International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 9 Issue: 5
Article Received: *25 February 2021* ***Revised:*** *12 March 2021* ***Accepted:*** *30 April 2021*

Hybrid Cloud Integration: Best Practices and Use Cases

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Abstract

Convention will not cause the amount of difficulty that may be imagined in a cloud data centre to increase. Businesses may embrace IT without having to pay a large initial cost by using computing in the cloud. Although there are many advantages to the Internet, model security is still a problem, which has a negative impact on cloud adoption. Underneath the data centre, the security issue becomes unmanageable, and the problem scope has expanded to include model design, multiple tenancies, elasticity, and multiple levels of dependency stack. To benefit from the new processing viewpoint that provides an innovative arrangement of activities for interaction to IT, the increased security risks in cloud-based computing must be overcome. The study's goal was to lessen security's barriers and hazards by using approaches and protection techniques to guarantee optimal data protection while preserving the option for the customer to choose the initial security degree. The globe has become a global village where individuals can cooperate, communicate, and exchange information quickly and securely thanks to the prevalence of smart devices that can access the internet. Clients may share possessions and utilize a variety of on-demand services using cloud computing environments. Workflow technology in the online environment is used to manage business processes, and because activities rely on one another, this poses a difficulty to efficiently utilize resources. This study proposes a Hybrid GA-PSO method to effectively distribute workloads among the available resources. In cloud computing settings, the Hybrid GA-PSO method seeks to balance the load of dependent activities among heterogeneous resources while reducing make span and cost. The experiment's findings demonstrate that, when compared to the GA, the PSO method, HSGA, WSGA, and MTCT computer programs, the GA-PSO approach reduces the workflow tasks' overall execution time. Moreover, it lowers the cost of performance.

Keywords: IT, Algorithms, Cloud Computing, Hybrid GA-PSO, Processing, Smart Internet, Environments, Workflow Technology, Model Design, Results.

I. INTRODUCTION

The very rapid business and IT environments are driving the demand for a successful secure information canter. Before new opportunities can be explored, equipment must be practically purchased and installed. In order to fulfil the increasing expectations for performance, reliability, and flexibility, the connection speed must be fast and accurate. Although cloud-based and virtualization systems have increased installation costs and times, they have also increased flexibility. Additionally, the majority of IT consulting and procurement services are employment-based and increasingly unable to meet the high standards of today's new applications. Your business may grow and prosper via cloud migration without causing any disruptions to its existing infrastructure [1]. This suggests that you may grow your information and mobile applications without compromising your ability to serve customers or your market's performance. Resource Allocation (RA) is the process of allocating available resources over the worldwide web to necessary cloud applications. Resource provisioning handles this issue by giving service providers control over the resources for each specific module.

Because of organizations' rigid security architectures, manual processes, and a variety of specialized virtualisation tools, convergence increases the risk of vulnerability [1, 2]. The next-generation data centre lowers risk by increasing the software-controlled environment for integrity and management. Technologies manages and orchestrates everything, including information security, intrusion detection, and surveillance of security [1, 2]. The protective capabilities of individual physical components are virtualized and combined beyond reasonable bounds. Automatically triggered security mechanisms protect an organization's files, policies, and contacts. Analytics are used for enhanced

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security and conformance verification in order to proactively monitor and prevent security incidents. Without depending on hardware resources, safety safeguards are less costly and simpler to put in place wherever and whenever they are needed.

The next development in Interties—realistically distributed databases that provide computer power "as a service"—is cloud computing. As "a paradigm for providing on-demand interaction provisioning of adaptable computational power (e.g., communication, laptops memories, applications and operations) that may be swiftly provided and scattered with minimum administrative effort or network operator the capacity to interact," NIST offers the most widely used definition of the cloud services concept [2, 3]. The cloud computing framework is shown in Figure 1. A cloud may be open or closed to the public. A public cloud offers its services for purchase to everyone with Internet connection. Private cloud computing is a closed network or data centre that provides a platform as a service to a limited group of people with certain permissions and access. Whether it's public or private, [4], the aim of computing in the cloud is to provide quick, scalable utilization of data and IT services [5].

