Adoption Conceptual Framework based on Agility and Flexibility in Cloud Computing System

اعتماد الإطار المفاهيمي على أساس خفة الحركة والمرونة في نظام الحوسبة السحابية

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Authorization

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Dedication

TO the big heart, my father

TO the fountain of patience and optimism and hope, my mother

TO my happiness in life, my wife

TO the wonderful girl, my sister

TO the best friend, my brothers

To my dear son

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Abbreviations	Meaning
CCAF	Cloud Computing Adoption Framework
CRF	Cloud Requirement Framework
IaaS	Infrastructure as a Service
IS	Information Systems
IT	Information Technology
LBC	Leeds Beckett Cloud
PaaS	Platform as a Service
SaaS	Software as a Service
SC	Supply Chain
SOA	Service Oriented Architecture
VM	Virtual Machine

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Abstract

Cloud computing is a relatively new business model in the computing world. It refers a model for enabling network access from anywhere and anytime to a shared pool of configurable computing resources, these resources represent in networks, servers, storage, applications, and services. The cloud computing is entrusting data to information systems that are managed by external parties (cloud providers).

the cloud computing is popular today because of the reliable services that provided by the cloud providers, the providers have several data centers spread all over the world to help users for handling their requirements, also, to facilitate storage redundancy and help with low latency response.

In this thesis, the researcher reviewed the general concepts of the cloud computing, and described the services offered by the major cloud service providers, then focused on the important role that these providers provide and how individual users and organizations could benefit. The important point, that faced the user when having more than cloud provider, is choosing the appropriate provider for transferring data and handling it. The researcher suggested some solution determine the best cloud provider

based on two important factors that should exist as a key in every cloud provider (flexibility and agility).

The proposed method has been implemented to distinguish between the cloud service providers based on a number of metrics; these metrics can rely on their values to estimate the service provider by the user. The metrics that the researcher depends on are Average, Max, Failure and throughput.

This thesis implementing the model based on the virtual machine. The virtual machine is different in setting; the researcher has been implemented number of experiments and calculates values by metrics equation for each type of virtual machine. To rely on these values, the researcher concludes: whenever the value of Average, Max, Failure is decreased it would be the better, and whenever the number of executed operation through the throughput is increasing the server would be the better.

Keywords: Adoption Conceptual Framework , Agility and Flexibility , Cloud Computing System

اعتماد الإطار المفاهيمي على أساس خفة الحركة والمرونة في نظام الحوسبة السحابية

إعداد

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إشراف

الدكتور هشام أبو صايمة

المُلخص

تُعتبر الحوسبة السحابية نموذج جديد في عالم الحوسبة. النموذج يشير في نفس الوقت الى امكانبة الوصول إلى الشبكة من أي مكان وزمان وإلى المجموعة المشتركة من تطبيقات الحوسبة المقدمة للخدمات، و تكثر هذه التطبيقات في الشبكات والخوادم ووحدات التخزين والتطبيقات والخدمات. والجدير بالذكر، إن الحوسبة السحابية تقوم بإيداع البيانات بنظم المعلومات التي تدار من قبل أطراف خارجية (مقدمي الخدمات السحابية).

في الوقت الحاظر تحظى، الحوسبة السحابية بشعبية كبيرة بسبب الخدمات الموثوق بها التي يقدمها مزودو الحوسبة السحابية للعديد من مراكز البيانات المنتشرة في جميع أنحاء العالم لمساعدة المستخدمين على التعامل مع متطلباتهم، وأيضاً لتسهيل عملية التخزين المنتشرة والمساعدة من حيث سرعة وقت الاستجابة.

في هذه الأطروحة يستعرض الباحث المفاهيم العامة للحوسبة السحابية وأيضا وصف الخدمات المقدمة من قبل المقدمين الرئيسيين لخدمات السحابية، ثم بعد ذلك ركز الباحث على الدور المهم الذي يوفره هؤلاء المزودون وكيف يمكن أن يستفيد منها المستخدمون والمنظمات الفردية. في

هذه الأطروحة النقطة المهمة التي واجهت المستخدم وجود أكثر من مزود سحابة، حيث يتم اختيار المزود المناسب لنقل البيانات والتعامل معها. و بهذا الصدد اقترح الباحث بعض الحلول التي تحدد أفضل مزود للحوسبة السحابية استنادا إلى عاملين مهمين، حيث يجب أن يكونين في كل مزود للخدمات السحابية (المرونة وخفة الحركة).

وقد نفذت الطريقة المقترحة للتمييز بين مقدمي الخدمات السحابية استنادا إلى عدد من المقاييس التي اعتمد عليها المؤلف (متوسط، الحد الأقصى، الفشل والإنتاجية) ويمكن الاعتماد على قيمة المقاييس لتقيم مقدم الخدمة من قبل المستخدم.

إن هذه الأطروحة تقوم بتنفيذ النموذج القائم على الجهاز الظاهري و الذي بدوره يختلف في الإعداد، وقد نفذ الباحث عددا من التجارب وقام بحساب الوقت الازم للتنفيذ بمعادلات المقاييس لكل نوع من أنواع الأجهزة الظاهرية. اعتماداً على نتائج التجارب، استنتج الباحث ما يلي :

1. كلما انخفضت قيمة المتوسط، الحد الأقصى، والفشل، سيكون ذلك أفضل.
2. كلما زاد عدد العمليات المنفذة من خلال الإنتاجية، كان الخادم هو الأفضل.

الكلمات المفتاحية: اعتماد الإطار المفاهيمي، خفة الحركة والمرونة، نظام الحوسبة السحابية.

CHAPTER ONE

INTRODUCTION

1.1 Background

Cloud concept is an evolutionary approach in a computing environment that combines the resources of different computers to function as a single entity. These resources (hardware and software) shared between different users through the internet and managed by the provider. The cloud offers many benefits to the web-connected devices and handling the amount of data.

These points make the cloud gaining and popularity over the past few years. Cloud Computing integrates a number of computing concepts such as Service Oriented Architecture (SOA), Web 2.0, virtualization and other technologies with reliance on the Internet. It combines them as a paradigm to deliver on-demand resources (e.g., infrastructure, platform, software, etc.) to customers similar to other utilities (e.g., water, electricity and gas).

The cloud offers common business applications online through web browsers to satisfy the computing needs of customers, and the customer uses cloud services based on pay only for the actual used without needing any details about the process.

Due to these business applications, many organizations have started building applications on the different types of cloud infrastructure;these types identified based on the organization’s requirements and their data volumes, types of services and uses of the organization (Hashizume, K., et al., 2013 and Garg, S. K., 2013).

In the recent years, the main concern for the organizations is how to manage the huge size of the database and to presented more services without increased cost. The database management needs more efforts for ensuring features of cloud database such as scalability, flexible, availability, reliability and agility. This chapter presents fundamental concepts of cloud and discusses the main idea of this thesis.

1.2 Cloud Services Model

Cloud computing vendor providing different resources to the customers by using a service business model, this model presented resources as services on an on-demand basis over the Internet. In practice, the cloud service offers through numerous delivery models, it is classified into three categories: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) (Villegas, D., et al., 2012), as shown in figure ().

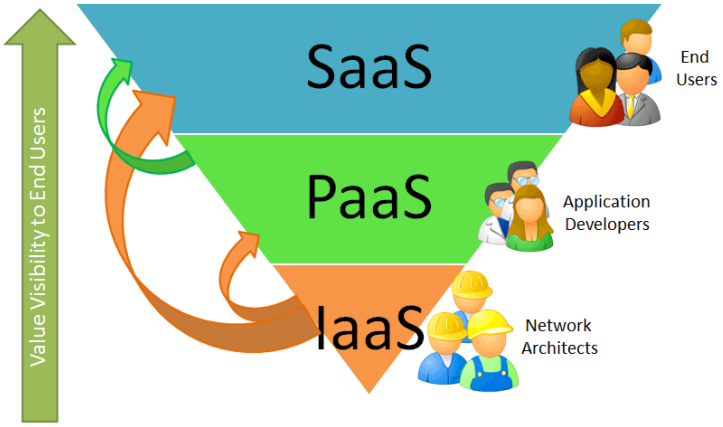

Figure (1-1): Cloud services model

1- Infrastructure as a Service (IaaS)

IaaS indicate to on-demand provisioning of infrastructural resources, it allows users to turn on the operating system via virtualization software that is presented by the service provider. this model characterized easily to collaborate or access data, Pay per use. it is supporting customer to supply the processing, storage, networks and other fundamental computing resources. but the same time, the customer can not manage the underlying cloud infrastructure, it is has controlled over the operating system, storage, and deployed applications, and possibly limited control of select networking components.

