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CREATING A MODEL FOR CLOUD BANKING SERVICES DSS

Aryan AbdullwahabQader, Shawkat K. Guirguis, Magda M. Madbouly

Department of Information Technology Institute of Graduate Studies and Researches, Alexandria University
163 Horreya Avenue, El Shatby 21526, P.O. Box 832, Alexandria, Egypt
shawkat_g@yahoo.com,mmadbouly@hotmail.com ,arean96@yahoo.com

Abstract

Cloud computing is a recent advancement wherein IT infrastructure and applications are provided as 'services' to end-users under a usage-based payment model. It can leverage virtualized services even on the fly based on requirements varying with time. It is becoming an adoptable technology for many of the organizations with its dynamic scalability and usage of virtualized resources as a service through the Internet.

These technical will likely have a significant impact on the Banks in the future. It is an excellent alternative for banks, which are especially under budget shortage, to operate their information systems effectively without spending more capital for the computers and network devices. Banks take advantage of available cloud-based applications offered by service providers and enable their own clients to access their accounts and information.

In this research, we present a DSS model of evaluating cloud computing banking services, highlight its key concepts, architectural principles, and the implementation as well as research helping banks to choose the best cloud providers'.

The aim of this research is to provide a practical answer for the following questions:

1. What are the best choices of cloud computing for hosting banking services?

2. How effective can cluster and maps between cloud computing providers and banking agencies be?

Keywords—*Cloud computing; DSS; Cloud Banking.*

1-Introduction: Cloud computing is much more than simply renting servers and storage on-demand to reduce infrastructure costs as many believe. Furthermore, it's not simply a technology issue. In fact, the cloud offers a host of opportunities for banks to build a more flexible and customer centric business model that can drive profitable growth [Nguyen et al. 2011]. Storing data in the clouds is convenient for users since it spares them the burden of having to care about the complexities of direct hardware management [Biruntha and Kumar 2009].

When we need to define a bank we can re-configure its business in-real-time by dynamically sourcing from several services providers via virtualization [Foster et a. 2008], for example, an e-invoicing company called Trade shift allows for dynamic invoices that "pay themselves". The service constantly monitors exchange rates and then automatically sends out an order to withdraw funds or to make a purchase when the process is cheapest. So, how to map between cloud computing providers and banking agencies?

In this paper, we design DSS for evaluation of cloud computing providers and map between them and the banking agencies. However, evaluation of commercial Cloud services is different to and

more challenging than that of other computing systems, as Evaluation results could be invalid soon after the evaluation and then not reusable[Stokes 2011].
Cloud providers may continually upgrade their hardware and software infrastructures, and new commercial Cloud services may gradually enter the market. Hence, previous evaluation results can be quickly out of date as time goes by. For example, at the time of writing, Google is moving its App Engine service from CPU usage model to instance model; Amazon is still acquiring additional sites for Cloud data center expansion; while IBM just offered a public and commercial Cloud. As a result, customers would have to continually re-design and repeat evaluation for employing commercial Cloud services.

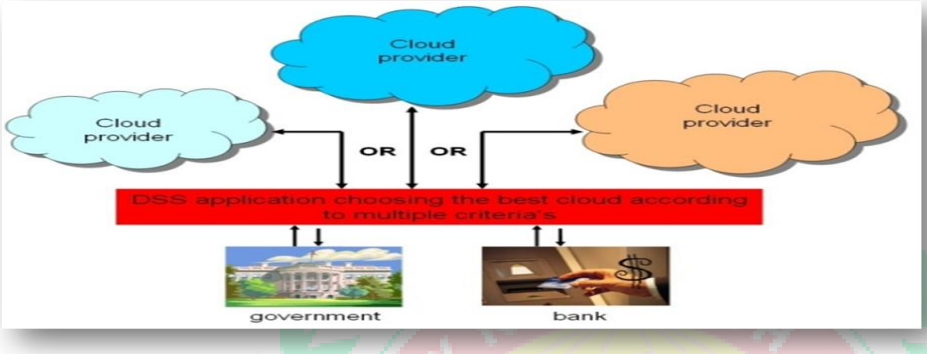


Figure 1: The Idea behind iDss

We have implemented four steps to evaluate cloud computing services and mapping between them and banking agencies as the following:
1. Gather requirements from cloud computing providers and banking agencies.
2. Classification of cloud computing providers and banking agencies based on previous requirements. 3. Grouping similar cloud computing providers and similar banking agencies into groups. 4. Matching between cloud computing providers and banking agencies.

