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A Review on: Task Scheduling in Cloud Computing

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Abstract— Cloud computing is emerging technology in IT domain. The scheduling of the cloud services to the consumers by service providers influences the cost benefit of these computing paradigms. Task scheduling and provision of resources are main problem areas in cloud computing. There are many algorithms like Min-Min, Max-Min, Suffrage, Shortest Cloudlet to Fastest Processor (SCFP), Longest Cloudlet to Fastest Processor (LCFP) and some meta-heuristics like Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Ant-Colony Optimizaion. This survey paper focuses on optimizing the task scheduling algorithms

Keywords— Fuzzy, Cloud, Web service, Evolutionary algorithm

I. INTRODUCTION

Cloud computing is the latest buzzword in the IT industry. It is an emerging computing paradigm with the foundations of grid computing, utility computing, service oriented architecture, virtualization and web 2.0. The user can access all required hardware, software, platform, applications, infrastructure and storage with the ownership of just an Internet connection. A cloud is a type of parallel and distributed system a collection of interconnected and virtualized computer that are dynamically provisioned and presented as one or more unified computing resources based on service level agreements established through negotiation between the service providers and consumers. In this information technology oriented growing market of businesses and organizations, cloud computing is an emerging and attractive alternative to satisfy their day by day increasing needs. It provides virtual resources that are dynamically scalable. It describes virtualized resources, software, platforms, applications, computations and storage to be scalable and provided to users instantly on payment for only what they use [10].

Cloud ecosystem comprises of three main entities: Cloud consumers, cloud service providers, and cloud services. Cloud consumers consume cloud services provided by the cloud service provider. These services may be hosted on the service provider's own infrastructure or on the third party cloud infrastructure providers [11]. Some of the applications of cloud computing are on-line gaming, social networking, scientific applications. One of the key issues in public clouds are that of security and privacy. In public clouds data centers hold end-users data which otherwise would have been stored on their own computers. Hence there is a growing demand of private clouds. A private cloud is one which is owned and operated within the firewalls of an organization. It allows an organization to manage its internal IT infrastructure effectively and provide services to its local users.

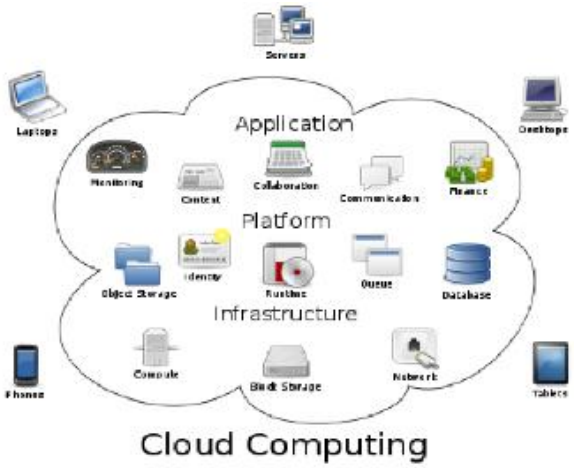

Fig. 1.1: Cloud computing Architecture

II. TASK SCHEDULING

Scheduling refers to the set of policies to control the order of work to be performed by a computer system. Job scheduling is very challenging task in cloud computing because it is parallel and distributed architecture. The job completion time determination is difficult in cloud because the job may be distributed between more than one Virtual machine. Task scheduling and provision of resources are main problem areas in both Grid as well as in cloud computing.

Cloud computing is emerging technology in IT domain. The scheduling of the cloud services to the consumers by service providers influences the cost benefit of these computing paradigms. However, there are so many algorithms are given by various researchers for task scheduling. In 2008, A heuristic method to schedule bag-of-tasks (tasks with short execution time and no dependencies) in a cloud is presented in [12] so that the number of virtual machines to execute all the tasks within the budget, is minimum and the same time speedup. In 2009, Marios D. Dikaiakos and George Pallis realized the concept of organization of Distributed Internet Computing as Public Utility and addressed the several significant problems and unexploited opportunities concerning the deployment, efficient operations and use of cloud computing infrastructures [13]. In 2009, Dr. Sudha and Dr. Jayarani proposed the efficient Two-level scheduler (user centric meta-scheduler for selection of resources and system centric VM schedular for dispatching jobs) in cloud computing environment based on QoS[14]. In 2010, Yujia Ge and Guiyi Wei proposed a new scheduler which makes the scheduling decision by evaluating the entire group of tasks in a job queue. A genetic algorithm is designed as the optimization method for a new scheduler who provides better makespan and better balanced load across all nodes than FIFO and delay scheduling [15]. In 2010, An optimal scheduling policy based on linear programming, to outsource deadline constraint workloads in a hybrid cloud scenario is proposed in [16]. In 2011, Sandeep Tayal proposed an algorithm based on Fuzzy-GA optimization which evaluates the entire group of tasks in a job queue on basis of prediction of execution time of tasks assigned to certain processors and makes the scheduling decision [17]. In 2011, Laiping Zhao, Yizhi Ren & Kouichi Sakurai proposed a DRR (Deadline, Reliability, Resource-aware) scheduling algorithm, which schedules the tasks such that all the jobs can be completed before the deadline, ensuring the Realiability and minimization of resources [18].In 2011, S. Sindhu & Saswati Mukherjee proposed two algorithms for cloud computing environment and compared it with default policy of cloudsim toolkit while considerin

