International Journal of Latest Trends in Engineering and Technology
Special Issue SACAIM 2016, pp. 279-284
e-ISSN:2278-621X

A STUDY ON ENERGY EFFICIENT RESOURCE SCHEDULING ALGORITHMS FOR CLOUD DATA CENTERS

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Abstract-Cloud Computing is very useful in IT centers all over the world because it is utility-oriented. In the large data centersenergy efficiency has become a primary concern. As it is based on a pay-as-you-go model it enables to host an extensiveapplications from consumer, scientific, and business domains. Data centers hosting cloud applications consumes huge amounts of electrical energy contributing high operational costs and carbon footprints. Green Cloud computing solutions minimize operational costs as well as reduce the environmental impact. In this paper, we have discussed RR, ONWID,OFWID and MBFDalgorithms for energy-efficient Cloud Data Centers.We highlight the Energy efficient resource allocation policies and scheduling algorithms and software technology for energy efficient management of clouds.

Keywords-Utility-oriented, carbon footprints, cloud computing, resource allocation

I. INTRODUCTION

Cloud Computing is called as on-demand computing which is anInternet-based computing that provides shared processing resources and data to computers and devices on demand. Cloud computing is a model for enabling universal on demand access to a shared pool of configuration computing assets which can be allocated and released with minimal management effort. Cloud Computing has become highly demanded service because of high computing power, cheap and cost of services. Cloud computing focuses in managing and configuring the application online at point of time and offer load obtaining that makes easier and reliable.

Cloud Computing is mainly developed in various advancements in virtualization, grid computing and recent technologies.It provides both platform and applications on demand through the internet or intranet. A data center is a centralized achieve for accumulating, managing data information. The key benefit of data center is storage resources are accumulated into storage pools from which logical storage is created .In this paper we have presented different energy efficient scheduling algorithms.

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A. Energy efficiencychallenges–

In this section we present the most important power management and energy efficient techniques. Data centers drive more carbon emissions and high energy costs incurred due to large amounts of electricity needed to power and cool servers hosted in that data centers. Lowering the energy usage of data centers is challenging and complicatedissue because computing applications and data are increasing where large servers and disks needed to process them fast enough within the required time.To achieve an efficient processing and utilization of computing infrastructure green cloud computing is achieved successfully to minimize energy consumption. This makes to ensure the future cloud computing is sustainable.Data centers need to be maintained in an energy-efficient manner to have green cloud computing.

The paper is organized as follows. Problem Statement are explained in section II.Literature Survey and Experimental Results are explained in section III and section IV.Concluding remarks are given in section V.

II. PROBLEM STATEMENT

In a cloud data center, for certain time period there are *M* Physical Machines, also called hosts, which configuration can be heterogeneous. CPU, memory and network bandwidth of each host are considered as multi-dimensional resources.

In Infrastructure as a Service, each user requests a Virtual Machine represented in a vector *r*=(*vC*, *vM*, *vN*) where *vC*, *vM*, *vN*is CPU, memory and network bandwidth requirement respectively. All virtual machines on a physical machine share CPU, memory and network bandwidth capacity provided by the physical machine.

A. Problem–

The virtual machine on physical machine share CPU, memory and network bandwidth. Allocating and adapting the virtual machines and taking out the features of the hosting physical machines are challenging in scheduling the resources in cloud data centers. The problem is defined as the given the m identical machines PM_1,PM_2,….$PM_m$and a set of n request make it possible in saving energy efficient, the objective is to provide efficiency of data center ,while delivering the quality of Service.

III. LITERATURE SURVEY

Virtual machines demand is changing time to time very highly in Cloud computing environment. So in this paper we consider how the energy efficient can be implemented by various algorithms and evaluate the energy efficient of that particular model.

A. Round-Robin algorithm[8]–

One of the simplest scheduling algorithms, it assigns tasks toeach physical server in uniform portions and in circular order, handling all tasks without priority.

B. *Modified Best Fit Decreasing (MBFD)algorithm[8]–*

Modified Best Fit Decreasing (MBFD) MBFD algorithm is another version of BFD method. However, the main difference is between the selectingcriteria on the basis of which a server is selected for task hosting. MBFD selects a host that shows the change in minimum energy consumption if the task is placed on it. MBFD uses the following formula to check the energy consumption of machine in case of task placing.

$P_{AP=}0.7*P_{max} + 0.3 * P_{max}* U$

Where PAP is energy after VM placement on the given machine, Pmax is maximum power that can beconsumed by the machine, and U is the utilization of machine after hosting of task.

