Tasks Scheduling with Multilayer Hybrid Energy Efficient Approach in Green Cloud Computing

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Abstract— Cloud computing is an important paradigm in Information Knowledge field. Energy consumption high is one of the major problem of cloud computing system. The main aim of Green Cloud computing is to reduce the energy consumed by physical resources in data-centre and save energy and also increase the performance of the system. There are several scheduling algorithms such as Adaptive Min-Min Scheduling Algorithm, Multilevel Feedback Queue Scheduling Algorithm etc. are utilized in green cloud computing to lower the energy consumption and time. In proposed work, one scheduling algorithm will be implemented which is Multilevel Feedback Queue Scheduling Algorithm. On its basis, energy consumption taking place will be reduced after using improved Adaptive Min-Min Scheduling Algorithm. Evaluate and comparison the performance parameters like energy consumption and energy consumption.

Key words: Cloud Computing, Energy Efficient and Green Scheduling, Data Centres

I. INTRODUCTION

Cloud is a computing framework which is dynamically scalable and virtualized resources are delivered as a specific service through the Internet. Cloud applications utilize huge information centres as well as operational servers which are utilized to host net applications plus services. Green Cloud computing is proposed to achieve not single efficient processing and utilization of computing infrastructure, but also minimize energy consumption. The main aim of green computing is to reduce the consumption of harmful chemicals, consumption of energy and enhancement of the recyclability.

Green Computing is a model for enabling convenient, environment sustainability in IT sector that can be rapidly provisioned and released with minimal management effort or green provider interaction. Green computing has been widely accepted from individual to official employee of government.

The first step of green computing came into existence in 1990s by ENERGY STRAR package. This is the tag that was given to those products whose energy consumption is less than others and that are successfully proved that they are using minimum energy. First step of green computing was to enable sleep mode in computers, laptops etc. After this various concepts came into recognised like thin client solutions etc.

The green computing mainly focuses on various parts like:

- Power management.
- Energy efficiency.
- Server virtualization.
- Green metrics.
- Recycling.
- Thin Client solutions etc.

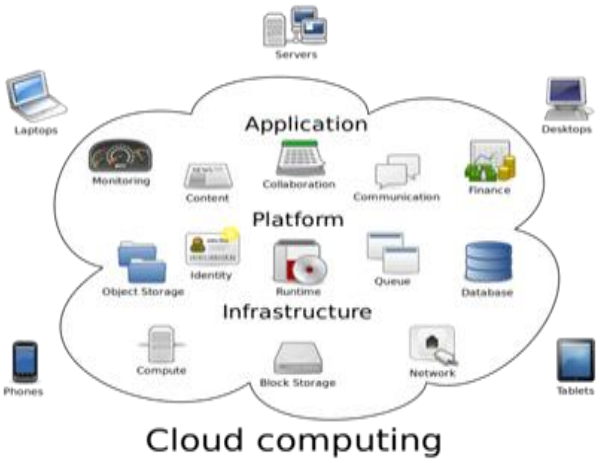

Fig. 1: Various Services of Cloud Platform

II. NEED FOR GREEN CLOUD COMPUTING

Cloud computing model are hosting a variability of application ranging from those that run for seconds to those that run for extended periods of time on shared hardware platforms. The constraint to manage several applications in a datacentre creates the challenge of on-demand resource provisioning and allocation in reaction to time varying workloads. Green Cloud computing is intended to achieve not only efficient processing and utilization of computing infrastructure, but also minimize energy consumption.

Following are few mentioned reasons for going green:

1) Computer energy is often wasteful.
   - Shut down the computer, when not in use.
   - Use LED rather than tubes.
2) Printing papers.
   - Do not print unnecessarily.
3) Pollution.
   - Use eco-friendly ways for travelling.
4) Reducing energy consumption.
   - Shut-off the room lights when not in use.

Following methods has been used to increase the use of the green computing:

5) Green Use- By minimizing the electricity consumption and increasing the use of the portable devices.
6) Green Disposal- Electronic waste recycling e.g. by remaking an existing computer.
7) Green Design- Efforts to improve environment quality while increasing the environment development.
8) Green Manufacturing- Economic welfares include long term cost saving as well as waste reductions.

