An Improved Energy- efficient Virtualized Algorithm for Public Cloud

Lalit Chourasia, Ratan Singh, Shivani Shrivastri

Computer Science and Engineering, RGPM Bhopal, India

Abstract - Cloud computing is an elegance of computing system where immensely scalable Information Technology-enabled proficiencies are delivered 'as a service' using Internet technologies to multiple outdoor clients. Cloud computing can be defined as new computational capabilities that focus on both academia and industry. Cloud computing is the outcome of development and acceptance of current technologies and prototypes. The scheduling objectives are to improve the system's schedule ability for real-time tasks and save energy. One of the important reasons about the extremely high energy consumption in cloud data centers can be attributed to the low utilization of computing resources that incurs a higher volume of energy consumption compared with efficient utilization of resources. The resources with a low utilization still consume an unacceptable amount of energy. Energy conservation is a major concern in cloud computing systems because it can bring several important benefits such as reducing operating costs, increasing system reliability, and prompting environmental protection .To address the issue of scheduling problem in real time system we introduced an improved scheduling algorithm which can also be scalable in cloud computing. Our proposed method also improved the performance of cloud system in real time cloud computing. The experimental result showed the performance and scalability of system in cloud computing.

Keywords: Cloud Computing, Virtualization, real time tasks, energy-aware, scheduling

I. INTRODUCTION

Cloud computing is a prototype for permitting universal, appropriate, on-demand network access. Cloud computing is a style of computing where enormously scalable IT-enabled proficiencies are delivered 'as a service' using Internet technologies to multiple outdoor clients. At its simplest form, cloud computing is the dynamic delivery of information technology resources and capabilities as a service over the Internet. Cloud computing can be defined as new computational capabilities that focus on both academia and industry. Cloud computing is the outcome of development and acceptance of current technologies and prototypes. The cloud computing resources are storage, networks, applications, servers, and services. This cloud computing model is consists of five important features, three service prototypes, and four deployment models [1]. Enormous progression in digital information and data, better broadband conveniences, altering data storage necessities, and Cloud computing led to the appearance of cloud databases.

Cloud computing is a prototype for permitting universal, appropriate, on-demand network access. An essential objective of cloud computing is to make available on-demand access to computational resources such as network, database, applications and platform on pay-as you-go basis alike to the way in which we get services from public usefulness services such as electricity, water, telephony, and gas. This cloud computing model is consists of five important features, three service prototypes, and four deployment models. Cloud computing architecture consists of end users, Internet and cloud providers. The end users can be mobile devices, applications and different computer software's, Internet with high speed, and different cloud service providers. Regardless of the above revealed service models, cloud services can be set up in four ways depending upon the consumers' necessities. Community Cloud, Private Cloud, Hybrid Cloud and Public Cloud.

Cloud computing is the outcome of development and acceptance of current technologies and prototypes. The scheduling objectives are to improve the system's schedule ability for real-time tasks and save energy. One of the important reasons about the extremely high energy consumption in cloud data centers can be attributed to the low utilization of computing resources that incurs a higher volume of energy consumption compared with efficient utilization of resources. The resources with a low utilization still consume an unacceptable amount of energy. Energy conservation is a major concern in cloud computing systems because it can bring several important benefits such as reducing operating costs, increasing system reliability, and prompting environmental protection. To address the issue of scheduling problem in real time system we introduced an improved scheduling algorithm which can also be scalable in cloud computing. Our proposed method also improved the performance of cloud system in real time cloud computing.

The rest of the paper is organized as follows. Section 2 provides the background, related work and literature review relevant for the context. Section 3 provides the proposed methodology, proposed algorithm and description of proposed methodology. Section 4 represents the implementation of proposed methodology, discussion on simulation Results and performance analysis of simulation results. Section 5 concludes the thesis with a summary of the main findings concluding remarks, limitation discussion and an outlook on future research directions.

