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Research Article

CLOUD COMPUTING AN EFFICIENT WAY TO PROVIDE FOR IT SERVICE IN IRAN METEOROLOGICAL ORGANIZATION

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ABSTRACT
The cloud computing is an efficient way to provide the information technology (IT) service which leads to the identification of business values in providing the appropriate information service and avoids spending too much costs in governmental organizations. This research is a mixed study according to the methodology since it is conducted with the aim at providing the cloud computing model for storing and retrieving the meteorological data; and it is among the fundamental and applied studies (in combination of both) n terms of objective. The qualitative section is implemented by grounded theory; and the quantitative section by AHP method. Based on the obtained results about the cloud rankings by experts, the target special cloud has the maximum weight and put in the first rank, and then, the private, hybrid, community and public clouds, respectively.

Keywords: *Cloud Computing, Meteorological Organization*

INTRODUCTION
The cloud computing is based on the large networks such as the Internet and provides the access to resources in a flexible and scalable way on the basis of demand via the Internet (Jie, 2014). In the governmental organizations, the cloud computing enables the users to receive their web-based service through any device connected to the network instead of installing the required software on their personal computers (Gao, 2011). The main reason for this study as described earlier is the existence of proper infrastructure for managing the large volume of data in the field of meteorology since the cloud computing space is economical and eliminating some of the infrastructures practically leads to the significant saving in costs and increases the performance and efficiency in addition to performing faster calculations (Iranpak, 2013). Due to the progress of global science in the field of meteorology, the volume of this data is increasing every day. Therefore, the meteorological sector will be faced with a huge volume of data in the near future, and the annual growth up to 40 percent is estimated for data chart (Sanchati, 2011).
Due to the high volume and willingness to share data, this organization will be forced to accept the cloud computing and include the meteorological data into the information cloud concepts of this sector in the near future (Subashini, 2011). Therefore, the cloud computing technology provides the affordable computer service for meteorological organization with utilization of higher productivity, lower costs, and lower environmental effects (Goli, 2013). Therefore, it is essential to provide a proper for data storage and retrieval in information clouds and it is important for preserving Iran in the sphere of science and development of knowledge boundaries in this field of IT (Sultan and Sultan, 2012).
According to the research methodology, it is among the fundamental and applied studies (a combination of both) in terms of objective and it has the mixed type. The qualitative sector is implemented by infrastructural theory method and the quantitative sector by AHP method. In other words, we have first studied the literature and resources of this field (the scientific and research papers, ISI papers, projects and research projects) and extracted the basic data (basic research) through a systematic approach in three steps (open, axial, and selective coding) in order to extract the leading and important indices for modeling the cloud computing in Iran Meteorological Organization and determine the key factors affecting the design of cloud cover of this organization by qualitative studies, and then an inventory of questions is developed in the form of a researcher-made questionnaire in order to identify and assess the indices of

main criteria in model indexing for storage and retrieval of meteorological data. Afterwards, the data is collected and analyzed by Fuzzy Analytic Hierarchy Process (FAHP) as well as providing the cloud computing model for Iran Meteorological Organization and creating an electronic information system. Finally, this model is again given to experts in order to ensure the accuracy of proposed cloud cover model and its validation.

In this section, we utilize the researcher-made questionnaire with the provided items based on basic data studies as well as the Fuzzy Analytic Hierarchy Process (FAHP) and Analytic Hierarchy Process (AHP) introduced by Thomas (1970s) as the most famous and practical techniques of multi-index decision making. This method relies on the FAHP of the paired comparisons.

The population of this study consists of the experts including the directors, deputies, stakeholders, and authorities in Iran Meteorological Organization and other relevant affiliated agencies and departments, professors and administrators with management experience of over 15 years in various sectors of Iran Meteorological Organization as well as the PhD students and researchers in the research center of organization (they are 20 subjects according to purposeful and convenience sampling, but the research experts in Table 1are 20 subjects including 3 professors, 7 associate professors,5 assistant professors, and 5 experienced managers.

Table 1: Distribution of sample size according to the respondents (experts)

Interviewed individuals	Total (n)
Professor	3
Associate professor	7
Assistant professor	5
Experienced managers	5
Sum	20

This research is started by purposive and convenience sampling. Therefore, the target individuals of statistical population are identified, and then the snowball or chain method are utilized for identifying other appropriate samples.

