

Task Scheduling and Resource Optimization in Cloud Computing Using Deadline-Aware Particle Swarm Technique: A Review

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Abstract- Cloud computing is defined as that type of computing that relies on *sharing computing resources* rather than having local servers or personal devices to handle applications. Cloud computing is used to achieve coherence and economy of scale over a network. Basically, cloud computing is a general term for the delivery of hosted services over the internet. Various characteristics which comes under cloud computing includes its location independent, multi-tenancy, its reliability and security, and its on-demand self service etc. Cloud Computing is spreading through IT world with innovative start-ups. Companies in the financial sector are also adopting cloud computing for specific workloads. Various strategies are used for optimization in cloud computing in which particle swarm optimization is one of them. It is used to achieve task scheduling algorithm. To achieve better results and performance, we used Particle Swarm Optimization.

Keyword- Cloud computing, architecture, scheduling, computing in IT sector, Particle Swarm Optimization

1. INTRODUCTION

Nowadays, to manage the cost and performance of the resources with its increasing demand, we used cloud computing. Cloud computing is also known as on-demand computing. It provides resources and data to computers and other devices on demand. Moreover, it provide users with various capabilities to store and process the data. By using cloud computing, we eliminate all our problems because we are not required to manage any hardware and software. It works as a utility i.e. we just only have to pay for what we need. All the upgrades are automatic and scaling up or down is easy. It provides three service models which are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Software as a service allows users to connect and use cloud-based apps over the Internet. Platform as a service provides the platform for developing applications and services and it is a cloud computing model that delivers applications over the Internet. Infrastructure as a Service provides the underlying operating systems, security, networking, and servers for developing applications and services and for deploying development tools and databases etc. Various advantages to use cloud computing includes its broad network accessing, rapid elasticity, disaster recovery and resource pooling etc. There are many real time scenarios in which cloud computing is used such as Email Communication, software development, law firms and in hospitals etc.

1.1 SERVICE MODELS OF CLOUD COMPUTING

The cloud-computing providers offer their services to different models. Among all models, three models are widely used in cloud computing. These models are:-

- i) Software as a Service (SaaS):** Software as a service (SaaS) allows users to connect and use cloud-based apps over the Internet. Common examples are email and industry applications. SaaS is a software distribution model in which a third-party provider hosts applications and makes them available to customers over the Internet.
- ii) Platform as a Service (PaaS):** Platform as a Service is the next step down from Software as a Service in the Cloud Computing Stack. It provides the platform for developing applications and services. It is a cloud computing model that delivers applications over the Internet.
- iii) Infrastructure as a Service (IaaS):** Infrastructure as a Service (IaaS) is a form of cloud computing that provides virtualized computing resources over the Internet. Instead of ready-made applications or services, IaaS provides the underlying operating systems, security, networking, and servers for developing such applications and services and for deploying development tools and databases etc.

2. CLOUD COMPUTING IN COMPANIES

Cloud Computing is spreading through IT world with innovative start-ups. Companies in the financial sector are also adopting cloud computing for specific workloads. Here are some companies which are using the concept of cloud computing:

Amazon is the most comprehensive cloud offering in the world. Its offerings range from compute, network, storage, and backup to software like DevOps and database. Its cloud offers services includes the Elastic Compute Cloud for computing capacity and the Simple Storage Service for on-demand storage capacity. Amazon is one of the true innovators in Web-based computing. In addition to this, it offers the SimpleDB (a database Web service); the CloudFront (a Web service for content delivery); and the Simple Queue Service (a hosted service for storing messages as they travel between computers).

Microsoft has embraced the cloud with a full on-demand service. Azure, a Windows-as-a-service platform consisting of the operating system and developer services that can be used to build and enhance Web-hosted applications. Microsoft also provides a set of business services over the Web including Exchange, SharePoint, Office Communications Server, and Live Meeting. Software companies Epicor, S3Edge and Micro Focus are among the early customers using Azure to develop cloud apps.