Genetic Algorithm

A **Genetic algorithm (GA)** is a search heuristic that mimics the process of natural evolution. This heuristic is routinely used to generate useful solutions to optimization and search problems. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which generate solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover. However, the appropriate representation of potential solutions is crucial to ensure that the mutation of any pair of individual (i.e. chromosome) will result in new valid and meaningful individual for the problem. An output schedule of tasks is an array list of population (called chromosomes or the genotype of the genome), which encode candidate solutions to an optimization problem, evolves toward better solutions. Time minimization will give profit to service provider and less maintenance cost to the resources. It will also provide benefit to cloud's service users as their application will be executed at reduced cost.

i. Comparison of SGA with MGA

In Standard Genetic Algorithm(SGA) the initial population is generated randomly, so the different schedules are not so much fit, so when these schedules are further mutated with each other, there are very much less chances that they will produce better child than themselves. We have provided an idea for generating initial population by using the Min-Min and Max-Min techniques for Genetic Algorithms. As discussed in Genetic Algorithm; the solutions that are fit, give the better generations further when we apply genetic operators on them and hence if Min-Min and Max-Min will be used for the individual generation, we will get the better initial population and further the better solutions than in the case of Standard Genetic Algorithm in which initial population is chosen randomly.

ii. Benefits of MGA with SGA

It can be observed that the Make-span of the Modified Genetic Algorithm (MGA) is less than that of Standard Genetic Algorithm (SGA). So the new Modified Genetic Algorithm can help in reducing overall execution time of the tasks and in proper utilization of resources.

iii. Benchmarks

- **Initial Population:** It is the set of all the individuals that are used in the genetic algorithm to find out the optimal solution. Every solution in the population is called as an individual. And every individual is represented as a chromosome for making it suitable for the genetic operations. From the initial population the individuals are selected and some operations are applied on those to form the next generation. The mating chromosomes are selected based on some specific criteria
- **Fitness Function:** A fitness function is used to measure the quality of the individuals in the population according to the given optimization objective. The fitness function can be different for different cases. In some cases the fitness function can be based on deadline, while in cases it can be based on budget constraints.

III. CLOUD COMPUTING SERVICE MODELS

In Cloud Computing the term Cloud is used for the service provider, which holds all types of resources for storage, computing etc. Mainly three types of services are provided by the cloud. First is Infrastructure as a Service (IaaS), which provides cloud users the infrastructure for various purposes like the storage system and computation resources. Second is Platform as a Service (PaaS), which provides the platform to the clients so that they can make their applications on this platform. Third is Software as a Service (SaaS), which provides the software to the users; so users don't need to install the software on their own machines and they can use the software directly from the cloud. Due to the wide range of facilities provided by the cloud computing, the Cloud Computing is becoming the need of the IT industries. The services of the Cloud are provided through the Internet. The devices that want to access the services of the Cloud should have the Internet accessing capability. Devices need to have very less memory, a very light operating system and browser. Cloud

Computing provides many benefits: it results in cost savings because there is no need of initial installation of much resource; it provides scalability and flexibility, the users can increase or decrease the number of services as per requirement; maintenance cost is very less because all the resources are managed by the Cloud providers.