2- Platform as a Service (PaaS).

PaaS is represented set of software and development tools on the provider's server, thus it plays a main part in cloud computing as it brings custom software development to the cloud. PaaS is a combination of related services for creating and deploying software on cloud, it offerings manages user subscriptions, security, resource metering, flexibility and all facilities to support building and delivering web application services. The PaaS provided the customer to deploy the cloud`s infrastructure or acquired application created using programming language, libraries, services and tools supported by the provider.

3- Software as a Service (SaaS)

SaaS is a new of software development, it is implemented on the virtualized and associated with pay-per-use costing model when software applications are rented to organizations by SaaS vendors. SaaS delivers special-purpose software that is remotely accessible by the consumers through the internet without the need to install and run any software on their device. SaaS is a more restrictive model than other types of services, which constrains customer to use an existing set of services, rather than deploying it.

1.3 Cloud Computing Characteristics

Cloud computing presents several characteristics that attracted any organization, to cover its needs by using the cloud service to realize the main characteristics of cloud in order to execute its services efficiently. The fundamental characteristics of cloud computing are listed below (Zhang, Q., et al., 2010 and Alfifi, F., et al., 2015):

1. On-demand self-services: The customer can implement the required services or processes on the cloud without any human intervention and accesses to these

services or processes through an online control panel. Such as email, applications, server and network storage.

2. Broad network access: the customer is using the cloud from anywhere at any time by a wide range of devices, such as tablets, PCs and smartphones.
3. Resource pooling: Resource pooling refers to describe providers serve multiple customers with provisional and scalable services. The resources such as storage, processing, virtual machines, memory, and network bandwidth are pooled together to serve these customers who are using a multi-tenant model with different physical and virtual resources.
4. Rapid elasticity: Rapid elasticity refers to scalable provisioning, or the ability to provide scalable services as needed. In the cloud environment, the customers are able to access tremendous computing power and they can purchase what they need.
5. Measured service: Cloud Computing systems automatically control and optimize resource usage by providing a metering capability to the type of services such as storage, processing, bandwidth, or active user accounts.
6. Lowering cost: Cloud computing offers one of the most important benefits reducing the cost for the customer based on the services required, the cloud reducing the hardware cost, software costs, Maintenance and upgrading cost.
7. Reducing business risks and maintenance expenses: the cloud computing is using the outsourcing service infrastructure, it is reducing of losing the company's proprietary and sensitive data, and it will also reduce the chances of greater financial impact and so on. In addition, the service supplier often has experience and is better equipped for managing the business risks.

1.4 Cloud Risk Management

When organizations are moving to the cloud services, they consider the cloud risk management to ensure business objective: -

1- Business-Alignment Strategy: into the cloud computing model, the organizations should make it a priority to align IT resources with business goals before adopting the cloud. The cloud computing is based on IT self-service and it depends on business community end-user groups, thus the business alignment of all IT self-service applications is necessary for maintaining information value and quality in the cloud model. The organization estimates risk of business-alignment strategy through business strategy risk assessment and risk appetite assessment.

2- Business Value: the organizations expect many benefits from cloud computing, thus they increasingly recognize the business value of cloud computing. The organization estimates risk of business value through risk assessment covering strategic risks, business case risks and commercial risks.

3- Reputation: the cloud's customers need to reputation system for authenticating the safety of their data in the cloud. The reputation concept depending on user's behavior inside of the cloud. The organization estimates risk of reputation through service provider strength, commercial risks, service-level agreement risks and business continuity and sustainability.

4- Flexibility and Agility: the cloud systems possess flexibility and agility for adapt to changing market conditions and variable customer requirements, this will help ensure schedule, cost, and quality compliance. The organization estimated risk of flexibility and agility through cloud interoperability and portability, commercial risks and data management risks.

5- Customer Experience: the cloud computing was built mainly to serve customers in the different fields, the customer opinion and experience is the basis for the continuity of working in the cloud. In this case, to get the customer experience clearly must deliver customer experience across all touch points with cloud providers, and the organizations must extend the efforts across sales and service departments. The organization estimates risk of customer experience through commercial risks, service-level agreement risks, business continuity and sustainability

1.5 Database Cloud Computing

Most organizations focused on the most important technology of the last decade which is represented by the cloud computing. This technology promised the users of developing a futurist business environment when the cloud database is considered as a solution that presented new approaches of using external resources that configure according to user requirements.

In the cloud environment, data is stored on multiple dynamic servers, rather than on the dedicated servers used in traditional networked data storage. The cloud users see a virtual server and handling their data without knowing the actual location of stored data. In this case, database management applications became an important parameter of cloud computing and it attempts to get the best database system performance in this environment (Al-Hamami, A. H., & Al-Khashab, R. A. 2014).

Deploying database in cloud environment and optimizing database performance face some challenges such as how to manage user operations without affecting other users.

The process of organizing these processes depends on two factors, agility and flexibility. These factors considered as among the key drivers of the shift towards cloud computing.

1.6 Agility And Flexibility

The organizations and users have a growing interest of flexible and agility factors.It depends, on these factors, to measure the adoption to the cloud and determined which service provider is the best. The definition of flexibility is the ability of the system to react to changes, while the definition of agility is the ability to be quick changing and the ability for responding to variety and changes.

These factors (flexibility and agility) considered as multi-dimensional concepts. Thus, any researcher needs to measure these factors, it obtains difficult to identify metrics that could affect them. In general, there are a number of metrics that effect the flexibility and agility factors, some of these metricsare listed below (Gong, Y., & Janssen, M., 2010):

- **Throughput**: it refers to the measurement of how many units of information system can process in a given unit of time, or the measure of the average amount of data that can be transferred through the network per unit of time. This unit of time can be calculated per year or per month or determined by the user.
- **Response Time**: it refers to the time needed to interact with a specific user-system interaction. It can be calculated through starting from a client submitting an application to the ending point that the result of the decision on the application has been returned to the client, or it is defined as the estimated time between the beginning of an inquiry or demand on an application and the beginning of a response to this inquiry.
- **Operational Cost**: it refers to the cost spent on the unit of time to the operation. The user depends on this point for evaluating the cloud option, it is important to calculate

the cost of applications in a cloud computing data center and compare it with costs of user current data center.

- **Quality**: generally,it refers to the performance, reliability, and availability metrics that offered by the cloud provider. This metrics can be measured from the point of view of client satisfaction or can identify specific methods by the service provider to determine how efficiently the cloud is.

1.7 Problem Statement

The cloud computing is considered as one of the most important concepts in the information technology. It refers to the applications that delivered as services over the Internet, at the same time, to the hardware and systems software in the datacenters that provide those services.

Cloud management is the exercise of administrative control over cloud providers. in the recent years, many types of research attempted to study the risk management of the cloud computing and suggested some ideas about it.

One of the most important problems in the cloud environment, the cloud providers attempt to differentiate themselves by focusing on specific aspects of their offerings service, and the user attempt to select the suitable cloud provider from among a group of the cloud providers. This thesis focuses on this problem and tries to help the user for choosing the most appropriate provider.

1.8 Scope of the Study

In this thesis, the researcher proposed a model to compare between different settings of virtual machines as cloud providers based on two factors (flexibility and agility), it runs several experiments over virtual machines by using SQL database.

1.9 Research Questions

In this thesis, there are many questions that need to be answered, as below:

1- What is the basis for comparison between more than one cloud service providers?

2- How determine the best provider among a group of cloud service provider?

3- Which parameters can select for choosing the best cloud service provider?

4- What is the impact of these parameters on the cloud service provided?