C. Offline without Delay (OFWID)algorithm[8]–

The algorithm places the requests in arbitrary order. It attempts to assign each request to the first PM (with the lowest index) that can accommodate it. If no non-empty PM is available, it starts a new PM and requestis assigned to it.

Input: VM requests (each indicated by their required VM type ID, start time, finish time, and requested capacity), the interval of start time and finish time of request i is denoted as Ii.
Output: Assign a PM ID to each request and allocate an interval for each request.
1. Sort intervals in the increasing order of their start time, breaking ties arbitrarily;
2. Let I1, I2, …, In denote the intervals in this order;
3. d=0;
4. for j = from 1 to n do
5. foreach Ii that precedes Ij in sorted order
6. if they are not overlapped or overlapped but still can share resources of an allocated PM do
7. allocateIj to the PM hosting Ii
8. else
9. start a new PM;
10. d=d+1;
11. allocateIj to PM d;
12. endif
13. endforeach
14. endfor

D. Online Without Delay (ONWID)algorithm[8]–

For the ISWCS problem, the VM requests are preceded by sorting based on the increasing order of their start time before algorithm is applied. This algorithm is an offline scheduling algorithm.

Input:VM requests (each indicated by their required VM type ID, start time, finish time, and requested capacity), the interval of start time and finish time of request i is denoted as Ii.
Output: Assign a PM ID to each request and allocate an interval for each request.
1. d=0;
2. for j = from 1 to n do
3. foreach Ii that precedes Ij
4. if they are not overlapped or overlapped but still can share resources of an allocated PM do
5. allocateIj to the PM
6. else
7. start a new PM;
8. d=d+1;
9. allocateIj to PM d;
10. endif
11. endforeach
12. endfor

IV. EXPERIMENT AND RESULT

Algorithms are tested using the cloud tool –Cloudsched. Cloudsched simulator generates different requests as follows: the total numbersof return (requests) can be randomly set; all requests follow Poisson arrival process and have exponential length distribution; Therefore to test the algorithm, it is executed six times and its average has been taken. Here test results are compared with executing the simulators with the duration 50,100,200 and 400 respectively. The results are showed in table 1 and the configuration settings is as showed in figure 1.

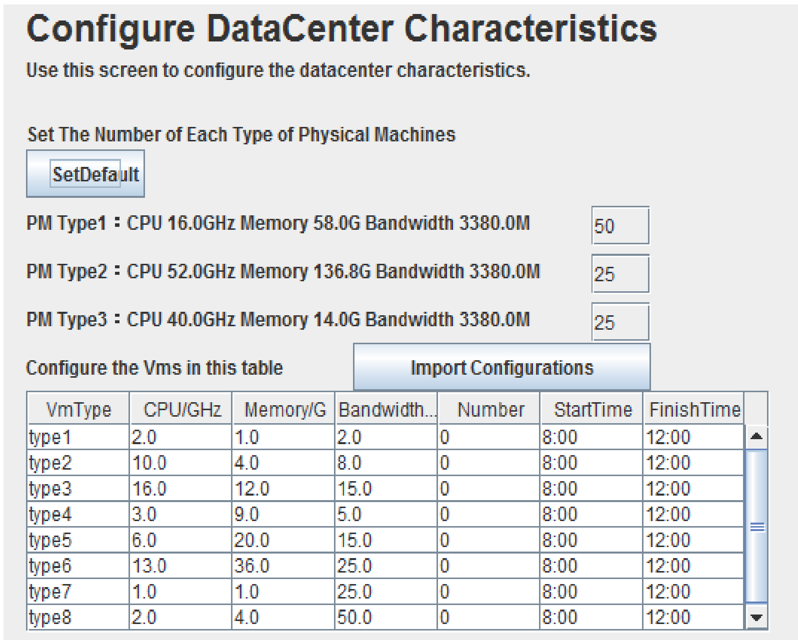

Figure 1: DataCenter characteristics_1(Dataset 1)

Table 1: Total energy consumption

	Duration=50ms	**Duration=100ms**	**Duration=200ms**	**Duration=400ms**
RR	**600**	**1200**	**2200**	**7250**
OFWID	**510**	**750**	**1550**	**5000**
ONWID	**530**	**816**	**1600**	**5500**
MBFD	**520**	**800**	**1550**	**5250**