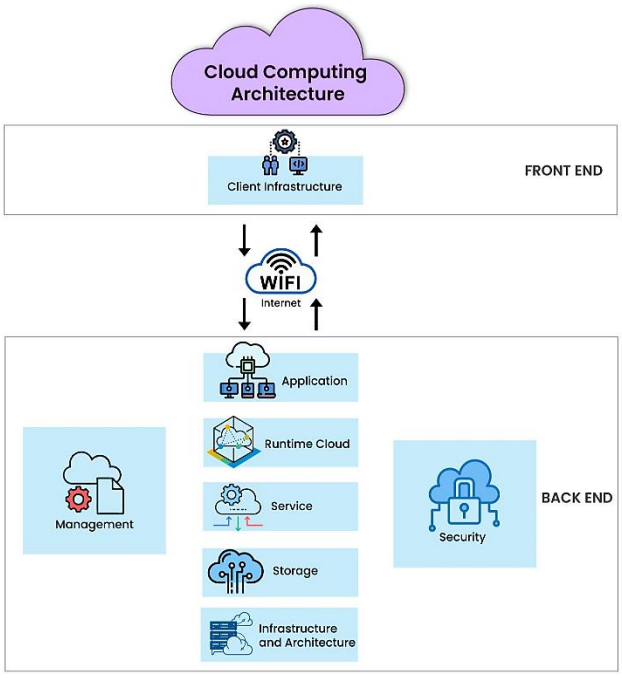

Fig. 1 Cloud computing.

A set of networks and all of the information that moves across them are referred to as cloud computing. In cloud computing, users usually choose to use a third-party intermediate source for Internet access rather than building their own physical systems, [5, 6], and they may use its methods indefinitely.

To put it another way, the cloud is a computer innovation that provides its users with high-quality services—like data and software—over remote servers. Without having to invest extra time or money in hardware like computers and data management software, people may benefit from the cloud. Client requirements and applications are satisfied by cloud computing without requiring a complete logical and physical platform [7, 8]. One of the main benefits of using cloud computing for customers is that data can be accessible from almost anywhere. Examples of cloud-based applications include Customer Relationship Management (CRM), video calling, and email.

Numerous fields, including astrophysics, bio informatics and catastrophe modelling and prediction, employ workflow applications [9]. Furthermore, the fusion of several approaches and methodologies into a single solution has led to the emergence of complex challenges in recent times, such as complex scientific applications. This kind of application has been run on grids, clusters, and supercomputers to meet this demand. Thankfully, many applications for workflows are now run on the cloud thanks to the development of clouds.

Workflow programs are the means by which large-scale business processes are executed. They include a series of tasks or events where data is moved between jobs according to certain technological guidelines in order to accomplish a main objective. The activities in the workflow application are interdependent, with one task's result serving as another task's input. As a result, in a multiprocessor environment, the tasks' execution order has to be taken into account while allocating them to virtual machine processors. It is well known that assignment the tasks that are dependent to the best virtual machine processors is an NP-complete issue [10].

The rise of Internet of Things (IoT)-based gadgets has opened up new avenues for organizations to carry out their daily tasks from new angles and with greater results. By creating new capabilities before new opportunities, firms were able to adapt to technical improvements in their present operations thanks to breakthroughs in information technology. Cloud computing offers an environment where shared processors, [11], desktops, laptops, sensors that are and many forms of communication technologies are combined to allow simple access to virtual resources, from the standpoint of transformational tendencies in the development of information technology [12, 13].

In order to choose the best Pareto solutions, the objectives must be ranked according to the users' importance. For example, minimizing the overall cost might result in maximizing the execution time and the load over a particular

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virtual machine. This is because the trade-off between the three objectives is what determines the most effective choice for the multiobjective workflow optimization [14, 15]. Various research endeavours have been undertaken to tackle the scheduling problem of workflows, which is an inherited issue from heterogeneous computing systems. In contrast to cloud settings, heterogeneous computing configurations are more difficult to set up and have a far lower capacity for more consistent performance with fewer failures.

Furthermore, just minimizing the completion time has been the primary goal of the many prior attempts to solve the workflow scheduling issue in heterogeneous systems. Therefore, it is necessary to take into account both the overall financial cost and the way things make span given the widespread usage of cloud environment and associated pay-per-use services. In turn, a number of metaheuristic algorithms were put out to address the workflow task scheduling issue and arrive at a workable solution for job distribution across the many Virtual Machines (VMs) in the cloud environment. Swarm intelligence, Artificial Bee Colony (ABC), Genetic Algorithm (GA), Ant Colonies Optimizing, and Artificial Bee Colony (ABC) are a few instances of the different workflow scheduling issue solutions that handle the overall financial cost and performance time span [16, 17].

