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Research Article

Promoting QOS through Virtual Machine Scheduling and Management in Cloud Domain

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ABSTRACT

The generally speaking conveyed processing showed up at 200 and forty billion US dollars in the year 2021. It is important to further develop asset usage to meet the different client prerequisites. Traditional resource allocation is based on a fixed price model. The virtual machine apportioning issue is solidly NP-hard and is horrid to settle, considering the time factor. Multi-resource appropriation increases on time as the amount of customers gets extended. While picking the virtual machine, the client can pick the sort designed by the suppliers. This significantly impacts the revenue of the cloud service provider. This paper forms an ideal VM planning and the executives interaction to advance the QoS during administration execution.

Keywords: Computational resource, Cloud Service Provider, Task Allocation, Quality of Service, Resource Management

INTRODUCTION

Cloud Computing can be viewed as a dynamically-scalable pool of resources. Virtualization is one of the key technologies enabling Cloud Computing functionalities (Yang Cao et al. (2021)). Cloud computing delivers huge computational resources, and a cloud service provider must allocate heterogeneous virtual machines for user applications. Thus optimal scheduling performed benefits both the cloud service provider and user. Simultaneously, these algorithms have to be designed to ensure that it satisfies the QoS constraints (Yassir et al. (2017)). Optimal allocation algorithm solves the requirement of users (Zhang et al. (2018)).

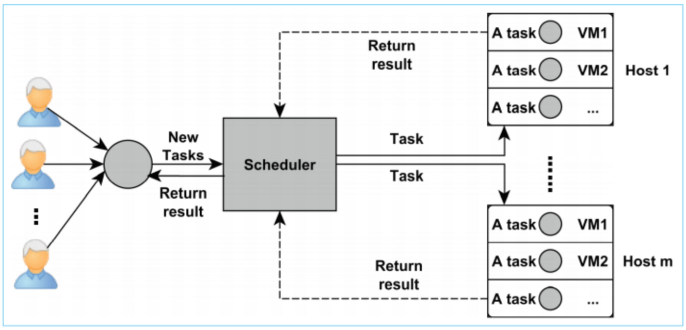

Figure 1: Task allocation architecture

Virtualization allows access to resources in a consistent way (Sonkar & Kharat (2016)). Migration of virtual machine transfers the main memory pages and states. Placement policy decides where to put the new virtual machine so that

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it can dynamically allocate resources. Utilizing the available resource and meeting user requests is resource allocation as depicted in Figure 1. Any resource allocation strategy should not have resource contention, fragmentation, over/under-provisioning.

The demand for virtualization increases as there is an increase in applications. The virtual machine can run both CPU intensive and I/O applications (Bhadoria et al. (2020)). The customer uses cloud computing services through the internet. The virtual machine concept runs multiple operating systems, and the hypervisor is the software layer used for dynamic resource allocation (Shen et al. (2019)). The virtual machine is an existing feature in the cloud.

The level of service guaranteed is defined in the Service Level Agreement (Barolli (2020)). The major challenge is to efficiently allocate virtual machines for resource allocation, consuming less time. An efficient optimization algorithm has to be chosen to select the qualified virtual machine for resource allocation to overcome this issue (Arshad Ali et al. (2018)).

The rest of this paper is organized as follows: Section 2 presents the literature survey and section 3 describes in detail the proposed methodology. Section 4 illustrates the results and discussion and section 5 presents the the conclusion.

LITERATURE SURVEY

Resource allocation and scheduling influence the revenue of the cloud service provider directly. Usually, for mathematical problems scheduling algorithms were utilized. First Come First Scheduling (FCFS) is one of the traditional cloud computing algorithms. Today, most cloud computing resources are disseminated and allocated dynamically. Thus, traditional algorithms are not sufficient to satisfy cloud computing's current requirements (Ar–Reza Mosavisadr& Karami (2017)).

Resource management consists of workload submission and execution. Resource provisioning and scheduling are the two stages of resource management. This identifies the adequate resources given for workload while simultaneously satisfying the QoS requirements described by the cloud consumer. Initially, the user submits their request in the form of workload as depicted in Figure 1. Considering the request, the broker finds suitable resource and determines the feasibility of provisioning the resource based on QoS (Singh & Chana (2016)).