2-Related Work: On the other side, with respect to ownership, a bank is either a state-owned bank, privately owned or a foreign bank. Since these banks have different structure, their financial tables and financial ratios differ significantly from each other. Some of the banks have so distinct ratios that their ratios are almost 15 times that of industry average, which may be a good sign for that observation to be accepted as an "outlier".
It is believed that "As of now, computer networks are still in their infancy, but as they grow up and become sophisticated, we will probably see the spread of 'computer utilities' which, like present electric and telephone utilities, will service individual homes and offices across the country." [Kleinrock 2005].
Also some of the banks have no data regarding some ratios, which in turn is the reason why some of the ratios are ignored in certain analysis. In this study, as a result of this, bank under the control of Deposit Insurance Fund, foreign banks operating as branches in Turkey, development and investment banks and Islamic banks are omitted from the study. As a result, data related to 23 banks which are state owned deposit banks, privately-owned deposit banks and foreign banks founded in Turkey have been included in the study. Data is analyzed using 48 different ratios which can be classified under capital, assets quality, liquidity, profitability, income-expenditure structure, share in sector, and share in group and branch ratios.
There is an expert system [Zheng and L. O 2013] about building DSS for cloud banking services evaluation, which concentrates on processes and experiences rather than results of Cloud services evaluation and it allows collecting and arranging data of detailed evaluation processes. Based on the primary evaluation data, general knowledge about evaluating commercial Cloud services can be abstracted and summarized. After manually constructing the Data/Knowledge Base, we can

design and implement an Inference Engine to realize knowledge and data reasoning respectively. As such, given particular enquiries, the proposed expert system is not only able to supply common evaluation suggestions directly, but also able to introduce similar experimental practices to users for reference.

3-Proposed methodology: The proposed system offers a model for decision support system to evaluate providers of cloud computing services based on a set of standards that are consistent with the security conditions and the required technicalities in banking, and spot light on the basic concepts and principles of architecture, implementation, as well as the challenges of research and help banks to choose the best providers of these cloud services. The following subsections discuss each step in detail.

3-1 Proposed System Software Components: Particularly for commercial Cloud services, it's necessary to find a way to facilitate evaluation, and make existing evaluation efforts reusable and sustainable. This paper suggests Decision Support System for Cloud-Bank Matching to addressthe aforementioned issues. This decision support system concen trates on processes and experiences rather than results of Cloud services evaluation. When it comes to the general implementation process of Cloud services evaluation, we can roughly draw three main components as specified below and illustrated in Figures.

3-1.1 Bank Database Depository: In order to collect and initially build our bank database we are developing our system so that it would be ready to manipulate banks' data. Adding, editing, deleting and retrieving one bank all of that which come across specific fields that tackles all the important criteria as shown in Figure2.

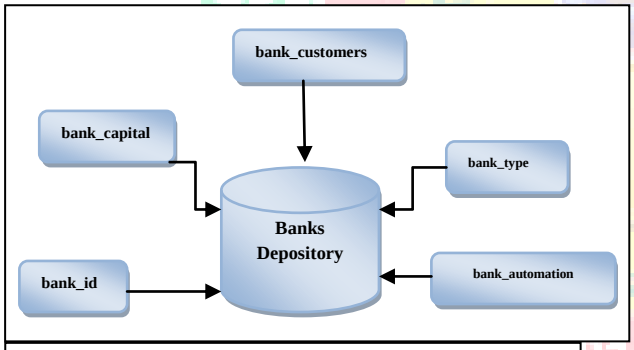


Figure 2: Bank Depository main factories

The data used to fill in these fields either comes from a new entry by system users or is already stored in the system from an old operation. The user should consult an expert when ranking these attributes depending on the bank capital; 1 for small banks, 2 for medium and 3 for large banks and also depending on number of customers in a bank normalized on range 1:10.This ranking will help in the process of clustering banks. [Altinel 2012]

