A Novel Architecutre for Hybrid Processor Pool Model using IITPS Scheme

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ABSTRACT
Nowadays, the function of Information Technology in environmental problem is getting more deliberation than ever. Some of the major concerns today over IT are increasing energy charges, older equipments stored in storage space and landfills, global warming, etc. To decrease the major environmental problem, a new term called Green IT is introduced. A Green IT is a term which is developed to illustrate the construction, administration, use and removal of IT in a way that minimizes damage to the environment. The most important purpose following the majority of eco-friendly business initiatives, including Green IT, is to encourage environmental sustainability. So, to make the environment more eco-friendly, our research project was aiming in reducing E-waste accumulated by computers. We look forward for a Green IT environment. At present, we can see that old-range and mid-range of processors are thrown out before their life-time expiry date. This contributes for E-waste accumulation and its one of the world's most dangerous situations to come. We thought about a novel architecture that supports accommodating (emulation) this old-range and mid-range processors together with modern high-end processors in the scenario of cloud computing. Through this architecture, we can use all processors depends on various applications till their expiry date, and so, we can reduce the processor E-waste accumulation. The proposed Integrated Time and Task based Process Schedule (ITTPS) for cloud computing in Green IT is implemented using CloudSim software and various performance characteristics are simulated to estimate the performance of the proposed ITTPS in terms of Execution time, Memory consumption, and Performance.

General Term
Cloud Computing, Green Computing.

Keywords
Cloud Computing, Green IT, E-waste, Low-range processor, Mid-range processor, High-end processor, ITTPS, Emulation.

1. INTRODUCTION
Environmental technology is the function of one or more of the ecological science, green chemistry, environmental supervising and electronic devices to observe, form and preserve the normal environment and resources, and to control the harmful crashes of human involvement. This is also termed as Green technology (abbreviated as *Greentech*). The Green IT is also used to illustrate sustainable energy creation strategies such as Wind Turbine, Photovoltaic etc. Sustainable progression is the central part of Green IT environment. The term *Green IT* is also illustrated as a class of electronic devices that can encourage sustainable administration of resources.

The resources (processors) are used in an IT environment to make all the jobs done in a more comfortable and satisfaction manner. The processors are of different types and can be generally classified as low-range processors, mid-range processors, and high-end processors. Low-range processor processes the task using less CPU schedule and only fewer instructions are needed for execution. The mid-range processor processes the task using more CPU schedule and more instructions are needed for execution compared to a low-range processor. And high-end processors perform several instructions at a less interval of time. These processors are emulated together and used under cloud computing scenario, in a very efficient manner in our architecture, to make the processing easier.

Cloud computing is the deliverance of "Computing as a Service" rather than a production, through which resources, software, and information are presented to the internetwork. The phrase "Cloud" is termed as a symbol for the Internet, supported on the cloud depiction used in the history to symbolize the network, and later on to characterize the Internet as an generalization of the primary infrastructure it represents. Cloud computing assigns, classically centralized, with data, software, and application programming interface (API) over a network.

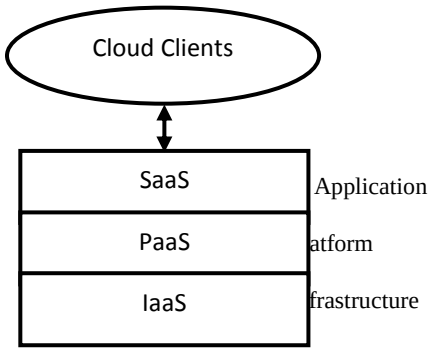

Fig 1: Service models of cloud computing

As per Fig.1, the main characteristics of cloud computing is Empowerment, Agility, Application programming interface (API), Cost, Device, scalability, and reliability. Based on the fundamental model, cloud computing provides

various types of services. The services are Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Iaas uses computers more frequently as essential machines, firewalls, and network systems. PaaS offers algorithms for executing applications, databases, and web server tools. SaaS stands for operating the software applications in the cloud environment.

