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# A PRIORITY-BASED HEURISTIC TASK SCHEDULING FOR OPTIMIZED CLOUD SCHEDULING USING ANT COLONY OPTIMIZATION AND PARTICLE SWARM OPTIMIZATION ALGORITHM

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**Abstract:**

These days, computing environments are undergoing permanent changes in the software production process. It is mainly due to competition between environments to reduce costs and wages in the production process. Provide customer satisfaction for the dynamic handling of customer orders to achieve mass production in a short period. However, resource allocation in the field of computing is a dynamic activity that needs to be changed based on manufacturing needs. In developing countries such as World, there is no proper understanding of efficient computing methods that can simultaneously meet the needs of users, suppliers, and customers. It mainly due to the communication gap between different stakeholder groups, which helps to manage services efficiently in a computing environment. Cloud Service Provider (CSP), there are more than 50 million CSP in World spread across the country. CSP account for fifty percent of worldwide industrial production and forty percent of all exports. Determining the responsibilities of many CSP is crucial because it affects work costs and time off. In this question, the primary goal of this work is to provide optimal and dynamic resource allocation in cloud-based computing. Workflow analysis on various algorithms such as Ant Colony Optimization(ACO), Differential Evolution Algorithm (DEA), Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Hybridization of the above algorithms (ADGP). In the proposed multipurpose scheduling methods, the ADGP algorithm performs better than all other proposed algorithms during resource response. This algorithm found to be superior to selected two hundred sources and thousands of tasks.

**Keywords:** *Cloud Scheduling, Cloud Service Provider, Ant Colony Optimization, Genetic Algorithm, Particle Swarm Optimization*

## Introduction

Cloud computing is a new computing model that provides customers with new demand, reliability, and usability-based services. Across corporate boundaries by adopting and using cloud services for IT-related tasks. There are two approaches to cloud computing, customer view, and provider view. According to consumers, cloud computing is the model to pay for services over the Internet. Automated services are stored on multiple virtualized servers across multiple computing nodes, depending on the provider's view. This model provides access to services such as platforms, infrastructure, and software without having to invest in hardware and software.In addition to investing, data backup, service upgrade, and maintenance, users can lease via the Internet because everything is now the responsibility of hosting the provider.

Now, cloud concepts and software are becoming more common among a Software-as-a-Service (SaaS) user. It mainly involves capital and labor costs, reduced operating costs, rapid product development, cost savings, and the ability to adapt to new or additional resources. Many computing programs have shifted from centralization to integrated operations due to the globalization of sophisticated computing models and technology. Currently, new technologies such as the Internet, IoT, service-based computing, and data analytics support the computing environment. Integrated with computing assets such as equipment, ships, and facilities. The use of IT-related ideas and smart technologies enables the computing environment from a product-driven service-oriented model. Computing environments use new IT processes to improve core competencies in the business. Internet of Things (IoT), Network Computing, Service Oriented Concepts (SOA), Computing Grid (C-Grid), Virtualization, and Other Advanced Computing Technologies. The SOA are technological advances, from traditional manufacturing to service-oriented concepts in computing. They provide web-based services that facilitate the virtualization of computing environments. This concept allows for effective communication with services through available interfaces and protocols.C-Gridconcept is the application of grid computing for the integration, allocation, management, and scheduling of computing resources. C-Grid is similar to NC, but its support for integrated technologies, standards, protocols, and platforms differs from. C-Grid uses all computing resources to manage multiple locations, partners, and organizations to allow users to access Internet services. Innovative computing technologies such as these promote faster, more efficient, quality, and lower-cost products.

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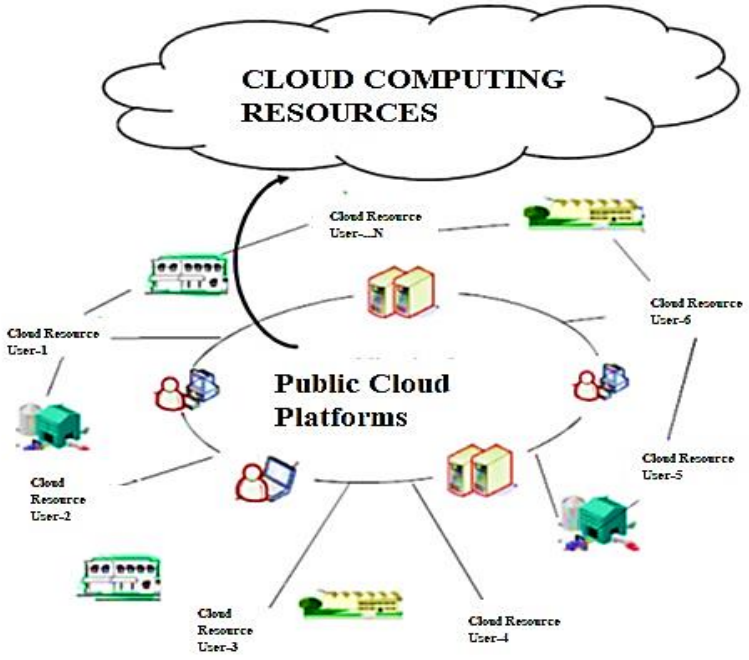


Figure 1: Cloud computing environment with sources from ISPs.