1.10 Objective

The objective of this thesis is to find the impact of the flexibility and agility factors on the cloud computing. This thesis aims to propose the following:-

1- Improve the setting of the server that provided a cloud service has a significant impact on the cloud adoption.

2- Identify the metrics that affects on the agility and flexibility factors.

3- Facilitate to the user for choosing the best cloud provider based on requirements.

1.11 Thesis Outline

This thesis contains five chapters:-

- Chapter one summarized the main concepts of cloud computing and focused on the main factors that effect on the cloud adoption. then, explain the problem from the user perspective and the suitable objective for it.

- Chapter two presented a summary of related work associated with the thesis idea to explain the difference between previous studies and the current study.
- Chapter three present the proposed model for how to measure the factors used to the cloud adoption, also, presented the main interface of the implementation.
- Chapter four explains the interface of the proposed model implementation and the results.
- Chapter five summarized conclusion about proposed system, and propose some ideas for future work.

CHAPTER TWO

Literature Review

2.1 Survey

There are many technology ideas that have emerged in recent, similarly, the cloud computing concept is increasing daily and it has a more attention in the scientific and industrial communities. It refers to the applications and services that delivered over the Internet, in addition to, the hardware and systems software in the datacenters that provide those services. All the applications and services represent entrusting the data to information that managed by external parties on remote service providers. Thus, the user was a concern of the service providers and identified the importance of it. This chapter sheds a light on the previous related work about the proposed model in this thesis, and focus on how to take advantage of these researches.

2.2 Literature Review

In the recent years, There are many technology ideas that are developed rapidly, similarly, the cloud computing concept is increasing daily and it has a more attention in the scientific and industrial communities. the researcher focuses on concepts of agility and flexibility, and effects of these concepts on the cloud performance. This chapter presented the previous related work about the proposed model in this thesis, and focus on how to take advantage of these researches, as listed below:-

Sonune, N. S., described architecture and benefits of cloud computing that represents a major transformation in information technology field when the resources are controlled, produced, and utilized. The cloud refers to the type of computing that presented virtualized resources as a service over the Internet. Cloud computing is a provided more IT efficiency and agility service to use it by organization or customer. The resources and services should be available for customers from different locations and with different devices with minimum effort and minimum impact on quality (Sonune, N. S. 2014).

Sawas, M., &Watfa, M. declared the organizations that facing the frequent economic situations, concepts like outsourcing, agile management, change management and cost minimization are gaining more attention. It presented the new technologies idea (cloud computing) which support utilizing IT, that has considered as a cost center and presenting flexibility and agility to the business. The researchers focused on the impact of cloud computing on Information Systems (IS) agility to evaluate how cloud computing changes IS agility. It started by collected four groups of attributes from literature review to be considered when handling the IS agility.

The proposed study built based on these attributes and was distributed to senior IT executives and professionals from organizations that have using cloud computing. Then responses were collected and statistically analyzed to find any relation between using cloud computing and improving agility. The results concluded that some cloud computing service models improve specific agility dimensions, and concluded that agility improvements in the business aspects were the dominant agility category in the IT industry (Sawas, M., &Watfa, M. 2015).

Chang, V., et al., declared some studies of Cloud Computing and explains the issues and risks of adopting Cloud Computing in a business environment. Understanding Cloud usage and adoption is important, it helps customers to understand their challenges and offers the benefits of Cloud adoption. The organizations need to use a framework for managing cloud design, deployment, and services. Existing frameworks all have their limitations that cannot respond to customers' requirements for cloud adoption challenges fully.

In this case, the organizations need a new framework to handling challenges and suggest solutions and recommendations in the weakness of other frameworks. The proposed framework is Cloud Computing Adoption Framework (CCAF), it would exploit

the benefits of Cloud adoption while minimizing the risks of Cloud adoption and can integrate existing and new projects with Leeds Beckett Cloud (LBC). A proposed framework needs to be dynamic and structured to help different types of Cloud services, thus, it minimize risk mitigation to Cloud (Chang, V., et al., 2015).

Avram, M. G., explains the attention about cloud computing idea, and multiple definitions of cloud computing. The organizations are gaining more experience in the cloud. In this case, the customers considered that cloud adoption is more complex, especially in the data management, system integration and the management of multiple cloud providers. The result of analyzing organization factors was making the decision of using cloud computing, because it considered the cloud is the latest concept in information technology, while, other organizations cannot believe the idea of having their important data outside of their control.

The researcher was focusing on the organization customers and the main response to their requirements. It declared any organization should define their economic objectives that related with four elements of suitable performance: financial, customer, internal and learning development and identify the way cloud services can sustain these objectives (Avram, M. G., 2014).

Kaur, K., &Bhathal, S. G., used the method of Application Virtualization in cloud computing as the main topic and concentrated, but is contain some risks. Application virtualization presents facility to deliver applications to devices that don't support those applications. The Agent-based and Agentless each have their execs and cons. In a way, Agent-based Application Virtualization may be a protection mechanism as a result of the Applications Virtualized by not running unless the agent is offered. Additionally, an application that virtualized operated on any version and on any system. Them applications

are protected if the Application Virtualization engine is agent-based since a malicious user requiring to walk away with your applications would somehow also require to gain and have the ability to install the agent before being able to use them (Kaur, K., &Bhathal, S. G., 2013).

Von Laszewski, G., et al., explain the existence of different types of cloud Infrastructure as a Service (IaaS), the organization or customers need to identify the best suited for them. The comparison between frameworks is difficult because either user does not have access to all of them or comparing the performance of such systems may occur from different resources. The researchers identified an experiment to be executed on FutureGrid. Through the researchers' test case, they found challenges in scalability experiments; this was especially apparent for Eucalyptus and even OpenStack. The researchers believe that the environment to execute an OpenStack experiment with VMs may look completely different from a deployment that uses many hundreds of servers on which Openstack may be hosted.

On the other hand, the researchers note that OpenNebula is very reliable and easy to deploy. Although in them experiments, they found it is quite slow due to the lack of saving image. The researchers depend on the requirements of the applications and the user community. OpenNebula and Nimbus were easier to install, but they observed that OpenStack and Eucalyptus have considerably worked on these issues in newer versions to be released shortly. Nimbus has been to be very reliable, but OpenStack and Eucalyptus Clouds have been much popular resulting in resource needed (Von Laszewski, G., et al., 2012).

Repschlaeger, J. et al., aim to contribute a framework addressing the adoption and selection of Cloud services. A Cloud Requirement Framework (CRF) was developed, focusing on relevant requirements for adopting Cloud services targeting all three-service models (SaaS, PaaS, IaaS). This framework can be seen as a contribution to achieve more transparency in the Cloud Computing market. Likewise, companies can be designed their approaches to define a Cloud strategy by means of this framework.

The proposed framework consists of two parts, the Cloud Computing target dimensions and the Cloud requirements. The target dimensions represent in Scope & Performance, Flexibility, IT Security & Compliance, Reliability & Trustworthiness, Costs, and finally Service & Cloud Management. While, the Cloud requirements and evaluation criteria are covering all target dimensions. A limitation of the presented framework is the lack of prioritization of the Cloud requirements and evaluation criteria. The researchers do not provide an adoption approach how the framework exactly can be used. The customer has to decide individually in which way he wants to use this framework, dependent on its purpose. This can be quite different based on the possible use cases (e.g. provider portfolio design, customer cloud service selection process, provider benchmarking) of this framework (Repschlaeger, J. et al., 2012).

Tordsson, J., et al., defined optimized algorithms of applications in multi-cloud environments by architecture for cloud brokering and multi-cloud VM management. The price and performance were combined in the proposed model, as well as restrictions in terms of hardware configuration, load balancing, etc. An evaluation of commercial clouds explains that compared to single cloud preparation, the multi-cloud placement algorithms improve performance, lower prices, or combined them. A set of computational clusters will spread across cloud providers and evaluate their performance in order to evaluate

both the feasibility of the cloud brokering architecture and the performance of the proposed scheduling algorithms applications.

