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Multitenancy in SaaS: Strength,Weaknesses, Opportunities and Challenges

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Abstract

In the age of utility computing or cloud computing, Multi-tenancy has become popular and is acknowledged mainly as Software as a Service (SaaS) to the next level generations. Also, the specific application of Cloud computing even allows users, customers, and tenants to modify it reliably or robustly. Notwithstanding, it cannot be denied that the specific software allows customisation to its tenants and due to these errors increases and causes security risks. Also, it cannot be denied that there are various benefits of Multi-tenancy in a SaaS. Whereas various studies determined the challenges and threats of Multi-tenancy in a SaaS as well.

In the present research paper, to understand the real meaning and strengths and weaknesses of Multi-tenancy in a SaaS a researcher has used a secondary data collection method. Also, the qualitative research method has been used to critically analyse the various opinions of researchers. The outcomes of the study have been focused to determine strategies for the challenges caused by Multi-tenancy in a SaaS.

Keywords : Cloud computing, SAAS application and Multi-tenancy.

Introduction

One of the famous modern techniques in which the Grid is adopted by businesses and organisations to increase profit ratio is called Cloud computing. The ability to serve numerous customers through anarchitectural software application at a single instance is called Multi-tenancy in SaaS (Aleem et al., 2019). Such numerous customers are termed as tenants. The full form of SaaS is Software-as-a-Service. The major strengths of Multi-tenancy in SaaS are its cost efficiency and customisation. Nevertheless, the determined weakness of SaaS is the security risksof potential data. Moreover, the biggest opportunity for Multi-tenancy in a SaaS is its faster innovation. But in contrast to it, performance optimisation and data segregation are the biggest challenges of Multi-tenancy in a SaaS. Nevertheless, there is a necessity to overcome such

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challenges for the effective usage of Multi-tenancy in a SaaS. This is because it helps upgrade new features and assure consistency.

The present report includes the meaning of multi-tenancy in SaaS. The present report majorly focuses on the strengths, weaknesses, opportunities, and challenges of Multi-tenancy in SaaS. In addition to it, the methodology of the present report includes distinct research strategies, research methods, and research data collection. However, the data in the present report is collected from secondary data resources. In furtherance, qualitative research has also been used to examine and evaluate different aspects of collected data. Notwithstanding, the challenges of Multi-tenancy in SaaS have been identified. Furthermore, the findings from the gathered data through secondary source has been presented and critically analysed. Lastly, the research report ends with a conclusion.

Literature review

The Definition of Multi-tenancy in Regards to SaaS and its Applications

According to the research carried out by Aranda et al. (2015), multi-tenancy is a more comprehensive concept that contributes to a reduction in the total expenses of ownership. In addition, research conducted by Grewal et al. (2015) found that the multi-tenancy model makes it possible for multiple tenants to keep their essential data on a public platform of the same type. In addition to this, the research carried out by Sharma et al. (2015) has made it possible todetermine that multi-tenancy has the ability to regulate the data of several tenants and to divide itup in accordance with their needs. According to the findings of Dangol et al. (2015)'s study,SaaS is an abbreviation for "Software as a Service," which describes a model that enables multiple tenants to use the software at the same time. In a similar fashion, it has come to light that the SaaS application enables users to access many databases at the same time. Because of this, tenants and customers have access to the same kinds of hardware resources, which means that they can simply share them while also being restricted. According to the findings of a study conducted by Mishra and Goyal (2016), the application code of SaaS is able to store data with ease and also maintains backups in large numbers. In addition, one more significant benefit of using SaaS is that it has less system needs, making it easier to maintain. On the other hand,Madni and Othman (2015) argued that forming a server for each and every client appears to bean insufficient solution to the problem. However, it is possible to assert that the utilisation of certain resources is more effective

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than the utilisation of other resources. In general, it is possibleto assert that multi-tenancy is a solution that enables better scale in optimising a large number of tenants all at once.

The importance of multi-tenancy in SaaS and selecting the appropriate model

According to the research carried out by Chetan and colleagues in 2016, software is the central processing unit of all modern businesses. In addition, the research carried out by Bezerra et al. (2016) uncovered the fact that businesses require diverse software in order for their operations to be carried out without being disrupted in any way. In addition to this, the research that was conducted by Trivedi and his colleagues in 2016 found that it is difficult to choose advanced software tools for improved functionality from the wide variety of digital products and services that are currently available. In a similar vein, the past several years have seen a huge shift away from on-premise software and towards cloud-based solutions in the software industry. Having said that, Moyer and Hollingsworth (2016) referred to this particular type of software as SaaS. Inspite of this, Software as a Service (SaaS) capitalises on the economies of scale that are created when a comparable service is utilised by several tenants who are all supplying the same version of a product. These economies of scale are made possible by the large number of consumers that SaaS serves.