Cloud-based companies use a combination of electronic commerce, including Internet marketing, to promote independent research. It is the underlying technology used by the Internet to integrate mobile technologies, networks, communication technologies, and the Internet of Things. Virtual Cloud Intelligent Scheduling functions that are part of Intelligent Computing used to schedule the enterprise computing process. This type of scheduling and production resources managed on a real demand basis. It allows customers to ensure performance-less waste, time, and time with resources. Scheduling a job in cloud computing is a complicated task. Decision-making plays a vital role in the speed of product development in the computing industries. Some standard scheduling rules included in the schedule includeEarliest Due Date (EDD), First in First out (FIFO), Shortest Job First (SJF), Slack Time Remaining (STR), Smallest Position Valve (SPV). Tasks are arranged based on the selected scheduling processin the calculation of defined goals. In addition to standard job scheduling procedures, the Special Job Shop Problem (JSP),Open Job Shop Problem (JSP) is the combined flow operations schedule. It is named the Hybrid Flow shop scheduling problem.

**Literature Review**

Cloud computing is a new manifestation of existing ideas. It involves integrating existing components through the virtualization of resources and services. The business model is used to access resources from the shared pool tailored to the user through service provider intervention. In different sources, users can access the configured resources according to their needs. From cloud-hosted resources to virtual machines, each VM handles multiple instances of the same source. The term cloud computing became famous in 2007. However, the use and distribution of

computing services through the global network began in the early 1960s. Cloud is used to deliver services over the Internet using current and popular concepts such as cloud computing, utility computing, virtualization concept, and service-oriented architecture[1]. Although Grid and Cloud share some standard capabilities, there are some differences between the two. Among them, one big difference is that the cloud solves scalability issues in its vast collection of different computing resources. However, the grid is suitable for large-scale computing problems in the resources allocated to that problem by Bohm et al,. Chunjieet al., proposed a cloud rank-d based benchmarking and ranking methodology for implementing big data applications[2].

Cloud computing technology is an integral part of public sector reforms in how governments work, communicate with citizens, share information, and serve customers. Many governments have begun working on projects related to cloud computing. Changing costs, promoting economic growth, increasing transparency and accountability, improving service delivery, improving public governance, reducing costs, e-Society , and various challenges to e-government in Ramon 2016). Electronic business development companies provide a viable solution for the development of the global digital economy by utilizing cloud-based technology[3]. Specific parameters used to gather feedback from essential people using some influencing factors. Vital implementations have introduced various ways to effectively use IT innovations to deliver government services to address public-related issues. The primary goal is to change the traditional service model "bridge" approach. Citizens must be able to pull services in a "push" model that hierarchically provides services based on preferences, needs, circumstances, and citizens' position[4].

Recently, cloud-based technologies have become increasingly important in the health care industry. Cloud used in the study of genetics, metabolism, and proteomics, also known as "omics." The health support system for H1N1 patients developed with cloud computing provides improved QS, cost reduction, and flexibility. A structure for identifying H1N1 infected individuals. To control the rate of infection. The system developed on Amazon EC2 instances provides 94 percent accuracy and 81 percent resource utilization[5]. Although there is some significance to the use of e-health, its full potential not yet identified. Temporary health workers use cloud-derived results to track patient data from remote health based on the medical history obtained . The following structure is for sharing data in an organization related to security and privacy. Confidentiality of patient-related information is essential in maintaining health-related data by Benjamin et al, . Gateway sensor networks and data transmitted over the Internet need to provide high-quality services, hence the introduction of smart e-health gateway[6].

Considering the recent growth in the space of computing with the introduction of cloud computing, Internet-of-Things, Grid Computing, Internet and information security, the newer dimensions are introduced for research. The notable work outcomes M. Armbrust et al on cloud computing, M. Whaiduzzaman et al. on vehicular cloud computing, P. M. Mell et al. on NIST , G. Han et al. on routing algorithms and T. Qiu et al[7]. on IoT have motivated number of research enthusiast in the recent era. With the introduction of cloud computing, the industry

received a huge attention due to the benefits and advantages. Various companies, ranging from small to minimum to large enterprises migrated their applications on the cloud. Some companies migrated their data on the cloud due to the large size of the data and high cost of the dedicated storage facilities[8]. The work by M. Ali et al. has demonstrated the challenges of storing data on the cloud and security issues. The practical approaches of the security implementations are discussed by T. A. Velte et al., which enabled the research dentations for various researchers. The trend followed by Z. Xia et al. by proposing rank based search scheme over encrypted data, Z. Fu et al.by demonstrating personalized search operations over encrypted data and again with Z. Fu et al. by secure searching operations on cloud data.

