E-Government Public Cloud Model (EGPCM)

Nada M. Al-Hakkak
Dept. of Computer Science
Baghdad College of Economic Sciences University
dr.nada@baghdadcollege.edu.iq
nadahakkak@hotmail.com
Ban Salman Shukur
Dept. of Computer Science
Baghdad College of Economic Sciences University
Ban_s_s_daoud@yahoo.com
Atheel Sabih Shaker
Dept. of Computer Science
Baghdad College of Economic Sciences University
Atheel.Sabih@baghdadcollege.edu.iq
Received in:9/October/2017, Accepted in:29/October/2017

Abstract

The concept of implementing e-government systems is growing widely all around the world and becoming an interest to all governments. However, governments are still seeking for effective ways to implement e-government systems properly and successfully. As services of e-government increased and citizens' demands expand, the e-government systems become costlier to satisfy the growing needs. The cloud computing is a technique that has been discussed lately as a solution to overcome some problems that an e-government implementation or expansion is going through. This paper is a proposal of a new model for e-government on basis of cloud computing. E-Government Public Cloud Model EGPCM, for e-government is related to public cloud computing.

Keywords: e-government, cloud computing, E-Government Public Cloud Model EGPCM

Introduction

the implementation of e-government and related organizations has witnessed more progress to make its related on-line services available to citizens in a useful and flexible manner.
The needs of citizens from e-government is growing and their usage of internet is one of main and major challenges that faces e-government [1 & 19].
Services applied by e-government in developing countries are harder and challengeable than in developed countries [7].
They are facing many well-known difficulties and problems to implement basics of e-government. Problems like shorten resources, high cost, digital divide and the poorness of IT infrastructure and management are examples of these problems [3, 5 & 21].
E-governments around the world are seriously looking into cloud computing as mean of increasing efficiency, reducing cost, providing more reliable and efficient services, and reducing cycle time [31].

E-Government

In the past few years, Information and Communication Technology (ICT) witnessed a very high speed development that goes beyond all expiations. The wide usage of Internet made the world wide like a small global village. Of course, this improvement has its impact over every aspect on everything in our lives. Governments as well as all other matters took the benefit of using ICT to present and deliver their services to citizens, which is referred to as e-government.

The Concept of Government

Many definitions and explanations about the concept of e-government have been introduced by researches, organizations and other involved agencies. However, most researchers define e-government with respect to the use of ICT [16]
The definition of United Nations Division for Public Economics and Public Administration (UNDPEPA) about E-government is “utilizing the Internet and the world wide web for delivering government information and services to citizens” [29]. In other hand, we see that the Organization for Economic Co-Operation and Development (OECD) explains that the e-government concept is using the ICT, especially the internet, as a way to get a better government [10].
By moving to the World Bank we have another definition for e-Government. The World Bank describes the use of information technologies (like internet, wide area networks, and mobile computing) by government agencies to change the relations with citizens, businesses, and other arms of government as the e-government [32].
In general, the term e-government is about the usage of technology to improve the ways that a government follows to deliver services to its citizens for the benefit of citizens, business, agencies and other engaged parties. It is the implementation of ICT by a government to support its activities and provide public services in a transparence, efficient, easy, less expensive, better and manageable manner. E-government is available anytime, anywhere for any citizen to use. E-government built a better relationship between government and citizens [38].

E-Government Categories

E-government categories, usually referred to as e-government models are classified according to the services they provide and the area these services serve. Most of these classifications divide these models to three models, some of the researches add a fourth model to the basic three models [13]. The models are:

1. Government-to-Citizen (G2C).

The communication and information exchanging between the government and its citizens using electronic format.

2. Government-to-Business (G2B).

This model focuses on enhancing the quality of communication and transactions with business in an effective way.

3. Government-to- Government (G2G)

This model reflects the inter relationship between the one government agencies and organizations in many levels.

4. Government to Employees (G2E)

Some researchers consider this model as an inner part of G2G model, while others consider it a separate model of e-government [28].

It refers to relationship between government and its employees as it represents the online services that government gives to its employees.

Benefits of E-Government [13]

According to [22], the most important benefits of e-government are:

1) Cost limitation for all stockholders involved; government, businesses and citizens with a raise in efficiency.