This paper's primary goal is to provide an approach for the workflow scheduling issue. Along with balancing the load among the virtual machines at the lowest possible total cost, the suggested technique should also shorten the make span execution time. In order to solve the workflow scheduling issue, this research suggests a hybrid GA-PSO method that combines the advantages of both techniques. To demonstrate the suggested algorithm's efficacy in resolving the workflow scheduling issue in the cloud surroundings, its efficiency is compared to that of other methods.

1.1 Objectives of the study

- The main goal is to conduct research and determine the best methods for integrating environments with hybrid clouds.
- The study's objectives are to evaluate the difficulties in integrating hybrid clouds and investigate possible fixes.
- Analysing actual use cases of hybrid cloud integration across a range of businesses is another important goal.

II. LITERATURE REVIEW

(Varghese, B., 2018) [18] Over the last ten years, there have been substantial changes to the cloud computing ecosystem. Not only has the market become more crowded with providers and service offerings, but cloud infrastructure, which was formerly restricted to data centres owned by a single provider, is also changing. In this article, we first address how cloud infrastructure is evolving, taking into account the utilization of infrastructure from various providers as well as the advantages of moving computers away from data centres. Future cloud infrastructure will provide a range of new computer architectures that are required as a consequence of these changes.

(Perboli, G., 2018) [19] A distributed ledger database for permanently and verifiably recording transactions between participants is what is known as block chain technology. One of the most important technological pillars for financial applications is block chain. However, in recent years, academics' and practitioners' focus has shifted to the use of block chain technology in other fields. It now serves as the foundation of a brand-new digital supply chain. Block chain may improve the efficiency, dependability, and transparency of the whole supply chain as well as the incoming operations because of its capacity to guarantee data inviolability and public availability of data streams. The majority of the literature on block chain in non-monetary programs concentrated on the technology aspect and business process modelling; it lacked a standard methodology for creating a plan to create, test, and incorporate the entire block chain solution into the business strategy.

(Aceto, G., 2020) [20] The worlds of production and services are totally shifting as a result of Industry 4.0 and its primary supporting technology for communication and information. This is particularly true for the health sector, since healthcare and its whole environment are being revolutionized by Big Data, Cloud and Fog Computing, and the Internet of Things, which is pushing the industry towards Healthcare 4.0. We thoroughly assess how the use of the aforementioned Industry 4.0 innovations (and their integration) applied to the health care industry is altering the manner that conventional services and goods are provided by judiciously analysing the literature.

(H.-J. Hong, D.-Y. Chen,) [15] In this article, we propose Hybrid Coin, the next-generation cryptocurrency that creates a highly flexible and effective digital asset by combining the best features of Ethereum and Bitcoin. Hybrid Coin aims to combine Ethereum's strong programming ability and ability to write smart contracts with Bitcoin's established store of value and security characteristics, opening up a plethora of use cases and applications. We introduce the architecture and design of Hybrid Coin, emphasizing the smart contract capabilities, scalability solutions, and consensus process. We

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also go over the suggested cryptocurrency's privacy and security aspects as well as its possible applications in asset management, Decentralized Finance (DeFi), and electronic payment methods.

(Schröer, C., 2021) [22] The industry-neutral procedure framework CRISP-DM is the de-facto preferred method of implementing data mining initiatives. We would want to provide a comprehensive literature evaluation of contemporary research concerning data mining application scenarios of CRISP-DM that have been published in IEEE, Science Direct, and ACM, twenty years after its debut in 2000. We give a description of the six stages of CRISP-DM, emphasizing potential gaps in the methodology, best practices, and research emphasis. Overall, the results show that CRISP-DM remains a de-factor standards in data mining, albeit there are issues since the majority of investigations do not account for a deployment phase.