3-1.2 Cloud Providers Database Depository: To collect and initially build our providers database and also to make our system ready to manipulate providers data, adding, editing , deleting and retrieving one provider all of that come cross specific fields as shown in fig3.

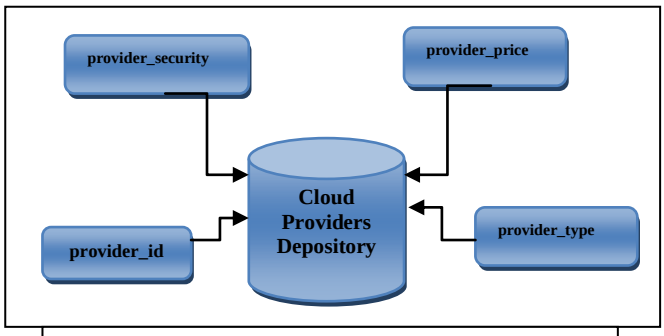


Figure 3: Cloud Providers Depository main factories

The data used to fill in these fields are collected either as new entries by system providers or is already stored in our system from an old operation, the user should consult an expert when ranking these attributes according to the provider' security on range 1:10.

3-1.3 Web Portal for iDss: In this paper, we have developed a web portal that will act as a centric point for all banks who are interested in receiving the services of cloud providers or planning to build their own private clouds. Furthermore, we will collect data from the end of the bank users as they should visit the site and fill full details about the bank under evaluation and provide all data and rank of

the bank under evaluation. The advantage here is that the collected data will include both the experience of bank agencies on one hand and the customers' experience on the other hand. [Zheng and L. O 2013]

The data provided about the bank will be decomposed and analyzed and then it will be used in classifying bank agencies and consequently assigning them to the nearest group via C-Means classifier.

Similar to general decision support system the iDss proposed in this paper also comprises an Interface with which banks interact, a Web Inference that performs knowledge/data reasoning, and a Knowledge Base that stores common and abstracted knowledge about all cases of commercial Cloud services and all selection criteria's provided by fuzzy algorithms that run automatically in back end. However, we did not employ a specific knowledge acquisition module for building up the Knowledge Base in this case. At the current stage, instead of obtaining knowledge by interviewing external experts, we extracted Cloud evaluation knowledge only from the collected data of published experimental studies and then we build our clouds depository.

Moreover, for the convenience of acquiring experimental references, a Data Base is maintained in this iDss to store initially-analyzed details of existing evaluation experiments. The complete structure of this decision support system can be illustrated as shown in Figure 4. Considering that the Interface of this iDss can bedesigned at last in the future, this paper only specifies how we are realizing the Cloud-Bank Matching and Inference of iDss.

On the other hand, the site that we have developed also provides handling cloud providers repository, manipulating data as described below and classifying all providers into cloud providers groups via same C-Means classifier algorithm.

The web portal includes a number of questionnaires that will help us to build our database. These questionnaires include general questions about the number of bank customers, the total balance in bank, the working time in bank, and number of vacations in bank. The collected data will help us to classify the bank and thus we will be able to assign it to the suitable cloud service provider.