II. LITERATURE SURVEY

Unfortunately, existing energy-aware scheduling algorithms developed for clouds are not real-time task oriented, thus lacking the ability of guaranteeing system schedule ability. To address this issue, [2] propose in a novel rolling-horizon scheduling architecture for real-time task scheduling in virtualized clouds. Then a task-oriented energy consumption model is given and analyzed. Based on our scheduling architecture, [2] develop a novel energy-aware scheduling

Algorithm named EARH for real-time, a periodic, independent tasks. The EARH employs a rolling-horizon optimization policy and can also be extended to integrate other energy-aware scheduling algorithms. Furthermore, we propose two strategies in terms of resource scaling up and scaling down to make a good trade-off between task's schedule ability and energy conservation. Extensive simulation experiments injecting random synthetic tasks as well as tasks following the last version of the Google cloud trace logs are conducted to validate the superiority of our EARH by comparing it with some baselines. The experimental results show that EARH significantly improves the scheduling quality of others and it is suitable for real-time task scheduling in virtualized clouds.

Green computing and energy conservation in modern distributed computing context are receiving a great deal of attention in the research community and efficient scheduling methods in this issue have been overwhelmingly investigated [3], [4]. In a broad sense, scheduling algorithms can be classified into two categories: static scheduling and dynamic scheduling [5]. Static scheduling algorithms make scheduling decisions before tasks are submitted, and are often applied to schedule periodic tasks [6]. However, periodic tasks whose arrival times are not known a priori must be handled by dynamic scheduling algorithms (see, for example, [7], [8]). In this study, we focus on scheduling periodic and independent real-time tasks.

Chase et al. considered the energy-efficient management issue of homogeneous resources in Internet hosting centers. The proposed approach reduces energy consumption by switching idle servers to power saving modes and is suitable for power-efficient resource allocation at the data center level [9].

Zikos and Karatza proposed a performance and energy-aware scheduling algorithm in cluster environment for compute-intensive jobs with unknown service time [8]. Ge et al. studied distributed performance-directed DVFS scheduling strategies that can make significant energy savings without increasing execution time by varying scheduling granularity [10]. Kim et al. proposed two power-aware scheduling algorithms (space shared and time-shared) for bag-of-tasks real-time applications on DVS-enabled clusters to minimize energy dissipation while meeting applications' deadlines [11]. N_elis et al. investigated the energy saving problem for sporadic constrained-deadline real-time tasks on a fixed number of processors.

The proposed scheduling algorithm is pre-emptive; each process can start to execute on any processor and may migrate at runtime if it gets pre-empted by earlier-dead line processes [12]. It should be noted that these scheduling schemes do not consider resource virtualization, the most important feature of clouds, thus they cannot efficiently improve the resource utilization in clouds.

Nowadays, virtualization technology has become an essential tool to provide resource flexibly for each user and to isolate security and stability issues from other users [13].Therefore, an increasing number of data centers employ the virtualization technology when managing resources. Correspondingly, much energy- efficient scheduling algorithms for virtualized clouds were designed. For example, Liuet al. aimed to reduce energy consumption in virtualized data centers by supporting virtual machine migration and VM placement optimization while reducing the human intervention [13]. Petrucci et al. presented the use of virtualization for consolidation and proposed a dynamic configuration method that takes into account the cost of turning on or off servers to optimize energy management in virtualized server clusters [14]. Bi et al. suggested a dynamic resource provisioning technique for cluster-based virtualized multitier applications. In their approach, a hybrid queuing model was employed to determine the number of VMs at each tier [15].

Verma et al. formulated the power-aware dynamic placement of applications in virtualized heterogeneous systems as continuous optimization, i.e., at each time frame, the VMs placement is optimized to minimize energy consumption and to maximize performance [16]. Beloglazovet al. proposed some heuristics for dynamic adaption of VM allocation at runtime based on the current utilization of resources by applying live migration, switching idle nodes to sleep mode [3]. Goiri et al. presented an energy-efficient and multifaceted scheduling policy, modelling and managing a virtualized data center, in which the allocation of VMs is based on multiple facets to optimize the provider's profit [17]. Wang et al. investigated adaptive model-free approaches for resource allocation and energy management under time-varying workloads and heterogeneous multitier applications, and multiple metrics including throughput, rejection amount, queuing state were considered to design resource adjustment schemes [17]. Graubner et al. proposed an energy-efficient scheduling algorithm that was based on performing live migrations of virtual machines to save energy, and the energy costs of live migrations including pre- and post-processing phases were considered [18].

Unfortunately, to the best of our knowledge, seldom work considers the dynamic energy-efficient scheduling issue for real-time tasks in virtualized clouds. In this study, we focus on the energy-efficient scheduling by rolling-horizon optimization to efficiently guarantee the schedule ability of real time tasks and at the same time striving to save energy by dynamic VMs consolidation.

