GREEN NETWORKING PROJECT REPORT

CLOUD SIMULATION

BY

NAYYAR IQBAL

GAYATRI CHADALAPAKA

BLEKINGE INSTITUTE OF TECHNOLOGY

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INTRODUCTION

Cloud computing is an emerging internet based computing approach that reduces the complexity in IT by using demand based and virtual infrastructure. It delivers infrastructure, platform, and software as a subscription-based services in a pay-as-you-go model to customers. Data is stored in cloud instead of storing it in the local hard drive or servers in the company [1].

CloudSim is an open source simulation tool enables which provides modeling and simulation of cloud computing scenarios. It provides support for user-defined policies for virtualized server hosts to virtual machines and policies for allocation of host resources to virtual machines [1].

STATE OF ART

There have been many studies to investigate the behavior of large scale distribution systems using simulation techniques. Cloud providers has to offer services which match the needs of cloud users [2]. Also a large portion of energy is consumed by servers and other network elements in datacenters. CloudSim is the simulation environment for studying cloud computing environment and its services. It gives us clear picture about power, traffic consumption and result of time.

METHODOLOGY

The cloud scenarios and strategies are designed and implemented using CloudReports. CloudReports is a GUI based tool of CloudSim which has a user friendly interface for modeling and simulating custom policies and scenarios to VMs [3]. After executing Simulation, log files are generated based on defined policies and strategies. These log files or reports are then analysed and focus is on resource utilization, power consumption, CPU utilization, cloudlets bandwidth and datacenters energy consumptions etc.

SETTINGS

Following are some of the requirements for successful execution of CloudSim project.

- Pc with either Linux, Windows OS or mac
- Java Runtime Environment 1.7
- For Windows OS, a hypervisor like Vmware or VirtualBox need to be install
- Ubuntu 12.04 LTS in case of Linux

EXPERIMENT AND RESULTS

Following are the simulation results obtained by utilizing different configuration settings.

Part A

Simulation Time: 04 seconds

Summary Of Configuration

Datacenter1	**Datacenter2**
Allocation policy: Single threshold Number of hosts: 1 Number of migrations: 0	Allocation policy: Single threshold Number of hosts: 1 Number of migrations: 0
Customer1	**Customer3**
Broker policy: Round robin Number of virtual machines: 1	Broker policy: Round robin Number of virtual machines: 1
Customer2	**Customer4**
Broker policy: Round robin Number of virtual machines: 1	Broker policy: Round robin Number of virtual machines: 1

Resource Utilization

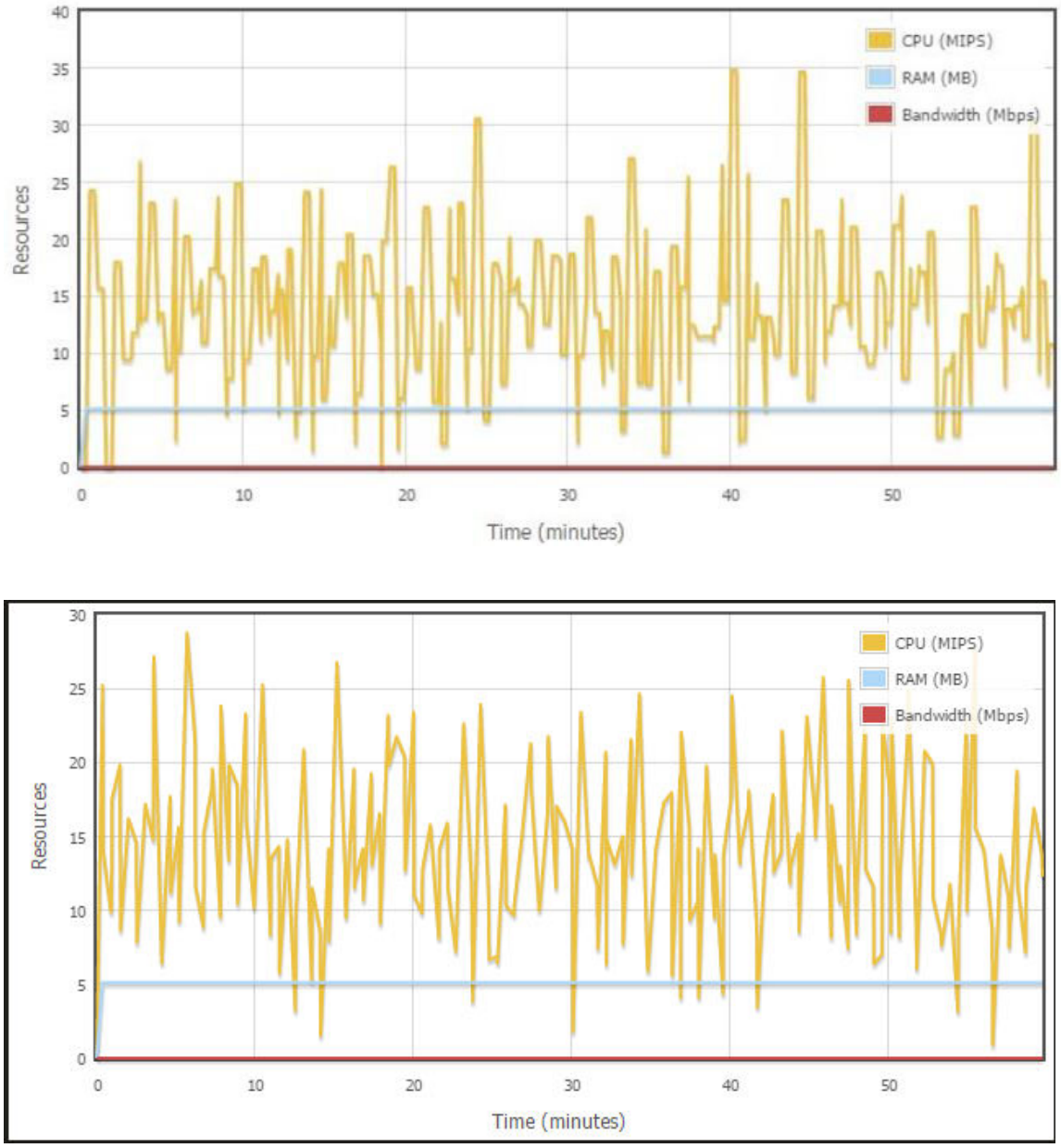


Fig 1: Resource utilization for Datacenter1 and Datacenter2

The Fig. 1 shows the Resource utilization of RAM and CPU versus time for datacenter1 and datacenter2. The resource utilization of RAM looks similar for both datacenters but there are clear fluctuations for CPU utilization for both datacenters. This happens because both datacenters have single host, each with the same RAM and bandwidth.