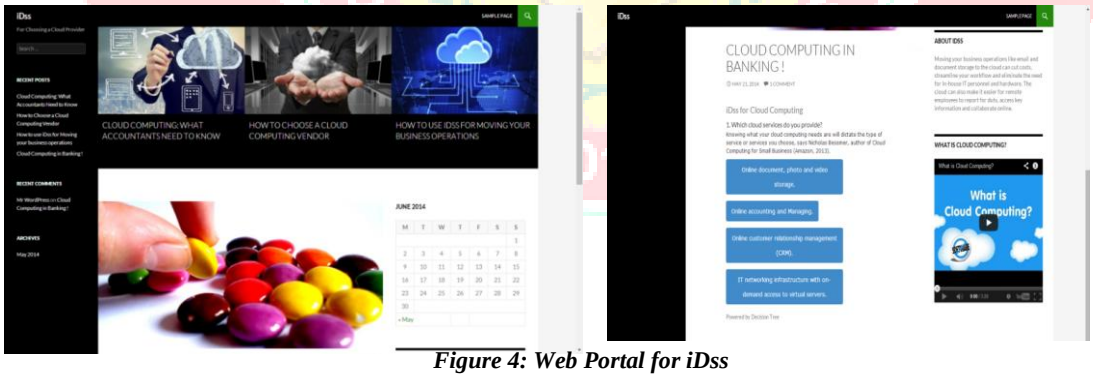


Figure 4: Web Portal for iDss

3.2 Proposed system implementation steps

The architecture of Cloud Banking Services DSS is simple and consists of four phases dealing with and gathering the requirements, clustering, and matching between cloud computing providers and banking agencies as shown in figure (1).

1. Cloud Computing Depository / Banking Agencies Depository:

This part of system is responsible for gathering all required information that will be used in evaluating, clustering and also matching bank - cloud perfect matching.

- ✓ Manual
- ✓ Automated scan

2. C-means Cloud Computing Providers / C-means Banking Agencies :

This is for dividing all cloud computing providers and banking agencies into multiple groups with common elements.

Cloud Computing Providers Evaluation / Banking Agencies Evaluation:

This is responsible for evaluating and rating of each group in both cloud computing providers and banking agencies evaluation.

- Fuzzy Based DSS :

This is the core of the process ofmatching between banks and clouds based on all the provided data and extracted information derived from the previous steps.
The phases of cloud banking services are shown in Figure 1

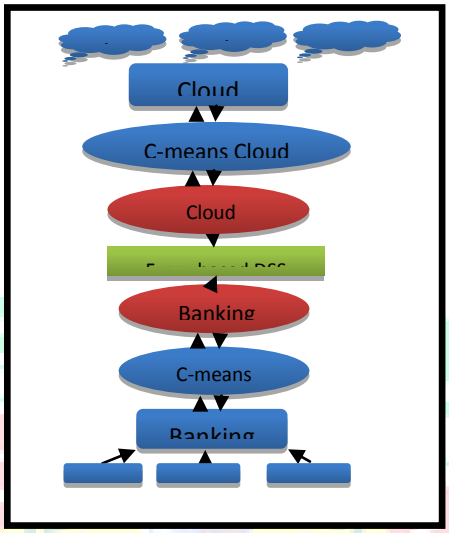
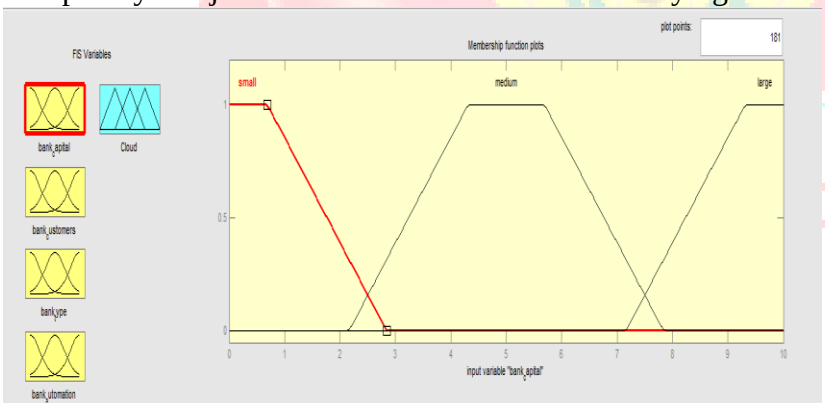