III. PROPOSED ALGORITHM

Initialize all the server allocation status to AVAILABLE in the state list

Initialize hash map with no entries

While (new request are received by the Intermediate server)

Do

Intermediate server queue the requests

Intermediate server removes a request from the beginning of the queue

If (hash map contain any entry of a server corresponding to the current requesting user

Base && server allocation status == AVAILABLE) then

The server is reallocated to the user base request

Else

Allocate a server to the user base request using Round Robin Algorithm

Allocate data center CPU to every process in round robin fashion, according to given time quantum only for one time.

After completion of step 1 process are arranged in increasing order or their remaining burst time in the ready queue.

New priorities are assigned according to the remaining burst time of processes; the process with shortest remaining burst time is assigned with highest priority.

The processes are executed according to the new priorities based on the remaining bursts time.

Update the entry of the user base and the server in the hash map and the state list

End if

End loop

End

The algorithm steps are as follows.

The list of available servers is stored in AVAILABLE server list. AVAILABLE is an array having list of all initialize data center server. Initialize hash map with no entry in it.

IV. IMPLEMENTATION

Cloud Sim simulator is used as tool for implementing proposed algorithm. Java platform is used for the implementation of the algorithm. Eclipse framework is used for implementation of java programs. Windows operating system is considered good in the security point of view. The simulations performed on Intel PIV machine having a single 3 GHz processor, 2 GB of RAM and two 7200 RPM 500 GB SCSI disks.

Total Energy Consumption (in Joules) of FCFS, Priority, Round Robin, Generalized Priority and Proposed New Hybrid Virtual Machine Scheduling Algorithms in table 1.

From Fig 1.the above results and experiment, we came to know that proposed algorithm is giving highly promising results and is better than the previous algorithm based on tasks.

TABLE 1

FCFS	Priority	Round Robin	Generalized priority	Proposed
133	485	65	219	131
81	228	64	122	74
361	847	153	354	231
237	633	130	221	321
147	393	75	177	141

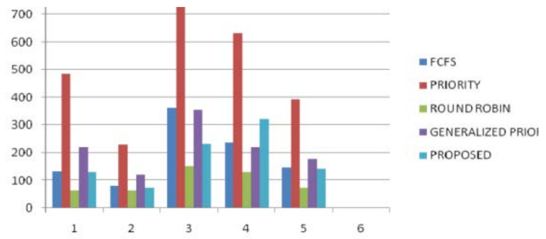

Fig 1

V. CONCLUSION AND FUTURE WORK

Energy conservation is a major concern in cloud computing systems because it can bring several important benefits such as reducing operating costs, increasing system reliability, and prompting environmental protection. The scheduling objectives are to improve the system's schedule ability for real-time tasks and save energy. To address the issue of scheduling problem in real time system we introduced an improved scheduling algorithm which can also be scalable in cloud computing. Our proposed method also improved the performance of cloud system in real time cloud computing. The experimental result showed the performance and scalability of system in cloud computing.

In future work we are planning to implement the algorithm in real public cloud environment. We are also planning to improve the security of public cloud with scheduling with authorization and audit.

REFERENCES

[1] Xiaomin Zhu, Laurence T. Yang, Huangke Chen, Ji Wang, Shu Yin, and Xiaocheng Liu, "Real-Time Tasks Oriented Energy-Aware Scheduling in Virtualized Clouds", IEEE TRANSACTIONS ON CLOUD COMPUTING, VOL. 2, NO. 2, APRIL-JUNE 2014, pp- 168- 180.

[2] R. Buyya, C.S. Yeo, S. Venugopal, J. Broberg, and I. Brandic," Cloud Computing and Emerging IT Platforms: Vision, Hype, and Reality for Delivering Computing as the Fifth Utility," Future Generation Computer Systems, vol. 25, no. 6, pp. 599-616, 2009.

[3] L. Liu, H. Wang, X. Liu, X. Jin, W. He, Q. Wang, and Y. Chen," Green Cloud: A New Architecture for Green Data Center ," Proc. Sixth Int'l Conf. High Performance Distributed Computing(HPDC '08), pp. 29-38, June 2008.