III. CHARACTERISTICS OF CLOUD COMPUTING

As stated by NIST, the Cloud framework is made up of five important features [18]:

- On-demand self-service: A user cloud one-sidedly provision computing abilities, for instance server time interval in addition to network stowage, as required mechanically deprived of demanding human communication with every single service supplier [18].
- Broad network access: Competencies are obtainable through the network as well as handled by using customary mechanisms which also stimulate utilize by means of heterogeneous thin or else thick user stages.
- Resource pooling: The supplier's computing assets are assembled to assist numerous users utilizing a multi-tenant framework, through dissimilar physical as well as simulated resources vigorously allocated as well as reallocated as stated by user request. There is an intellect of position individuality in which the user in general has no controller or familiarity over the particular position of the offered assets nevertheless this might be competent to specify position by the side of a greater level of abstraction. Instance of assets which also comprise of memory, storage handling, as well as network bandwidth.
- Rapid elasticity: Competences cloud probably be elastically delivered as well as unconfined, in some circumstance mechanically, to measure promptly outward as well as inward proportionate through request. To the user, the proficiencies obtainable for provisioning frequently seem to be unrestricted as well as could be taken in any kind of magnitude at any time.
- Measured service: Cloud framework mechanically control as well as enhance resource utilize through leveraging a metering proficiency on round about some particular level of abstraction which is suitable to the category of service.

IV. RESEARCH AREAS FOR GREEN CLOUD COMPUTING

It is predicted in which the environment footprints from several data centres would get triple amongst 2002 upto 2020 that is currently 7.8 billon tons of dioxide every single year. There are several reports on Green Information Technology investigation of clouds along with data centres which demonstrates that cloud Computing is "Green", even though others display that it would directs to disturbing upsurge in Carbon emission. So as to make cloud computing a green computing we requisite to work on precise regions for instance:

- Though cloud is providing multi-tenant type environment in the form of software as a Service nevertheless we required to function on the run-time behaviour of the software.
- To permit the green-cloud data-centres, the Cloud providers necessitate to comprehend and evaluate prevailing data centre power along with cooling designs, power consumptions of various servers and their required specific cooling level, and its equipment resource utilization to accomplish maximum efficiency.
- All obtainable resources had better be used efficiently nevertheless setting up new infrastructure for global coverage, service offering, and competitiveness should not be there.
- It is the obligation of to both facility providers and customers to make sure that new technology should not produce any health hazard to human society.

V. PROBLEMS ENCOUNTERED

In data centre, where all physical resources are available, machine consumes power and emits heat which affects the conservational conditions. The green cloud computing solves the problem of global warming by providing eco-friendly atmosphere. whenever energy consumption is increase the heat emission also increase. The main aim of green cloud computing is to reduce the energy consumed by physical resources in data centre.

VI. SIMULATION TECHNIQUES

In proposed work, one scheduling algorithm will be implemented which is Multilevel Feedback Queue Scheduling algorithm. On the basis of it, energy consumption taking place will be reduce after using improved Adaptive Min-Min Scheduling Algorithm.

A. Multi-Level Feedback Queue Scheduling:

Multi-level feedback queue scheduling allows a procedure to move between queues. This association is facilitated by the characteristic of the CPU burst of the procedure. If a process uses too much CPU period, it will be moved to a lower-priority queue. In addition, a process that waits too long in a lower-priority queue may be relocated to a higher priority column. This form of aging also helps to prevent starvation of certain lower priority processes.

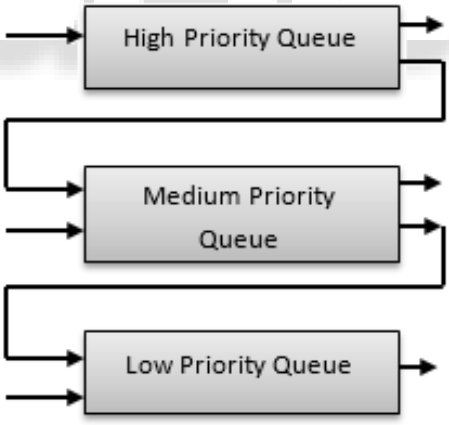

Fig. 2: Multi-Level Feed Queue Scheduling

Multiple FIFO queues are used and the operation is as follows:

- A novel process is inserted at the end of the highest FIFO queue.
- At some stage the process reaches the head of the queue & is allocated the CPU.
- If the procedure is completed within the time quantum of the given queue, it leaves the scheme.
- If the procedure voluntarily relinquishes control of the CPU, it leaves the queuing network, and when the procedure becomes ready again it is introduced at the tail of quantum which it relinquished earlier.