NetSuite is one of the industry's most successful online business software providers. It has a tendency to make competitive moves that are both entertaining and potentially profitable for customers. Thousands of small business and enterprise customers worldwide including Wolfgang Puck Coffee, Wrigleyville Sports and Isuzu uses this service. NetSuite offers cloud-based ERP, CRM and e-commerce applications for small businesses. It has been acquired by Oracle.

Google Cloud Platform is running third in the race for cloud market share. Google Apps is a set of online office productivity tools which includes e-mail, word processing and a simple Web site creation tool. Google App Engine, a platform-as-a-service offering that lets developers build applications and host them on Google's infrastructure. It provides a credible alternative in the platform-as-a-service market.

AT&T's foray into the cloud began in 2006. It is an application service provider with enterprise customers in more than 30 countries. AT&T combined USi technology's five "super Internet Data Centers" in the United States, Europe and Asia, which will act as regional gateways to the AT&T cloud network. Its cloud offers Synaptic Hosting, an application hosting service and storage integrated with security and networking functions.

Enomaly Its Elastic Computing Platform (ECP) is software that integrates enterprise data centers with commercial cloud computing offerings, letting IT pros manage and govern both internal and external resources from a single console, while making it easy to move virtual machines from one data center to another. Enomaly doesn't offer services of its own over the Web. But its software can manage the problem of computing resources that live both inside and outside the firewall.

GoGrid (a division of ServePath) is a platform which offers Web-based storage and the ability to quickly deploy Windows- and Linux-based virtual servers onto the cloud, with preinstalled software including Apache, PHP, Microsoft SQL and MySQL. Mostly start-ups, Web 2.0 and SaaS companies uses this service.

RightScale uses software-as-a-service that helps the customers to manage the IT processes they have outsourced to cloud providers such as Amazon and GoGrid. It helps the customers to build and clone virtual servers for the cloud and performs load Balancing.

Table-1 Comparative Study of companies which uses Cloud Computing

S. No.	Company Name	Cloud Offering	Who uses the service
1.	Amazon	Amazon Web Services includes the Elastic Compute Cloud for on-demand storage capacity.	Small businesses, enterprises and individual users.
2.	Microsoft	Azure, which consists of operating system and developer services that can be used to build and enhance Web-hosted applications.	Software companies like Epicor, S3Edge and Micro Focus.
3.	NetSuite	A business software suite including e-commerce, CRM, accounting and ERP tools.	Thousands of small business and enterprise customers worldwide.
4.	Google Cloud Platform	Online office productivity tools including e-mail, calendaring, word processing.	Small businesses, enterprises and colleges.

5.	AT&T	Synaptic Hosting with security and networking functions.	Official Web site of the U.S. Olympic Committee.
6.	Enomaly	Integrates enterprise data centers with commercial cloud computing offerings.	More than two dozen customers including Business Objects, France Telecom, the Canadian government, and several universities.
7.	GoGrid	Offers Web-based storage with preinstalled software including Apache, PHP, Microsoft SQL and MySQL.	Mostly start-ups, Web 2.0 and SaaS companies.
8.	RightScale	Uses Software-as-a-service (SAAS)	Social networking vendors and other companies.

3. RELATED WORK

Many scheduling algorithms were designed so as to get the proper utilization of resources. These algorithms are described as below:

In [2], Zhi et al. tells the adaptive particle swarm optimization to improve the performance of PSO. In this, the learning technique is used to control the inertia weight, acceleration coefficients and other algorithm parameters which is used to provide better performance. This proposed approach was compared with other algorithms and results prove that this algorithm is well suited for the improvement of ordinary particle swarm optimization.

In [7], Azadi Khalili proposed a hybrid Particle Swarm Optimization (PSO) for scheduling in cloud. This type of optimization gives better results as compared to Max Min Scheduling. When tasks increases, then the average schedule length of hybrid PSO was reduced from 4.6 to 4.8% than Max Min Scheduling whose range is 2.4 to 3.4%.