To make the cloud computing environment more eco-friendly, in this work, we introduced a new technique named Integrated Time and Task based Process Schedule (ITTPS) by combining the tasks and time schedules of low-range, mid-range processors together with the modern high-end processors to analyze the various performances of processes, thereby walking towards Green IT reducing E-wastes.

2. LITERATURE REVIEW

Cloud computing is the upcoming technology in information technology field. Cloud computing has several different merits which can be accessed to identify (cloud) process execution. A new scheduling algorithm was developed, which considers the characteristics of cloud computing to accumulate transaction-intensive cost-constrained processes by taking the execution time and cost using user input used on the fly [1]. The MABOCCF (Mobile Agent Based Open Cloud Computing Federation) mechanism integrates the merits of Mobile Agent and Cloud computing, to present a realization for the Open Cloud Computing Federation [2]. Based on ant colony and complex network, a load balancing strategy theory in open cloud computing federation is presented [3]. To make the cloud computing environment more effective, various characteristics have been proposed that makes cloud computing distinguish from other research areas [4]. Cloud Analyst proposed to reproduce large-scale Cloud applications with the aid of learning the performance of such applications under diverse deployment configurations [5].

The main goals of Cloud computing is to produce the computing allotted in a large number of distributed computers, rather than on local computer or remoter server. Development of the application field and the advantage of cloud computing, such as, user's top level requirement is not needed, and thus minimizing the user's cost [6].The impacts of Green IT are vast. The IT sector and users must enlarge a constructive attitude to address the ecological concerns and approve forward-looking, green-friendly policies and practices [7]. Another work presented an intellectual Green IT management method through the system outlining and application of Machine Learning techniques towards producing the system usage patterns [8].

As a kind of raising business evaluation model, Cloud Computing shared computation task on the resource pool. The paper [9], discussed the distribution process of cloud computing, the present technologies accessed in cloud computing, as well as the systems enterprises. The "Cloud" chiefly presented Web, based on the TCP/IP protocol or protocols practicable with the automatic test system [10]. Cloud Computing enlarged the process and size of parallel computing into all of the computing devices, linking into the "Clou Although" cloud computing, is normally accessed as a technology which will have a prominent impact on IT in the future [11]. To group the tasks and process it more accurately on a cloud interface, the ITTPS (Integrated Time and Task based Process Schedule) is proposed here.

3. ITTPS IN GREEN IT

The proposed ITTPS (Integrated Time and Task based Process Schedule) is efficiently designed for cloud computing by combining the low-range and mid-range processors with the high-end processor to make the Information technology environment towards Green IT for reducing E-wastes. The novel ITTPS architecture for cloud computing consists of mainly three components. They are the cloud processors pool, users' tasks collection and grouping, and a cloud interface. The architecture of the proposed ITTPS for green cloud computing is show in Fig.2.