In addition, the research carried out by Cho et al. (2017) has made it possible to establish that cloud computing has evolved into a competitive advantage for a wide range of enterprises over the past decade. In addition to this, large companies are investing in cloud computing in the hopeof maximising their revenues by taking advantage of the many opportunities that lie ahead. In addition, Srivastava et al (2017) noted that multi-tenancy is essential for software as a service (SaaS) since it hosts several computer programmes, avoids complications, and reduces costs associated with on-premises maintenance of pricey software and hardware, respectively. In a similar vein, the relevance of Multi-tenancy in SaaS lies in the fact that the cost advantage of cloud infrastructure may be shared by various users all over the world. A single tenancy model isone of the selected SaaS application models that can benefit from cloud computing. This is discussed more in the next paragraph. Within this particular form of system, different copies of each of their processes are kept in accordance with the consumers who are now in use. In spite ofthis, Cao et al. (2019) said that there is a restriction placed on a single tenancy while the application is being infused. In contrast to this, Jayachandran and Sankarnarayanan (2017)argued against it and stated that the multi-tenancy model is superior to the single-tenancy model due to the fact that it is more

efficient and can be scaled horizontally as well as distributed. They added that this makes it superior to the single-tenancy model. In general, it is possible to makethe assertion that multi-tenancy is a fundamental component of SaaS and should be the modelthat is chosen.

Multi-tenancy in Software as a Service Providers: Pros and Cons

According to the findings of the research conducted by Akinrolabu et al (2019), multi-tenancy in SaaS possesses a variety of advantageous qualities. According to the findings of Pinto et al. (2019), the most significant benefit of using Multi-tenancy for SaaS is the ability to customisethe service. This is due to the fact that it implies improved adjustable options, which make it possible to satisfy the requirements of tenants. In addition to this, Chandra et al. (2017) conducted a study in which they found that multi-tenancy in SaaS has the advantage of beingable to easily update their software by removing unneeded feedback and upgrading both new andadvanced features. In a similar vein, it reduces the need for maintenance while simultaneously ensuring consistency. According to the research conducted by Rodrigues et al (2017), two more advantages of multi-tenancy in SaaS are scalability and cost-effectiveness. Adequate scalability helps in accommodating various tenants, while cost-effectiveness eliminates the operational and infrastructural costs. Scalability and cost-effectiveness are both benefits of multi-tenancy in SaaS.

Bezerra et al. (2016) conducted research and found that multi-tenancy in SaaS applications has a number of drawbacks that need to be addressed. A study conducted by Cao et al. (2019) found that multi-tenancy has a detrimental influence on performance, despite the fact that it offers a number of advantages in terms of cost and other factors. This is due to the fact that if the performance of the particular software is not handled effectively, then it might result in negative consequences that affect both the infrastructure and the resources. In the same manner, the research conducted by Aranda et al. (2015) identified another flaw, which is restricted customising. This is a situation in which in-depth and sophisticated customisation are sacrificed so that the standard can be maintained. In addition, security threats are another deficiency of the particular application. This is due to the fact that the non-implementation of data and thecontinued isolation of it both give rise to privacy concerns, and the capacity to keep data secret isdiminished as a result. When taken as a whole, it is possible to say that multi-tenancy in SaaS carries with it both positives and negatives.

Multi-tenancy in SaaS presents both opportunities and challenges.

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The research that was conducted by Grewal et al. (2015) found that multi-tenancy in SaaS is expanding at a rapid rate. In addition to this, the research conducted by Dey et al. (2019) revealed that its primary opportunity is the limited barrier that must be overcome in order to reach the SaaS market. This is due to the fact that the companies that supply SaaS sell their services at a discounted price. In addition to this, there has been a reduction in costs, which has led to an increase in accessibility for both small and medium-sized businesses. In addition to this opportunity, Srivastava et al. (2017) found that their research opened the door to a more rapid pace of innovation. Rapid development of advanced features is seen among providers of multi- tenancy. In addition, it gives renters access to sophisticated capabilities that can be used by the company.