For this set of experiments, they considered the ElasticHosts and Amazon EC2 cloud providers. The implemented evaluation will be performed in two-step:

- In the first step, the performance of the four instance types will be determined with respect to the cluster computing use case.
- In the second step, few VM placement plans are spread and the performance of these infrastructures are analyzed.

Through proposed case study, the cloud brokering architecture and scheduling algorithms are evaluated wherever a group of high throughput computing clusters is spread across contemporary cloud providers. Multi-cloud placement results in excellent performance for 11 of 14 budgets, even though no load balancing restraints are implemented, also perceived that it is possible to perform load balancing with 20% of VMs in each cloud with only a secondary decrease in performance equaled to an unconstrained placement solution. In some cases, the acquired cluster performance is very close to the academic one, whereas it generally is around two-hundredth slower because of temporary performance declines within the numerous clouds. A crucial lesson learned from this that a cloud scheduling algorithm should, additionally to considering price and performance parameters, additionally try to model the deviations in cloud provider performance over time (Tordsson, J., et al., 2012).

Seethamraju, R., &Seethamraju, J. investigated the role of an Enterprise System (ES) in building business process agility, they reviewed the literature on ‘agility’ and discussed different characteristics of enterprise systems that are used as a framework for this study. The aim of this study is to analyses the impact of ES implementation on business process in an organizational context. Components of enterprise systems that

combine integration, standardization, best practices and process orientation are utilized as a framework for this study.

The study results propose the impact of integration and standardization features on the firm's ability to build readiness into their processes. The effects differ depending upon the character of integration and the degree of that integration accomplished by the organization after the implementation of the enterprise system. Though the technical tight-coupling of the enterprise system infrastructure may reduce the firm's ability to create agile processes, both vertical and horizontal integration, and standardization of the processes and information seems to be providing positively. It is not easy to create agility into business processes and implementing them and is not depending on the IT infrastructure containing enterprise systems, but also on other features like business process management levels and process characteristics specific to a particular organization (Seethamraju, R., &Seethamraju, J. 2009).

Gong, Y., & Janssen, M., discussed the types of flexibility and agility of business processes on a basic level and proposed an approach to measure the level of flexibility and agility. There is no uniform definition or a single measure of flexibility and agility. This makes it hard to develop a measurement approach. Furthermore, as business processes can be different, this might result in different metrics for measuring the level of flexibility and agility. Thus, both qualitative and quantitative metrics should be used to measure the level of flexibility and agility.

the proposed approach used seven metrics to reflect process flexibility and agility, these metrics are 'throughput', 'case handling time', 'law implementation time', 'operational cost', 'law implementation cost', 'number of complaints', and 'number of appeals'. the researchers proposed quantitative metrics for measuring the level of

flexibility and agility, the use of quantitative measure has the advantages of that these are more precise and interpretation is not ambiguous, although more data is needed as an input (Gong, Y., & Janssen, M., 2010).

Azevedo, S.,focused on the attention of conceptual level the subsystems necessary process information to the coordination, guidance and control of the agility assessment system.They presented supporting the development of two agility indices: one to assess the individual company agile behavior, and the other one to determine the same behavior, but for the entire supply chain (SC). Managers can use the proposed assessment model as a mean to adjust the organizations' behavior according to the reached agility index score in order to improve the company efficiency. Moreover, it makes it possible to implement functional benchmarking approaches in the SC and to do a ranking among the companies, according to the agility index value. This serves as a motivation to companies try to reach better position among their partners and to be more rigorous in establishing priorities, targets and goals in terms of agility (Azevedo, S., et al., 2012).

Mircea, M., & Andreescu, A. I.,used the cloud computing within education to identify the benfits of service. Therefore, it has have considered the risks and benefits of cloud architecture and proposed a cloud selection system appropriate.Despite its critics and disadvantages, it appears that Cloud Computing is here to stay. Display economic situation will constrain increasingly associations in any event to think about receiving as a cloud solution. There are proofs that show critical diminishing of costs because of the usage of cloud arrangements.

The design and criteria shownfor example, availability and importance of applications and also the data's mission, sensitivity, confidentiality, integrity and availability. The proposed system includes five phases, with concentrated on the assessment of information and procedures/functions/applications from a few majer in view of some key criteria,

while making a correspondence between these perspectives and the models/services/applications that exist on the Cloud showcase. The results acquired are empowering and bolster the utilization of Cloud arrangements by enhancing knowledge in this field and giving a down to earth manage versatile to the college's structure (Mircea, M., & Andreescu, A. I., 2011).

2.3 Discussion

Consequently, there are many types of research to shows the principle of the service provided by cloud computing, which enabled it to acquire an important role in the technological development field, it helps the users to store and transfer the data via the Internet.

In this thesis, the researcher presented some of the related work that explains the concepts of cloud computing to take advantage of the services that its own.

In the beginning, several types of research that generally describe the services provided at the level of individuals and organizations.

The second part of the studies, research was reviewed shows the principle of flexibility and agility factors, and presented each service separately of these factors to explain how to prove their importance for cloud computing. Some ways have been presented to describe how to take advantage of these services and application.

This research will clarify the importance of flexibility and agility services by implemented some of experiments and tests through setting three criteria by which to determine acceptable and unacceptable periods of time and based upon will determine the ideal period for acceptance and rejection in order to explain the usefulness of the services provided by the service provider of cloud. The following chapter shows the way of how to apply and implement, and to prove the usefulness of these services.

The researcher has implemented a number of metrics by utilizing mathematical equations and fixed measurements and tested these metrics on different virtual machines based on the different setting.

CHAPTER THREE

The Proposed Technique

3.1 Overview

Nowadays, there are many requirements to encourage users for adapting to the cloud and choosing the best cloud sever among different cloud providers. This thesis focused on the flexibility and agility as important factors which have effects on the user's requirements.these factors to decide which cloud server selected of the reaction to any change as shown in the Figure (3-1).

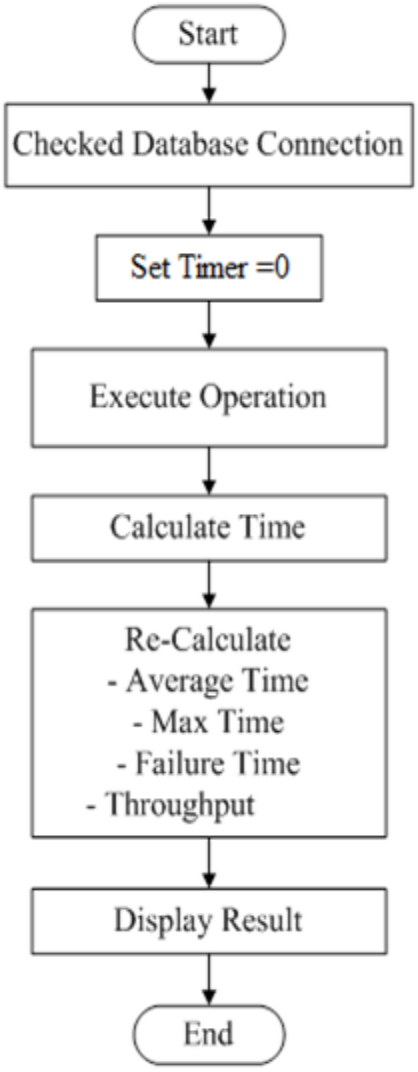

Figure (3-1): Proposed Model

The proposed model is divided into four parts. Based on these parts, the user compares between desired servers to declare the best of the cloud server:-

- **Average Part**

  The user has implemented the desired operation on a specific number of records and register the estimated time of each process. This average represents a summation of estimated time of each operation that occurred by the user divided by the number of operations. The equation of average part as the following:-

  Average = $\frac{\sum (estimated\ time) for\ all\ operations}{number\ of\ operations}$ .....(3-1)

- **Max Part**

  The estimated time of each operation is saved in array; this part is selects the maximum time in the time array and consider this time as the critical time which may not be exceeded in every server. The equation of Max part is:-

  $$Max\ (time) = \begin{cases} Time\ 1 & : n=1 \\ Max(Time1, Time2) & : n=2 \\ Max\ (Max\ (Time1, \ldots, Time_{n-1}), Time_n & : n>2 \end{cases} \quad ..(3\text{-}2)$$

  n=number of operations

- **Failure Part**

  This part calculates the time of each implemented process and compared it with the average, then calculated the percentage of the total number of operations.The times of larger than the calculated average divided by the total number of operations. The equation of failure part is:-

  Failure = $\frac{number\ of\ operations\ (time\ is\ larger\ than\ average)}{total\ numeber\ of\ operations}$ .....(3-3)

- **Throughput Part**

  This part represents the number of operations that occurred in a given amount of time. The server that implementes the larger number of operations in same time, is considered as the best. The equation of Throughput part is:-

  Throughput = Count of operation in amount of time.....(3-4)

3.2 Interface of Proposed System

This thesis has been implemented to improve the agility and flexibility factors of the database system in the cloud environment. Based on these factors, the user chooses the best cloud server for adapting it. The researcher has designed and implemented the model according to following patrs:

- virtual machine part
- Clinet part

3.2.1 Virtual Machine part

The user application runs on a VM which is managed by the Hypervisor running across all the servers. The VMs are moved across servers based on the server utilization. There is no guarantee that the VM that the user launch will run on the same physical server. There will be a load balancer which will ensure that the user applications are scalable by exploiting the power of all the VMs associated with application(Sharma, P., etal., 2016).