[4] X. Wang, Z. Du, and Yi Chen, "An Adaptive Model-Free Resource and Power Management Approach for Multi-Tier Cloud Environments," The J. Systems and Software, vol. 85, pp. 1135-1146, 2012.

[5] Y.-K. Kwok and I. Ahmad, "Static Scheduling Algorithms for Allocating Directed Task Graphs to Multiprocessors," ACM Computation Survey, vol. 31, no. 4, pp. 406-471, 1999.

[6] X. Qin and H. Jiang, "A Novel Fault-Tolerant Scheduling Algorithm for Precedence Constrained Tasks in Real-Time Heterogeneous Systems," J. Parallel Computing, vol. 32, no. 5, pp. 331-356, 2006.

[7] X. Zhu, C. He, K. Li, and X. Qin, "Adaptive Energy-Efficient Scheduling for Real-Time Tasks on DVS-Enabled Heterogeneous Clusters," J. Parallel and Distributed Computing, vol. 72, pp. 751-763, 2012.

[8] S. Zikos and H.D. Karatza, "Performance and Energy Aware Cluster-Level Scheduling of Compute-Intensive Jobs with Unknown Service Times," Simulation Modelling Practice and Theory, vol. 19,no. 1, pp. 239-250, 2011.

[9] J.S. Chase, D.C. Anderson, P.N. Thakar, A.M. Vahdat , and R.P. Doyle, "Managing Energy and Server Resources in Hosting Centers," Proc. 18th ACM Symp. Operating Systems Principles (SOSP '01), pp. 103-116, Oct. 2001.

[10] R. Ge, X. Feng, and K.W. Cameron, "Performance-Constrained Distributed DVS Scheduling for Scientific Applications on Power-Aware Clusters," Proc. ACM/IEEE Conf. Supercomputing (SC '05),p. 34, Nov. 2005.

[11] K.H. Kim, R. Buyya, and J. Kim, "Power-Aware Scheduling ofBag-of-Tasks Applications with Deadline Constraints on DVS Enabled Clusters," Proc. Seventh IEEE Int'l Symp. Cluster Computing and the Grid (CCGrid '07), pp. 541-548, May 2007.

[12] V. N_elis, J. Goossens, R. Devillers, D. Milojevic, and N. Navet," Power-Aware Real-Time Scheduling upon Identical Multiprocessor Platforms," Proc. IEEE Int'l Conf. Sensor Networks, Ubiquitous, and Trustworthy Computing (SUTC '08), pp. 209-216, June2008.

[13] M. Arm brust, A. Fox, R. Griffith, A.D. Joseph, R.H. Katz, A. Konwinski, G. Lee, D.A. Patterson, A. Rabkin, I. Stoica, and M. Zaharia, "Above the Clouds: A Berkeley View of Cloud Computing," Technical Report UCB/EECS-2009-28 Univ. Of California, Berkeley, 2009.

[14] V. Petrucci, O. Loques, and D. Moss_e, "A Dynamic Configuration Model for Power-Efficient Virtualized Server Clusters," Proc. 11thBrazillian Workshop Real-Time and Embedded Systems (WTR '09), May 2009.

[15] J. Bi, Z. Zhu, R. Tian, and Q. Wang, "Dynamic Provisioning Modeling for Virtualized Multi-Tier Applications in Cloud Data Center," Proc. Third IEEE Int'l Conf. Autonomic Computing (ICAC '06), pp. 15-24, June 2006.

[16] A. Verma, P. Ahuja, and A. Neogi, "p Mapper: Power and Migration Cost Aware Application Placement in Virtualized Systems," Proc. Ninth ACM/IFIP/USENIX Int'l Conf. Middleware (Middleware'08), pp. 243-264, Dec. 2008.

[17] _I. Goiri, J.L. Berral , J.O. Fit_ o, F. Juli _a, R. Nou, J. Guitart, R. Gavald_ a, and J. Torres, "Energy-Effici ent and Multifaceted Resource Management for Profit-Driven Virtualized Data Centers," Future Generation Computer Systems, vol. 28, pp. 718-731, 2012.

[18] P. Graubner , M. Schmidt, and B. Freisleben, "Energy-Efficient Management of Virtual Machines in Eucalyptus," Proc. IEEE Fourth Int'l Conf. Cloud Computing (CLOUD '11), pp. 243-250, 2011.