(Tabrizchi, H., 2020) [23] Due to steadily rising needs, cloud computing has attracted a lot of interest in recent decades. The organization using cloud-based data storage systems have several benefits. These include the potential cost savings associated with cloud computing, remote access from almost anywhere in the globe with a reliable Internet connection, and streamlined IT infrastructure and administration. More research is needed on the related safety and privacy concerns associated with cloud computing. In the previously released investigations, researchers from business, academia, and standards bodies have offered possible answers to these problems. This survey's narrative an assessment includes information on known vulnerabilities, recognized threats, and cloud security challenges and needs. Actually, the goal of this paper is to examine the many elements of cloud computing and to highlight the privacy and security challenges that these systems encounter.

(Li, J., 2019) [24] Numerous issues plague the construction sector, such as low productivity, inadequate cooperation and information sharing, lax regulations and compliance, and unethical payment methods. Developments in Distributed Ledger's Technologies (DLT), additionally referred to as block chains, are currently being looked at more and more as components of the changing digital landscape of the construction sector and how it is responding to these issues. This study's main goal was to analyse the status of Distributed Ledger Technology (DLT) in the context of building and the building services sector in order to create a strategy that would encourage the industry to fully embrace DLT.

(Lnenicka, M., 2019) [25] Numerous new difficulties related to the use of technology for communication are being faced by municipal and government agencies alike. The volume of data is growing exponentially. Several formats are available for the data sets' publication. The foundation of new services is the connecting and processing of diversely organized data from several sources. Users anticipate quick processing times, clear visualizations, and free access to public data. The paper discusses the difficulties and suggests a fresh paradigm for government enterprise architecture. Included are the following component architectures: cloud-based processing, publishing, and massive and open interconnected archives of information. First, definitions of the main ideas are given. The fundamental responsibilities and elements of architecture are then described. The elements arise from the disintegration of associated frameworks. The article's primary focus is on the comprehensive architectural framework proposal and its component parts, or sub-architectures.

III. METHOD

When the specified number of repetitions is split evenly between the GA and PSO algorithms, the GA-PSO approach performs best, according to studies. This also supports the divide and conquer strategy, which splits a single issue into two smaller ones to create a complexity equivalent to $\boldsymbol{T(n) = 2xT\left(\frac{n}{2}\right) + F(n)}$, where $\boldsymbol{F(n)}$ is the divide and conquer time. The solution for such equation depends on $\boldsymbol{F(n)}$ and the complexity is $\boldsymbol{O(F(n))}$ if $\boldsymbol{|F(n)| > n}$ (by master theory). Furthermore, it is well-established that several function evaluations are necessary for both the GA and the PSO as they both need to assess the goal of every member of the population in the present sample [26]. Thus, it is usual practice to reduce the population count in a GA or PSO (i.e., the number of variations) in order to prevent a degradation in the accuracy of the results and decrease rate of the GA or PSO.