The researcher has implemented the experiment results on different virtual machines, these machines differ base on the setting.

the researcher has selected eight types of the virtual machines as the cloud provider for testing the experiments, and these types divide in the two procedures: the first procedure is Fixed CPU and Different RAM, the second procedure is Fixed RAM and different CPU. the selected virtual machines declared below:

3.2.1.1 Fixed CPU and Different RAM procedure

In this procedure, the researcher studies the effect of fixed CPU and changing RAM. It was used four different types of changing RAM, as the following:

- The first machine: in this machine, the opreatining system is Windows 7 (32bits), CPU one Core, RAM 1 GB, as show in the table (3-1).

Base Memory	1024 MB
Video Memory	16 MB
CPU	1 core
Operating system	Windows 7 (32-bit)

table (3-1) ... The first type of fix CPU

- The second machine: in this machine, the opreatining system is Windows 7 (32bits), CPU one core, RAM 2 GB, as show in the table (3-2).

Base Memory	2048 MB
Video Memory	16 MB
CPU	1 core
Operating system	Windows 7 (32-bit)

table (3-2) ... The second type of fix CPU

- The third machine : in this machine, the opreatining system is windows 7 (32bits), CPU one Core, RAM 3 GB, as show in the table (3-3).

Base Memory	3027 MB
Video Memory	16 MB
CPU	1 core
Operating system	Windows 7 (32-bit)

-
-

table (3-3) ... The third type of fix CPU

- The fouth machine: in this machine, the opreatining system is Windose 7 (32bits), CPU one Core, RAM 4 GB, as show in the table (3-4).

Base Memory	4096 MB
Video Memory	16 MB
CPU	1 core
Operating system	Windows 7 (32-bit)

-
-

table (3-4) ... The forth type of fix CPU

3.2.1.2 Fixed RAM and different CPUprocedure

In this procedure, the researcher studies the effect of fixed RAM and changing CPU. It was used four different type of changing CPU, , as the folloning procedure:

- The first machine: in this machine, the opreatining system is Windose 7 (32bits), CPU Doul Core, RAM 2 GB, as show in the table (3-5).

Base Memory	2048 MB
Video Memory	16 MB
CPU	2 core
Operating system	Windows 7 (32-bit)

-

table (3-5) ... The first type of fix RAM

- The second machine: in this machine, the opreatining system is Windose 7 (32bits), CPU 4 Core, RAM 2 GB, as show in the table (3-6).

Base Memory	2048 MB
Video Memory	16 MB
CPU	4 core
Operating system	Windows 7 (32-bit)

table (3-6) ... The second type of fix RAM

- The thrid machine: in this machine, the opreatining system is Windose 7 (32bits), CPU 6 Core, RAM 2 GB, as show in the table (3-7).

Base Memory	2048 MB
Video Memory	16 MB
CPU	6 core
Operating system	Windows 7 (32-bit)

table (3-7) ... The third type of fix RAM

- The fouth machine: in this machine, the opreatining system is Windose 7 (32bits), CPU 8 Core, RAM 2 GB, as show in the table (3-8).

Base Memory	2048 MB
Video Memory	16 MB
CPU	8 core
Operating system	Windows 7 (32-bit)

-

table (3-8) ... The forth type of fix RAM

3.2.2 Client part

The user has implemented number of experiments on the different types of service providers of the cloud computing through a special application of the user. The user must apply some processes (get, insert, update and delete) on the virtual machines to choose the best cloud provider accurately.

The main interface of the application contains three buttons:

- The first button is Employee Info System which allows the user to choose the number of records to deal with and choice of the type of operation required.

- The second button is Delete All Time Performance which allows the user to delete all previous operations.
- The third button is Result which displays the results of operations carried out by the user.

The user selected the desired server through pressing on the connect the server, as shown in figure (3-2).

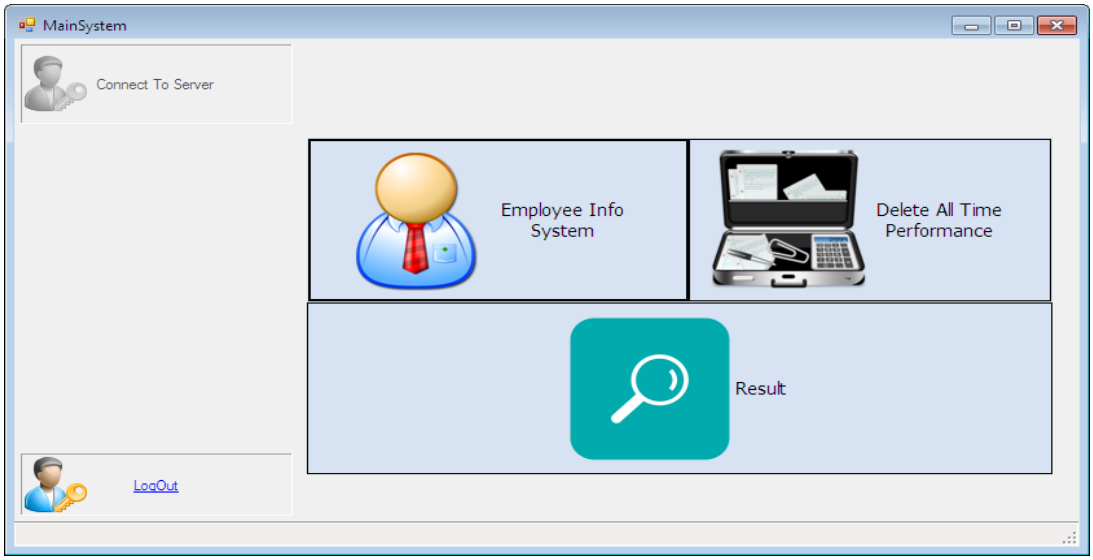

Figure (3-2): Application Interface

The proposed application offers the user to handle with the database virtual machines the many of buttons as listed below:-

- Clear-Data Button:- this button deletes all the data or information in the database virtual machines.
- Get-All-Data Button:- this button retrieves all the data or information from the database virtual machines.
- Get-Top-Data Button:- this button retrieves a limited number of the data that is determined by the user from the database virtual machines.

- Insert-Data Button:- this button adds a limited number of the data that is determined by the user to the database virtual machines.
- Update-Data Button:- this button modifies a limited number of the data that is determined by the user in the database virtual machines.
- Delete-Date Button:- this button deletes a limited number of the data that is determined by the user in the database virtual machines.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Implementation

Cloud computing is a concept for the delivery of hosted services over the internet; there are different types of cloud service providers. Thus, any user when using a cloud computing systems presents an important question on how to choose the suitable provider for adoption. In this thesis, the researcher has implemented the proposed model in the different setting of virtual machines, these machines provide the delivery of services to users via the Internet as cloud concept.

the researcher has been implemented the experiments on different types of virtual machines, and it studies the results of each virtual machine to find which virtual machine achieves the best performance as the cloud provider. The user has implemented all the experiments on two procedures:-

- The first procedure has implemented on local process.
- The second procedure has implemented on remotely process.