Power Consumption

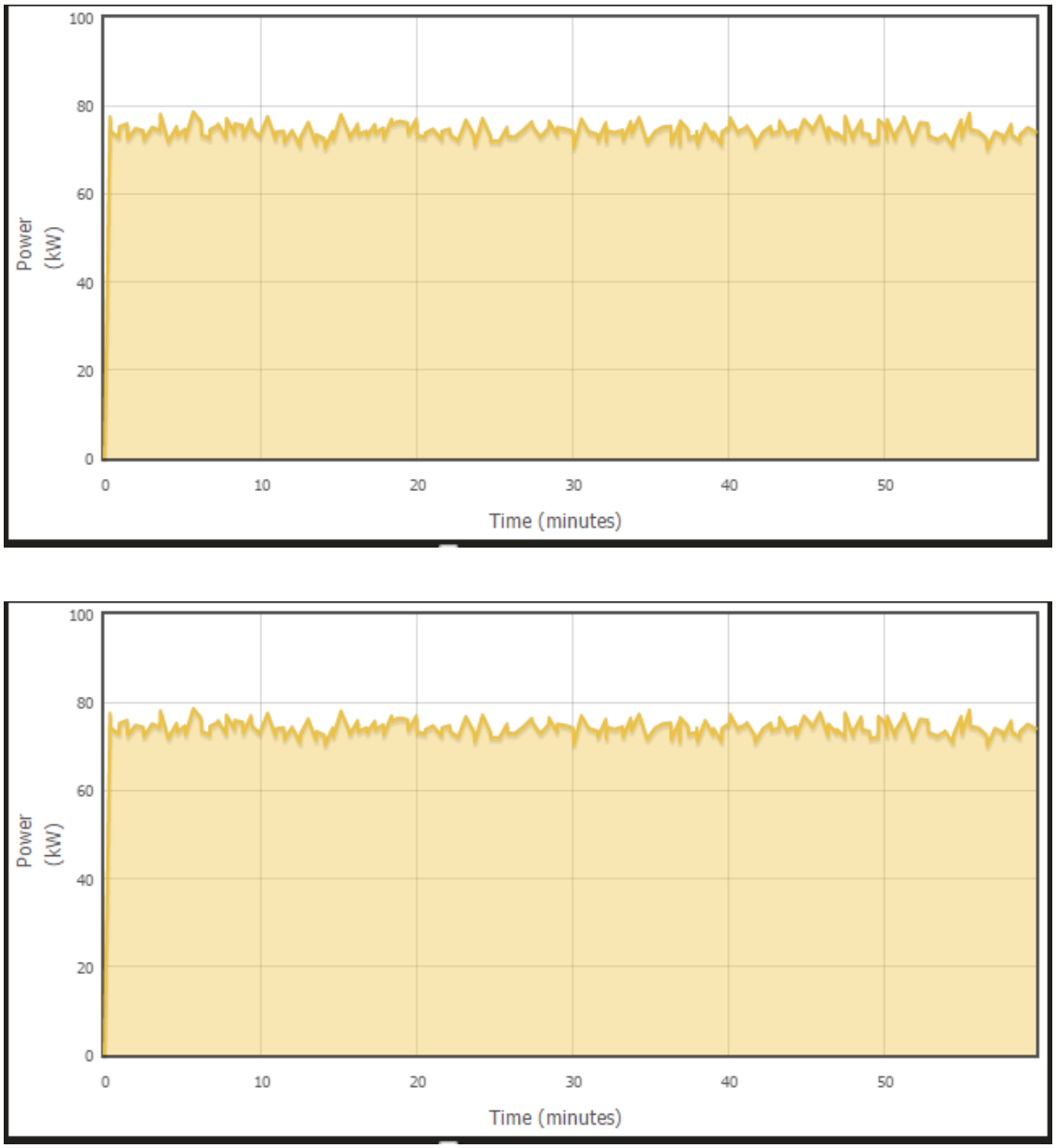


Fig 2: Power Consumption versus time for Datacenter1 and Datacenter2

There is no prominent difference in power consumption of both datacenters as shown in Fig.2. Power consumption becomes constant after reaching approximately 80kW for both datacenters.

Virtual Machines

Fig. 3 shows the allocation of virtual machines by each customer for datacenter1 and datcenter2.