IV. CLOUD COMPUTING CHARACTERISTICS

- On demand self services: computer services such as email, applications, network or server service can be provided without requiring human interaction with each service provider. Cloud service providers providing on demand self services include Amazon Web Services (AWS), Microsoft, Google, IBM and Salesforce.com. New York Times and NASDAQ are examples of companies using AWS (NIST). Gartner describes this characteristic as service based.
- Broad network access: Cloud Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms such as mobile phones, laptops and PDAs.
- Resource pooling: The provider's computing resources are pooled together to serve multiple consumers using multiple-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. The resources include among others storage, processing, memory, network bandwidth, virtual machines and email services. The pooling together of the resource builds economies of scale (Gartner).
- Rapid elasticity: Cloud services can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

V. PROBLEM AREAS IN CLOUD COMPUTING

- Security: Security issues faced by cloud providers (organizations providing software, platform, or infrastructure as a service via the cloud) and security issues faced by their customers.
- Fault Tolerance: The increasing popularity of Cloud computing as an attractive alternative to classic information processing systems has increased the importance of its correct and continuous operation even in the presence of faulty components.
- Resource Discovery: Cloud computing is an emerging field in computer science. Users are utilizing less of their own existing resources, while increasing usage of cloud resources. With the emergence of new technologies such as mobile devices, these devices are usually under-utilized, and can provide similar functionality to a cloud provided they are properly configured and managed. Resource discovery and allocation is critical in designing an efficient and practical distributed cloud.
- Load Balancing: Cloud Computing is an emerging computing paradigm. It aims to share data, calculations, and service transparently over a scalable network of nodes. Since Cloud computing stores the data and disseminated resources in the open environment. So, the amount of data storage increases quickly.
- Task Scheduling: Task scheduling and provision of resources are main problem areas in both Grid as well as in cloud computing. Cloud computing is emerging technology in IT domain. The scheduling of the cloud services to the consumers by service providers influences the cost benefit of these computing paradigms.

VI. RELATED WORK

The various approaches and filtering technique used to restore an image are described below:

A. Host scheduling algorithm using genetic algorithm in cloud Computing environment

Tarun goyal & aakanksha agrawal[1][2013] describe cloud computing as a paradigm in which it (information technology) application provide as a service. Cloud computing allows users to utilize the computation, storage, data and services from around the world in commercialize manner. In cloud environment, scheduling is the major issue. Scheduling is responsible efficient utilization of the resources. In this paper, a scheduling model based on minimum network delay using suffrage heuristic coupled with genetic algorithms for scheduling sets of independent jobs algorithm is proposed, the objective is to minimize the make span.

B. An efficient approach for task scheduling based on multi-objective genetic algorithm in Cloud computing environment [2014]

Sourabh budhiraj et. Al. [2] [2014] explain cloud computing represents supplement, consumption and delivery model for IT services that are based on internet on pay as per usage basis. Its ability to reduce cost associated with computing while increasing flexibility and scalability for computer process has proved to be a great advantage. The scheduling of the cloud services to the consumers by service providers influences the cost benefit of this computing paradigm. In such a scenario, tasks should be scheduled efficiently such that the execution cost and time can be reduced. In this paper, we proposed an efficient approach for task scheduling based on multi- objective genetic algorithm (moga) which minimizes execution time and execution cost as well. For task scheduling, a multi-objective genetic algorithm is implemented and the research is focused on crossover operators, mutation operators, selection operators and the pareto solutions method. The experimental results show that the proposed algorithm can obtain a better solution.

C. Dynamic scheduling of data using genetic algorithm in cloud computing[2013]

A.kaleeswaran et. Al. [3] [2013] depict cloud computing is the utilization of pool of resources for remote users through internet that can be easily accessible, scalable and utilization of resources. To attain maximum utilization of resources the tasks need to be scheduled. The problem in scheduling is allocating the correct resources to the arrived tasks. Dynamic scheduling is that the task arrival is uncertain at run time and allocating resources are tedious as several tasks arrive at the same time. To avoid this scheduling problem, genetic algorithm is used. Genetic algorithm is a heuristic method that deals with the natural selection of solution from all possible solutions. Using genetic algorithm the tasks are scheduled according to the computation and memory usage. The tasks are scheduled dynamically. The execution time is reduced by parallel processing. The scheduled data is stored in cloud. By using ga we obtain global optimization.

D. A study on strategic provisioning of cloud computing services[2014]

Md whaiduzzaman et. Al. [4][2014] illustrate **c**loud computing is currently emerging as an ever-changing, growing paradigm that models "everything-as-a-service." Virtualised physical resources, infrastructure, and applications are supplied by service provisioning in the cloud. The evolution in the adoption of cloud computing is driven by clear and distinct promising features for both cloud users and cloud providers. However, the increasing number of cloud providers and the variety of service offerings have made it difficult for the customers to choose the best services. By employing successful service provisioning, the essential services required by customers, such as agility and availability, pricing, security and trust, and user metrics can be guaranteed by service provisioning.hence, continuous service provisioning that satisfies the user requirements is amandatory feature for the cloud user and vitally important in cloud computing service offerings. Therefore, we aim to review the state-of-the-art service provisioning objectives, essential services, topologies, user requirements, necessary metrics, and pricing mechanisms.we synthesize and summarize different provision techniques, approaches, and models through a comprehensive literature review. A thematic taxonomy of cloud service provisioning is presented after the systematic review. Finally, future research directions and open research issues are identified.

