Resources Scheduling in Cloud Computing Security

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Resources Scheduling in Cloud Computing Security

**Abstract.**

*Cloud computing is one of the areas that has grown tremendously due to new advancement of new technologies and business models. Importantly, resources scheduling within the virtual clouds is a very complex task because of the amount of resources available and existence considering that resources allocation depends on what has been provided by the cloud service provider. This becomes more complex when the security aspect is factored in within the cloud environment. This research paper provides analysis of systematic literature review, which is a methodology, which involves analysis of critical and reproduceable literature based on summary of results published by different authors. Application of systematic literature review will be paramount in identifying relevant research that has be undertaken within the provided research topic on resources scheduling in cloud computing security environment. This research will be guided on several research questions, which include assessing previous research done and proposed based on resources scheduling in the cloud environment in the presence of security aspects. The second question that will guide this research is based on security issues are available with respect to cloud computing resources scheduling. The third question will be based on quality of service evaluation metrics can be put in place to improve the performance of resources scheduling in the cloud environment. The last question as per this research will be geared towards assessing the mechanisms and constraints are available in enhancing optimal resources scheduling in the cloud systems. This paper will aim to research on resources scheduling in virtual clouds, putting into consideration the challenges in implementing this, and quality of service that can be derived as a resort of having better scheduling algorithm in the virtual clouds.*

# **Introduction**

Resources scheduling in cloud computing is an approach used in minimizing wastage of minimal resources by allocating them efficiently in all cloud computing nodes. Inn cloud computing platform, virtual machines and nodes are assigned virtual resources to run services and executing available tasks (Sheikh et al., 2019). Notably, resources scheduling is a complex process in cloud computing, and it involves allocation of resources, improving server utilization, enhancement of service performance, and tasks executings. In cloud computing resources scheduling, there are there are two main methods that can be adopted, which include static and dynamic methods. The rationale behind cloud computing resources scheduling to enhance efficient use of cloud resources with an aim of meeting quality of service requirements. With resources scheduling, the issue of conflicts in allocation of active resources is fully resolved.

Cloud computing servers and applications require enough resources for them to run efficiently. Failure to allocate enough resources to these applications may lead to issues relating to data integrity and security. Therefore, there is a need to consider such issues and security issues of cloud computing resources. Several studies affirm that with the availability of different services provided by cloud computing, optimal solutions for virtual clouds can be useful in task scheduling (Amini et al., 2020). Effective resources scheduling considers various quality of service requirements, such as security, reliability and availability. In cloud environment there are 2 parties: cloud consumers and cloud providers, whereby cloud consumer submits workloads while cloud provider offers resources for workloads executing.

Understandably, resources management in cloud computing involves two main stages, i.e. resources reprovisioning and resources allocation. Resources reprovisioning is all about identifying resources for the specific workload based on quality of service aspects. On the other hand, resources scheduling involves mapping of the provisioned resources to the specific workloads, executing of the workloads, and releasing of the resources to the pool after the completion the workload (Singh & Chana, 2016). In terms of quality of service requirements, scheduling of resources for enough workloads becomes a real challenge. For the effectivey7 scheduling or the available resources, it is important to consider quality of service requirements. Therefore, there is a need to identify and discuss the research challenges that are evident in resources scheduling in executing the work-loads, without impacting the quality of service requirements.

Undoubtedly, activity scheduling is a key area in cloud computing because it involves large executing time and the cost of resources. Various criteria for scheduling and parameters are always direct to various categories of resources scheduling algorithms. According to Signh and Chana (2016), effective and efficient resources scheduling minimizes executing time and cost of executing. Similarly, an efficient task scheduling in cloud computing must be geared towards maintaining quality of service, without having any unpredictable environment. The primary reason why scheduling of resources is considered to be more challenging is because of the fact that cloud providers are not willing to share some information with each other; this is because of reasons such as challenges associated with heterogeneity of resources, which cannot be resolved by traditional resources scheduling algorithms.

This paper aims to discuss the concept of resources scheduling in cloud computing, including the security aspects. This paper also discusses several approaches of resources scheduling in virtual clouds and advantages of resources scheduling approaches. Since data security is a major concern in resources scheduling in cloud computing, this paper will also look at security aspects of resources scheduling in virtual clouds.