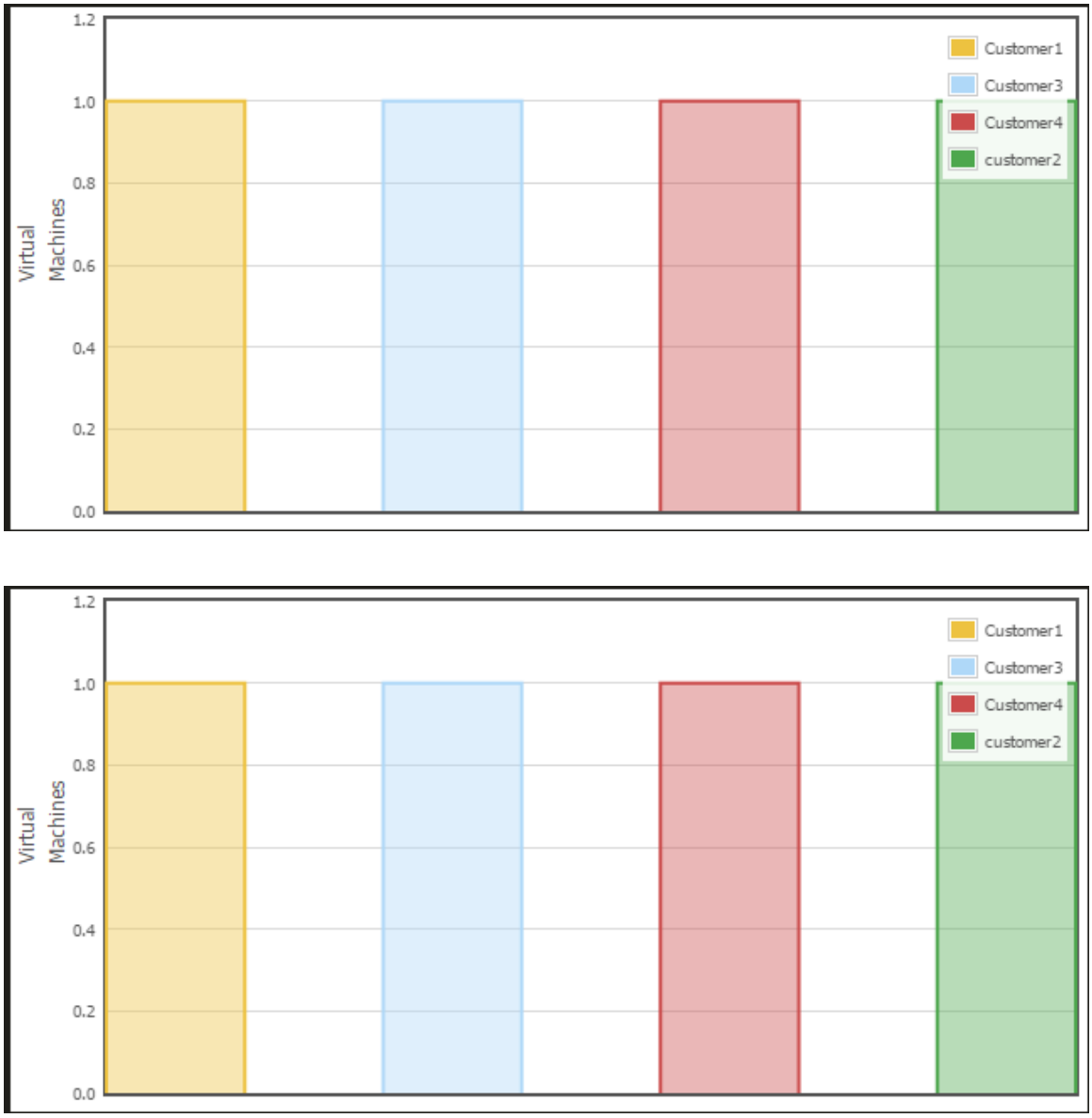


Fig.3 Virtual machine allocation by each customers for both datacenters.