Coyote Optimization Algorithm (COA) is successful in solving persistent problems proving it useful for binary optimization problems. Swarm intelligence is one of the branches of meta-heuristics, a set of metaphor-based algorithms. The population entity represents the various solution to the different problem domains. The entities will jointly work towards an optimal solution. The social behaviour of Canis Latrapsinspired its naming as coyotes. The Algorithm emphasizes the social structure of packs. The packs all have the same size (Pettersson (2019)). Two Coyotes of the same pack produce new entities inheriting the parent conditions.

PROPOSED METHODOLOGY

User requests include CPU, storage space, and memory. Each user request is termed as a task. Hence optimization for resource allocation is a common technique. The proposed methodology performs a demand-based dynamic resource allocation utilizing the novel Binary Cosine Coyote Optimization Algorithm (BCCOA).

BCCOA measures the degree of goodness of the virtual machine by defining a fitness function. Numerous servers built up the cloud. Each server runs multiple virtual machine V(I) where I=0,1,...n, and n is the maximum number of virtual machines available to complete the user requests. User requests are sent to the scheduler and allocate to meet the cloud environment's needs. The novel BCCOA optimization algorithm has the characteristics of coyotes. The implementation of the Binary Cosine Coyote Optimization Algorithm (BCCOA) is shown in the Algorithm and depicted in Figure 2. To handle user requests and perform multiple design constraints-based grouping. Initially, based on the classified user requests, the coyote community corresponds to the candidate solutions reflecting the phase one calculated fitness function. The community divisions are grouped into two, where on each group, the calculated number of coyotes the virtual machine is scheduled.