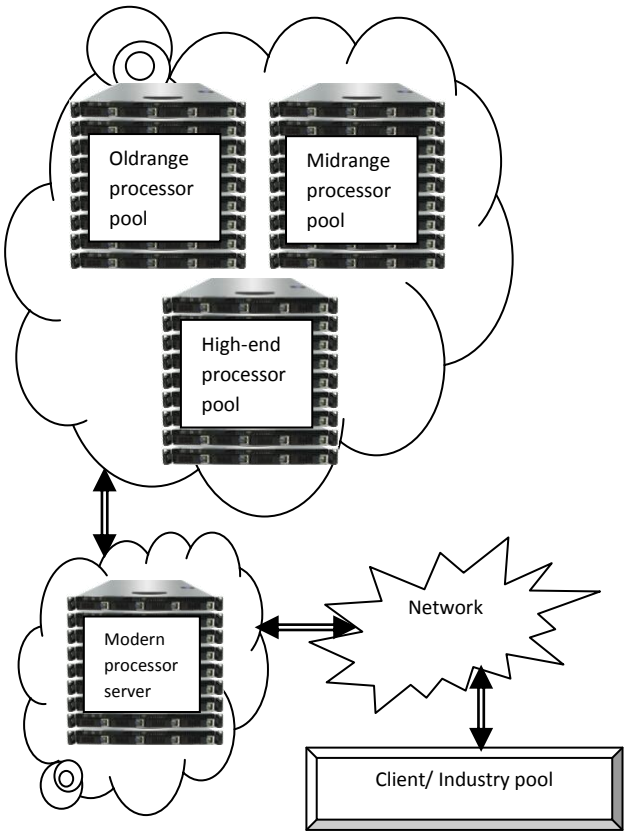

Fig 2: Architecture Diagram for Hybrid Processor Pool

The first operation describes the process of identifying the pool of processors from the cloud environment. The cloud environment has various types of processors under the range of low-range and mid-range processors. These processors are classified under slave-cloud and master-cloud. The integration of old-range (low-range) processors and the mid-range processors together with the high-end processors in the network is referred to as hybrid pool processors. Hybrid processors pool architecture shown in fig.2.

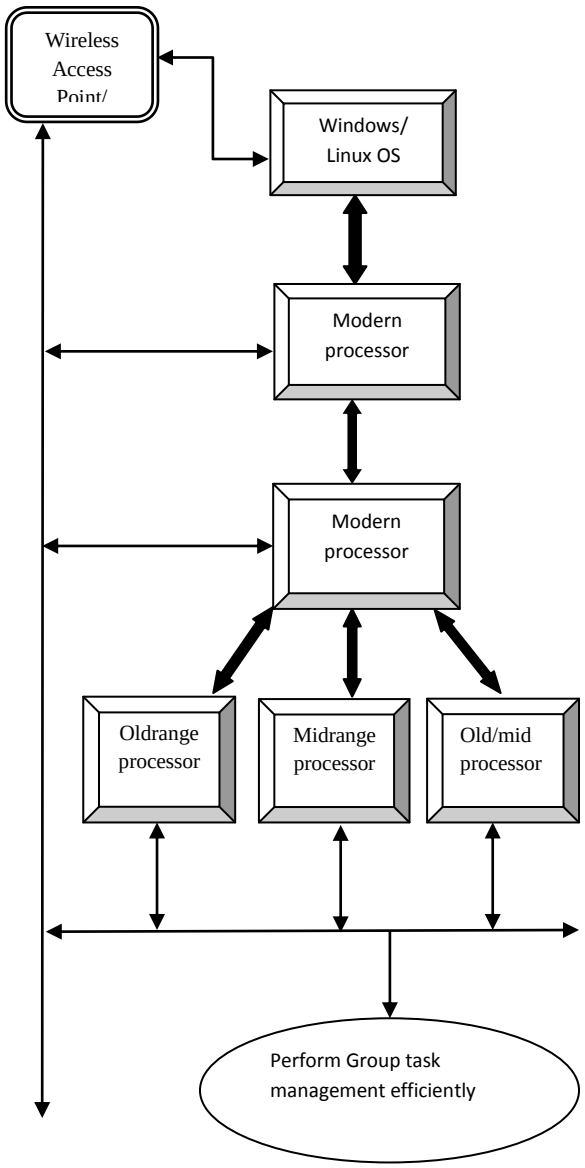

Fig 3: ITTPS for cloud computing in green IT

The second operation describes the process of identifying the number of tasks to be performed in the pool of processors. It displays the number of tasks that are included by the user or user group. It displays the tasks with task-id, task-name, which processor allocated to run each tasks, and the total number of instructions to be run per second.

The third operation describes the cloud interface component. The cloud interface component consists of task scheduling and process allocation. The cloud interface chooses the processor from a pool of processors based on time and the number of instructions to be executed. The cloud interface will assign the appropriate tasks to the processor which is free and continues the task to be performed. The process allocation is done based on the time and memory it needs. The grouping of task is done efficiently through cloud interface to make the IT as Green IT. The processes of cloud interface are shown in fig 3.