Cloudlets

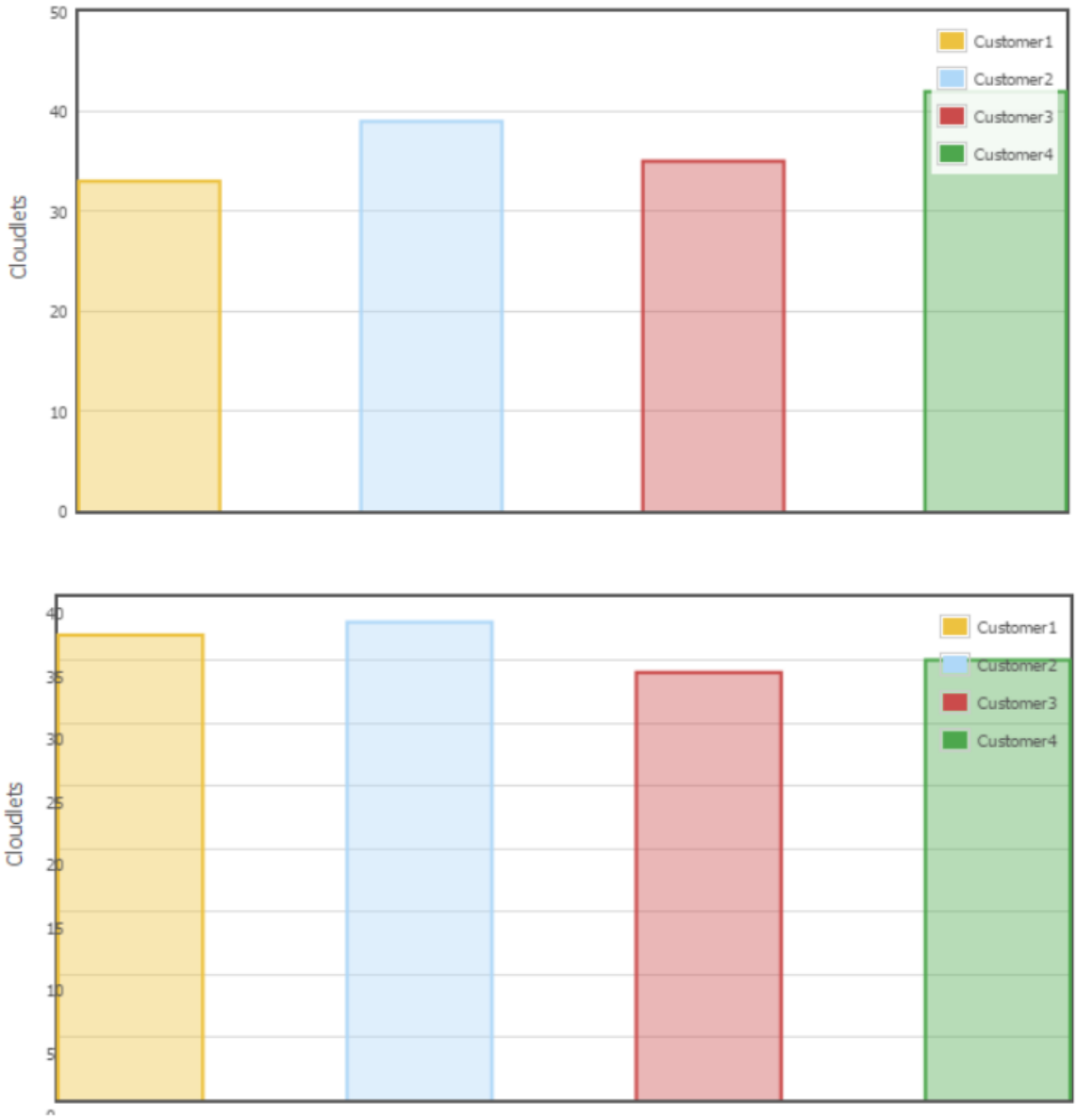


Fig 4: No. of cloudlets for every customer

The number of cloudlets are shown in fig.4 which are successfully executed for both datacenters by each customer. As RAM and Bandwidth configuration is same for both datacenters. There are some minor variations for each customer because of arbitrariness of CPU utilization.

Costs

The cost is approximately 27 m.u for each customer as shown in figure below. It is cost generated by each customer based on their resource utilization on datacenters.

Fig 5: Costs generated by each customer

Overall resource utilization for virtual machines

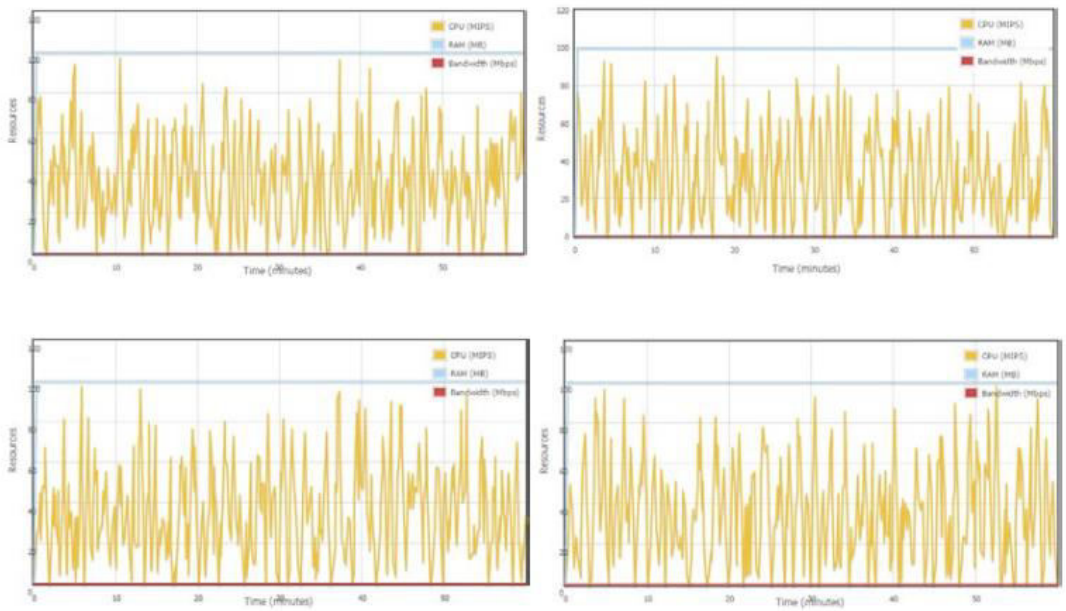


Fig 6: CPU & RAM usage versus Time for each virtual machine

Above figure shows the Resource utilization for RAM, CPU and Bandwidth versus time for every virtual machines. Again variation is due to CPU utilization while RAM usage remains constant for each virtual machine.

Cloudlets executed on each virtual machine

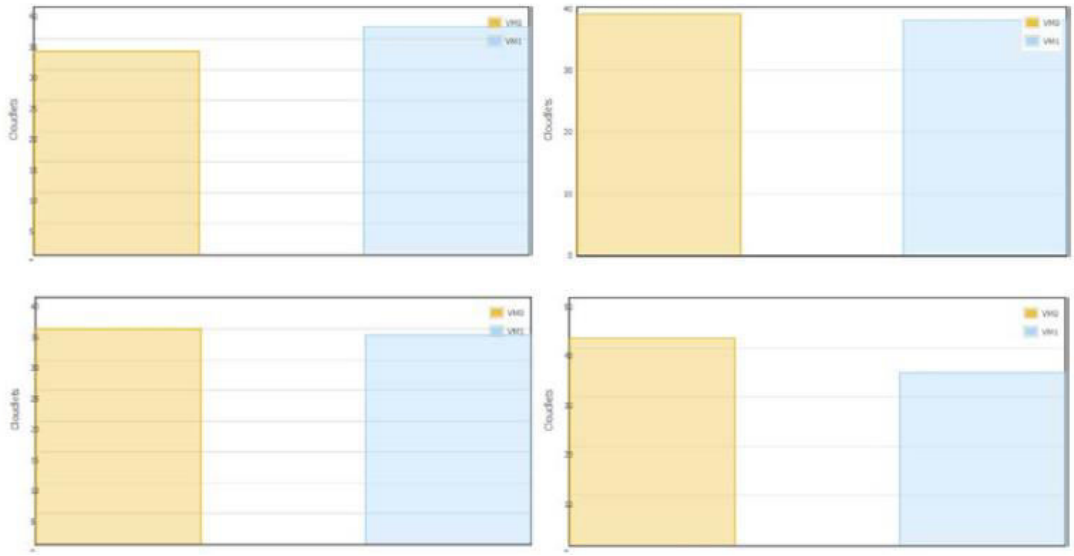


Fig 7: Cloudlets executed on each virtual machine

Datacenter's Debt

*****Datacenter: Datacenter1*****	*****Datacenter: Datacenter2*****
User id Debt	User id Debt
4 26.6	4 26.6
5 26.6	5 26.6
6 26.6	6 26.6
7 26.6	7 26.6
**********	**********

Table-1: Datacenter Debt

From table-1 it is clear that debt remains the same for both datacenters 1 and 2. Each datacenter is configured for 4 customers.