2) Increasing service quality by the mean in saving time, money and effort.

3) Transparency, accountability and less corruption.

4) Reduce cost and time for e-government agencies.

5) Creation of the development community

6) Improve the decision making process and its quality.

7) Improve the usage of ICT tools in many society sectors.

While AGIMO summarize these benefits in four points only, which are [3]:

1. Government agency benefits
2. Consumer financial benefits;
3. Social benefits.
4. Contribution to broader government objectives.

Smith pointed out that the main three domains of e-government initiatives are [27]:

1- Improving the services served by the government.
2- Connecting people.
3- Creating interaction for businesses.

He puts a relation between these three initiatives which are illustrated in figure (1) [27].

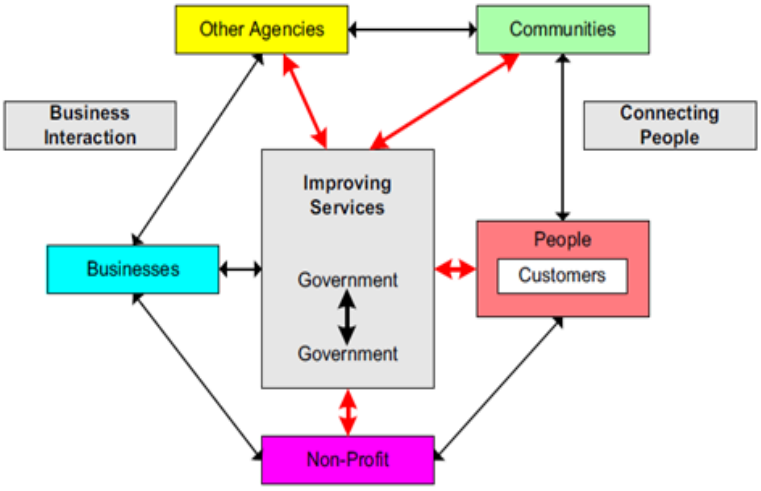

Figure (1): Main domains for E-government initiatives [27]

Cloud Computing

To meet every change in business needs organization we need to invest time and budget to balance their IT infrastructure such as Hardware, Software and services, However the scaling process can be slow, so the solution is cloud process can be slow, so the solution is cloud computing because it provides computing over the internet.

Cloud computing service consists of highly optimize virtual data centers, they provide software, hardware and information resources for use when needed, organizations can be simply connected to the cloud and use the available resource, this helps organization for avoiding extra changes for additional infrastructures, hence they can scale up or scale down according to business requirements

There are four different models of cloud computing:

1- Private Cloud: For one organization on private network and it's highly secured.
2- Public Cloud: Owned by cloud service provider and offers the highest level of efficiency and shared resources.
3- Hybrid cloud: A combination of private and public.
4- Community Cloud: A Kind of private cloud but many organizations which share same interests or offer same services [26].

Cloud computing consists of the three service models, this classification is according to the services that the cloud computing can offer for the user. A summarize of these service modes is shown in figure (2) [6, 12, 15].

1- IaaS: Infrastructure as a service.
2- PasS: Platform as a service.
3- SaaS: Software as a service

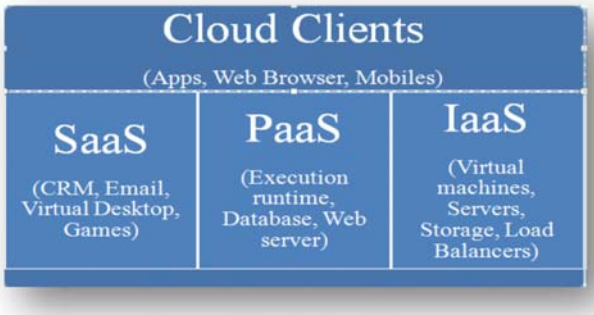

Figure (2): Service models in cloud computing [6, 12 & 15]

Iaas Model means the provider provides the infrastructure for the user/organization such as computing power and storage capacity, where the organization gets control over the IT infrastructure including the hosting environment and the applications.

PasS model means the provider provides the user/organization with a platform, which means running and maintaining operating system and resources required by the user/organization, hence the organization is only responsible for the development, maintenance and management of the application.