Figure 4. *Cloud Banking Services DSS Desig*

3.3Proposed system working scenarios

Ideally, this decision support system is supposed to deal with enquiries about any bank that needs to take its first step with cloud providers and either need to select from providers list or select either public or private providers. For example, given a particular security, we can ask iDss for candidate benchmarks supplying the security; or given particular experimental operations, we can ask the iDss for what evaluation requirement can be satisfied. Therefore, in general practices of Cloud services evaluation, the proposed decision support system can be applied after planning an evaluation and before designing and implementing the evaluation.
Here we use three real examples to show the possible application cases of this expert system. The three cases can meanwhile be viewed as a conceptual validation of our current work. Note that, to highlight the application flow, iDss working mechanism is simplified without elaborating the data/knowledge reasoning procedures.

3-3.1 C-means Cloud Computing Providers / C-means Banking Agencies: In fuzzy clustering, a degree of belongingness to clusters is assigned to each point rather than belonging completely to just one cluster. It means classifying the collected information about cloud computing providers and banking agencies stored in the database into clusters so that the items hat belongs to the same cluster are as similar as possible, and the items that belong to different clusters are as dissimilar as possible. Each data point could be a member of only one cluster. The fuzzy c-means algorithm recognizes spherical clouds of points in a p-dimensional space where each cluster is assumed to have similar sizes and represented by its center. Depending on the nature of the data and the purpose for which clustering is being used, different measures of similarity may be used in order to distribute items among clusters, where the similarity measure controls how the clusters are formed. And in our method we use c-means fuzzy clustering (FCM) algorithm to generate these clusters. [6]



The aim of fuzzy c-means clustering algorithm is to classify a number of data points (data points represent the banking agencies and cloud computing services in this context) into a number of predefined classes. In this formulation, c represents the number of clusters to be formed. In other words to minimize a set of data points into self-similar groups such that the points that belong to the same group are more similar than the points belonging to different groups. Each data point is

assigned a membership value which shows the probability that a particular data point falls into a certain cluster and therefore it takes a value between 0 and 1.

This differs from the k-means objective function in the addition of the membership values uij and the fuzzifier m. The fuzzifier m determines the level of cluster fuzziness. A large m results in smaller memberships wij and hence, fuzzier clusters. In the limit m = 1, the memberships wij converge to 0 or 1, which implies a crisp partitioning. In the absence of experimentation or domain knowledge, m is commonly set to 2. The basic FCM Algorithm, given n data points (x1, . . ., xn) to be clustered, a number of c clusters with (c1, . . ., cc) the center of the clusters, and m the level of cluster fuzziness with.

In fuzzy clustering, every point has a degree of belonging to clusters, as in fuzzy logic, rather than belonging completely to just one cluster. Thus, points on the edge of a cluster, may be in the cluster to a lesser degree than points in the center of cluster. An overview and comparison of different fuzzy clustering algorithms is available.

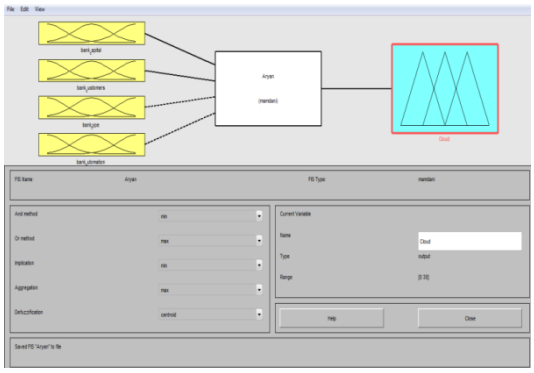
Any point x has a set of coefficients giving the degree of being in the kth cluster wk(x). With fuzzy c-means, the centroid of a cluster is the mean of all points, weighted by their degree of belonging to the cluster: $c_k = \frac{\sum_x w_k(x)^m x}{\sum_x w_k(x)^m}.$

3-3.2 Cloud Computing Providers Evaluation / Banking Agencies Evaluation: It means evaluating and rating each group or cluster. As it has been mentioned before, fuzzy clustering algorithm groups the cloud computing services having similar characteristics. But, this algorithm does not give any information regarding which cluster is composed of cloud banking services having the best or worst characteristics. The results of the fuzzy c-means clustering algorithm have been processed further using characteristics ratios so that the weighted score of the clusters could be used in ranking these clusters and consequently we would be able to evaluate them.