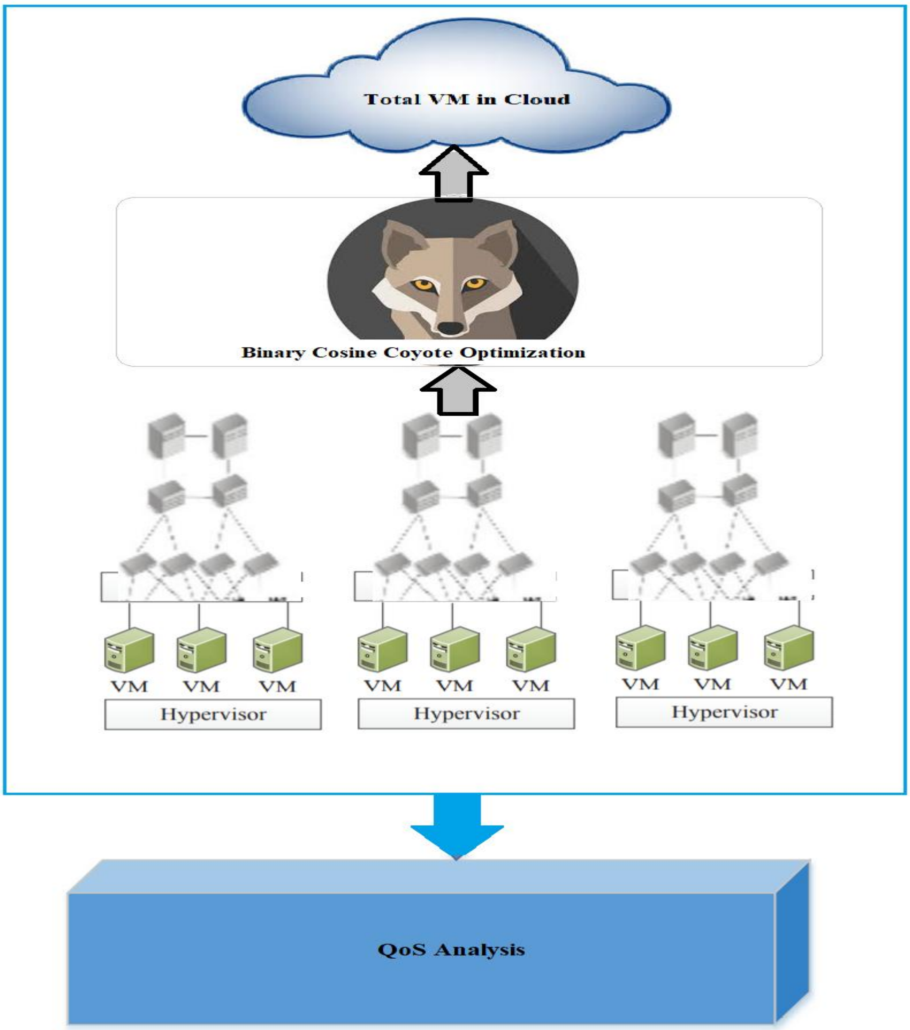

Figure 2: Proposed BCCOA Framework

Algorithm – Binary Cosine Coyote Optimization Algorithm (BCCOA)

Begin

Population initialized randomly;

$$C_c^t = (c_1, c_2, \dots\dots\dots c_D);$$

Division of coyote community into valid and in-valid groups;

If request invalid, then

{Remove Request;}

Else

While t<=T do

For each pack do{

Fixup scheduling strategy;

Evaluate Scheduling{

$$R_{c,j}^t = lw_j + r_j * (uw_j - lw_j);\}$$

```
}
For each coyote in pack do{
Update Execution Cost and Response Time;}
If scheduling strategy invalid then
{Remove strategy;}
End If
Evalaute Fitness();
End For
End For
End While
Update Coyote cycle();
End if
t=t+1;
Selection(Best Coyote);
End
```

In BCCOA the every Coyote is confined in a hamming space. This enables the distance calculation between entities. Here the hamming distance is active for binary encoding (Pettersson (2019)). The bits need alternation for the coyotes to get close. The distance calculation is expressed in equation (1) and (2).

$$d_1 = dH(aplha, r_1) \quad (1)$$

$$d_2 = dH(median, r_2) \quad (2)$$

Where dH the hamming distance and r_1 and r_2 are the random Coyotes of the same pack, and the value is {0,1} with t the current iteration.

RESULTS AND DISCUSSION

The proposed technique is implemented in the JAVA CloudSim platform, and it is evaluated by utilizing an optimization algorithm. The CloudSim toolkit supports both system and behaviour modeling of Cloud system components such as data centers, Virtual Machines (VMs), and resource provisioning policies. Each virtual machine has a single core and 1GB physical memory size. In the proposed method, virtual machines are provided as access to the user to complete the request by resource allocation. The proposed technique is evaluated for the parameters fitness function, average scheduling length, response time, and execution cost.

The proposed BCCOA optimization checks all virtual machines and evaluates their fitness. To complete user requests, numerous virtual machines are present. Initially, the population of the virtual machine is assumed as B. The value of B ranges from 0 to 800. Once the community is divided, the VM in one community will be the leader termed alpha VM. It communicates with other members and gets the fitness value of VM. For several times this information is exchanged, and the alpha VM is well-known by other VMs. Thus the best fitness is selected for resource allocation and remaining discarded.