# **Problem Statement**

Cloud systems are highly complex because of their unpredictable environment. It is important to note that it is hard to obtain accurate information regarding accuracy of information on the states of the cloud systems. According to Selvi et al. (2014), the key factors affecting resources management in the cloud environment include security, performance, cost, and functionality. Undoubtedly, resources scheduling in cloud computing is linked with fluctuation of workloads, which leads to a critical challenge that is associated with the elasticity of cloud computing. The issue of fluctuation of workloads is mostly in two ways which include planned spiked and unplanned spike in the workloads. Resources scheduling. Ideally, resources scheduling in cloud computing needs to be allocated on demand. However, this has been a problem in most of the cloud computing systems due to lack of better scheduling algorithms and better quality of service requirements.

Notably, resources scheduling in cloud computing requires various considerations to be made, which include general policies for resources management, such as admission control, for example taking decision on whether to admit new job request or not to be processed. Another issue in this case is based on resources allocation in the virtual and physical machines. For cloud computing systems, server performance issues can also be influenced by the resources available in the system, which may have an impact on the server’s throughput, response time workload and load balancing of available jobs or tasks (Sheikh et al., 2019). It is important to note that running and executing tasks on the resources allocated tends to raise some security concerns than need to be looked at. Such security concerns include data security, data availability service security, among others. Data security comprises of privacy protection against any threats, and integrity.

In ensuring that the above-mentioned problems are resolved, optimal resources scheduling scheme that is secure need to be considered. Hence, there is a need to put consideration on these on the issues as well as security issues that includes data availability and security to obtain optimized and secure resources scheduling in the cloud environment. The main focus of this research is on resources scheduling approaches in cloud environment with a key focus on security within the cloud model.

# **Research Questions**

This research paper is based on the following research questions:

1. What has the previous research done and proposed based on resources scheduling in the cloud environment in the presence of security aspects?
2. What security issues are available with respect to cloud computing resources scheduling?
3. What quality of service evaluation metrics can be put in place to improve the performance of resources scheduling in the cloud environment?
4. What mechanisms and constraints are available in enhancing optimal resources scheduling in the cloud systems?

# **Related Review**

Based on the review of related literature of resources scheduling in cloud computing, various researches have been undertaken, and they have presented different aspects of the research topic. In assessing the work Amini et al. (2020), millions of users depend on the cloud resources which requires high level of security, large processing power. Similarly, the requests received by this large number of users are associated with communication costs, tasks size etc. Further studies indicate that scheduling in cloud involves obtaining optimized mappings for the number of tasks to be allocated and executed to the specific number of processors. Several criteria can be adopted regarding the scheduling to be done, taking into consideration the resources to be utilized and mappings that are required.

Sheikh et al. (2019) presents quality of service requirements (QoS) and concerns in the cloud computing resources scheduling. Such requirements that have been presented include security which is considered in the research as a shared service management between cloud providers and cloud consumers. Additionally, further studies affirm that cloud consumers must have a clear understanding of the level of security on their side, and threats that might interfere with resources scheduling. Based on the article presented by Dewangan et al. (2018), resources scheduling is enhanced since cloud providers are able to achieve scalability by running several virtual machines on physical servers. Service delivery is defended against the security threats and risks from unauthorized access of cloud applications or resources. Amini et al. (2020) in his research argues that cloud providers never use virtual machines must provide security to the server and data storage space from any possible security threat within the virtual clouds. Notably, any security threat within the virtual environment that enables the co-occupant virtual machines or servers to make unauthorized access of cloud could lead to information assets being compromised.

Service performance in cloud resources scheduling has also been presented in several research. Ideally, cloud consumers require specific level of service performance to execute the required level of service within this environment. According to Mehta et al. (2017), the service level agreement between cloud service providers and consumers ought to specify to both parties the specific level of service performance. Service level agreement is important to cloud consumers in determining the best cloud providers based on their needs. Mell and Grance (2011) in their research assert that the cloud architecture comprises of three fundamental components, which include essential characteristics, service models and deployment models. Essential characteristics are those features that enables both providers and consumers to manage, access and measure the cloud services and resources allocated to those services. With such features, they provide measure of security to the cloud providers and consumers, which feature has a security concern. Such security concerns include access availability, confidentiality, data integrity, access and fata availability.