In spite of this, Aleem et al. (2019) conducted research and found that multi-tenancy in SaaS faces a number of potential risks. The absence of performance optimisation, in which service providers are required to continually improve and monitor service levels, has been identified as the most significant risk. In a similar vein, the research conducted by Rodrigues et al. (2017) demonstrated that it is difficult to keep the onboarding process of a large number of talents organised. However, doing so requires a significant amount of time and disrupts the software's normally efficient operation. In addition, Hollingsworth (2016) identified a further risk associated with multi-tenancy in SaaS, which is the separation of users' data. It ensures the isolation of limited data and even safeguards unauthorised data, which can cause authorised data to be compromised if it complies with it and causes damage to it. In general, it is possible to statethat multi-tenancy in SaaS involves both positive and negative aspects, that is opportunities and dangers respectively.

Problems Associated with Multi-tenancy in SaaS

According to the findings of Dey et al. (2019), numerous businesses improve their cloud-native capabilities by moving their applications to the cloud. However, as a result of this, many organisations are confronted with difficulties in the management of subscription tenancies and multiple accounts due to the existence of numerous cloud service providers.

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However, according to Yassin et al. (2019), the research conducted by Sastry and Basu (2019) demonstrated that suchproblems inevitably develop owing to cloud sprawl when organisations and units collaboratewith one another. In addition, according to the findings of the research carried out by Sharma et al. (2015), such difficulties are brought about when different companies and teams collaborate onprojects by jointly establishing accounts and subscribing to the relevant services without engaging in any form of communication or coordination. In addition to this, there are three significant security risks that are associated with multi-tenancy that every user needs to be aware of. These issues are our poor data security management, overallocated rights, and a lack of visibility into accounts. The inadequate management of data security is the most significant obstacle presented by multi-tenancy in SaaS, as stated previously. According to Pinto et al (2019), the availability of a wide variety of storage formats in data services is one of the primary reasons why multi-tenant data cloud security is so important. Concerns with users' privacy can also arise when an excessive number of capabilities are granted, such as the ability to keep various records and permit a variety of user groups and individuals to perform several actions simultaneously. Bezerra et al. (2016) found that a lack of centralised view in asset inventory and subscription configurations is the root cause of the visibility difficulty in accounts. On the other hand, problems like as security concerns are solvable, and they can be solved by placing a greater emphasis on configuration control, monitoring, and central governance. In general, it is true that security issues are the root cause of interruptions in multi-tenancy in SaaS, and there is an immediate demand to find a solution to this problem.

Methods

A method of explaining the intention of the researcher to carry out research is called research methodology (Snyder, 2019). Also, it is a systematic as well as logical plan to solve the challenges of the research problem. In addition to that, the approach of the researcher in a research methodology is to assure valid and reliable outcomes which address the determined aims and objectives. Similarly, research methodology is important because it aids in maintaining the researcher's track, and makes the entire process of research smooth, manageable and effective. In the same way, a detailed research methodology even aids the researcher in understanding the methods and approach of research which can be helpful in the specific subject matter.

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Notwithstanding, there are two types of research methods namely, quantitative andqualitative. The qualitative research methodology includes gathering and examining spoken words as well as written data Grewal et al (2015). In furtherance, it focuses on visual elements and body language. On the other hand, quantitative research methodology focuses on gathering, testing, and analysing numerical data. Nevertheless, in the present study qualitative research methodology is used because it aids the researcher in framing and creating a detailed description of the subject matter. In furtherance, qualitative research methodology helps in specifically subjective, and it aids in understanding the perceptions of other humans regarding products, persons, and events.

Procedures and techniques used in collecting information for research are called data collection methods Srivastava et al (2017). However, such methods can be varied from easy self-reports to critical reports and experiments to fulfil the subject matter of any study. In the same way, it involves various approaches to collect and analyse data. The methods of data collection are important because it identifies the accuracy and quality of gathered data. However, two types of data collection methods aid in fulfilling the subject matter of any study namely, primary data collection and secondary data collection. In addition to that, the primary data collection method is the authentic information collected by the researcher itself and is accurate whereas, thesecondary data collection method gathered data from distinct available sources Pinto et al (2019). In furtherance, the present study uses a secondary data collection method based on the specific topic that is Multitenancy in SaaS: Strengths, weaknesses, Opportunities and Challenges. Also, itcannot be denied that secondary data includes data which has been already published as well as used in past and it is easy for the researcher to obtain it from sources both externally and internally. The external sources that will be used in the present study are business journals whereas the internal sources that will be used are articles, journals, and CRM software (Alpi and Evans, 2019). This is because such secondary data sources can help compare data published by different researchers and can aid in critically examining it.