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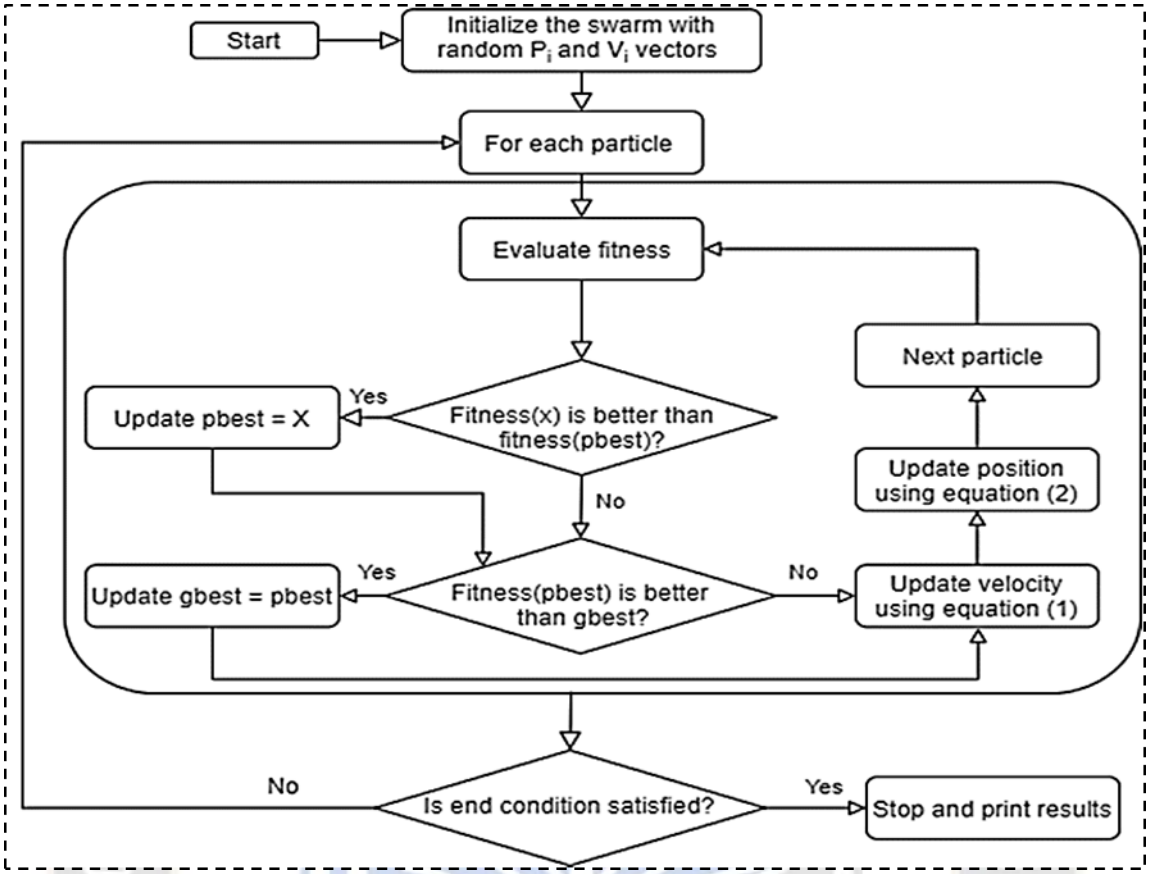

Fig. 2 The GA-PSO algorithm's flowchart. [27]

The solutions in the GA algorithm are referred to as chromosomes, and the GA operators (selection, crossover, and mutation) steadily improve the chromosomes at each iteration. The PSO algorithm obtains the resultant chromosomes during the remaining half of the specified rounds. The chromosomes are referred to as particles in the PSO method, and each time the process is running, the particles become progressively better [27]. The particle chosen to symbolize the workflow task problem's solution has the lowest fitness value.

IV. RESULTS AND DISCUSSION

The suggested GA-PSO method was put into practice utilizing the Workflows in order to assess the method. The Work Flow Sim enhances the current Clouds simulator by offering an additional level of management for the workflow by creating an appropriate setting for implementing various scheduling methods. Additionally, the outcomes of the suggested GA-PSO algorithm were additionally compared with those of other work scheduling methods, such as GA and PSO, in order to assess the algorithm's performance. Furthermore, as previously mentioned, the suggested GA-PSO algorithm's performance was contrasted with that of other relevant research.

We conducted extensive tests on actual applications for workflow using the simulation settings in Table 1 to assess the effect of the proposed method on the workflow scheduling issue relative to other techniques.

Table 1 parameters for simulation.

Parameter	Values
Number of tasks in application	26-100
The number of Vm's	17
MIPS	251-1028
RAM	259-1829 (mb)
BW	258-18900 (mbps)
Processor speed	10,001

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Number of processor	8
VM Policy	Time-shared

The GA-PSO assessment experiments were conducted using the settings specified in Table 2.

Table 2 Parameters of the GA-PSO algorithm.

Parameter	Value
Population sizes	101
Mutation rate	0.08
Crossover	Single point
Number of iterations	101
Number of executions	501
C1	1
C2	1.8
R1, R2	[0.4]
α1, α2	0.5
α3	0.9

Table 3 provides an overview of the features of the Montage workflow program that were used in the trials.

Table 3 The features of the processes at Montage.

Scenarios	Number of tasks	Number of edges	Average data size (mb)
One	29	98	7.89
Two	58	208	6.89
Three	104	489	3.89
Four	1000	4479	6.48

4.1 Performance Analysis

of order to compare the suggested GA-PSO method to the GA and PSO algorithms and assess the decrease of make span, execution cost, and load balance, all four scenarios were run. Table 4 reports the outcomes of the experiments that were conducted for each of the four situations.

Table 4 The outcome of the trials that were carried out.

