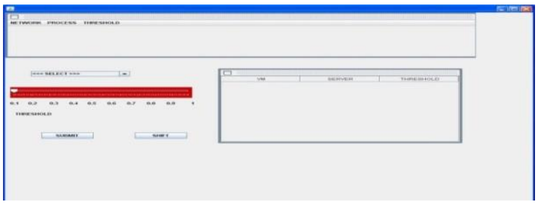
calculate the expected finish time of the work Wj
if the response time of the node j is less than the assigned response time, i.eRTj<RT, then
RT=RTj ; x j;
end for
else
for each node b in the system do
calculate the availability cost of work Wj on node b, CAj
if the availability cost of the work on node b is less than assigned availability cost, i.eCAj<CA then
CA=CAj ; RT=RTj ; x j ;
end for
end if
22. WLmin=N1 ;LImin = ; /* Assume that node 1 is lightly loaded and its load capacity is */
for each node b belongs to Na do
calculate its work load LIb ;
if the load of the node b is less than minimum load index, i.eLIb<LImin then
set the load index of b as the minimum load index LIb and node b is the lightly loaded node
Allocate work Wj to node b
else
Allocate work Wj to node WLmin
end if
The main concept of the VM shift algorithm is to calculate the overload in the server. Here an intelligent interface is placed on the data center.
Hotspot Identification
Here a particular hotspot value is set as a threshold value to the CPU usage. It can be set as 90%and above, when a particular server's CPU usage is more than 90%.
Cold spot Identification
It is a method for identifying the idle server. The threshold for the cold spot is set as 20% of the CPU usage.
Hot and Cold Spot Migration
This step starts with the sorting of hotspots in the descending order .It implies the hottest spot is first in the list and then cold.

8.3 VM Shift Algorithms

Input: Set of data items
Fix quasi-identifiers
Initiate VM shift algorithm
Set the number of virtual machines we need
Choose the load prediction randomly
For each load prediction calculate the hot spots
Find the idle machine
Calculate cold spots for load prediction.
End for
Initiate VM Migration
For each hot spot do the migration.
Find the IMPS
Repeat step 10 to 12 until we get Resource balance
End for
End VM Shift process
Check number of hot spots for each Virtual machine.
The process of VM shift algorithm is to checks the unevenness utilization of the server. This algorithm is placed on the Data center. If any unevenness occurred on the server, it provides the resource to the opposite server desires an equivalent resource and VM shifted to the opposite machine by reducing the overload. Thus, it will increase the performance of the server.
The algorithm executes periodically to evaluate the resource allocation status based on the predicted future resource demands of VMs. It defines a server as a hot spot if the utilization of any of its resources is above a hot threshold. This indicates that the server is overloaded and hence some VMs running on it should be migrated away. The algorithm defines a server as a cold spot if the utilizations of all its resources are below a cold threshold. This indicates that the server is mostly idle and a potential candidate to turn off to save energy.
The algorithm sorts the list of hot spots in the system in descending Temperature. The goal is to eliminate all hot spots if possible. Otherwise, keep their temperature as low as possible.



8.4 Automated Resource Allocation

When the research work focuses on the Resource Allocation, the Service level Agreement (SLA) should be satisfied. For this purpose, the Resource patterns are changed on the application and user demands, leading to the introduction of the concept called Auto Control. This manages all the different resources on the different users. Auto Control permits when the workload of the server changes; the image of the resource is also changed.

8.5 Resource Allocation by Runtime

Runtime migration is used for allocating resources. The main advantage of this system is that it satisfies the Service Level Agreement of users. Elimination of the overload with the physical machine has its beginning with the shifting of virtual machine to reduce overload. This result in increased performance of the overall systemonline migration begins with the identification of the volume of a physical machine and a virtual machine. The algorithm sorts out the physical and virtual machines on the basis of volume. Migration is done with the size of volume ration between the servers.

8.6 Simulation Results

The experimental result shows the number of hotspots with load prediction and without load prediction.VM wave simulation is the simulation tool that has been used for identifying the various Hotspots available. A graph has been plotted for hotspot identification for situations with and without load predictions.
Hot Spot Identification: The number of virtual machine is taken on the X-axis and number of hotspot on the Y-axis. The algorithm sorts the list of hot spots in the system in descending Temperature. The goal is to eliminate all hot spots if possible. Otherwise, keep their temperature as low as possible.

In the graph (Fig. 8.6), the number of hot spots is less in load prediction. The reason for the above result is that the predicted load always gives best performance. Unpredicted load gives more hot spots due to the inability to get the exact load.