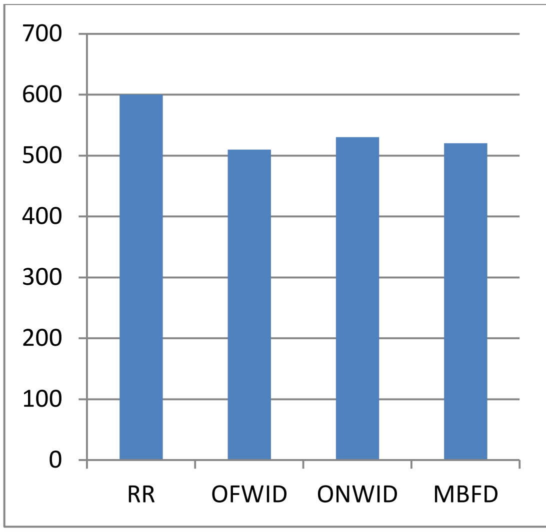

Figure 2: Energy consumption (in kilowatt hours) of Dataset 1 and Duration=50

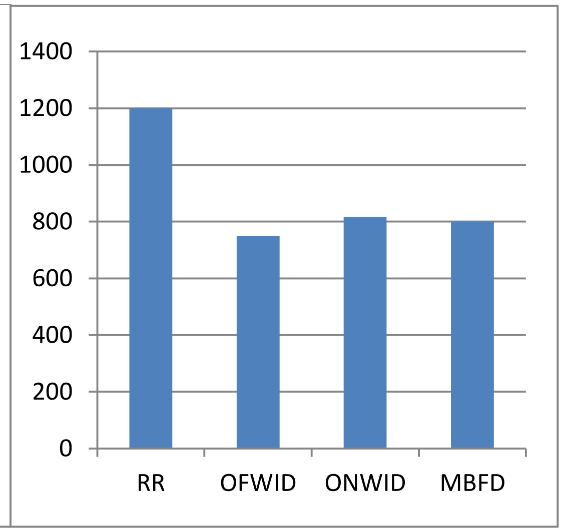

Figure 3: Energy consumption (in kilowatt hour) Dataset 1 and Duration=100

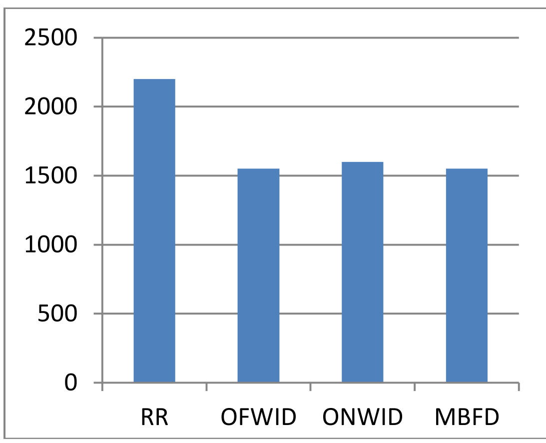

Figure 4: Energy consumption (in kilowatt hours) of Dataset 1 and Duration=200

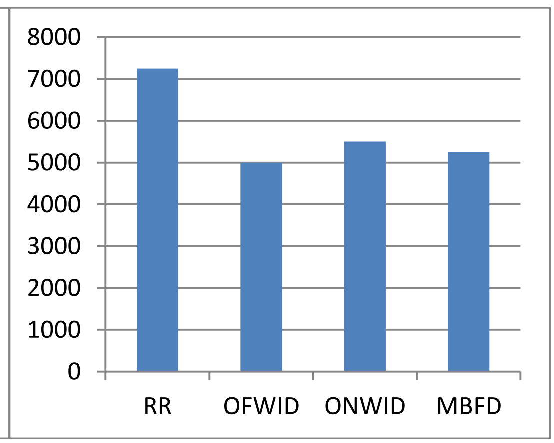

Figure 5: Energy consumption (in kilowatt hours) Dataset 1 and duration=400

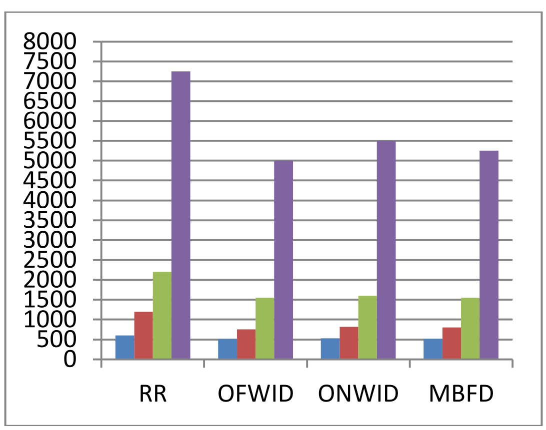

Figure 6: Energy consumption (in kilowatt hours) of

Dataset 1 and duration of 50,100,200,400

V. CONCLUSION

Essential requirements of a dynamic resource scheduler is to reduce energy consumption of the datacenter. Simulation results shows that OFWID algorithm has the minimum energy consumption in compare with the other scheduling algorithms like RR,ONWID and MBFD.

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