The key issues of green computing are modelling and evaluation of energy efficiency, Energy awareness and green networking. First issues is how to offer solution for extensively large-scale computing system like super computers and data centres where there is large amount of energy consumption. Another issue deals with saving overall energy of computer system. Other issues include standard benchmarking technologies for network devices, green metrics and virtualization of networks, control plain abstraction layers and networking equipment [9].

Today's data centre became vital source of greenhouse gases by increasing the use of electricity. Over 50% of the total carbon footprints produced by data centres and that's why data centres are primary cause of green house emission. Data centres are the powerful force behind the green computing association because of their high energy cost and progressively more negative impact on environment. There are certain factors that driving the adoption of green-computing practices are the rapid growth of internet, increasing equipment power density, increasing cooling requirements, increasing energy costs, restrictions on energy supply and access, low server utilization rates and Growing awareness of IT's impact on the environment [9].

Advanced scientific application and compute- intensive enterprises increase the requirement for high performance infrastructure. This advancement in IT sector led to the creation of large-scale data centre and these data centres are the main source of consuming huge amount of electrical energy. Overall energy consumption remains continues to grow due to increase in requirements for computing resources. For instance, cost of energy consumption by IT industry in 2006 was estimated to be 4.5 billion dollars and by 2011 this cost is likely to be doubled [11]. Many problems are arises from energy consumed by data centres such as emission of carbon dioxide, overheating, reducing system reliability and device lifespan due to insufficient and malfunctioning cooling systems.

The term 'Green Computing' is the learning and practices that covers the computing lifecycle from cradle to grave. It start from designing to manufacturing the use of equipment and then securely disposing-off computers, associated devices, networking and communications equipments efficiently and effectively with minor or no impact on the environment [12]. First and most decisive research on computing shows that Carbon Dioxide (CO2) and additional emissions cause global climate and environmental harm. To preserve our valuable planet is a main and lawful goal because it aims to preserve life. It has given tremendous attention by researchers and professionals to minimize e-waste and utilize of non-toxic resources in preparation of e-equipments. Energy competence is increasingly vital for future ICT (Information and Communication Technologies) as the cost, and availability of energy is getting higher day by day. The increased usage of ICT with increasing energy expenditure and the need to diminish greenhouse gas emissions claim for energy-efficient technologies that lessen the overall energy utilization of computation, storage space and network communications. The very primary and most certain research shows that CO2 and other emissions are causing global climate and environment a massive damage. Therefore it is the top most priority and challenge for Green Computing technologist to preserve our beloved planet. On the other hand a study by "The Climate Group" entitled Smart 2020 (http://www.theclimategroup.org/programs/ict/) predicts that, greenhouse gas emissions from the Internet industry will raise to approximately 1.3 Giga- tons of CO2, and the combined impact of smart grid; smart logistics; smart buildings; and videoconferencing could reduce emissions by approximately 7.8 tons.

In recent years focus of enterprises and technology firms has been shifted towards Green Computing rapidly. Green Computing discusses the options to support critical computing needs in sustainable manner by reducing strains on resources and environment. One of the main objectives of Green Computing is about improving computing performance and reducing the energy consumption & carbon footprints. This paper is organized as follows: next, section 2 reviews current trends in the field of Green Computing; section 3 will explore the related work of Green Computing; section 4 will discuss the methodology that we precede towards Green Computing; and finally this result are summarized in the form of graphs and conclusions.

III. CURRENT TRENDS

Existing trends of Green Computing are towards efficient utilization of resources. Energy is considered as the major resource and the carbon footprints are considered the main threat to environment. Therefore, the focus is to diminish the energy exploitation & carbon footprints and raise the performance of Computing. There are numerous areas where researchers are putting lots of hard work to get desired results:

A. Energy Consumption

Organizations realize that the foundation and amount of their energy consumption notably contributes to Greenhouse Gas (GhG) emissions. In reaction to this finding, organizations are currently using the following equation:

Reduced energy consumption

Reduced greenhouse gas emissions

Reduced operational costs for the data centre

It means adopting smaller amount and more energy efficient systems while refactoring application environments to make most favourable use of substantial resources is the most excellent architectural model. According to Environmental Protection Agency in the order of 30% to 40% of personal computers are kept 'ON' after office hours and all through the weekend and even around 90% of those computers are idle.

B .E-Waste Recycling

Based on the Gartner estimations over 133,000 PCs are surplus by U.S. homes and businesses every day and a lesser amount of 10 percent of all electronics are at present recycled. Bulk of countries around the world need electronic companies to investment and manage recycling programs for their products particularly under-developed Countries. This Computing paradigm must take the merchandise life cycle into consideration; starting from production to operation to recycling. E-Waste is a convenient piece of the waste stream and recycling e-Waste is simple to adopt. Recycling computing tools such as lead and mercury enables to restore equipment that otherwise would have been contrived The reuse of such equipments allows reduction in energy and reducing impact on environment, which can be owed to electronic wastes [13].