4.2 local Process

In this process the operations are implemented on the same device by the VM as each person would input information and execute it through time period which is calculated within the program.

4.2.1 Implementing Fixed CPU and Different RAM procedure

The researcher studies the effect of the changing of RAM and fixed the CPU, it has been implemented a software to compare the results of changing RAM through implementing different operations on a different number of records starting, Then calculates each of Average, MAX and Failure. The results of Average, MAX, and Failure was calculates based on estimated time of each operation.

The first implementation was applied to the setting (Windows 7 (32bits), CPU 1Core, RAM 1 GB), as shown in table (4-1).

Average	Maximum	Failure
36.7	36.7	0
48.1	48.1	0
68.1	75.5	0.5
0.1	0.1	0
0.2	0.2	0
0.3	0.5	0.3
91.4	91.4	0
121.9	127.2	0.5
140.5	140.5	0
254.4	302.3	0.5

table (4-1) ... results of the first implementation

The second implementation was applied to the setting (Windows 7 (32bits), CPU 1Core, RAM 2 GB), the number of operations of (50) units is 3, and the following table (4-2) is showing the other results of this implementation.

Average	Maximum	Failure
45.1	45.1	0
60.9	60.9	0
31.7	31.7	0.5
0.2	0.2	0
0.2	0.2	0
0.3	0.7	0.3
22.6	22.6	0

3.5	3.8	0.5
137.3	137.3	0
25.4	25.4	0.5

table (4-2) ... results of the second implementation

The third implementation was applied to the setting (Windows 7 (32bits), CPU 1Core, RAM 3 GB), the number of operations of (50) units is 6, and the following table (4-3) is showing the other results of this implementation.

Average	Maximum	Failure
38.2	38.2	0
25.4	25.4	0
22.5	22.9	0.5
0.1	0.1	0
0.1	0.1	0
0.2	0.4	0.3
1.6	1.6	0
2.1	2.2	0.5
25.7	25.7	0
25.1	29.2	0.5

table (4-3) ... results of the third implementation

The fouth implementation was applied to the setting (Windows 7 (32bits), CPU 1 Core, RAM 4 GB), the number of operations of (50) units is 6, and the following table (4-4) is showing the other results of this implementation.

Average	Maximum	Failure
35.9	35.9	0
27.8	27.8	0
22.3	22.5	0.5
0.1	0.1	0
0.1	0.1	0
0.2	0.4	0.3
1.6	1.6	0
2.3	2.7	0.5
16	16	0
20.5	20.7	0.5

table (4-4) ... results of the fourth implementation

Finally, this chart explains the difference time of local process to be executed in every operation between RAMs in the required time needed by the opeations, as shown in figure (4-1).

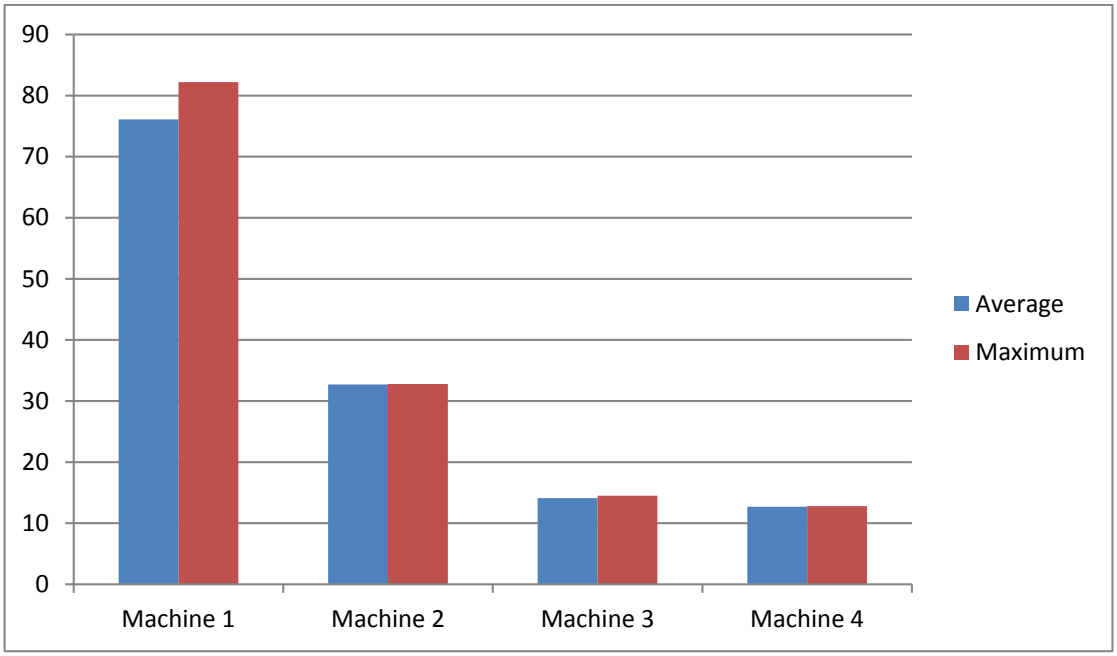

Figure (4-1) ... Diffrent time of local process depend on RAM

While the effect of the local process of Fixed CPU and Different RAM procedure on the throughput is declared in following table(4-5):-

Machine Name	Number of processes
Machine 1	1
Machine 2	3
Machine 3	6
Machine 4	6

table (4-5) ... throughput of local process depend on RAM

the fourth machine is the best virtual cloud between them because its implemented the processes with less time.

4.2.2 Implementing Fixed RAM and Different CPU procedure

The researcher studies the effect of the changing of CPU and fixed the RAM, it has been implemented a software to compare the results of changing CPU through implementing different operations on a different number of records starting, Then calculates each of Average, MAX and Failure. The results of Average, MAX, and Failure was calculates based on estimated time of each operation.

The first implementation was applied to the setting (Windows 7 (32bits), CPU Doul Core, RAM 2 GB), as shown in table (4-6)

average	maximum	throughput
18.6	18.6	0
25	25	0
33.5	35.6	0.5
0.1	0.1	0
0.1	0.1	0
0.3	0.4	0.3
2.6	2.6	0
3.4	3.7	0.5
30.7	30.7	0
32.1	32.2	0.5

table (4-6) ... results of the first implementation

The second implementation was applied to the setting (Windows 7 (32bits), CPU 4 Core, RAM 2 GB), the number of operations of (50) units is 3, and the following table (4-7) is showing the other results of this implementation.

Average	Maximum	Failure
17.1	17.1	0
22.6	22.6	0
30.1	32	0.5
0.1	0.1	0

0.1	0.1	0
0.2	0.4	0.3
2.2	2.2	0
6.9	7.6	0.5
34	34	0
30	31	0.5

table (4-7) ... results of the second implementation

The third implementation was applied to the setting (Windows 7 (32bits), CPU 6 Core, RAM 2 GB), the number of operations of (50) units is 3, and the following table (4-8) is showing the other results of this implementation.

Average	Maximum	Failure
13.7	13.7	0
18.2	18.2	0
30.2	31	0.5
0.1	0.1	0
0.1	0.1	0
0.2	0.5	0.3
4.7	4.7	0
3.9	4.6	0.5
26.1	26.1	0
32.8	36.7	0.5

table (4-8) ... results of the third implementation

The fourth implementation was applied to the setting (Windose 7 (32bits), CPU 8 Core, RAM 2 GB), the number of operations of (50) units is 3, and the following table (4-9) is showing the other results of this implementation.

Average	Maximum	Failure
14	14	0
20	20	0
24	25.1	0.5
0.1	0.1	0
0.2	0.2	0
0.2	0.3	0.3
3.2	3.2	0
2.1	2.2	0.5
25.8	25.8	0
27.2	28.1	0.5

table (4-9) ... results of the fourth implementation

Finally, this chart explains the difference time of local process to be executed in every operation between CPUs in the required time needed by the opeations, as shown in Figure (4-2).