Start and finish times of cloudlets for each VM

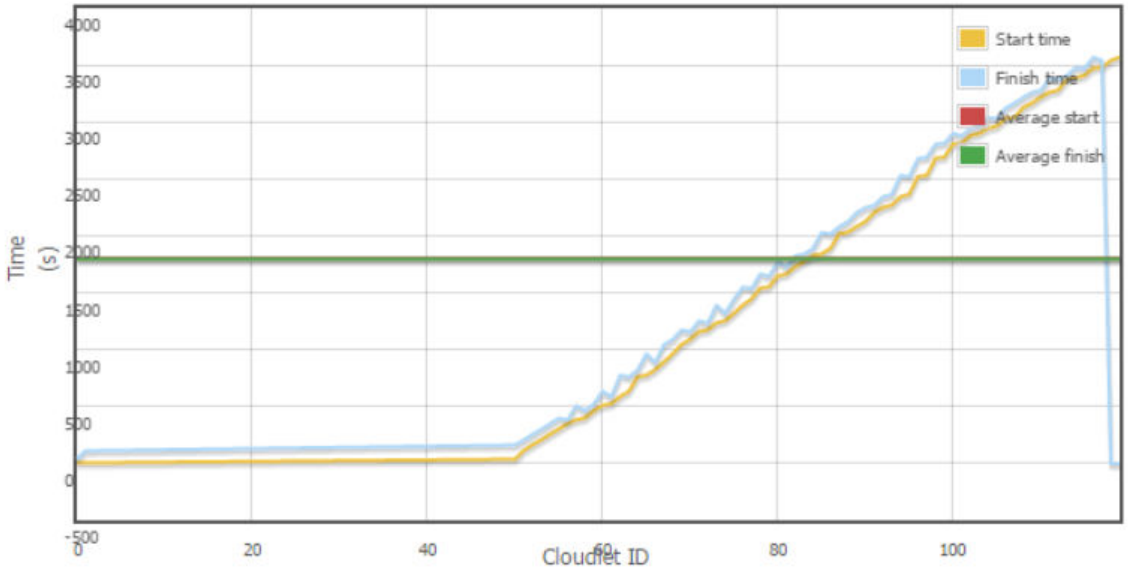


Fig 8: Amount of time taken by each customer's cloudlets

As shown in above figure, the start time and finish time remain constant until cloudlet 50. After that it starts to increase linearly and it keeps on increasing until it reaches saturation.

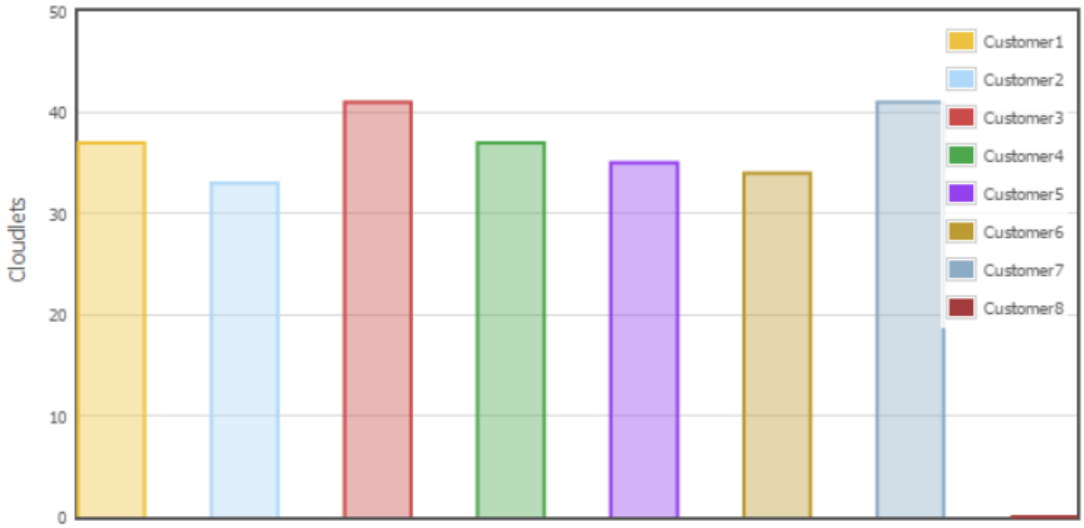
Part B

Simulation Time: 08 seconds

Summary of Configuration

Datacenter1	**Datacenter2**
Allocation policy: Single threshold Number of hosts: 1 Number of migrations: 0	Allocation policy: Single threshold Number of hosts: 1 Number of migrations: 0
Customer1	**Customer5**
Broker policy: Round robin Number of virtual machines: 2	Broker policy: Round robin Number of virtual machines: 2
Customer2	**Customer6**
Broker policy: Round robin Number of virtual machines: 2	Broker policy: Round robin Number of virtual machines: 2
Customer3	**Customer7**
Broker policy: Round robin Number of virtual machines: 2	Broker policy: Round robin Number of virtual machines: 2
Customer4	**Customer8**
Broker policy: Round robin Number of virtual machines: 2	Broker policy: Round robin Number of virtual machines: 2