Balista et al. (2015) in his research talks about service models in the cloud computing, which provides definition to a consumer type of systems operations and management, and access to cloud systems. Further studies indicate that security, performance and availability are the key elements that may affect the provisioning of cloud services. Additionally, such elements also affect resources scheduling in the virtual clouds. According to Sheikh et al. (2019), there are three service models types that offers different capabilities to obtain service. Such models are also critical in resources scheduling, they include infrastructure as a service (IaaS), which offer basic form of a service like virtual storage space, virtual machine, and server network bandwidth. The second service model is software as a service (SaaS), which enables service providers to provide software and applications in the cloud environment. Cloud consumers can access such applications using devices through different interfaces.

# **Methodology**

This research heavily relies on systematic review of literature, which will identify issues relating to resources scheduling in the cloud computing and cloud scheduling security. With this approach, it will help to identify the existing gaps in the research and providing an overview of the research area. One of the reviews shows that various cloud security models are linked to data as a service, cloud repository and research for scheduling focusing on the resources scheduling algorithms. Understandably, a good systematic review of literature should comprise of three key stages, which include review protocol, need for review, conducting and reporting of the review. Importantly, systematic literature review is necessary in identifying further research more than has been undertaken before in this research area. This is important in this research methodology since the outcome of this research will be geared towards providing a new model for research scheduling in the cloud security. This methodology will provide various previous research undertaken, and research findings gaps for further research.

## **Review Protocol**

For the purposes of this research, the development of a systematic review protocol is paramount. Review protocol defines methods to be applied in review and offers an explicit strategy for this research. It is important to note that the rationale behind review protocol is to facilitate a systematic review, by keeping track and answering the original research questions. The review protocol in this research comprises of research team information, background which describes what is all about review the review question search strategy, eligibility criteria, among other things. The research will be geared towards registering a review protocol to access various aspects of the literature searches in assessing resource scheduling in cloud computing environment.

## **Need for Review**

The primary goal of need for review is to provide evidence-based information from the research studies. Similarly, this research is driven by the formulation of review objectives with the guidance provided by the review questions. In this case, this study is driven by review questions that associated with resource scheduling in cloud computing. This review is also based on the on the systematic literature review that depicts contextual purpose and issues that are connected to review questions provided

## **Review Objectives**

|  |
| --- |
| The primary objective of this research is to assess on resource scheduling in cloud computing security and deduce the conclusion regarding achieving quality of service.  The research aims at performing systematic literature review on resource scheduling in cloud computing |

## **Review Question**

|  |
| --- |
| **Full Review Question**   1. Assessment of previous research done and proposed based on resources scheduling in the cloud environment in the presence of security aspects 2. Assessment of security issues are available with respect to cloud computing resources scheduling. 3. Assessment of quality of service evaluation metrics can be put in place to improve the performance of resources scheduling in the cloud environment. 4. Assessment of mechanisms and constraints are available in enhancing optimal resources scheduling in the cloud systems |

## **Search Strategy with Pilot Search Sources**

|  |
| --- |
| **Databases for Search Strategy**  *This comprises list of bibliographies to be assessed which will include the following:*  Afzal, S., & Kavitha, G. (2019). Load balancing in cloud computing–A hierarchical taxonomical classification. Journal of Cloud Computing, 8(1), 22  Amini Motlagh, A., Movaghar, A., & Rahmani, A. M. (2020). Task scheduling mechanisms in cloud computing: A systematic review. International Journal of Communication Systems, 33(6), e4302.  Sheikh, A., Munro, M., & Budgen, D. (2019). Systematic Literature Review (SLR) of resources scheduling and security in cloud computing. International journal of advanced computer science and applications., 10(4).  Singh, S., & Chana, I. (2016). A survey on resources scheduling in cloud computing: Issues and challenges. Journal of grid computing, 14(2), 217-264.  etc |

## **Pilot Search Table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Keyword** | **String** | **Database** | **Results** | **Refine Keywords** | **Refined Results** |
| Resource Scheduling, Cloud Computing,  Systematic Review | “Resource scheduling” OR “task scheduling” AND “cloud computing” AND “systematic review” | Google Scholar | 978 | Resource Scheduling | 727 |
| Cloud Security, Quality of Service | “Cloud security” or “cloud computing security” AND “quality of service” | IEEE | 65 | Task Scheduling in Cloud Computing Environment | 27 |
|  |  | Research Gate | 14 | Resource Scheduling algorithms | 9 |

## **Eligibility Criteria**

Eligibility criteria in this research will be based on various aspects as depicted in the table below

|  |  |  |
| --- | --- | --- |
| **Framework** | **Inclusion Criteria** | **Exclusion Criteria** |
| Populations |  |  |
| Interventions |  |  |
| Comparisons |  |  |
| Outcomes |  |  |