In the next step, the elements of each column of a certain ratio have been ranked. This way, nominal values of these ratios have been replaced by their corresponding rank indices. In the following step, these rank values have been converted into percentile ranks so that the rank values arenormalized to fall in interval [0, 1]. Next, calculated percentile rank values are linearly combined using an equal weight of 0, 1 for each ratio so that a numerical value for each cloud banking service has been obtained. In-cluster average values of these scores are calculated so that each cluster is mapped to a single average numerical score. Finally, these scores have been used for group-by-group comparison of clusters.

3-3.3 Fuzzy Based DSS: Some researches in AI, focused on enabling systems to respond to novelty and uncertainty in more flexible ways, are starting to be used in intelligent decision support systems. For example intelligent agents that perform complex cognitive tasks without any need for human intervention have been used in a range of decision support applications.

With fuzzy logic, propositions can be represented with degrees of truthfulness and falsehood. And range from 'almost certain' to 'very unlikely'. For example, the statement, today is sunny, might be 100% true if there are no clouds, 80% true if there are a few clouds, 50% true if it's hazy and 0% true if it rains all day. Fuzzy logic has proved to be particularly useful in expert system and DSS. So, it will be used to match between banking agencies and cloud banking services.



Fuzzy logic controller: design of fuzzy logic or rule based non-linear controller is easier for our handling since its control function is described by using fuzzy sets and if-then predefined rules rather than cumbersome mathematical equations as used in the work suggested by W. Mamdani. It will greatly reduce the development cost and time and needs less data storage in the form of membership functions and rules. Fuzzy logic controller is adaptive in nature and can

also exhibit increased reliability, robustness in the face of changing transaction's features, and external factors and so on.

Fuzzy Logic Systems are commonly recognized to be successful at modeling uncertainty in a large variety of industries. Mainly, it provides an effective means of capturing the approximate, inexact nature of the real world. The use of fuzzy logic is the advantage especially at DSS by decision making processes where the description by algorithms is very difficult and criteria are multiplied. The advantage is that the linguistic variables are used. The fuzzy logic measures the certainty or uncertainty of membership of element of the set. Normally the man makes decision during the mental and physical activities. The solution of certain case is found on the principle of rules that were defined by fuzzy logics for similar cases. The fuzzy logics belong among methods that are used in the area of decision making of banks and cloud providers.

4- Experimental Results

4-1 Experimental:

4.1.1 First experiment: Bank A: Small Bank with automation operations:

Now bank A is going to cut huge costs spent on connecting its branches via leased line and hardware/software network then the questions are does the bank really need to take this step or is it better to stay as it is? Which type of cloud is better for bank A? If the public clouds is better which is the best among providers?

Bank A should visit iDss and build large profile which contains all data described in bank depository section then bank A should fill iDss decision tree that contains questions list that is used in determining the bank preferences.

For selectingthe best alternatives among cloud providers for bank A web portal call FCM algorithms to cluster banks and providers then call fuzzy rule system that return all alternatives for Bank A.

After running these cases and testing all cases of Bank A iDss answer is: 1. Private Cloud Providers will be so expansive for bank a. 2. Amazon Cloud may be good choice. 3. VMware Cloud also might be a possible choice.

4.1.2 Second experiment: Bank B: Medium Level Bank with automation operations:

Now bank B is going to cut huge costs spent on connecting its branches via leased line and hardware/software network then the questions are does the bank really need to take this step or is it better to stay as it is? Which type of cloud is better for bank A? If the public cloud is better which is the best among providers?