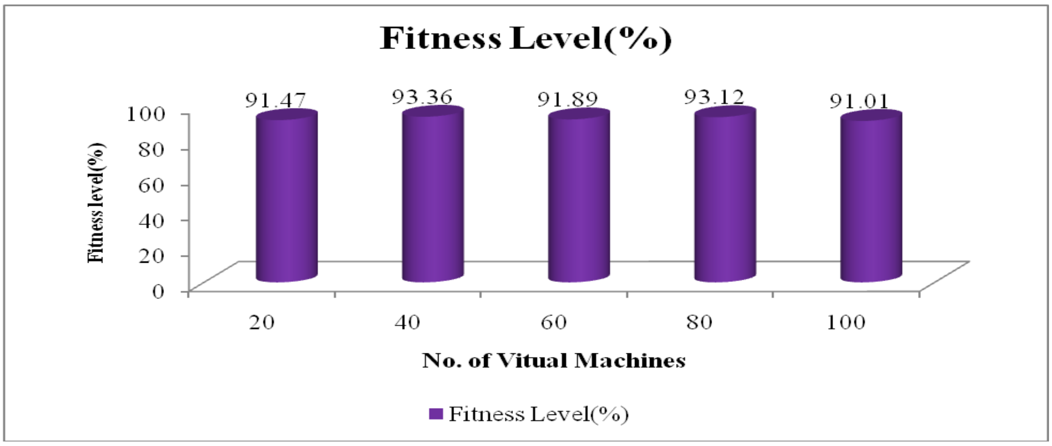

Figure 3: Fitness level measure

Figure 3 depicts the fitness level measure as the number of VM gets increased, the changes occur in the fitness function. Here the virtual machines requests of 20, 40, 60, 80, and 100 are considered. For 20 virtual machine, the fitness function obtained is 91.47%. Similarly, for others such as 40, 60, 80, and 100, the fitness measure is 93.36, 91.89, 93.12, and 91.01. If the selected VM fails in satisfying the constraints or if unable to complete the deployed tasks, the particular VM is detected and rejected.

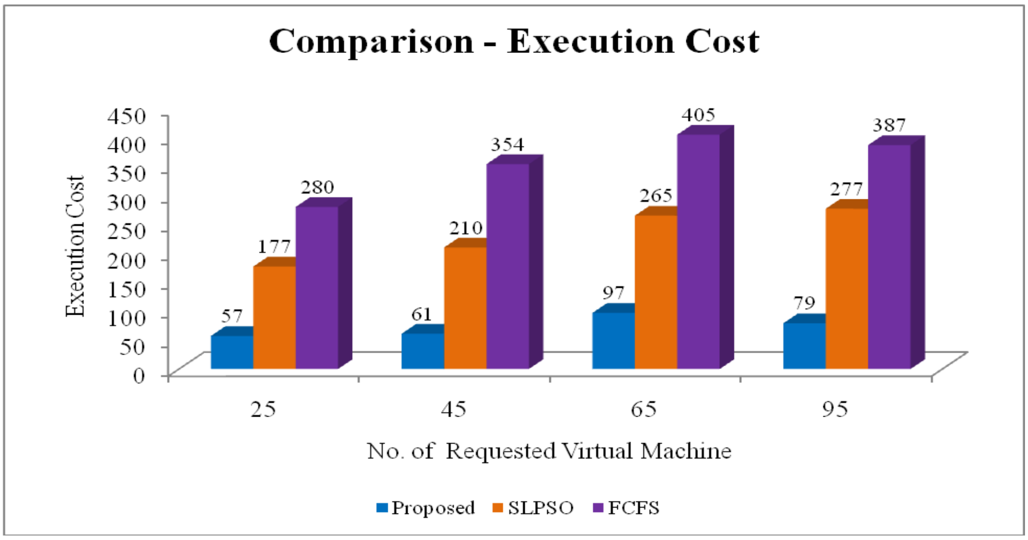

Figure 4: Comparison of the Execution Cost

Figure 4 depicts the comparison of the execution cost of the proposed BCCOA with the other two existing algorithms. If the number of Virtual Machines is 25, our proposed method's execution cost is 57, SLPSO method execution cost is 177, and FCFS method execution cost is 280. Similarly, for the virtual machine of numbers 45, 65, and 95, the execution cost of BCCOA is 61, 97, 79, SLPSO 210, 265, 277, and FCFS the execution cost is 354, 405, and 387, respectively. Based on this, it can be concluded that the execution cost of our proposed method is low.

CONCLUSION

Resource allocation in Cloud computing is an unfathomable and fastly emerging area of a study aiming to changes due to innovations. BCCOA utilized these two sets of virtual machines and optimized them to produce the best qualified virtual machines in this work. The experimental result shows that the approach is effective and efficient than the existing methods. The time consumption too is deficient when compared to the previous work. Thus, this paper reveals that the adoption of BCCOA compared with other methods yields best in terms of resource allocation and saving time consumption.

REFERENCES

[1] Yang Cao and Cheul Woo Ro. (2021). "Adaptive Scheduling for QoS-based Virtual Machine Management in Cloud Computing", International of Contents, Vo.8, Issue 4.