B. Data Centre Consolidation & Optimization

At present much of the focus on new computing paradigm i.e. Green Computing area is on Data Centres, as the Data Centres are recognized for their energy starvation and wasteful energy consumptions. United State Department of Energy (DoE) reported in its study in 2006 that United States data centres consumed 1.5% of all electricity and their requirement is increasing by 12% per year and rate $7.4 billion per year by 2011. According

to DoE's present report in July 2011 Data Centres are consuming 3% of all US electricity and this consumption will double by 2015 [14]. With the idea of dropping energy consumption in Data Centres it is valuable to concentrate on following [15]:

• Information Systems – well-organized and right set information systems for industry needs are a solution in building Green Data Centres. As per green computing finest practices efficient servers, storage devices, networking equipments and power supply range play a major role in designing of information systems.

• Cooling Systems – it is suggested by the professionals that at the preliminary stage of design process for data centre cooling systems, it is important to consider both current and future necessities and design the cooling system in such a mode so it is flexible as needs for cooling dictates.

• Standardized environment for equipment is must for Data Centre Air Management and Cooling System.

• Consider early and future loads, when designing & selecting data centre electrical system equipment.

C. Virtualization

One of the main styles of Green Computing is virtualization of computer resources. Abstraction of computer resources, such as the running two or more logical computer systems on one set of physical hardware is called virtualization. Virtualization is a tendency of Green computing it offers virtualization software as well as management software for virtualized environments [15]. One of the finest ways to go towards green and save enough space, enough resources, and the environment is by streamlining efficiency with virtualization. This form of Green Computing will go ahead to Server consolidation and improve computer security [16]. It runs fewer systems at higher levels of utilization. It also allows full utilization of computer resources and benefits in:

• Decrease of total amount of hardware;

• Switch off unused Virtual Server to save resources and energy; and

• Cutback in total space, air and rent necessities eventually reduces the cost

E.IT Products and eco-labelling

An additional approach to support Green Computing and save environment is to initiate policies all around the World, so that, companies design products to receive the eco-label [17]. There are several organizations in the world which support "eco-label" IT products. These organizations offer certificates to IT products based on factors including design for recycling, recycling system, noise energy consumption etc. [18].

IV. RELATED WORK

Yi-Ju Chiang et al. (2013) discussed that cloud computing is a latest service model for allowance a pool of computing resources that can be quickly accessed and unrestricted based on a converged infrastructure. In the earlier period, a person or company can only utilize their own servers to supervise application programs or store data. Thus it may be the foundation in dilemma of complex management and trouble in "own-and-use" patterns. To assure uncertain workloads and to be highly accessible for users anywhere at any time, providing more resources are necessary. As a result, resource over provisioning and redundancy are ordinary situations in a conventional operating system. However, most electricity reliant facilities will unavoidably suffer from unoccupied times or under-utilized for some days or months since there usually have off-seasons cause by the nature of accidental arrivals.

Lucio et al. (2014) presents a hybrid optimization model that allows a cloud service provider to set up virtual machine (VM) placement strategies for its data centres in such a way that energy efficiency and network quality of service are jointly optimized. Usually, VM placement is an activity not fully integrated with network operations. As such, the VM placement strategy does not take into account the impact it produces on the network performance in terms of quality of service parameters such as packet losses and traffic delays. The proposed strategy allows cloud providers to reach a balance between the energy efficiency of their infrastructures and the network quality of service they offer to their customers.

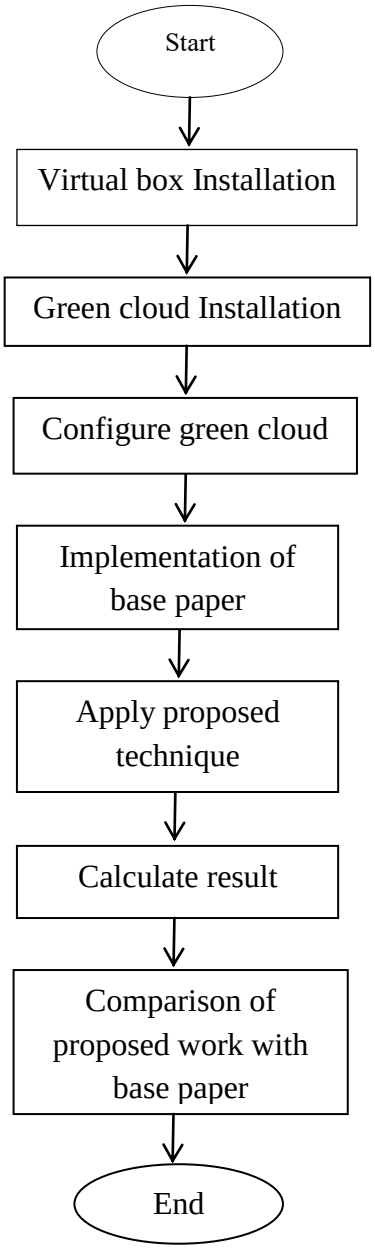
Bharti Wadhwa et al. (2014) uses the carbon footprint rate of the data centres in distributed cloud architecture and the concept of virtual machine allocation and migration for reducing the carbon emission and energy consumption in the federated cloud system. The proposed approach reduces the carbon dioxide emission and energy consumption of federated cloud data centres as compared to the classical scheduling approach of round robin VM scheduling in federated cloud data centres.