In this section, the questionnaire is utilized to assess the indices of main criteria in model indexing for storage and retrieval of meteorological data. The indices of main criteria in model indexing for storage and retrieval of meteorological data such as ranking the criteria of indexing the stored data, integration, the speed of searching the overload data types, implementation are put in an inventory of question options and in the form of a researcher-made questionnaire, and then the preliminary questionnaire is designed and approved by advisor and supervisor professors and distributed among a population of 20 experts, researchers and PhD students in Iran Meteorological Organization and Research Institute of Meteorology. Afterwards, the data is collected and analyzed by Fuzzy Analytic Hierarchy Process (FAHP), a cloud computing model for data of Iran Meteorological Organization is provided, and acclimate electronic information system created. Finally, this model is presented to experts (including the professors, directors, deputies and some of heads in relevant ministries) in order to ensure the accuracy of proposed cloud cover model and its validation. To provide the proposed model for cloud computing, the meteorological data is stored step by step, and finally the cloud computing model is designed by a simple image.

Data Storage

As noted, the data is stored in the cloud centers at this stage. This stage has several subsections as follows.

Classification of Meteorological Data

The meteorological data is classified into three groups of public, applied and critical-applied data according to the importance and accessibility. The public data refers to the information which can be seen by all users. The applied data is the information which is only seen by users who are authenticated by customer. Even the cloud centers will not be able to see this information. The critical-applied data is special and vital and should not be published under any circumstances.

Building the Index for Different Data

After information classification, this information is coded according to the group. Since the applied and critical-applied data is stored on the cloud as the codes and it is difficult to search the coded data, an index should be prepared from them. The index is a list of key words each which is a list of pointers to documents where that word is applied. The indices should also be coded to avoid the type of stored information on the cloud. In this regard, the processing mechanisms on the data are as follows:

Public Data

The index is not provided for this data and it is coded only be the customer's private key. The data centers will be able to see this data by a public key.

Applied Data

Since this data should not be available by the cloud centers, the index of this data should be built for searching in cloud centers. Afterwards, this index is coded by the customer's private key and sent. However, the main data is put under the cryptography of an algorithm and then coded by a private key in order not to be recognized by even the data centers.

Critical-applied Data

Like the applied data, an index of this type of data is initially prepared and sent. However, the main data is coded during three stages, First by the customer's public key and then by cryptography algorithm and finally by customer's private key.

Data Retrieval

At this stage, the data is retrieved according to the users' demands. First, the user determined his rate of access by entering the website and doing the stages of authentication. If he is able to see the public data, he only receives the public key and in the case that he has access to applied data, he receives the cryptography algorithm key in addition to the public key. If he has access to the critical-applied data, he receives the public, cryptography and private keys. Then the user sends his request to cloud centers. The request is searched in cloud centers and its result is sent to user. The user requests for loading the desired file by selecting one of the results of searching and sends the data cloud center. The pair-wise comparison and normalized matrixes ate provided to rank various clouds in cloud computing.

What is the best type of proposed cloud for meteorological data in Iran Meteorological Organization? First, the pair-wise comparison matrix is done based on the following normalized matrix tables in order to answer this question.

Table 2: Pair-wise comparison matrix

	Private Cloud	**Public cloud**	**Hybrid cloud**	**Community Cloud**	**Special-purpose cloud**
Private Cloud	1.00	1.51	0.97	1.37	0.33
Public cloud	0.66	1.00	0.90	0.85	0.32
Hybrid cloud	1.03	1.11	1.00	0.81	0.47
Community cloud	0.73	1.17	1.23	1.00	0.40
Special-purpose cloud	3.04	3.11	2.14	2.49	1.00
Sum	6.4639	7.9083	6.252	6.5152	2.5184

To answer this question, first the pair-wise comparison matrix is performed based on the table 2.

Table 3: Normalized matrix

	Private Cloud	**Public cloud**	**Hybrid cloud**	**Community Cloud**	**Special-purpose cloud**	**Index weight**
Private Cloud	0.15	0.19	0.16	0.21	0.13	0.16814
Public cloud	0.10	0.13	0.14	0.13	0.13	0.125675
Hybrid cloud	0.16	0.14	0.16	0.12	0.19	0.153856
Community Cloud	0.11	0.15	0.20	0.15	0.16	0.153417
Special-purpose cloud	0.47	0.39	0.34	0.38	0.40	0.398912

The normalized values and normalized matrix of cloud model indices are presented in Table 3.
Based on the obtained results in above figure of cloud ratings by experts, the special-purpose cloud has the maximum weight and put in the first rank, and then the private, hybrid, community and public clouds, respectively.