[2] Arshad Ali, S., Affan, M., & Alam, M. (2018). "A Study of Efficient Energy Management Techniques for Cloud Computing Environment", Vol. arXiv, pp. arXiv-1810.

[3] Ar–Reza Mosavisadr, S. M., & Karami, R. (2017). "Presenting a Virtual Machine Scheduling Approach to Reduce Costs in Cloud Computing", IT Cost Management Strategies, Vol. 4, No. 1, pp. 1-10.

[4] Dennis Ananth, A., Kala, I., Rajesh Babu, M., Uma, S., Primya, T., and Ajith, R. (2025). "Interactive Brain Edema Tumor Segmentation in Different Modality Images with a Combined Noval Neural Network", Journal of Information Systems Engineering and Management, Vol.10, No. 20s.

[5] Gokila, R.G.., Kala, I., Rajesh Babu, M., Uma, S., Sivakumar, T., and Arun Bharathi, V.S. (2025). "Improving Network Quality of Service with Multipath Routing Protocol for Wireless Sensor Networks", Journal of Information Systems Engineering and Management, Vol.10, No. 20s.

[6] Markkandeyan, S.., Kala, I., Rajesh Babu, M., Uma, S., Prasanna, D., and Senthil Kumar, M. (2025). "Applying Optimization Techniques for Enhancing Personalization to Recommend a Web Page", Journal of Information Systems Engineering and Management, Vol.10, No.20s.

[7] Nandhini, T., Rajesh Babu, M., Balakrishnan Natarajan., Kamalraj Subramaniam., and Prasanna, D. (2024). "A Novel hybrid Algorithm combining Neural Networks and genetic Programming for Cloud Resource Management", Frontiers in Health Informatics, Vol.13, No. 8.

[8] Barolli, L. (2020). "Advances in Intelligent Networking and Collaborative Systems: The 12th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2020)", Springer Nature.

[9] Bhadoria, A., Marwaha, S., & Kamboj, V. K. (2020). "A solution to statistical and multidisciplinary design optimization problems using hGWO-SA algorithm", Neural Computing and Applications, pp. 1-26.

[10] R Thiyagarajan, Rajesh Babu, M. and M Moorthi. (2021). "Quality of Service based Ad hoc On-demand Multipath Distance Vector Routing protocol in mobile ad hoc network", Journal of Ambient Intelligence and Humanized Computing, Vol. 12, No. 3.

[11] Dr. P. Deivendran, Dr. K. Anbazhagan, P. Sailaja, Dr. E.Sujatha, Rajesh Babu, S. Sudhakar.(2020). "Scalability Service In Data Center Persistent Storage Allocation Using Virtual Machines", International Journal of Scientific & Technology Research, Vol.9, Issue 02, pp 2135-2139.

[12] Pettersson, R. (2019). "Efficiency of Different Encoding Schemes in Swarm Intelligence for Solving Discrete Assignment Problems: A Comparative Study".

[13] Shen, D., Luo, J., Dong, F., & Zhang, J. (2019). "VirtCo: Joint coflow scheduling and virtual machine placement in cloud data centers", Tsinghua Science and Technology, Vol. 24, No. 5, pp. 630-644.

[14] Singh, S., & Chana, I. (2016). "A survey on resource scheduling in cloud computing: Issues and challenges", Journal of grid computing, Vol. 14, No. 2, pp. 217-264.

[15] Sonkar, S. K., & Kharat, M. U. (2016). "A review on resource allocation and VM scheduling techniques and a model for efficient resource management in cloud computing environment", In 2016 International Conference on ICT in Business Industry & Government (ICTBIG), IEEE, pp. 1-7.

[16] Yassir, S., Mostapha, Z., & Claude, T. (2017). "Workflow Scheduling Issues and Techniques in Cloud Computing: A Systematic Literature Review", In International Conference of Cloud Computing Technologies and Applications, Springer, Cham, pp. 241-263.

[17] Zhang, F., Liu, G., Fu, X., & Yahyapour, R. (2018). "A survey on virtual machine migration: Challenges, techniques, and open issues", IEEE Communications Surveys & Tutorials, Vol. 20, No. 2, pp. 1206-1243.