Using this architecture (Fig 3.), it shows that it's possible to emulate all these processors of different architecture under cloud computing and can be used at data centers as public cloud or as a private cloud in private firms/organizations.

3.1 Process of ITTPS in Green IT

The process of the proposed ITTPS (integrated time and task based process schedule) for cloud computing in Green IT is described in step by step process using pseudo code.

3.1.1. Cloud Processors pool

A pool of processors is defined as a collection of processors in a variety of range like low- range, mid-range and high-end processors.

Step1: Let the Processors be P_i where i= {1,2,…,n}
Step2: For Each Processor P_i do
Step3: Compute the speed, S measured in MHz
Step4: Identify the MIPS (Instruction per second)
Step5: Identify the number of clock cycles C per second
Step6: End For
Step7: Range the processor P_i based on Name, S, MIPS, C
Step8: End

Using above steps, identify the old processors such as 286, 386, Pentium and let the speed of those old processors measured in MHz. The mid range processor be Pentium Pro, Pentium III, Pentium IV. The modern processors are core2, corei7.

3.1.2. User Tasks

Step1: Let the number of tasks be Ti for processors P_i, where i= {1,2,…,n}
Step2: If user requests new task newT
Step3: Get the Task ID (TID)
Step4: Get the task Name (TName)
Step5: Get the number of instructions to be executed(TMIPS)
Step6: Get the time taken to run the task (t)
Step7: End If
Step8: Add the new newT to the group tasks GT
Step9: List the tasks with TID, TName, TMIPS, task.
Step10: Group the tasks based on TMIPS, task.
Step11: End
List the number of tasks based on its processing time, number of instruction it can be executed per second and the cycles it needs to perform the tasks.

3.1.3. Cloud Interface

Step1: Schedule the task based on TMIPS, t, to the processors Pi.
Step2: Move the appropriate task to the processor Pi based on its TMIPS, t.
Step3: Let the allocated process time be APiT where i= {1, 2… n}
Step4: For each task Ti do
Step5: Compute the processing time
Step6: End For
Step7: Allocate the task Ti to the processor which is compatible
Step8: End

Allocate the processor Pi to the task Ti and that particular tasks are performed within a given interval of time. By integrating the old and mid range processors with modern processor, the tasks has been done efficiently with the given processors based on the processes scheduled time and resources.

4. EXPERIMENTAL EVALUATION

The proposed Integrated Time and Task based Process Schedule is implemented in Java using CloudSim software. The proposed ITTPS accumulates old-range, mid-range and high-end processors for cloud computing processes. The old-range processors includes 286, 386, Pentium, the mid range processors includes Pentium pro, Pentium III, Pentium IV, the high end processors be core2, core i7. These types of hybrid processors are integrated into the processor pool to analyze the performance of the proposed ITTPS for cloud computing to make IT as Green IT. The number of tasks assigned to the processor is based on the time and task schedule done by the processors. The proposed ITTPS first identifies the tasks schedule, processing time and MIPS. After that, based on the task and processing time, the tasks have been assigned to the pool of processors. The proposed ITTPS carried three types of operations it first identified the pool of processors and the users' tasks are scheduled with clock cycles and MIPS. Then the cloud interface is performed efficiently for making the IT as Green IT. Operations can be assigned to the pool of old range and mid range processors with high end processors. The proposed ITTPS for cloud computing infrastructure is measured in terms of:

i.) Execution time
ii.) Memory Consumption rate
iii.) Performance rate

Execution Time is the time taken to complete the given task in a given interval of processing time and schedule for cloud computing process. Memory consumption rate is the rate computed to identify the consumption of memory it needs to execute the task, and this is measured in terms of kilobytes.