Therefore, it can be stated that the present study will use qualitative research methods and secondary data collection methods to fulfil the subject matter of the present study.

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Findings

After conducting research on a wide variety of literature and examining the results of those studies, it was discovered that multi-tenancy is one of the well-known software programmes that incorporates an architectural strategy that is simple to implement in Service as a Service (SaaS). Additionally, it has come to light that the collective group of users who make use of cloud computing at the same time is referred to as tenants. This is due to the fact that renters make an effort to manage the isolation of customer data and even make an effort to retain the individualised experience of consumers. In spite of this, multi-tenancy in a SaaS has its own unique set of advantages, disadvantages, difficulties, and opportunities. After reviewing the research conducted by Grewal et al. (2015) and Aleem et al. (2019), it has been determined that scalability and the capacity to perform maintenance and updates are the two primary benefits thatmulti-tenancy offers in a SaaS environment. Similar to what was stated before, the research conducted by Yassin et al (2019) and Dey et al (2019) has made it possible to determine the other two benefits of multi-tenancy, which are cost-efficiency and the flexibility to customise. Nevertheless, the research conducted by Snyder (2019) has been of assistance in evaluating the limitations of Multi-tenancy in a SaaS, and it has mentioned that data isolation is one of the mostsignificant limitations. According to the findings of the research, one of the most important parts of both privacy and security is the proper management of restricted data isolation among all tenants. This is due to the fact that ensuring complete data separation is a hard endeavour, and failure to do so may even violate the rights of a number of tenants. According to the research conducted by Newman and Gough (2020), one of the drawbacks of multi-tenancy in a SaaS is restricted customization, which describes a situation in which renters are granted the ability to customise their accounts, but the customization does not adapt to the tenants' specific needs. However, in contrast to all of the shortcomings, the study referenced above was helpful in investigating the prospects presented by Multi-tenancy in a SaaS environment. According to the findings of the research, the most important opportunity is community and collaboration, in which tenants can share their expertise in order to provide a more advanced level of service.

According to the findings of Aranda et al. (2015)'s study, multi-tenancy SaaS enables all service providers to serve customers with effective scalability, which in turn enables them to grow their businesses in worldwide markets.

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However, it is possible to make it easier to accomplish by utilising shared resources, discussion boards, and forums because doing so encourages users to increase the number and scope of their interactions.

Contrary to the findings of all studies, it has been determined through analysis that multitenancy in a SaaS presents a number of issues. These challenges, in turn, cause major disruptions to all of the networks and tenants. The inability to maintain one's privacy and sense of safety is the most significant difficulty brought about by this. This is due to unauthorised access being gained to the encryptions, controls, and access points, which compromises not just the data but also thetenants' right to personal privacy. According to the findings of various research, one of the other obstacles is poor regulatory compliances, which occurs when complicated regulations do not fulfil the necessary parameters necessary for the effective operation of Multi-tenancy in a SaaS. In the same vein, improper performance optimisation does not make it possible for all tenants to make advanced use of shared apps. Overall, after reviewing all of the research, it is possible to draw the conclusion that despite the fact that multi-tenancy in a SaaS has a number of advantages, it is essential to deal with its flaws and difficulties in order to get past problems and make use of its advantages.

Conclusion

As a result, it is possible to assert that cloud computing has advanced significantly as a paradigm of computing for the purpose of delivering and sustaining services through the internet. However, it is impossible to deny that the concept of cloud computing is undergoing rapid change across the board in many different businesses, including the industry of information technology. In spite of this, it is indisputable that as a result of the lightning-fast expansion of cloud computing, controllers are finding it increasingly difficult to keep track of the ever-increasing demand for its services. In the same manner, the concept of multi-tenancy has becomemore widespread in cloud computing, which allows a large number of users to utilise a single piece of software concurrently without experiencing any disruptions. However, a study that included contributions from a number of researchers came to the conclusion that multi-tenancy poses a threat to the privacy of tenants' personal data. In conclusion, it is possible to assert that

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multi-tenancy in a SaaS possesses a variety of strengths and benefits, but that it also possesses a significant number of flaws and dangers along with those strengths and benefits. In spite of this, it is possible to assert that the aforementioned difficulties associated with multi-tenancy can be conquered by implementing the appropriate solutions.

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