- If the procedure uses all the quantum period, it is pre-empted and inserted at the end of the next lower level queue. This next minor level queue will have a period quantum which is more than that of the previous higher level queue.
- This system will continue until the method completes or it reaches the base level queue.
  - At the base level queue the processes flow in round robin fashion until they whole and leave the system. Processes in the base level queue can also be scheduling on a first come first served basis.
  - Optionally, if a procedure blocks for I/O, it is 'promoted' one level and placed at the end of the next-higher queue. This permits I/O bound processes to be preferred by the scheduler and allows processes to 'escape' the base level queue.

Pseudo code
Ready queue is partitioned into separate queue:
Foreground (interactive)
Background (batch)
Each queue has its own scheduling algorithm,
Foreground – RR
Background – FCFS
Scheduling must be done between the queues.
Fixed priority scheduling; (i.e., serve all from foreground then from background). Possibility of starvation.
Time slice – each queue gets a certain amount of CPU time which it can scheduling amongst its processes; i.e., 80% to foreground in RR 1.20% to background in FCFS.

B. Adaptive Min-Min Scheduling Algorithm:

- The approval of the Internet and the availability of powerful computer & high-speed system as low-cost commodity mechanisms make it possible to construct large-scale great performance Grid computing schemes.
- These technical chance enable the distribution, selection, and aggregation of geographically dispersed heterogeneous resource for resolving large-scale problems in science, engineering, and commerce.
- To achieve the talented potential of tremendous dispersed properties, effective and efficient scheduling algorithms are basically important. The scheduling problematic implement the users applications.
- Task routing as the system that tasks are dispensed to processors and assignment scheduling as how tasks are scheduled on the allocated computer. Task routing procedure may be either static or adaptive. The previous uses only data about the average performance of the system, ignoring the current state, while the latter reacts to scheme state.
- Adaptive strategies are more difficult but produce significantly better performance results than static strategies. Static policies are detached into deterministic and probabilistic procedures adjust the routing choice to a probability spreading.
- In deterministic strategies once the set of currently ready assignment has been specified, the routing.
- Correction is applied. Task routing processes can also be separated into instant mode and batch method routing algorithms.
- Immediate mode algorithm advancing the task of every job as soon as they arrive in the scheme. On the contrary, batch mode algorithms distribute a batch of tasks of several jobs which are in the line of the scheduler.
- The scheduling of the resources many factors such as CPU operation rate, throughout, turnaround period, waiting time, & response period should be focused for all the processors when assigned with the jobs. The jobs are assigned to the resources considering the system's presentation. Thus the scheduling productions an significant role in achieving the best operation of resource and the better completion of the submitted jobs.

Pseudo cod
Input: Task set T
Cluster Node set N
Output: Task – Node Mapping
1) While there are tasks to schedule
2) For each Ti ϵ T
3) For each nj ϵ N
4) Get power-state sj of node Nj
5) If Si ≠ 0
6) Modify the starting Time of Tj;
Aij ' = aij + wj.
7) En dif
8) Calculate CTij = ETij + Aij
9) End for
10) Calculate metric j = min {CTj1, CTj2,….}
11) End for
12) Select best metric Match
(t.n) = min {metric1, metric2,….}
13) Calculate minimum Ctn,m
14) Schedule Task n on M
15) Modify Aij = Aij + ETn,m , J ≠ n for each task j not schedule yet. And set each node to the proper power state according to the online strategy.
End while.

VII. Result and Discussions

The figure below shows time consumption of Adaptive min-min algorithm with more than one tasks queue and having a system network for their execution. It is less time consuming algorithm as compare to MSQ. The way it works with multiple queue is, it use optimal solution for execution over a network.

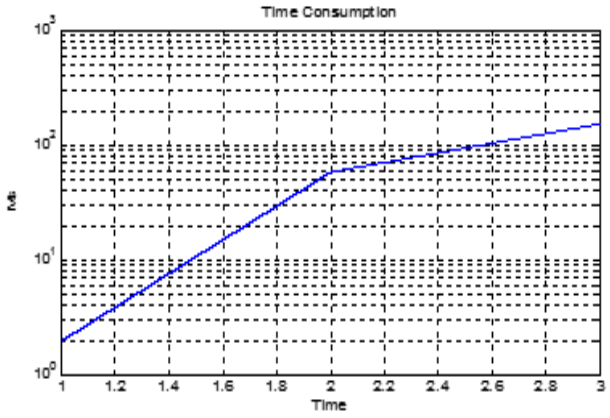

Fig. 3: Time Consumption Adaptive Min-Min

The figure below shows Energy consumption of Adaptive min-min algorithm with more than one tasks queue and having a system network for their execution. It is more energy consuming algorithm as compare to MSQ because it doesn't have ability to work with multiple queues at a time.