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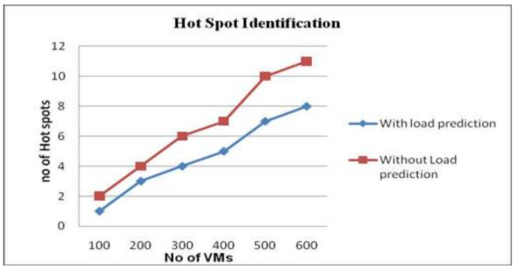

Fig 6. Number of hot spots

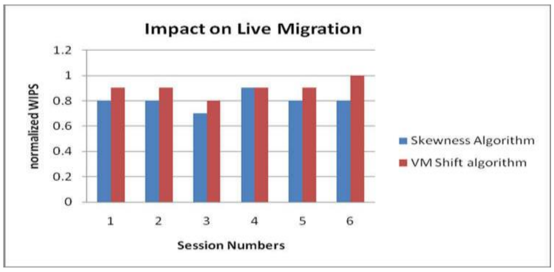

Fig 7. Hotspot and cold spot mitigation

When the VM broker is initialized, it displays the details of the VM broker. It also displays the starting and shutting down of the broker. It monitors the start time and completion time of VM. The final status of VM is considered as the output.

Resource Balance

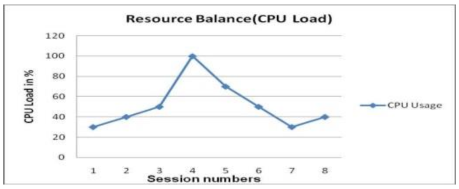

Fig 8. Resource balance in CPU load using VM Shift algorithm

Fig 9. Resource balance in time using VM Shift algorithm

8.7 Genetic algorithm based resource allocation

Resource allocation in cloud computing should be flexible and need modification as per the availability of virtual machines in data center for allocation of the resources to the user. The algorithm for resource allocation should take decision based on dynamic information. In the existing work, an aggressive resource provisioning task using SPRNT algorithm [7] makes a dynamic allocation of the data center resources. The Existing work focuses on increased number of virtual machines and increased workload .The work should take a decision on the basis of dynamic information. This method lacks in memory access time.In general, cloud computing focuses on self-solutions. These solutions are based on application demands. This means cloud environment ensures the flexibility pay per utilization model. Flexibility in cloud is implemented through handling and arranging the dynamic resources on a particular instance. When any extra needs an algorithm, it should consider the dynamic information. Cloud computing always falls in utilization price. There is no advanced price in it. In order to reduce the computational cost the algorithm should effectively manage the resources [8]. SPRNT system fails when the workload increases. This research work proposes an intelligent resource allocation based on artificial and computational intelligence. The algorithm sorts the list of hot spots in the system in descending Temperature. The goal is to eliminate all hot spots if possible. Otherwise, keep their temperature as low as possible

8.8 Energy efficient resource allocation

The emerging technology of cloud computing offers virtualization models and new computing models where resources such as online applications, computing power, storage and computing infrastructures can be shared as services through the web[1,4].The computing model adopted mainly by cloud computing providers (e.g., Microsoft, Google) is inspires features for customers whose demand on virtual resources varies with time [1,8].The cloud provides suitable, on-demand service, elasticity, broad network access, resource pooling and measured service in highly customizable manner with minimal management effort[3,8].Cloud programs are implemented in remote data centers (DCs) wherever high capability servers and storage systems are located. A quick growth of demand for cloud primarily based services results in an established order of large data centers taking high volume of electrical energy [7, 9]. Energy efficient model is needed for complete infrastructure for reducing functional prices, while maintaining very important Quality of Service (QOS). Energy improvement is achieved by way of combining resources as in keeping with the current usage, green virtual network topologies and thermal processing of computing hardware's and nodes[1,2].The objective of scheduling algorithms is to map tasks onto nodes and order their execution in an exceedingly thanks to optimize overall performance. In scheduling theory, the fundamental assumption is that each one machine is always available for the process. This assumption may well be affordable in some cases. However it is not valid in eventualities wherever there exist & maintenance definite requirements, breakdowns, or different constraints, which make the machines unavailable for process [29]. Examples of such constraints are often found in several application areas. As an example, machine nodes in Heterogeneous systems in Cloud environment have to be sporadically

8.9 Energy efficient in cloud environment

Energy efficiency has emerged as a special problem in large data center & and cloud providers. The datacenter include & a large and wide variety of web servers, also called physical machines (PMs). The power consumption is that & in the key difficulty in content distribution machine and maximum disbursed systems (Cloud systems) [9]. These requirements are the buildup of networked computing resources from one or multiple companies on datacenters increasing over the world.

8.10 Energy efficient algorithm

As per earlier research the energy management has been applied in cloud datacenter [16]. This work, the arriving virtual machine (VM) makes a request to the cloud data center and provides exact physical machine (PM) to the cloud data center. This proposed work reduces energy consumption to the cloud Figure.

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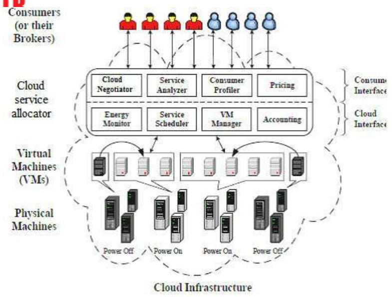

Fig 10. Resource balance in the cloud

8.9 Energy efficient in cloud environment

datacenter by sleep the unused PMs. This work proposes three frameworks, viz., data clustering, workload prediction and power management. These frameworks used analysis and observe the workload variations of the particular time. The data clustering method uses K-means the clustering algorithm. This algorithm groups any type of VM request.