In going deep to the roots of resources scheduling in cloud computing, proper research methodology based on the available literature was followed to the later. The literature was conducted in accordance to the general research strategy that stipulate the mechanisms in which in which resources scheduling in cloud environment is done and outline the methods, theories, algorithms, and algorithms associated in it (Afzal & Kavitha, 2019). Notably, the resources scheduling in cloud security was studied as per the constructive generic framework, associated with systematic literature review, which is mostly divided into three sub processes: variables, factors and parameters that are linked with cloud computing resources scheduling with respect to the security issues. Moreover, study of the literature review was carried through the guidelines provided in systematic literature review as discussed by Sheikh et al. (2019) who put focus on resources scheduling in cloud. It is worth noting that a systematic literature review is a repeated research replicable by other researchers with an aim of exploring more insights about the topic.

The primary studies in the research will involve reading from the literature materials with an aim of assessing the research questions provided in this topic. The primary studies will offer more insights to the readers about various aspects of resources scheduling in cloud first research question on what are the previous research done based on resources scheduling in the cloud environment with respect to security aspects (Amini et al., 2019). This question has been/ will be answered by assessing different literatures done in the past studies. For the case of the second question about security issues are available with respect to cloud computing resources scheduling, this question classifies the security question in terms of enhancing data security, privacy, integrity and data availability, among others. About the quality of service evaluation metrics as per the systematic literature, quality of service discussed include security of service, improved performance, data availability, etc

# **Results**

The primary goal of this research was to assess resources scheduling in clouding computing security which has been stated in the research questions. Regarding the results obtained as in the first research question on resources scheduling in the cloud environment security aspects, several researches have been undertaken on this topic. According to Sign and Chana (2016), cloud computing is an open issue in cloud computing where the cloud providers do not necessarily have access to system security of the physical data. For the data processing and VM migration services, it should only be permitted or occur when there is confidentiality between both the sender and receiver.

Amini et al. (2020) has presented optimal resources scheduling framework in the cloud that adopts heuristic algorithms, with aim of minimizing the cost. The results from the literature shows that that this model could lead to reduction in cost, executing, response time, and better performance. Based on the results obtained from Zhang and Zhou (2017) on cost effective resources scheduling mechanism in the cloud, virtual machines are primarily assigned to tasks because the goal is to reduce on the executing time. Additionally, the simulation results presented proves the maintenance of the quality of service which is associated with better performance in the executing of tasks and its associated cost.

Notably, new workflow scheduling algorithm as presented by Zhang et al. (2017), present a workflow scheduling mechanism that is geared towards solving multi-objective scheduling issue that is mostly in workflow applications through a heuristic algorithm. Simulations results presented by this author also proves the least executing time of tasks as well as cost of resources performance through the specific bi-objective model provided. Additionally, the resources scheduling in terms of the cost and security factors in cloud computing mostly rely on heuristic algorithms. Importantly, these simulations results have proved to be an efficient mechanism based on providing the solution for real-time resources scheduling in the virtual clouds.

# **Discussion**

This part presents analytical classification, for example resources scheduling algorithm categories, environmental analysis on resources scheduling, and quality of service in the virtual clouds. The methodology adopted was systematic literature review, the applied algorithm was both heuristic and non-heuristic algorithm. The key evaluation factors of resources scheduling in virtual clouds include security, time, cost and reliability. While the analysis environment as per the literature reviewed is simulation environment as presented in the results. The main context of this research is based on fault tolerance scheduling framework in the virtual clouds as well as quality of service in resources scheduling in the cloud system. Lastly, this discussion assessed both the advantages and limitations based on quality of service in resources scheduling in the cloud environment. Advantages include improved service reliability, reduced job executing time, and low executing delay. In terms of limitations as per this research include no comparability with other resources scheduling algorithms.

# **Conclusion**

The primary goal of this paper was to illustrate a comprehensive research on resources scheduling in cloud computing security. The research also provided the problem statement within the virtual clouds in terms of resources scheduling, and quality of service requirements that can affect service performance, reliability, data security among other critical performance issues of the virtual cloud systems. Also, this paper has described systematic literature review methodology as adopted in this research to disseminate relevant information linked to resources scheduling in the cloud computing. Lastly, in this paper which was guided by relevant research questions, it addressed the main context of the research, advantages and limitations associated on the quality of service aspects, which were the major consideration when assessing resources scheduling within the cloud environment.

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