E. Scheduling in hybrid clouds

Luiz f. Bittencourt et. Al. [5] uses concept of schedulers to determine on which processing resource jobs of a workflow should be allocated. In hybrid clouds, jobs can be allocated either on a private cloud or on a public cloud on a pay per use basis. The capacity of the communication channels connecting these two types of resources impact the makespan and the cost of workflows execution. This paper introduces the scheduling problem in hybrid clouds presenting the main characteristics to be considered when scheduling workflows, as well as a brief survey of some of the scheduling algorithms used in these systems. To assess the influence of communication channels on job allocation, we compare and evaluate the impact of the available bandwidth on the performance of some of the scheduling algorithms.

VI. SUMMARY OF FILTERING TECHNIQUE

SUMMARY OF VARIOUS FILTERING METHODS

In the following Table, contains all task scheduling methods that are explained previously.

Table 1 Task Scheduling Methods used previously

RESEARCHER	METHOD	BASED ON	FINDINGS
Tarun goyal & aakanksha agrawal[1][2013]	Host Scheduling Algorithm	Genetic Algorithm	A scheduling model based on minimum network delay using suffrage heuristic coupled with genetic algorithms for scheduling sets of independent jobs algorithm is proposed, the objective is to minimize the make span.
Sourabh budhiraj et. Al. [2] [2014]	Task Scheduling	Objective Genetic Algorithm	For task scheduling, a multi-objective genetic algorithm is implemented and the research is focused on crossover operators, mutation operators, selection operators and the pareto solutions method. The experimental results show that the proposed algorithm can obtain a better solution.
A.kaleeswaran et. Al. [3] [2013]	Dynamic Scheduling Of Data	Genetic Algorithm	Using genetic algorithm the tasks are scheduled according to the computation and memory usage. The tasks are scheduled dynamically. The execution time is reduced by parallel processing. The scheduled data is stored in cloud. By using ga we obtain global optimization.

Md whaiduzzaman et. Al. [4][2014]	Strategic Provisioning	Service Provisioning	We aim to review the state-of-the-art service provisioning objectives, essential services, topologies, user requirements, necessary metrics, and pricing mechanisms.we synthesize and summarize different provision techniques, approaches, and models through a comprehensive literature review. A thematic taxonomy of cloud service provisioning is presented after the systematic review.
Luiz f. Bittencourt et. Al. [5]	Scheduling In Hybrid Clouds	Concept Of Schedulers	This paper introduces the scheduling problem in hybrid clouds presenting the main characteristics to be considered when scheduling workflows, as well as a brief survey of some of the scheduling algorithms used in these systems.

VIII. CONCLUSION

Task Scheduling in cloud computing is used to organize jobs according to availability of resources. Multiple techniques have been used by various researchers before. Our main emphasis is on Genetic scheduling. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which generate solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover SGA(Standard Genetic Algorithem) was used before for allocation of jobs. Because of simplicity of SGA algo, MGA(Modified Genetic Algorithm) is used. Better results are provided by MGA as compared to SGA. Eg. Make-span of the Modified Genetic Algorithm (MGA) is less than that of Standard Genetic Algorithm (SGA).

REFERENCES

[1] Tarun Goyal & Aakanksha Agrawal., "*Host Scheduling Algorithm Using Genetic Algorithm In Cloud Computing Environment*", International Journal Of Research In Engineering & Technology (Ijret), Impact Journals. Vol. 1, Issue 1, June 2013, 7-12.

[2] Sourabh Budhiraja, Dr. Dheerendra Singh, "*An Efficient Approach for Task Scheduling Based on Multi-Objective Genetic Algorithm in Cloud Computing Environment*", IJCSC VOL. 5, number 2 july-sept 2014 pp. 110-115.

[3] A.Kaleeswaran, V.Ramasamy, P.Vivekanandan.,"*Dynamic Scheduling Of Data Using Genetic Algorithm In Cloud Computing*", International Journal Of Advances In Engineering & Technology, Jan. 2013. 2231-1963.