Cloudlets Executed on Datacenters



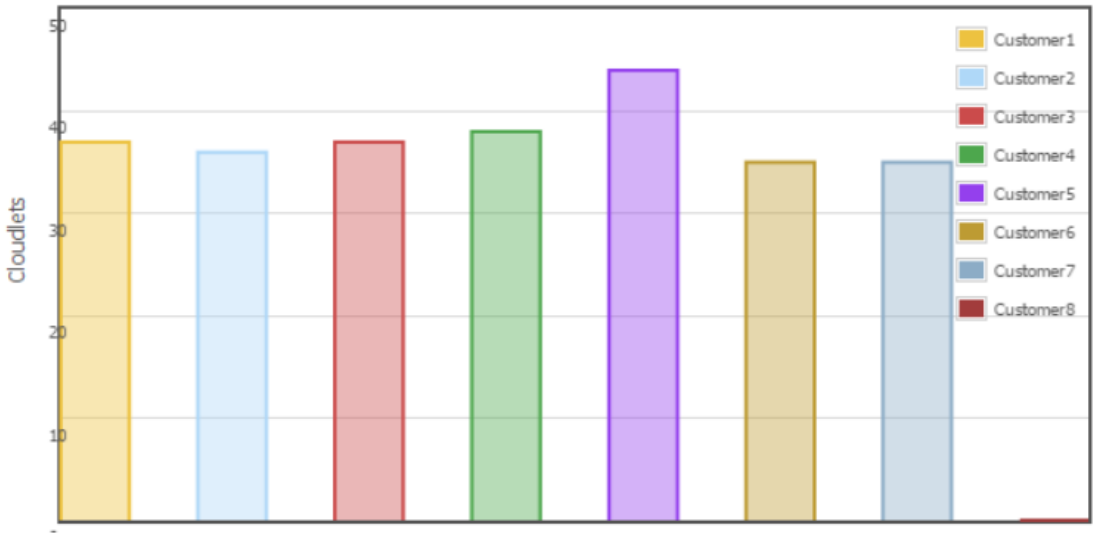
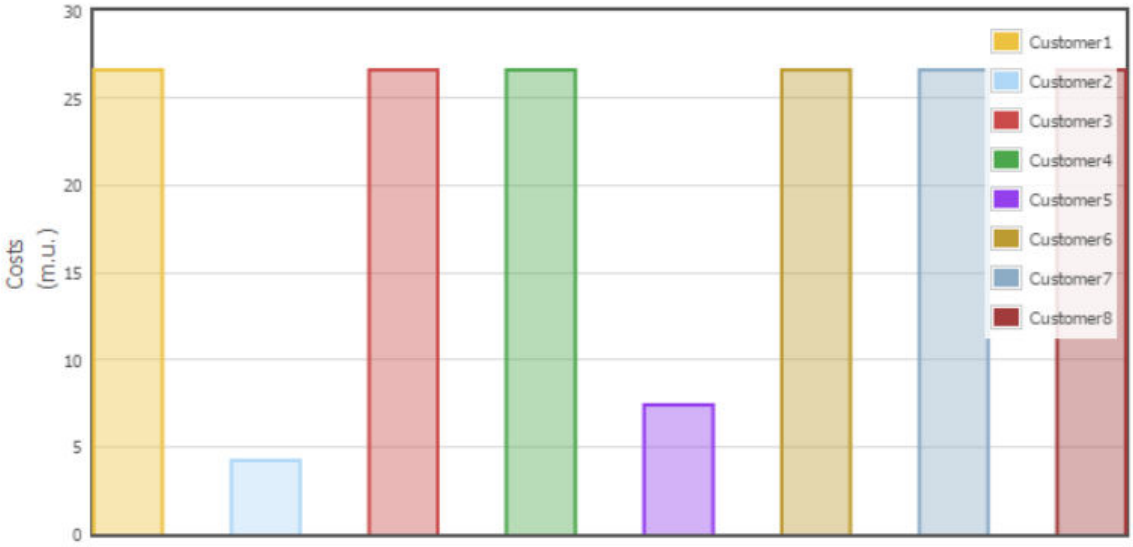


Fig 9: No. of cloudlets executed on each datacenter for each customer

Above figure shows the number of cloudlets which are successfully executed by Datacenter1 and Datacenter2 for each customer. In Datacenter1, Customer2 and Customer5 executed small number of cloudlets comparatively. It is because these customers were configured with less RAM and Bandwidth. For Datacenter2, since Customer5 was configured with almost double RAM than others so it executed more cloudlets.

Costs



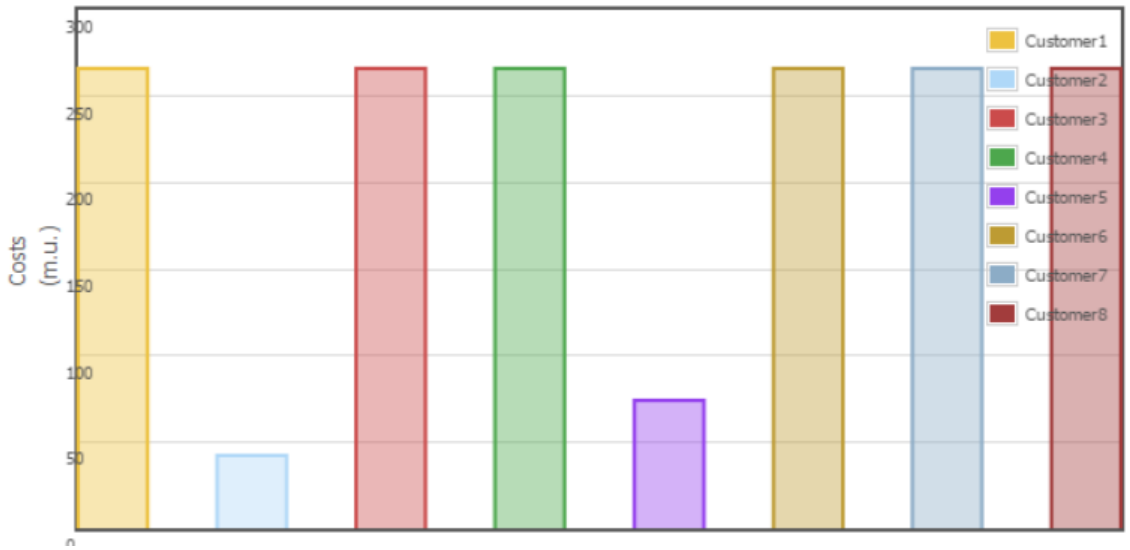
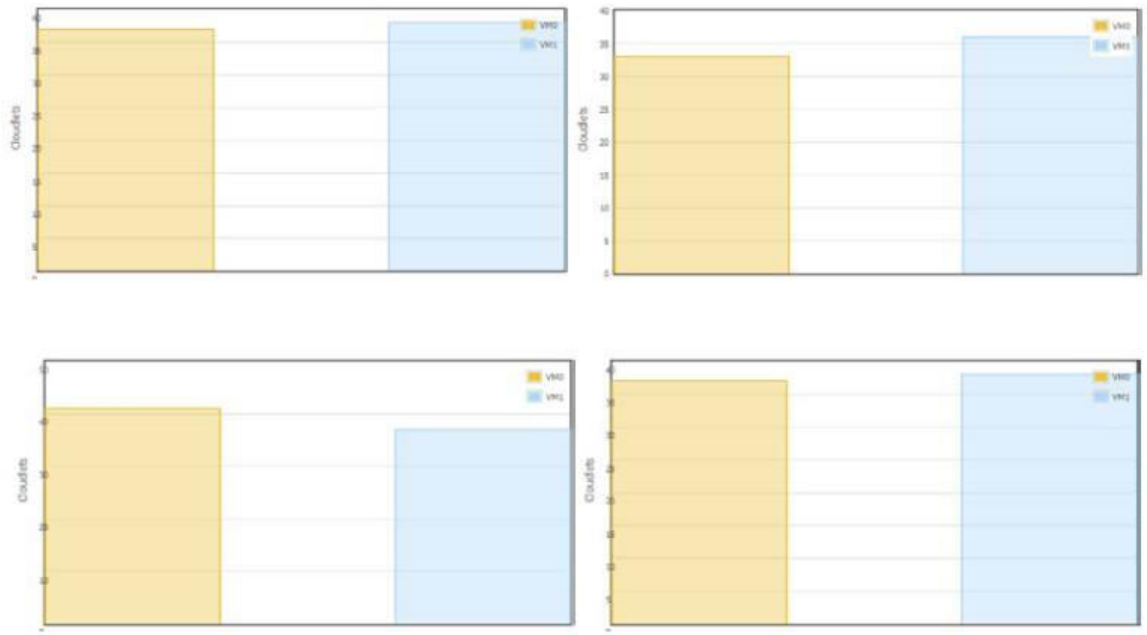