Table 4: Pair-wise comparison matrix

	IAAS	PAAS	SAAS	DAAS	HAAS
IAAS	1.00	0.32	0.92	0.98	0.37
PAAS	3.13	1.00	3.65	2.52	1.68
SAAS	1.08	0.27	1.00	1.01	0.41
DAAS	1.02	0.40	0.99	1.00	0.67
HAAS	2.73	0.59	2.42	1.48	1.00
Total	8.9639	2.5833	8.9889	6.9989	4.1368

Finally, the pair-wise comparison and normalized matrix are presented in tables 3 and 4in order to rank the architectures of provided cloud computing service (Table 4).

Table 5: Normalized matrix

	IAAS	PAAS	SAAS	DAAS	HAAS	Net weight
IAAS	0.11	0.12	0.10	0.14	0.09	0.112793
PAAS	0.35	0.39	0.41	0.36	0.41	0.382594
SAAS	0.12	0.11	0.11	0.14	0.10	0.116017
DAAS	0.11	0.15	0.11	0.14	0.16	0.136431
HAAS	0.30	0.23	0.27	0.21	0.24	0.252165

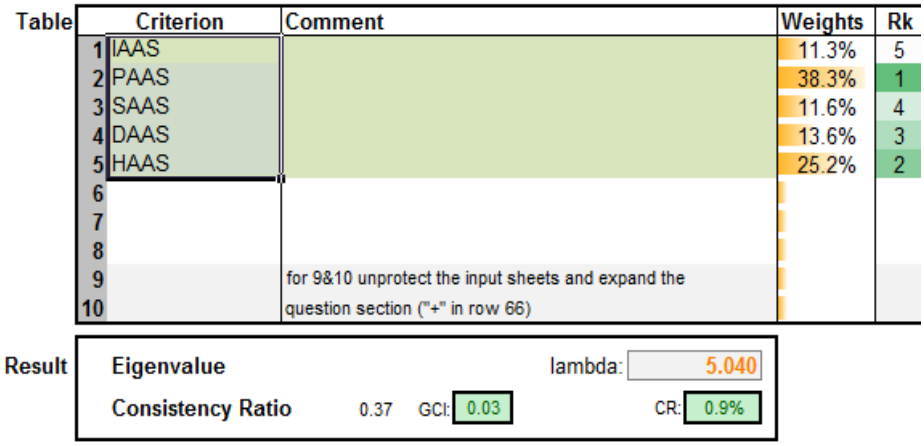

Figure 1: Final weight

Based on the obtained results of Tables and Figure the ranked architectures for providing the cloud computing service indicate that the weight of PAAS is equal to 38.3% and is put in the first place, and then HAAS, DAAS, SAAS and IAAS respectively.
Based on the obtained results of ranking the clouds by experts, the special-purpose cloud has the maximum weight and is put in the first rank, and then the private, hybrid, community and public clouds, respectively. The pair-wise comparison and normalized matrixes are provided in order to rank the architectures for providing the cloud computing service. Based on the obtained results of ranked architectures for providing the cloud computing service, the weight of PAAS is equal to 38.3% and is put in the first place, and then the HAAS, DAAS, SAAS and IAAS, respectively. According to the current studies, the expert's in Iran Meteorological Organization have reported that they will need the utilization

of cloud computing in near future. Like the application of any type of innovation, the application of cloud computing requires considering the various dimensions and factors.

Discussion

This research investigates and identifies the factors affecting the decision making for application of cloud computing in Iran Meteorological Organization in six categories of organizational, human, environmental, legal and technical factors, commercial and intellectual rights, as well as the storage and retrieval of meteorological data along with the components in quantitative sector, the Fuzzy Analytic Hierarchy Process (FAHP) and Analytic Hierarchy Process (AHP), and finally ranks the best type of cover cloud for Iran Meteorological Organization by forming the pair-wise comparison matrix and normalization of weights.

- According to the mean rank of clouds by experts, the special-purpose cloud has the maximum weight and is put in the first rank, and then the private, hybrid, community and public clouds, respectively. According to the ranked architectures of weight, the PAAS is equal to 38.3% and is put in the first place, and then the HAAS, DAAS, SAAS and IAAS. The application of special-purpose model in Iran Meteorological Organization leads to the wealth creation and sustainability and survival of Iran Meteorological Organization in current turbulent and competitive world.

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