**Methodology**

The genetic algorithm is a random search-based probability technique for optimization processes. It simulates natural selection and development processes in most commonly used optimization algorithms for scheduling problems to find the best job scope. It starts with a generation of individuals called demographics. It is an evolutionary algorithm based on the experimental property of the entire population. After the initial population, an individual from each generation is selected based on their age. A new population seed created using the crossover. Adjustments are needed to get better solutions than the previous ones, and then they are added to the new population[9].

**Particle Swarm optimization (PSO).**

The cattle herd inspired by the social behavior of bird cattle and fish conservatories. Each cell updates its location in the solution space based on the experiences of the cells and neighbors. This refresh process performed using the best solution and the best location of the cell for the entire population of the search space[10].

**Ant Colony Optimization (ACO)**

ACO is an ideal simulation development algorithm for NP-hard combinatorial and optimization problems. The idea behind the ACO was to mimic the aggressive behavior of ant colonies. When an ant tries to find food in a group, she uses a particular chemical called pheromone. First, ants use the direction of movement to find food. After releasing a pathway to this food source, it releases pheromones along the way. As this process develops, most ants are attracted to the maximal pathways of the pheromone. It gives the ants a small path into the food source and enhances positive response patterns, empathy, and development. The primary drawback of this method is that the solution is stable after a certain amount of searching.

**Gravity Search Algorithm (GSA).**

The process of gravity search works based on the law of gravity. Candidates are objects that measure performance according to their mass. When the mass is dense, it fits with the optimal solution, while the lighter mass gives the weaker solution. The force of gravity usually increases as the mass of each other increases . In this way, gravity, graphene, and some degree of iteration

between objects are the product of 'mass' ms1' and 'ms2'. Explain that 'ED' is the Euclidean distance between candidates. Workflow analysis on different tasks and resources conducted to determine its impact on resource response time performance. Resources vary from 1 to 100, and tasks taken as 75, 150, and 200. The performance of the various algorithms of the workflow evaluated, and the results shown in the table. The results show a better performance of ADGP compared to other algorithms in terms of resource response time estimation. PSO performed better with a response time of 2.957 sec on 200 tasks and 100 resources compared to the result without the hybridization process. However, the latter performs better with its hybridization processes in reducing resource response time compared to the original methods. Of the three hybridization approaches considered during the evaluation, ADGP performs better than other algorithms

**Results and Discussions**

The simulations and algorithms implemented in the CloudSim software integrate with the CloudSim layer. Tasks and resources are identified and mapped to VMs according to each work process. VMs considered for distribution across three geographical regions. These locations are CSP that host the resources needed to complete tasks. The model value obtained from the representation matrix in Table ***. VM pre-configured with 258Kbps bandwidth. Memory ranges from 512MB to 2.0GB, which varies dynamically depending on the size of the job. Performance analysis of the proposed algorithm for large workflows, operating sizes 100 to 2000, and resource size 1 to 100.