Fig 10: Cost generated by each customer

The processing, memory, storage and bandwidth costs of Datacenter1 were set 10 timers more than Datacenter2 as shown in fig 10.

Cloudlets



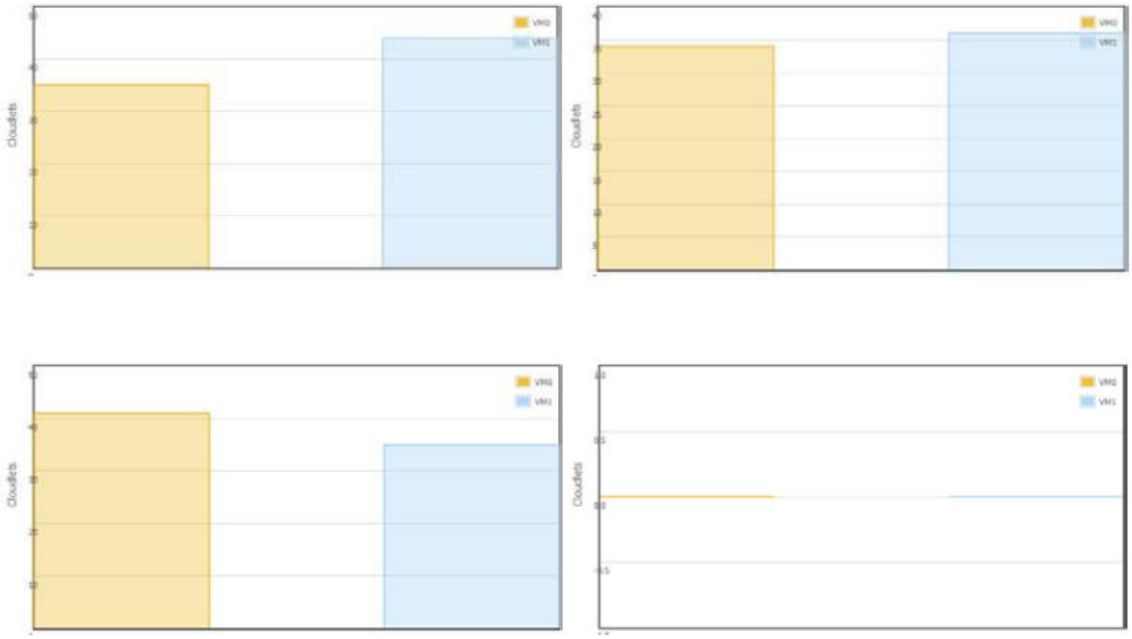


Fig 11: No. of cloudlets executed on each virtual machine

Fig.11 shows the number of successfully executed cloudlets for both datacenters.

Debt

*****Datacenter: Datacenter1*****	*****Datacenter: Datacenter2*****
User id Debt	User id Debt
4 26.6	4 266
5 4.2	5 42
6 26.6	6 266
7 26.6	7 266
8 7.4	8 74
9 26.6	9 266
10 26.6	10 266
11 26.6	11 266
**********	**********

Table-2: Datacenter Debt

The above table shows debt of both datacenter1 and datacenter2.
Here we change the Ram and Bandwidth settings of customer2 and customer5 in datacenter1 and cutomer5 in datacenter2.

Configuration on Customer4

Ten virtual machines were set for customer4 and simulation was rerun with these settings. Five virtual machines were running for cutomer4 and one virtual machine was running for each of the remaining customers for each datacenter. The cost become 125 m.u. for customer4 and it remained less than 25 m.u. for other customers.