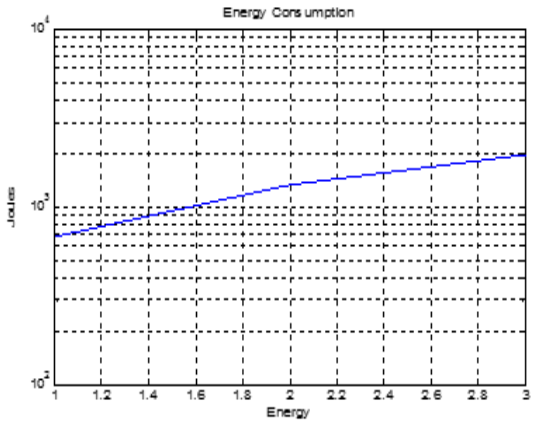

Fig. 4: Energy Consumption Adaptive Min-Min

Figure no. 7.3 shows time consumption of Multi-Queue Scheduling algorithm with more than one tasks queue and having a system network for their execution. It is more time consuming algorithm as compare to adaptive technique. The way it works with multiple queue is, it use optimal solution for execution over a network with little more time because the handling and pre-processing is time consuming process.

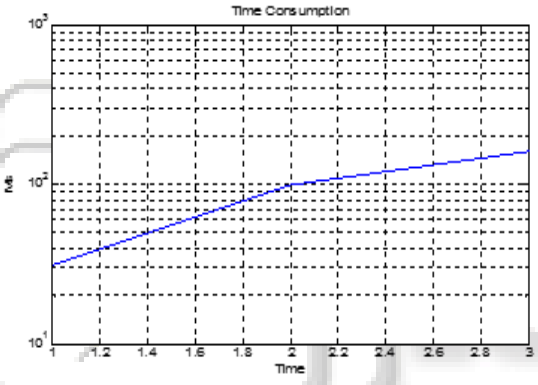

Fig. 5: Time Consumption MQS(Multi-Level Queue Feedback Scheduling)

The figure below shows Energy consumption of Multi-Queue Scheduling algorithm with more than one tasks queue and having a system network for their execution. It is less Energy consuming algorithm as compare to adaptive technique. The way it works with multiple queue is it find a less cost solutions during pre-processing and execute them over a cloud network.

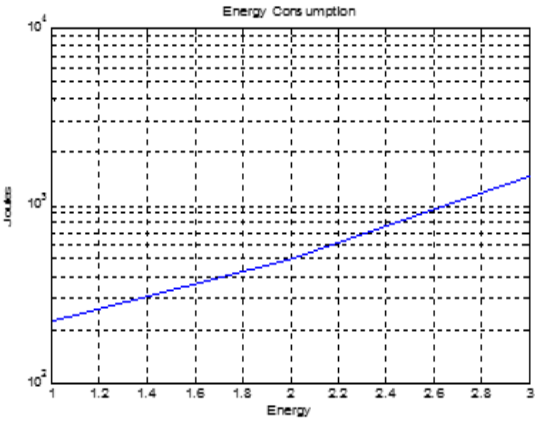

Fig. 6: Energy Consumption MQS(Multi-Level Queue Feedback Scheduling)

Below figure 7.5 shows time consumption of Hybrid Scheduling algorithm with more than one tasks queue and having a system network for their execution. It is less time consuming algorithm as compare to other existing technique. The way it works with Hybrid is, it is a combination of both adaptive and MQS scheduling algorithm. It generates optimal solution for execution and process all queue timely over a cloud server.

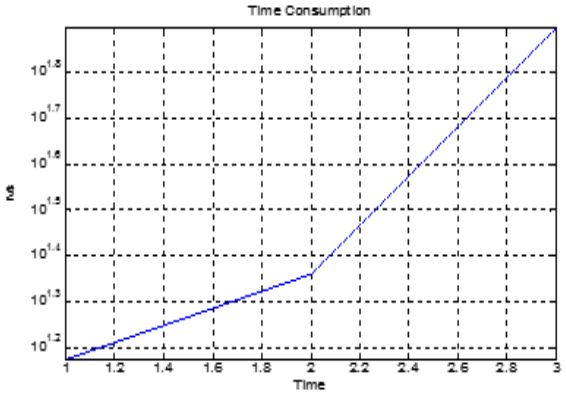

Fig. 7: Time Consumption Hybrid Approach

The figure 7.6 below shows energy consumption of Hybrid Scheduling algorithm with more than one tasks queue and having a system network for their execution. It is less Energy consuming algorithm as compare to other existing technique. The way it works with Hybrid is, it is a combination of both adaptive and MQS scheduling algorithm. It generates optimal solution for execution and process all queues with less cost consumption over a cloud server.