Algorithm	Make span (Sec)	Execution cost ($)	Load balanced (rate)
Scenario one			
GA-PSO	98.58	18.96	9.58
GA	179.58	54.98	58.96
PSO	105.89	18.96	25.94
Scenario Two			
GA-PSO	149.65	79.89	14.58
GA	250.96	96.49	18.96
PSO	189.89	68.59	18.49
Scenario Three			
GA-PSO	256.96	179.58	36.96
GA	365.95	148.89	49.8
PSO	289.49	136.96	54.96
Scenario Four			
GA-PSO	1965.8	1089.79	58.96
GA	2489.58	1649.89	148.96
PSO	1489.69	1498.89	29.86

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After doing the aforementioned experiment several times, the average outcomes for the suggested GA-PSO, GA, and PSO approaches with the four scenarios were computed and combined in Table 5. These findings were expressed in terms of make span, execution cost, and load balance. In addition, Table 6's findings show how well the suggested method performs when compared to the GA and PSO algorithms in handling the workflow task-scheduling issue.

Table 5 For each method, the average outcomes in terms of make span, execution cost, and load balance.

Methods	Avg. make span	Avg. execution cost	Avg. load balanced
Hybrid GA-PSO	896.58	362.595	89.6589
GA	796.891	489.590	48.896
PSO	589.6089	639.596	24.8968

Significant cost savings may be achieved in terms of resources, upkeep, and real estate, in addition to the opportunity to optimize workloads for increased productivity. Utilizing resources wisely is essential to cutting down on energy usage in data canters. To wrap up the study, the efficiency improvements from the resource allocation approach, exact resource allotment, and precise allocation combined with migration are investigated for practical cases with a limited position of parameters.

4.2 Forensic Analysis on Clouds

Digital forensics investigations are often carried out by several police agencies in cases involving cybercriminals or other illicit behaviour. When handling gathered evidence, they adhere to procedures and guidelines that are specified in standards. This is necessary to ensure that the data gathered during the process complies with legal requirements and may be used as evidence in court. Cloud investigations provide a distinct set of difficulties for these forensic specialists due to their transient nature.

4.3 Cloud-Based Forensic Exams: Things to Think About

We investigated the many challenges that investigators have while working remotely and found that the current approaches for evaluating cloud services were ineffective. The physical, private, and legal limitations that the researchers faced seemed to be the main challenges. This may be significantly more challenging when it comes to cloud investigation since there are thousands of virtual computers, several systems, and a large number of cloud users—just one of whom is important to the matter—involved. Service outages for others not involved in the case would result from it. Without the participants' knowledge, the machines are in communication with one another thanks to their connection to the data centre. Furthermore, login credentials and passwords are the sole means of maintaining identity when there isn't a physical connection due to the open nature of the cloud, which makes them vulnerable to being stolen and used improperly by unauthorized users [28, 29]. Because of this, there is a big difference in the technology that investigators may use to interact with cloud data centres. Building such technologies for forensics information collecting is challenging because to the proliferation of bridge building and the absence of standard of sources [29].

In conclusion, the bulk of cloud security problems stem from the absence of a consistent general framework, which may improve forensic analysts' ability to do investigations by correctly implementing international regulations. Government could attempt to create agreements that safeguard privacy for the purpose of bridging inquiries, but the decision of which courtroom or legal system to bring up the topic in continues to pose challenges. However, a forensic investigation of the Internet cannot be carried out using the instruments that are prepared to support a comprehensive assessment.

V. CONCLUSION

This research suggested and implemented a GA-PSO method for workflow scheduling tasks in a cloud environment using the Workflows simulator. Additionally, the suggested algorithm's performance was contrasted with other well-known algorithms, including GA, PSO, HSGA, WSGA, and MTCT. The suggested approach aims to minimize the make span and processing cost of workflow applications in computing cloud environment by distributing the workload equitably across the available Virtual Machines (VMs) while taking into account the sequence in which the tasks are executed. Based on the VMs' speed of execution and the quantity of the workflow tasks, the GA-PSO algorithms chooses which VMs will complete the tasks in the shortest amount of time. It claims to continue enhance energy efficiency after overhaul termination and is based on a virtual machine migration. In the future, a unique technique will be proposed to reduce the total amount of migration by precisely selecting the Virtual Machines (VMs) to be migrated via the

use of Machine Learning (ML). Because of the excessive use of PMs, it also results in a decrease in energy efficiency.