Then power management method calculates the PM utilization using BFD algorithm. The proposed an energy aware resource allocation for scientific workflow execution in cloud environment. This method helps reducing the energy consumption of cloud platform using the energy aware resource allocation method. This method finish and analysis the idle virtual machines then migrates that virtual machine. Earlier research work focused on MADLVF algorithm for overcoming the problem in energy consumption and resource utilization of datacenter [10]This algorithm uses the VM consolidation method that reduces high energy consumption of datacenter. One of the most vital resources of cloud computing is the calculated or estimated processor. The components present in this processor are the transistor values ranging between thousands to billions. Processors with 2300 transistors having a cyclic frequency of about 740 KHz were developed in the 19th century. In the current scenario, the clock frequency up to 3GHz can be achieved including transistors nearly 1.7 billion in number. A study suggests that in the rapid development continues, it is possible to develop a processor having transistors equal to the total neurons present in the human body by the year 2026. Loss

Reduction in the energy consumption of the distributed computing system can be achieved by means of using various algorithms or other techniques which leads to the improvement of the system performance. Some of the vital techniques such as Dynamic Voltage and Frequency scaling are used for reducing the energy in hardware level. Scheduling policies with Constraints in energy and estimation time are introduced for reducing the energy consumption in software level. It is evident from Arrhenius equation that heat generated from the system due to the increased level of energy consumption increases the overall system temperature which may lead to the breakdown of the various components for every 10oC. In general, usage of energy in any processor increases with increase in the estimation time of the processor and vice versa.

An algorithm is designed for reduction in the energy consumption. In this algorithm, energy used by any processor is assumed to be the primary objective of the proposed algorithm which is as follows,

Step: 1 Position of the particle, its best fitness value and velocity are set randomly by considering the population.

Step: 2 Unit addition, comprehensive addition and inactivity assessment are initialized.

Step: 3 Primary objective functions are designed for reducing energy consumption.

Step: 4 Fitness value for each particle is calculated for a particular population.

Step: 5 Particle with low fitness value is selected and compared with its best fitness value.

Step: 6 The position of the particle and its speed are updated using mathematical Equations

8.10.1 Fitness Function Generation

In this approach the best virtual machines are selected by using the equation 5.1. The total fitness values are calculated using equation 5.2. Since hybrid genetic algorithm is a combination of a genetic algorithm, K-means and the migration algorithm, it is must to calculate the fitness value. This fitness value gives the best virtual machines in the data center. The cloudlet corresponding to virtual machines are selected for the migration process. CPU utilization between Energy aware algorithm, Heuristic algorithm and Hybrid genetic algorithm are explained. The number of cloudlets is taken in the X axis and number of virtual machines is taken in the Y axis. The initial parameter is set between 100 and 200 cloudlet. Number of cloudlet increases if number of virtual machines is increased. For example 100cloudlets are allotted with 10 virtual machines in the cases of Energy aware algorithm and Heuristic algorithm. But, for Hybrid genetic algorithm, 6 virtual machines are needed for the same number of cloudlet. This provides efficient CPU utilization on servers. So energy also reduced. In this approach the best virtual machines are selected by using the equation 5.1. The total fitness values are calculated using equation 5.2. Since hybrid genetic algorithm is a combination of a genetic algorithm, K-means and the migration algorithm, it is must to calculate the fitness value. This fitness value gives the best virtual machines in the data center. The cloudlet corresponding to virtual machines are selected for the migration process. Resource allocation starts in the next step. All the cloudlets are mapped with the physical machine available in the server side. The algorithm starts the migration process, when the clock frequently is increased. More energy consumed when the clock frequency increased. Cloud Simuse’s Sim Java as the distinct occasion simulator engine that facilitates several primary features, such as lining up and handling of activities, development of cloud computing system organizations (services, variety, data middle, agent, VMs), interaction between elements, and control of the simulator time.

IX. CONCLUSION AND FUTURE WORK

9.1 Conclusion

The proposed thesis overviews cloud computing and its background describing the architecture, models and benefits moving further towards the concept of green cloud computing as the energy efficiency is one of major problem with cloud computing. The proposed work thus puts forward an efficient energy consumption technique. Keeping in mind the problems formulated in the existing system. The proposed technique cloud environment is developed in java, deployed on cloud sim toolkit and the experimental results have been compiled as per quantitative analysis. In proposed techniques power saving in green cloud environment has been done using k means clustering at virtual machine level to classify the machines as low level and high level virtual machines. The cloudlets are also categorized into 3 parts: Suspend able cloudlets, cancellable cloudlets and non-permutable cloudlets.

9.2 Future Work

This work shows the energy consumption of the heterogeneous workload other processing element like no of CPU required by a cloudlet can also be considered to further increase the efficiency of work load consolidation techniques. To achieve green cloud computing server data center can use renewable energy resources like the solar system, bio gas plant energy.

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