In [6], Salman proposed the particle swarm optimization algorithm for task assignment and the results are then compared with other heuristic algorithms. Several other parameters such as speed, cost, efficiency and throughput etc. were also compared with other strategies. The results shows that the algorithm is much suitable for task assignment problem.

In [4], Nuttapon Netjindra et al. provided a different framework in which the number of purchased instance, purchasing option and their scheduling were considered within an optimized process. For this, they considered Particle Swarm Optimization (PSO) technique. They used this technique for cloud provisioning cost optimization. Its mechanism was to allow the generated particles to move around and at each iteration, the position of particle would be updated.

In [5], BU Yanping provided an improved Particle Swarm Optimization. He tested this algorithm against the MaxMin Heuristic and the results prove that this algorithm increased the performance of the system. Its main motive was to find the best strategy for task scheduling. He also consider other

factors such as to reduce the complexity of implementation and to minimize the computational burden.

In [3], Xingquan Zuo et al. [14] established an integer programming model which is used for the allocation of resource problem of an IaaS cloud in a hybrid cloud environment. For this problem, a self-adaptive learning PSO (SLPSO) is used which is based on the scheduling approach. In SLPSO, each dimension of a particle denotes a task and particle as a whole represents the priorities of tasks. This approach gives high quality scheduling solutions. Its main objective was to find the high quality scheduling policy and this can only be achieved by updating the position of particle using self-adaptive learning algorithm.

In [8], a particle swarm optimization algorithm is used to solve the task assignment problem in grid computing. Its main aim is to minimize the completion time of tasks. Its results shows that this strategy gives better results when compared with genetic algorithm. The experiment was studied under different parameters such as time, speed and cost. The results shows that this algorithm is best suited for task assignment under grid computing.

In [9], the Particle Swarm Optimization is used to assign tasks to resources. In this, he used position rule which converts continuous optimization technique to small position. This results prove that the PSO is suitable for cloud computing. He also describes an algorithm which can able to reduce the computational cost and the algorithm is given by using particle swarm optimization. This algorithm gives optimal solution and its convergence property is fast.

In [10], ChienHung Chen et al. studied the Deadline Constrained Map Reduce Scheduling (DCMRS) problem in heterogeneous cloud computing systems. Its main objective was to divide a job deadline into two sub deadlines: map and reduce deadlines. Then, the sub-deadlines were used for finding appropriate slots which is used to run the task. They also presented a heuristic algorithm involving the node group technique which is used to decrease the computational time.

In [12], Himani et al. introduced a soft real time scheduling approach having cost constraints and deadline constraints.

They illustrates that earlier approaches are not able to meet the deadline efficiently. Therefore, they introduced a deadline-meeting methodology which is used to schedule tasks over a cloud and reduce the number of missed deadline. The results shows that the given approaches was more effective in defined parameters such as Task Profit, Task Penalty and Provider profit etc.

In [1], Dr. M. Sridhar et al. introduced hybrid Particle Swarm Optimization (PSO) for scheduling in cloud. In this, the best values of parameters are determined experimentally. Then the algorithms with the number of tasks (varying from 100 to 1000) were evaluated. The results shows that the algorithm achieves better resource utilization.

In [11], a modified PSO algorithm is used to reduce the execution time and computational cost. The experiments are evaluated under different parameters i.e. time, speed and efficiency. The results shows that modified PSO is better than ordinary PSO. The ordinary PSO was not able to provide optimal solution. By modifying the algorithm, the results gives optimal solution and fast convergence.

4. CONCLUSION AND FUTURE SCOPE

Cloud computing is one of the most talked about IT trends today. This is because cloud computing has helped several enterprises to save money and provides good results. This paper deals with various policy and strategies for scheduling the task in cloud computing. In the future, we will work on modifying the particle swarm intelligence algorithm so as to maximize the value of profit and to get better efficiency and results.

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