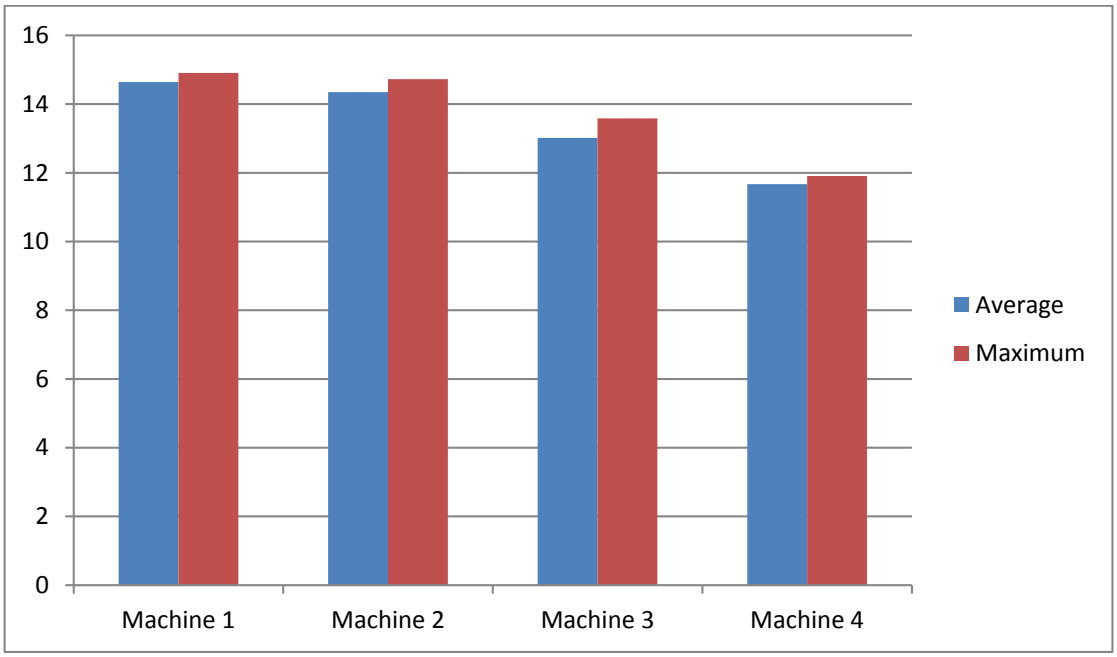

Figure (4-2) ... Diffrent time of local process depend on CPU

While the effect of the local process of Fixed CPU and Different RAM procedure on the throughput is declared in following figure(4-10):-

Machine Name	Number of processes
Machine 1	**3**
Machine 2	**3**
Machine 3	**3**
Machine 4	**3**

Figure (4-10) ... throughput of local process depend on CPU

4.3 Remotely process

In this process, the operations are implemented by another device through the remote desktop as each person would input information and execute it through time period which is calculated within the program.

4.3.1 Implementing Fixed CPU and Different RAM procedure

The researcher studies the effect of the changing of RAM and fixed the CPU, it has been implemented a software to compare the results of changing RAM through implementing different operations on a different number of records starting, Then calculates each of Average, MAX and Failure. The results of Average, MAX, and Failure was calculates based on estimated time of each operation.

The first implementation was applied to the setting (Windows 7 (32bits), CPU 1Core, RAM 1 GB), as shown in table (4-11)

average	maximum	failure
45.8	45.8	0
71.9	71.9	0
47.3	50.2	0.5
0.2	0.2	0
0.2	0.2	0
1.4	2.7	0.3
167.4	167.4	0
7	10.9	0.5
592	592	0
66.3	78.9	0.5

table (4-11) ... results of the first implementation

The second implementation was applied to the setting (Windows 7 (32bits), CPU 1Core, RAM 2 GB), the number of operations of (50) units is 2, and the following table (4-12) is showing the other results of this implementation.

Average	Maximum	Failure
45.2	45.2	0
85.5	85.5	0
45	55.3	0.5
0.2	0.2	0
0.2	0.2	0
0.3	0.4	0.7
92.4	92.3	0
2.9	2.9	0.5
235.5	235.5	0
49.6	49.6	0.5

table (4-12) ... results of the second implementation

The third implementation was applied to the setting (Windows 7 (32bits), CPU 1Core, RAM 3 GB), the number of operations of (50) units is 2, and the following table (4-13) is showing the other results of this implementation.

Average	Maximum	Failure
18.5013	18.5013	0
25.2342	25.2342	0
31.41225	32.0011	0.5
0.0995126	0.0995126	0
0.130017	0.130017	0
0.23686333333333332	0.290037	0.666666666666667
3.42794	3.42794	0
10.332045	12.0845	0.5
51.8656	51.8656	0
108.37795	131.172	0.5

table (4-13) ... results of the third implementation

The fouth implementation was applied to the setting (Windows 7 (32bits), CPU 1 Core, RAM 4 GB), the number of operations of (50) units is 2, and the following table (4-14) is showing the other results of this implementation.

Average	Maximum	Failure
19	19	0
26.2	26.2	0
31.6	31.7	0.5
0.1	0.0990125	0
0.1	0.1	0
0.2	0.4	0.3
2.3	2.3	0
3.1	3.3	0.5
49.4	49.4	0
67	67.8	0.5

table (4-14) ... results of the fourth implementation

Finally, this chart explains the difference time of remote process to be executed in every operation between RAMs in the required time needed by the opeations, as shown in figure (4-3).

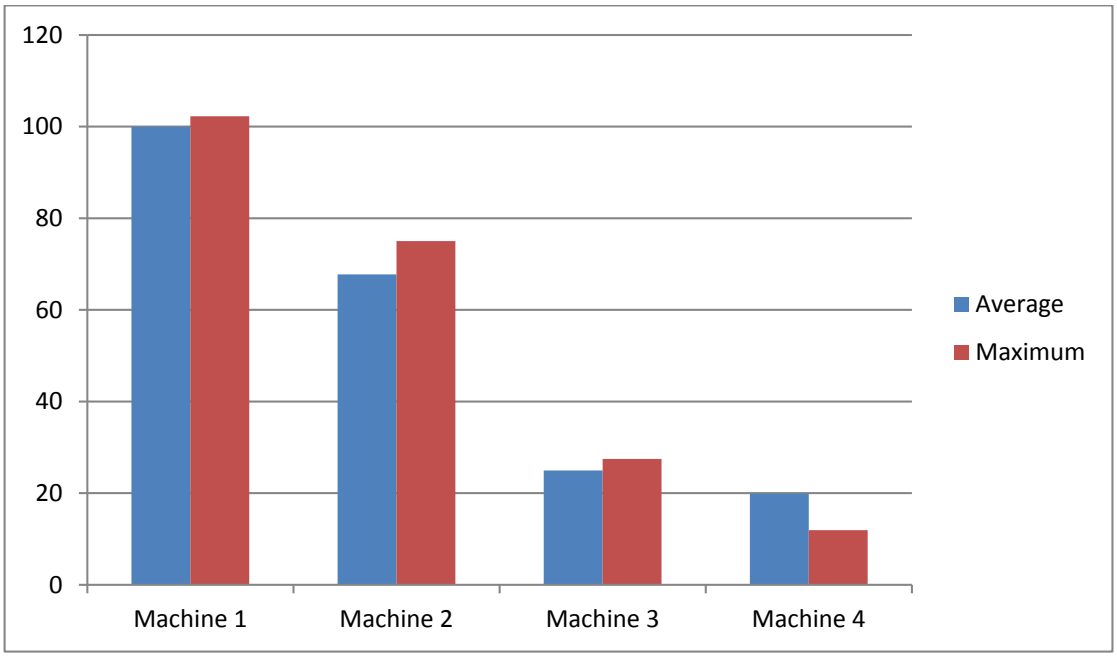

Figure (4-3) ...Diffrent time of remote process depend on RAM

While the effect of the remote processof Fixed RAM and Different CPU procedure on the throughput is declared in following figure(4-15):-

Machine Name	Number of processes
Machine 1	2
Machine 2	2
Machine 3	2
Machine 4	2

table (4-15) ... throughput of Remote process depend on RAM

4.3.2 Implementing Fixed RAM and Different CPU procedure

The researcher studies the effect of the changing of CPU and fixed the RAM, it has been implemented a software to compare the results of changing CPU through implementing different operations on a different number of records starting, Then calculates each of Average, MAX and Failure. The results of Average, MAX, and Failure was calculates based on estimated time of each operation.