FUTURE WORK

The work may be expanded to several data centres in an assortment of settings in future years. Additionally, the workflow application's dissemination may be expanded into two levels: the first occurs when tasks related to the workflow are routed to the service broker, and the second occurs when the tasks are allocated to the available Virtual Computers (VMs) in each DC, taking into consideration the size and performance of each VM. Through a real-time cloud-based setting, the reasoning may be confirmed. Additionally, the procedure may be enhanced by using dynamically workflow, which gives users greater freedom to modify the workflow tasks' properties while they are executing.

REFERENCES

1. R. Hassan and N. Karodiya, “Dynamic architectural framework for cloud computing,” Computer Science and Information Technology, vol. 1, no. 1, pp. 9–18, 2013.
2. J. Gutierrez-Aguado, J. M. Alcaraz Calero, and W. Diaz Villanueva, “IaaSMon: monitoring architecture for public cloud computing data centers,” Journal of Grid Computing, vol. 14, no. 2, pp. 283–297, 2016.
3. Singh Rajawat, P. Bedi, S. B. Goyal, and A. R. Alharbi, “Amer aljaedi, sajjad shaukat jamal, piyush kumar shukla, “fog big data analysis for IoT sensor application using fusion deep learning,” Mathematical Problems in Engineering, vol. 2021, Article ID 6876688, 16 pages, 2021.
4. R. Dhaya and R. Kanthavel, “Cloud—based multiple importance sampling algorithm with AI based CNN classifier for secure infrastructure,” Automated Software Engineering, vol. 28, no. 16, 2021.
5. E. N. Ekwonwune, C. D. Anyiam, and O. E. Osuagwu, “Modelling conceptual framework for private cloud infrastructure deployment in the ICT centre of tertiary institutions,” Communications and Network, vol. 10, no. 3, pp. 117–125, 2018.
6. S. I. Alshathri, “Towards an energy optimization framework for cloud computing data centers,” in Proceedings of the Eleventh International Network Conference (INC 2016), pp. 1–4, Frankfurt, Germany, July 2016.
7. R. Dhaya, R. Kanthavel, and M. Mahalakshmi, “Enriched recognition and monitoring algorithm for private cloud data centre,” Soft Computing, 2021.
8. M. A. Arfeen, K. Pawlikowski, and A. A. Willing, “Framework for resource allocation strategies in cloud computing environment,” in Proceedings of the in 35th IEEE Conference on Computer Software and Application, pp. 261–266, Munich, Germany, July 2011.
9. M. N. Bennani and D. A. Menasce, “Resource allocation for autonomic data centres using analytic performance models,” in Proceedings of the IEEE International Conference on Autonomic Computing, pp. 192–208, Seattle, WA, USA, June 2005.
10. C.-M. Wu, R.-S. Chang, and H.-Y. Chan, “A green energy-efficient scheduling algorithm using the DVFS technique for cloud datacentres,” Future Generation Computer Systems, vol. 37, pp. 141–147, 2014.
11. J. Bhola, S. Soni, and J. Kakarla, “A scalable and energy-efficient MAC protocol for sensor and actor networks,” International Journal of Communication Systems, vol. 32, no. 13, 16 pages, 2019.
12. Y. Al-Dhuraibi, F. Paraiso, N. Djarallah, and P. Merle, “Elasticity in cloud computing: state of the art and research challenges,” IEEE Transactions on Services Computing, vol. 11, no. 2, pp. 430–447, 2018.
13. P. Mell and T. Grance, “The NIST Definition of Cloud Computing,” 2009.
14. S. Dutta, T. Taleb, and A. Ksentini, “QoE-aware elasticity support in cloud-native 5G systems,” in Proc. IEEE Int. Conf. Commun. (ICC), Kuala Lumpur, Malaysia, 2016, pp. 1–6.
15. S. Deshmukh, K. Thirupathi Rao, and M. Shabaz, “Collaborative learning based straggler prevention in large-scale distributed computing framework,” Security and Communication Networks, Hindawi Limited, vol. 2021, Article ID 8340925, pp. 1–9, 2021.
16. J. K. R. Sastry and M. T. Basu, “Securing multi-tenancy systems through multi DB instances and multiple databases on different physical servers,” International Journal of Electrical and Computer Engineering, vol. 9, no. 2, p. 1385, 2019.
17. S. Saralch, V. Jagota, D. Pathak, and V. Singh, “Response surface methodology based analysis of the impact of Nano clay addition on the wear resistance of polypropylene,” The European Physical Journal - Applied Physics, vol. 86, no. 1, pp. 10401–10413, 2019.
18. Varghese, B., & Buyya, R. (2018). Next generation cloud computing: New trends and research