Fahimeh Farahnakian et al. (2015) investigated the effectiveness of VM and host resource utilization predictions in the VM consolidation task using real workload traces. The proposed approach provides substantial improvement over other heuristic algorithms in reducing energy consumption, number of VM migrations and number of SLA violations. Dynamic Virtual Machine (VM) consolidation is one of the most promising solutions to reduce energy consumption and improve resource utilization in data centers. Since VM consolidation problem is strictly NP-hard, many heuristic algorithms have been proposed to tackle the problem.

Sonika P Reddy et al. (2014) presented a system that handles real-time and non-real time tasks in an energy efficient method without compromising much on neither reliability nor performance. Of the three processors, two processors i.e. the first and second , handle real-time tasks, using earliest-Deadline-First (EDF) and Earliest-Deadline-Late (EDL) scheduling algorithms respectively. On the third processor, the non-real-time tasks are scheduled using the First Come First Served (FCFS) scheduling algorithm and the tasks are run at an energy efficient frequency. Our simulation results show significant energy savings compared to the existing Stand-by Sparing for Periodic Tasks (SSPT) for a few execution scenarios.

V. METHODODLOGY

Heterogeneous architectures have become more popular and widespread in the recent years with the growing reputation of general-purpose processing on graphics processing units, multi- and many core architectures, asymmetric cores, coprocessors, low-power systems on a chip and solid state drives. The design and management of cloud computing data-centres must become accustomed to these changes while target objectives of civilizing system performance, energy efficiency and reliability. In our planned technique we introduce a pipeline and parallel concept to reduce the bottleneck trouble and this will also help to reduce processing time.



Step 1: [Read the clients request data i.e, time, importance, price, node and requested server name] Insert all values into the linked list;

Step 2: [For each request and its tasks find the time priority value based on the predefined conditions]
Assign priority value to each task for the client's request.
t_p[i] = priority value;

Step 3: [For each request and its tasks find the node priority value based on the predefined conditions]
Assign priority value to each task for the client's request.
n_p[i] = priority value;

Step 4: [For each client's input data check whether it is within the threshold value or not]

Sum[k] = t_p[i] + n_p[i] + importance + price
Print —Ready to execute available node = available node – total node
else if (input value is within the threshold limit)
sum[k] = t_p[i] + n_p[i] + importance + price
print —within the limit but it is in queue
if (input value is within the threshold limit and total node <= available node)
[Add respective computed time and node priority value and other parameters like importance and price]
else
print —Exeed the condition

Step 5: [Sort the sum[k] values]

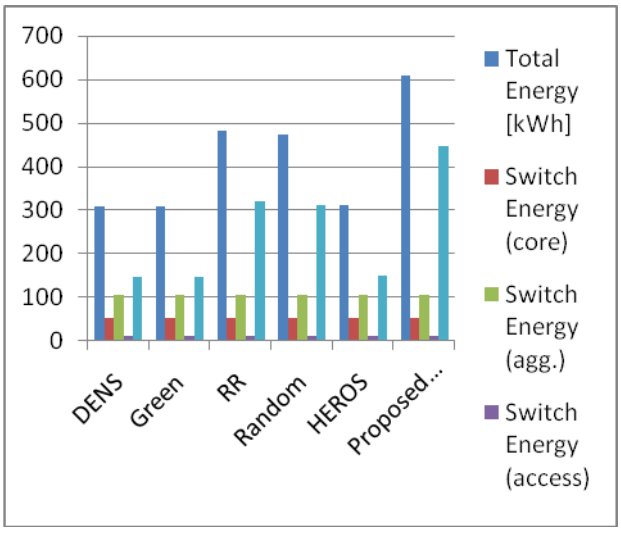
Step 6: Client's request is ready to execute from least values of sum[k]
Stop

VI. RESULT AND DISCUSSIONS

In our work we perform the comparison of six different schedulers on the based on five different parameters.

Scheduler	Total Energy [kWh]	Switch Energy (core)	Switch Energy (agg.)	Switch Energy (access)	Server Energy
DENS	307.1	51.4	102.8	9.0	143.8
Green	306.8	51.4	102.8	9.1	143.5
RR	482	51.4	102.8	9.1	318.7
Random	472.1	51.4	102.8	9.1	308.8
HEROS	309.9	51.4	102.8	9.1	146.6
Proposed HEROS	609.7	51.4	102.8	9.1	446.4

VII. CONCLUSION



In today's world we need a computing paradigm that is environment sustainable. In this paper we discussed about new computing paradigm i.e. Green computing which lessens the environment dissipates while we are using a computer and mitigate the electricity as well as energy. In this paper we discussed current trends of this new computing paradigm and perform a comparison between existing and proposed Scheduler based on six parameters (Total Energy, Servers Energy, Mean Response Time, Response Time, Tasks Failures and Unfinished Tasks) And our proposed scheduler i.e. deterministic scheduler based on a pipeline and parallel concept to reduce the bottleneck problem and this will also help to reduce processing time and saves energy up to 73% while HEROS saves energy up to 47%.

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