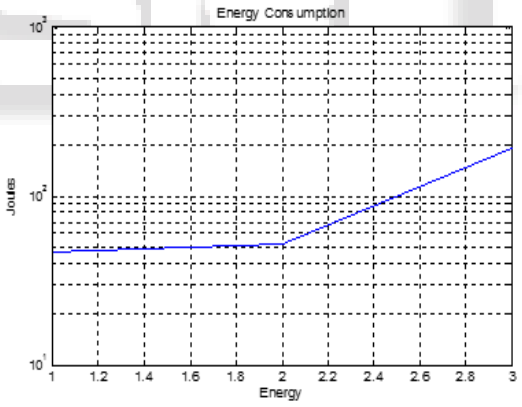

Fig. 8: Energy Consumption Hybrid Approach

The table below shows various execution tests have various existing approaches with our proposed approach. The table consist various tasks variations to test one algorithm in various possible conditions. In all cases the hybrid proposed approach consuming less time as compared to other existing approaches as shown in the graph also.

Algo/tests	3	5	8	10
Adaptive min-min	152	214	310	496
Multi queue scheduling	162	238	314	524
Hybrid algorithm	96	170	255	389

Table 1: Variations to Test One Algorithm In Various Possible Conditions

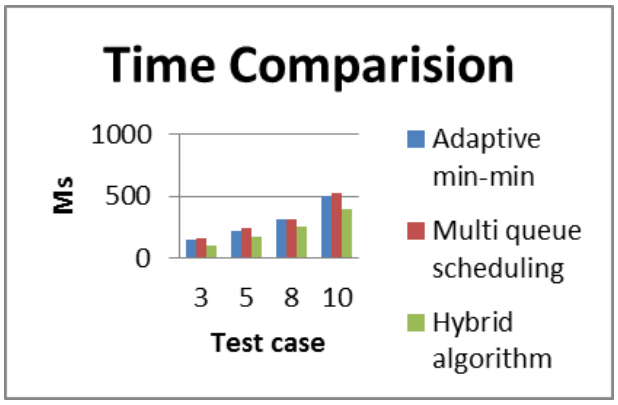

Fig. 9: Time Comparison

The table below shows various execution tests executions tests have various existing approaches with our proposed approach. The table consist various variations to test one algorithm in various possible conditions. In all cases the hybrid proposed approaches consuming less energy as compared to other existing technique as shown in the graph also.

Algo/tests	3	5	8	10
Adaptive min-min	1974	2364	3550	4362
Multi queue scheduling	1462	1963	2957	3896
Hybrid algorithm	780	1285	2268	3254

Table 2: Variations To Test One Algorithm In Various Possible Conditions

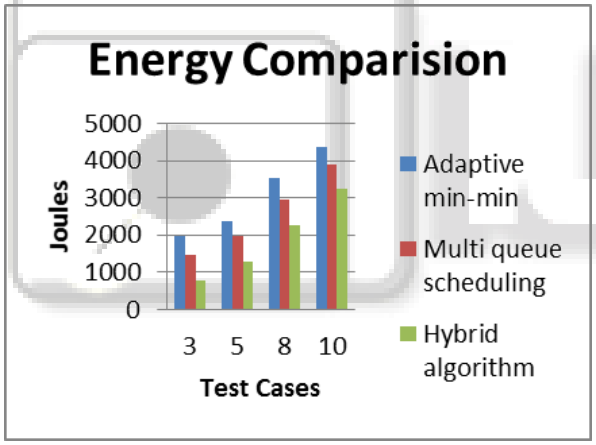

Fig. 10: Energy Consumption

VIII. Conclusion

In this paper tow techniques i.e. multilevel feedback queue scheduling algorithm and adaptive min-min algorithm have been taken into consideration by replacing the already existing accurate results green cloud computing is intended to accomplish not solitary competent processing as well as the use of computing infrastructure, but also minimize energy consumption.

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