directions. Future Generation Computer Systems, 79, 849-861.

19. Perboli, G., Musso, S., & Rosano, M. (2018). Blockchain in logistics and supply chain: A lean approach for designing real-world use cases. Ieee Access, 6, 62018-62028.
20. Satish, Karuturi S R V, and M Swamy Das. "Review of Cloud Computing and Data Security." IJAEMA (The International Journal of Analytical and Experimental Modal Analysis) 10, no. 3 (2018): 1-8.
21. Aceto, G., Persico, V., & Pescapé, A. (2020). Industry 4.0 and health: Internet of things, big data, and cloud computing for healthcare 4.0. Journal of Industrial Information Integration, 18, 100129.
22. H.-J. Hong, D.-Y. Chen, C.-Y. Huang, K.-T. Chen, and C.-H. Hsu, "Placing virtual machines to optimize cloud gaming experience," IEEE Trans. Cloud Comput., vol. 3, no. 1, pp. 42–53, Jan. /Mar. 2015.
23. Schröer, C., Kruse, F., & Gómez, J. M. (2021). A systematic literature review on applying CRISP-DM process model. Procedia Computer Science, 181, 526-534.
24. Tabrizchi, H., & Kuchaki Rafsanjani, M. (2020). A survey on security challenges in cloud computing: issues, threats, and solutions. The journal of supercomputing, 76(12), 9493-9532.
25. Li, J., Greenwood, D., & Kassem, M. (2019). Blockchain in the built environment and construction industry: A systematic review, conceptual models and practical use cases. Automation in construction, 102, 288-307.
26. Lnenicka, M., & Komarkova, J. (2019). Developing a government enterprise architecture framework to support the requirements of big and open linked data with the use of cloud computing. International Journal of Information Management, 46, 124-141.
27. E. Veldman and R. A. Verzijlbergh, "Distribution grid impacts of smart electric vehicle charging from different perspectives," IEEE Transactions on Smart Grid, vol. 6, no. 1, pp. 333–342, 2015.
28. S. Maharjan, Q. Zhu, Y. Zhang, S. Gjessing, and T. Basar, "Dependable demand response management in the smart grid: a stackelberg game approach," IEEE Transactions on Smart Grid, vol. 4, no. 1, pp. 120–132, 2013.
29. P. Wang, J. Ma, and L. Song, "Balanced interest distribution in smart grid: a Nash bargaining demand side management scheme," in Proceedings of the 2016 IEEE Global Communications Conference (GLOBECOM), Washington, DC, USA, December 2016.
30. P. D. Diamantoulakis, K. N. Pappi, P.-Y. Kong, and G. K. Karagiannidis, "Game theoretic approach to demand side management in smart grid with user dependent acceptance prices," in Proceedings of the 2016 IEEE 84th Vehicular Technology Conference (VTC-Fall), Montreal, Canada, September 2016.
31. A. Srivastav, P. Nguyen, M. McConnell, K. A. Loparo and S. Mandal, "A Highly Digital Multiantenna Ground-Penetrating Radar (GPR) System," in IEEE Transactions on Instrumentation and Measurement, vol. 69, no. 10, pp. 7422-7436, Oct. 2020, doi: 10.1109/TIM.2020.2984415.
32. Satish, Karuturi S R V, and M Swamy Das. "Quantum Leap in Cluster Efficiency by Analyzing Cost-Benefits in Cloud Computing." In Computer Science and Engineering by Auroras Scientific Technological & Research Academy Hyderabad, vol. 17, no. 2, pp. 58-71. Accessed 2018. https://www.ijsr.in/article-description.php?id=ZU9rWnA5d3R1Q1dzK2tLSTNTbDRZZz09