Boosting Latency are used to model the Cloud platform, while the suggested scenarios, like Workloads rise and fall repeatedly, are used to model the Cloud-hosted workloads.

Unlike the previous bank, the suggested scenarios such as Repeat experiment at different time are used to prepare and perform some cases and after running these cases and test all cases of Bank A iDss the answer is: a. Private Cloud Providers might be a good choice. b. IBM Cloud may be good choice. c. VMware Private Cloud also highly recommended.

4.1.3 Third experiment: Bank C: Large Level Bank: Now bank C is going to expand with new branches in new countries then the questions are which type of cloud is better for bank A? If the public cloud is better which is the best among providers?

In this case, suppose we plan to measure how variable the real Cloud service performance fuzzy is. Similarly, the requirement here can be translated into "Variability" as the input to iDss

After running these cases and test all cases of Bank A iDss the answer is:

- Private Cloud Providers is highly recommended we suggest EMC.
- Microsoft Cloud may be a good choice.
- Oracle Private Cloud also maybe a choice.

4.2 Software tools:

 Programming Languages and framework:
o PHP 5.3 , Word press Framework 1.9 and MySql.
o JavaScript, CSS and HTML.
o Matlab

 Servers Tools
o Apache
o Mysql
o Xamp Windows Package

 Editors and IDE
o Eclipse
o Notpad ++
o Sqlyog

4.3 Evaluation metrics

- **Objective:** The main objective of this work is to find a new idea to make banks work more efficiently with cloud computing adoption of a decision support system to choose the best for both parties.
- **Performance measure:** TheScale Parent adopted to measure the success or failure of this work is the time it takes the system proposed in the implementation and choose the cloud better across various business functions and form a hybrid cloud which enables banks to gain the benefits of cloud computing while also maintaining the security and confidentiality of its own data.

4.4 Comparison between previous experiments:

	Creating a iDSS model for cloud banking services	**[5] Building an Expert System for Evaluation of Commercial Cloud Services**
Delay time	our system requires more data	this system requires less data
Complexity	our system consists of three stages ; collecting bank data, iDss,	Addresses the challenges and matches directly between the cloud and the bank
Security	Property based on the type of cloud computing	Property based on the type of cloud computing
Congestion control	Easier to retrieve data since it is stored in a database	Does not deal with congestion because it chooses just one cloud
Routing methodology	Easier to retrieve data since it is stored in a database	Difficulty in retrieving data
Reliability	we deal with the bank so our reliability is higher	Dealing with the client
cost	There are no differences	There are no differences

5-Conclusion and Future Work

Given the rapidly changing and customer uncontrollable conditions, evaluation of commercial Cloud services are inevitably more challenging than that of traditional computing systems. To facilitate evaluation work in the context of Cloud Computing in industry, we proposed to accumulate existing evaluation knowledge, and to establish iDss for Cloud Bank matcher to make evaluation experiences conveniently reusable and sustainable. Note that the proposed decision support system does NOT work like an automated evaluation tool or benchmark involved in

evaluation implementations, but gives better suggestions or guidelines according to bank enquiries.

This paper roughly introduces the structure and components of this decision support system, and mainly specifies the study methodology we are following. The methodology then reveals and guides our current and future work, such as using the FCM to collect and analyze existing evaluation practices, following the procedure of fuzzy based rules to extract evaluation knowledge, building the web portal to conduct knowledge reasoning and data retrieving, and patching a well-designed Interface to complete the decision support system.

However, the changing of cloud computing services will be more challenging for evaluation than that of traditional computing systems. So; we presented in this research a new DSS model for cloud banking service evaluation as there are many banking agencies who are not familiar with this new approach. But, after providing them with our DSS, it'll be easy to choose an appropriate cloud computing provider.

Finally, the results of the fuzzy c-means clustering algorithm have been processed further using these class so that the clusters could be used in ranking these providers.

Banking services organizations are starting to adopt cloud computing technologies in a number of fields, in particular for mobile applications, innovation testing and micro banking.

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