[4] Md. Whaiduzzaman, Mohammad nazmul haque, Md rejaul karim chowdhury, and Abdullah gani., "*A Study On Strategic Provisioning Of Cloud Computing Services*", Hindawi Publishing Corporation, E Scientific World Journal Volume 2014, article id 894362, 16 pages. Http://dx.doi.org/10.1155/2014/894362

[5] Luiz F. Bittencourt, , Edmundo R. M. Madeira, and Nelson L. S. Da Fonseca, "*Scheduling In Hybrid Clouds*", Institute of Computing – University of Campinas – UNICAMP, Campinas – S˜ao Paulo – Brazil, 13083-852.

[6] Verma R., Dhingra S., " *Genetic Algorithm for Multiprocessor T ask Scheduling*", IJCSMS International Journal of Computer Science and Management Studies, Vol.1, Issue 02, pp. 181-185, 2011

[7] Loukopoulos T., Lampsas P., Sigalas P., "*Improved Genetic Algorithms and List Scheduling Techniques for Independent Task Scheduling in Distributed Systems*", IEEE, Eighth International Conference on Parallel and Distributed Computing, Applications and Technologies, Adelaide, SA, pp. 67-74, 2007

[8] Zhao C., Zhang S., Liu Q., Xie J., Hu J., "*Independent Tasks Scheduling Based on Genetic Algorithm in Cloud Computing*", IEEE 5th International Conference on Wireless Communications, Networking and Mobile Computing WiCom '09, Beijing, pp.1-4, 2009

[9] Abdulal W., Jadaan O.A., Jabas A., Ramachandram S., " *Genetic Algorithm for Grid Scheduling using Best Rank Power*", IEEE World Congress on Nature & Biologically Inspired Computing, 2009. NaBIC 2009, Coimbatore, pp. 181-186, 2009

[10] Kaur, P.D., Chana, I. ―Unfolding the distributed computing paradigm‖ ,In: International Conference on Advances in Computer Engineering, pp. 339-342 (2010)

[11] Mei, L., Chan, W.K., Tse, T.H., ―A Tale of Clouds: Paradigm Comparisons and Some Thoughts on Research Issues‖, In: APSCC 2008, pp. 464-469 (2008)

[12] http://code.google.com/appengine

[13] Dikaiakos, M., katsaros, D., Mehra, P., Vakali, A.: ―Cloud Computing: Distributed Internet Computing for IT and Scientific Research‖. In:IEEE Transactions on Internet Computing 13(5), pp. 10-13 (2009)

[14] Sadhasivam, S.,Nagaveni, N.: ―Design and Implementation of an efficient Two-level Scheduler for Cloud Computing Environment‖. In: International Conference on Advances in Recent Technologies in Communication and Computing, pp. 884-886 (IEEE 2009)

[15] Van den Bossche, R., Vanmechelen, K., Broeckhove, J.: ―Cost Optimal Scheduling in Hybrid IaaS Clouds for Deadline Constrained Workloads. In: 3rd IEEE International Conference on Cloud Computing, Miami (July 2010)

[16] Tayal, S.: ―Tasks Scheduling Optimization for the Cloud Computing Systems‖. In: (IJAEST) International Journal of Advanced Engineering Sciences and Technologies, vol. 5, Issue No.2, pp. 111-115 (2011)

[17] Ge, Y., Wei, G.: ―GA-Based Task Schedular for the Cloud Computing Systems‖. In: IEEE International Conference on Web Information Systems and Mining, pp 181-186, WISM.2010.87 (2010)

[18] Zhao, L., Ren, Y., Sakurai, K.: ―A Resource Minimizing Scheduling Algorithm with Ensuring the Deadline and Reliability in Heterogeneous Systems‖. In: International Conference on Advance Information Networking and Applications, AINA.(IEEE 2011)

[19] Sindhu, S., Mukherjee S.: ―Efficient Task Scheduling Algorithms for Cloud Computing Environment‖. In: International Conference on High Performance Architecture and Grid Computing (HPAGC-2011), vol 169, pp 79-83 (2011)

[20] Rodrigo N. Calheiros, Rajiv Ranjan, Anton Beloglazov, Cesar A. F. De Rose, and Rajkumar Buyya, CloudSim: A Toolkit for Modeling and Simulation of Cloud Computing Environments and Evaluation of Resource Provisioning Algorithms, Software: Practice and Experience (SPE), Volume 41, Number 1, Pages: 23-50, ISSN: 0038-0644, Wiley Press, New York, USA, January, 2011.