5. RESULTS AND DISCUSSION

In this work, we have seen the design of hybrid processor pool with respect to users' tasks to analyze the performance of cloud computing process in Green IT to other systems written in mainstream languages such as Java. We run independent tests with growing number of users' task with a pool of processors, and constant number of tasks sent by each user. The entire process of the proposed ITTPS for cloud computing in Green IT is explained in section 3 briefly and this section described the performance of the proposed architecture. The table and graph below shows the performance of the proposed ITTPS for cloud computing compared with an existing processing task based on individual processors.

Table 1. describes the execution time for performing the group tasks in the cloud computing environment. The various number of task groups are used in the experimentation to validate the proposed ITTPS for cloud computing in green IT. Comparison result of the proposed ITTPS for cloud computing in green IT with an existing Process Schedule based on individual processors availability, measured in terms of seconds. When number of group tasks in the cloud computing environment increases, the execution time taken by the processes is less in the proposed ITTPS for cloud computing in Green IT, which is in contrast to the existing Process Schedule based on individual processors pool scenario. The performance graph of the proposed ITTPS for cloud computing in green IT is shown in the fig.4. The variance in the time consumption for executing the group tasks was found to be 30-35% less in the proposed ITTPS for cloud computing than the existing system.

Table 1. No. of Groups vs. Execution time (secs)

No. of Group tasks	Execution Time (secs)	
	Proposed ITTPS for cloud computing	Existing PS based on availability
1	186.7	200.15
2	371.0	625.8
3	4017.0	5287
4	5212.3	8214.3
5	5987.1	8925.6

Table 1. describes the performance of the proposed ITTPS for cloud computing in green IT based on execution time.

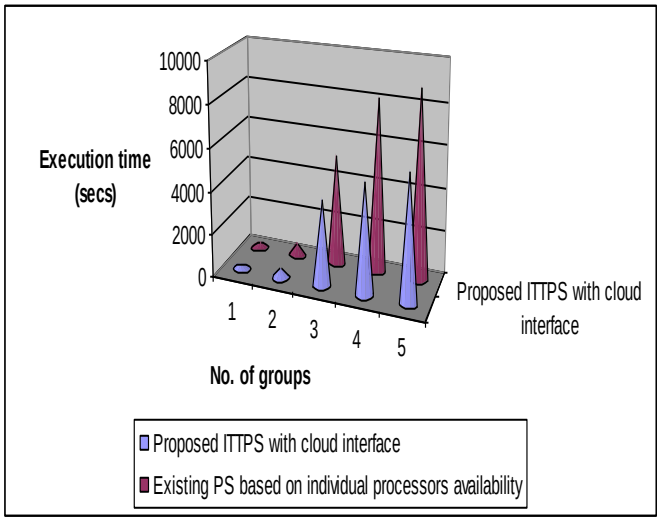

Fig 4: No. of Groups vs. Execution time (secs)

Table 2. describes the memory consumption for performing the group tasks in the cloud computing environment. Since the hybrid pools of processors are maintained under slave cloud, the task processing is efficiently done with less memory consumption. Comparison result of the proposed ITTPS for cloud computing in green IT with an existing Process Schedule based on individual processors availability, measured in terms of Kilobytes (kb). When number of group tasks in the cloud computing environment increases, the consumption of memory for performing the task based on processors available is less in the proposed ITTPS for cloud computing in green IT contrast to an existing Process Schedule based on individual processors availability. The performance graph based on memory consumption of the proposed ITTPS for cloud computing in green IT is shown in the fig.5. The variance in the memory consumption for executing the group tasks would be 25-35% less in the proposed ITTPS for cloud computing compared to existing system.

Table 2. No. of Groups vs. Memory consumption (KB)

No.of Group tasks	Memory Consumption (KB)	
	Proposed ITTPS for cloud computing	Existing PS based on processors availability
1	210.8	360.8
2	424.4	647.9
3	4572.0	5384.3
4	5314.3	8216.2
5	5994.1	8746.9

The above table (table 2) described the performance of the proposed ITTPS for cloud computing in green IT based on memory execution.