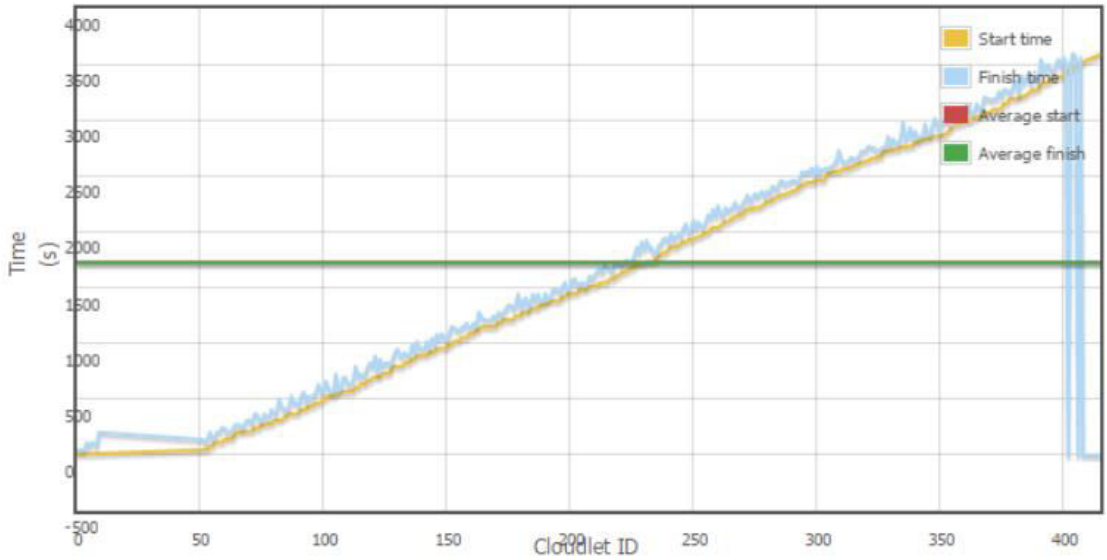
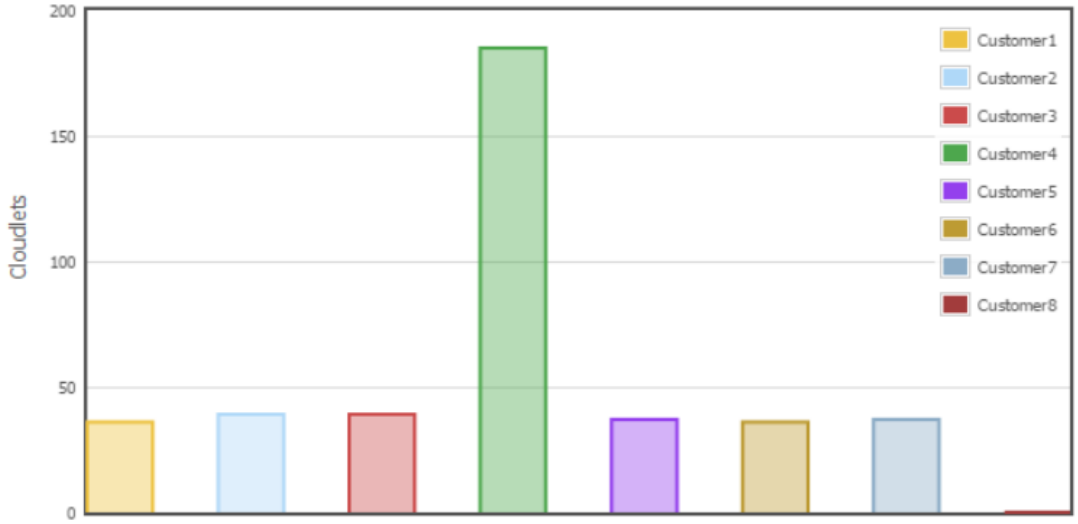


Fig. 12 Scheduling of cloudlets on the VM of Customer 4

Start time and finish time of cloudlets are clearly shown in fig 12. In beginning start time and finish time is pretty slow but after reaching 50 cloudlets it becomes linear.



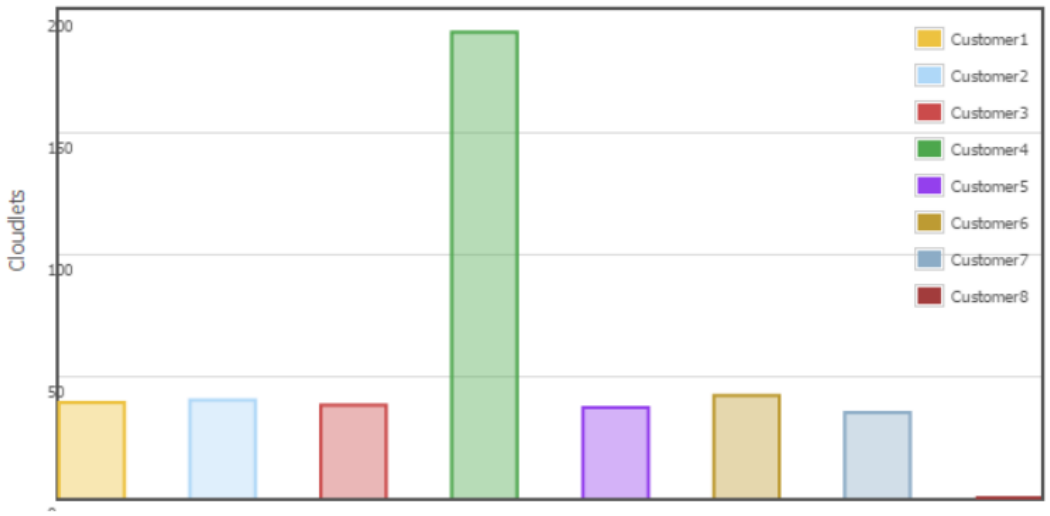


Fig. 13: No. of Cloudlets for every customer

From the Fig. 13, it is shown that Customer 4 executed the more number of cloudlets compared to other customers for both datacenter1 and datacenter2.

CONCLUSION

The aim of this project is to study the importance of Green Networking principles which can be applied in datacenters and cloud computing. Using a simulator like CloudSim to simulate a cloud computing datacenter helps to avoid spending time and efforts to configure a real testing environment. The simulation was run by setting different parameters of cloud networking environment and helps in understanding energy efficiency, resource utilization, virtual machine efficiencies and monetary costs. For instance, it is also noticed that by reducing the VM RAM and Bandwidth for two of the customers, the monetary costs of them also reduced significantly and vice versa.

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