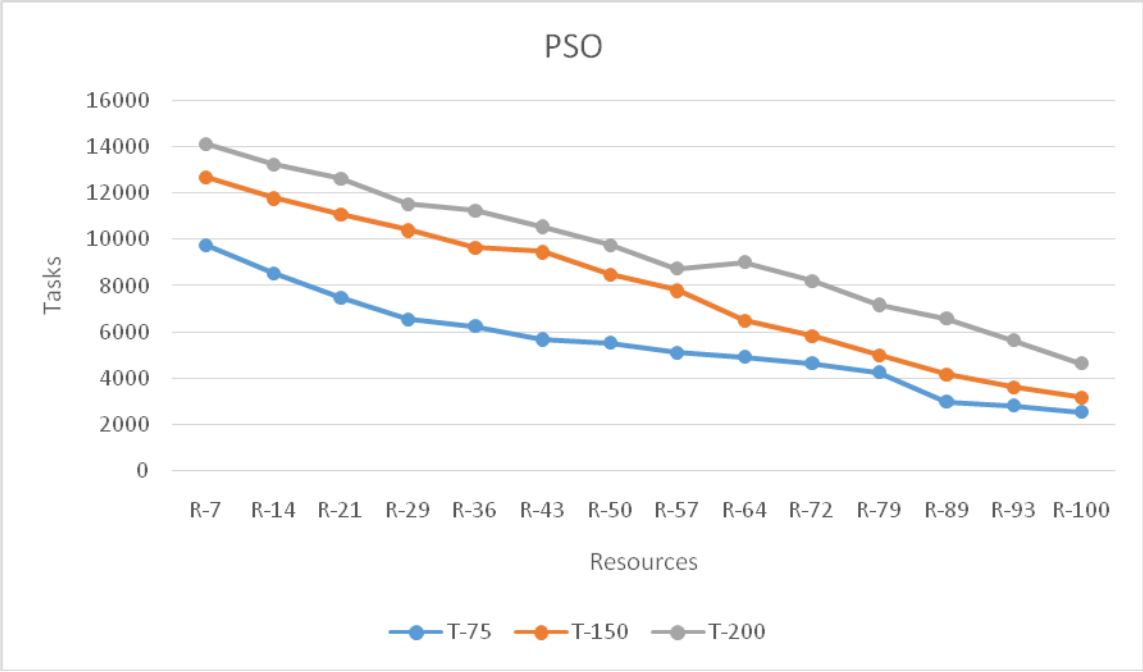

Figure 2: Resource response time Analysis in PSO

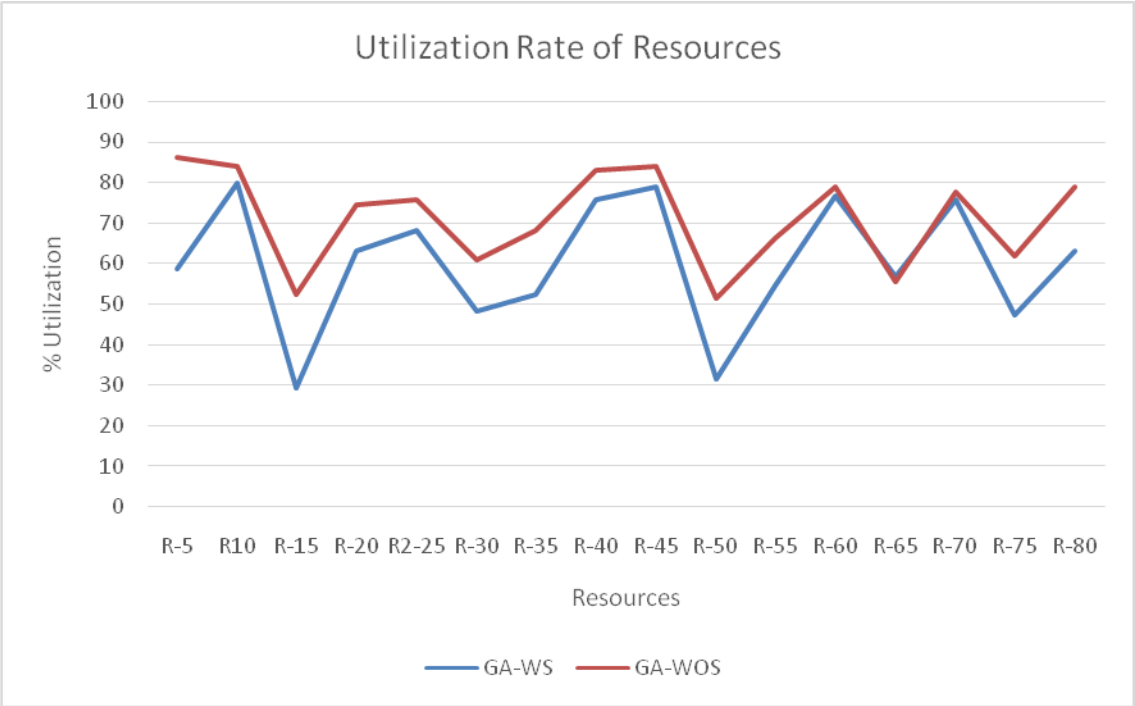


Figure 4: Utilization Rate of Resources with and With GA

**Conclusion**

In different algorithms, ACO and hybrid ACO can result in lower performance during resource response. The results show that when allocating more resources to the resource pool, resource allocation time reduced as more resources are available to perform tasks. Resource hit time improves when copying the same resources to multiple CSP. It is because the resource available from the service node can be used based on function proximity. The resource utilization rate is excellent when considering ACOs with load balancing. This improved resource utilization rate reduces the total resource response time of the workflow during the simulation process. Overall, the hybrid algorithm performs better in scheduling. GA and ACO performed better than all other proposed algorithms to reduce resource response time. This algorithm found to be superior to selected sources (1 to 70) and tasks (1 to 150). Resource response time 'it' is reduced by creating duplication of service nodes in many places. It is because this algorithm combines faster solution source response times faster than other algorithms. Better resource utilization in hybrid ACOs achieved when the workload is distributed evenly across multiple virtual machines. However, hybrid PSOs are the best choice of resources when it comes to cost reduction.

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