The first implementation was applied to the setting (Windows 7 (32bits), CPU Doul Core, RAM 2 GB), as shown in table (4-16)

Average	Maximum	failure
21	21	0
26.4	26.4	0
32	33.4	0.5
0.1	0.1	0
0.2	0.2	0
0.25	0.4	0.3
3.2	3.2	0
6.3	6.6	0.5
74.4	74.4	0
60.7	65.7	0.5

table (4-16) ... results of the first implementation

The second implementation was applied to the setting (Windows 7 (32bits), CPU 4 Core, RAM 2 GB), the number of operations of (50) units is 2, and the following table (4-17) is showing the other results of this implementation.

Average	Maximum	Failure
19.1	19.1	0
27.3	27.3	0
36.1	39.2	0.5
0.1	0.1	0
0.1	0.1	0
0.3	0.4	0.3
4.5	4.5	0
6.9	9.4	0.5
43.8	43.8	0
62.2	69	0.5

table (4-17) ... results of the second implementation

The third implementation was applied to the setting (Windows 7 (32bits), CPU 6 Core, RAM 2 GB), the number of operations of (50) units is 3, and the following table (4-18) is showing the other results of this implementation.

Average	Maximum	Failure
19.4	19.4	0
25.7	25.6	0
33.6	35.2	0.5
0.1	0.1	0
0.1	0.1	0
0.6	1.1	0.3
2.7	2.7	0
5.2	6.5	0.5
32.4	32.4	0
42.2	42.7	0.5

table (4-18) ... results of the third implementation

The fouth implementation was applied to the setting (Windows 7 (32bits), CPU 8 Core, RAM 2 GB), the number of operations of (50) units is 3, and the following table (4-19) is showing the other results of this implementation.

Average	Maximum	Failure
13.7	13.7	0
17.5	17.5	0
23.2	24.3	0.5
0.1	0.1	0
0.1	0.1	0

0.2	0.4	0.3
1.8	1.8	0
2.2	2.3	0.5
26.8	26.8	0
32.9	33.1	0.5

table (4-19) ... results of the fourth implementation

Finally, this chart explains the difference time of remote process to be executed in every operation between CPUs in the required time needed by the opeations, as shown in figure (4-4).

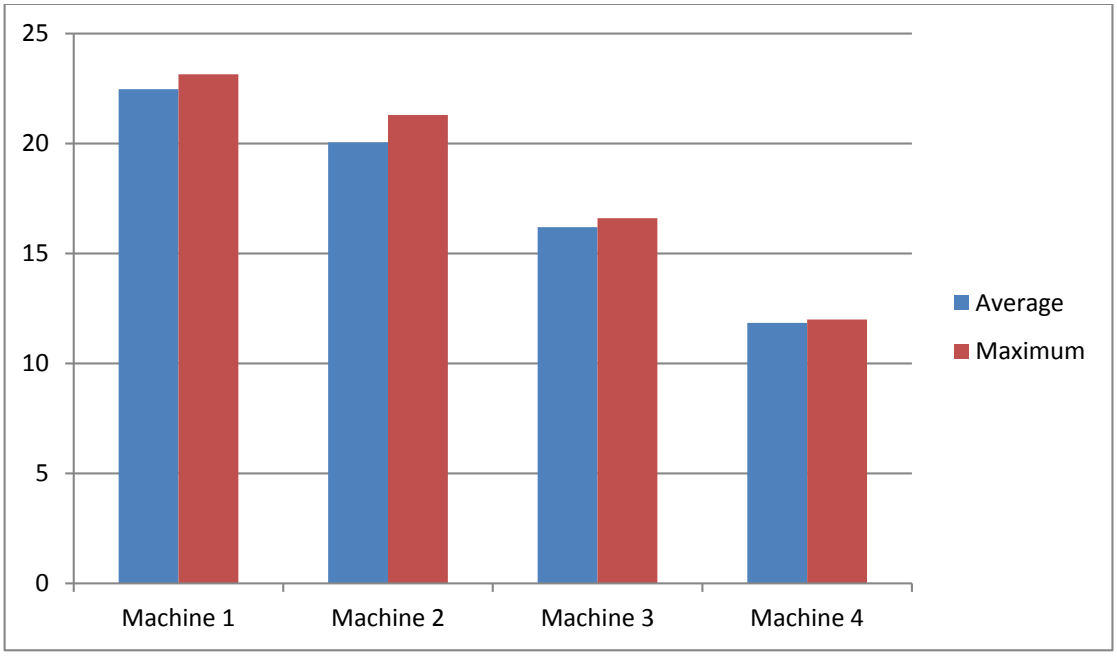

Figure (4-4) ...Diffrent time of remote process depend on CPU

While the effect of the remote processof Fixed RAM and Different CPU procedure on the throughput is declared in following figure(4-20):-

Machine Name	Number of processes
Machine 1	2
Machine 2	2
Machine 3	3
Machine 4	3

Figure (4-20) ... throughput of Remote process depend on CPU

the following tables explain time of the execution of all processes for each machine(cloud)

Locally(different ram)

Machine Name	Average	Maximum	Failure	Settings
Machine 1	76.2	82.7	0.2	1 GB
Machine 2	32.7	32.8	0.2	2 GB
Machine 3	14.1	14.6	0.2	3 GB
Machine 4	12.7	12.8	0.2	4 GB

table (4-21) ... locally with different RAM

locally(different cpu)

Machine Name	Average	Maximum	Failure	Settings
Machine 1	14.6	14.9	0.2	2 cores
Machine 2	14.3	14.7	0.2	4 cores
Machine 3	13	13.6	0.2	6 cores
Machine 4	11.7	11.9	0.2	8 cores

table (4-22) ... locally with different CPU

Remotely(different ram)

Machine Name	Average	Maximum	Failure	Settings
Machine 1	99.7	102	0.2	1 GB
Machine 2	67.7	75	0.2	2 GB
Machine 3	25	27.5	0.2	3 GB
Machine 4	19.9	20	0.2	4 GB

table (4-23) ... remotely with different RAM

Remotely(different cpu)

Machine Name	Average	Maximum	Failure	Settings
Machine 1	22.5	23.1	0.2	2 cores
Machine 2	20.1	21.3	0.2	4 cores
Machine 3	16.2	16.6	0.2	6 cores
Machine 4	11.8	12	0.2	8 cores

table (4-24) ... remotely with different CPU

after all expirments that implemented ,the researcher noticed when increasing RAM units will reduce the time of implementation processes in two procedures.

CHAPTER FIVE

Conclusion And Future Work

5.1 Conclusion

In the recent years, the cloud computing concept is growing rapidly, so the researchers should attention of this concept. There are many services providers that offer cloud computing services, the selection process between these providers is a complex process and there are many factors that depend on them. This thesis provides factors that can help the user to choose the better cloud provider to provide services.

the researcher used two factors(Flexibility and Agility) to help the users for choosing the best cloud provider among collection of cloud providers.

There are many metrics to measure the flexibility and agility, the researcher chooses Average, Max, Failure and Throughput metrics to evaluate the cloud service provider. The researcher implemented the first procedure(locally with different ram) noticed the time reduced for each time when RAM units increased significantly.While implemented the second procedure (locally with different processor) noticed the time reduced for each time when CPU cores increased but not significantly.As well as the same result when the researcher implemented the processes remotely(access to the computer from other device).

After implemented the experiments from the researcher noticed when increasing CPU cores and Ram units will reduce the time and this refer to increasing number of processes in the cloud computing but increasing RAM units better than increasing CPU cores to reduce the time of implementing processes .

5.2 Future Work

At the end of the thesis, the researcher offers some suggestion for future work, this suggestion is summarized in:-

1- Implementation of the proposed model on other servers.
2- Dependence on other factors except for the flexibility and agility to evaluate the service provider.

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