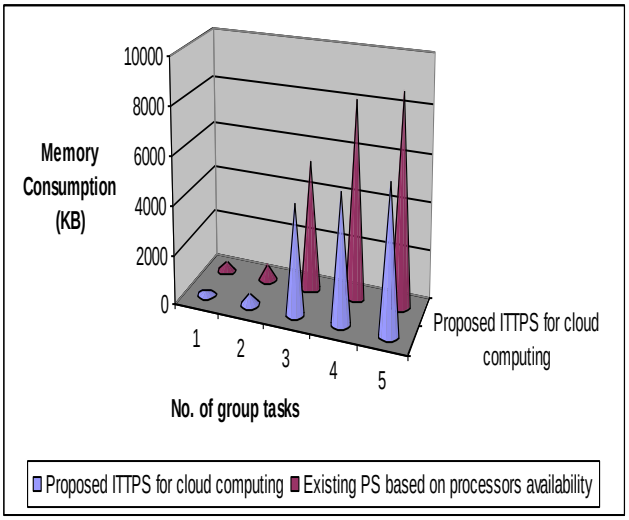

Fig 5: No. of Groups vs. Memory Consumption (KB)

Fig 6. described the performance rate of the proposed ITTPS for cloud computing. When compared to an existing Process schedule based on the individual processors availability, the proposed provided a good performance results since it maintained a hybrid pool of processors under cloud computing environment.

Finally, it is observed that the proposed ITTPS for cloud computing in Green IT outperforms well in terms of Execution time, Memory consumption rate and Performance evaluation. The proposed ITTPS for cloud computing assigned the tasks to the processors based on the process schedule time and processing time. The existing assigned the task to the processor based on its availability, so it is not an appropriate one to make IT as Green IT.

Table 3. No. of Groups vs. Performance rate (%)

No. of Group tasks	Performance Rate (%)	
	Proposed ITTPS for cloud computing	Existing PS based on processors availability
1	15	8
2	26	15
3	34	22
4	62	34
5	75	42

The above table (table 3) described the performance rate of the proposed ITTPS for cloud computing in green IT.

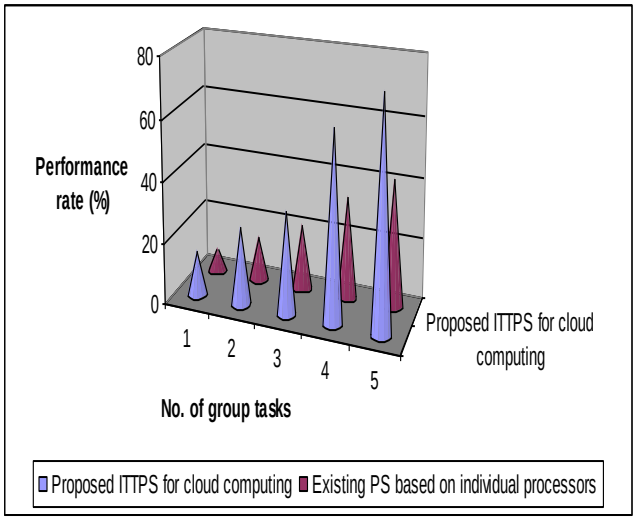

Fig 6: No. of Groups vs. Performance rate (%)

6. CONCLUSION

In this paper, Integrated Time and Task based Process Schedule (ITTPS) has efficiently implemented integration of time and tasks based on processors schedules for constructing cloud computing to fulfill the interoperability and reliability of Information Technology. The hybrid pool of processors are identified and classified as old-range and mid-range processors to bind with high-end processors. Integrated Time and Task based Process schedule for cloud computing in Green IT infrastructure framework is measured with metrics such as Execution time to perform the group task, Memory consumption rate and Performance ratio. Standard users' tasks are taken from users to conduct the performance evaluation of the proposed ITTPS for cloud computing. The results showed that the proposed ITTPS is 75% better in performing the users' tasks based on the processing time and memory consumption rate.

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