SaaS model means that the provider of the cloud is responsible completely about the application software provided for user/ organization in running and maintaining these applications, while the user/organization will see and use these applications as web-based applications [30, 39, 12 and 15].

The National Institute of Standards and Technology (NIST) says that the concept of cloud computing, services and deployment models could be summarized as shown in figure (3), which shows the characteristics of these services and deployment models and other characteristics which are expected when applying a cloud computing model [40].

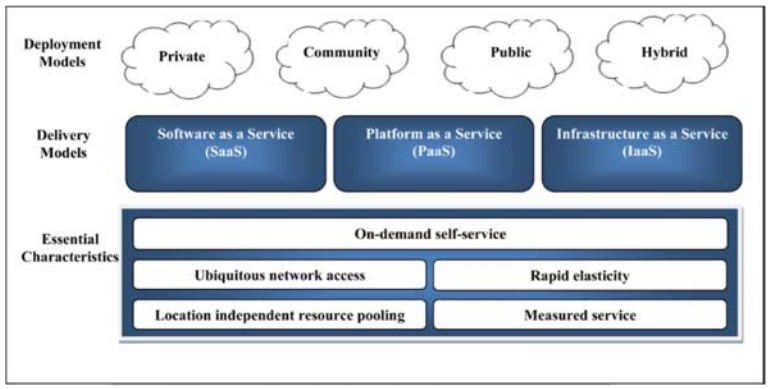

Figure (3): NIST cloud computing definition [40]

Cloud Computing Adoption in E-Government

The adoption of cloud computing in e-government is a reality aspect and has been implemented in many countries around the world. In Europe [35], for example, many countries have planned the adoption, adopted and/ or already implemented the cloud computing in their e-governments. The summarization of European countries is shown in table (1) [35].

Table (1): A summary of European countries adopting cloud computing in E-government

Country	Cloud computing fastened in the country Strategy	Adoption Of cloud computing	The level of Cloud Adopting	Models used in Cloud	The model of Cloud service	Applied services for E-government within cloud
Austria	Done	In Plan	Country Region Town	Public , Private and Community Cloud	IaaS Pas SaaS	A framework for cloud E-government applications with backup and archiving and collaboration groups services
Denmark	Not yet	In Plan implemented	Town	Public , Private and Community Cloud	SaaS	E-Mail arrangements
Finland	Not yet	In Plan				
France	Done	Developing	Country	Community Cloud	IaaS	
Germany	Done	In Plan				
Ireland	Done	In Plan	country	Public , Private and Community Cloud	IaaS Pas SaaS	Open Data Public Information Reposition Collaboration groups E-Mail
Spain	Not yet	In Plan implemented	Country Region Town	Public , Private, Community and Hybrid Cloud	IaaS Pas SaaS	Services of E-government Open Government Participation of citizens E-Mail arrangements Storage Backup Office arrangements
United Kingdom	Done	Developing implemented	Country	Private and Community Cloud	IaaS Pas SaaS	E-Mail arrangements Office arrangements Customer Relationship Managing

In USA, a project was started by the administration connected to the cloud computing to identify which services are suitable to be used within cloud computing. The result of passage to the cloud for the official web portal of the United States government (www.usa.gov) result in dropping charges (up to 90%). At the same time it increased the flexibility of the system, enhanced the abilities and improved the process and automation.

Reaching this level, any citizen's request becomes a real time handling and data is easily accessed in an integrated manner with other websites by citizens [30].

The accessibility of the website reaches 99.99 % with nearly zero downtime per month. The budget was reduced to only $650.000 for the website www.usa.gov annually [16].

The Government of Thailand, has also started an e-mail service in a cloud-base concept and put a plan to add a SaaS in future. The government believes that this plan will improve the services of agencies related to government and at the same time reduce cost of IT in a noticeable way [33 & 14].

In Australia, many government's agencies are using some kind of cloud solutions. Australia government is hoping to offer their citizens the best service and cover business needs in a good manner taking into consideration cost, flexibility and security [8]. For example the west Australian health implemented and already uses a private cloud and the department of immigration and citizenship implemented a hybrid cloud.

For the government of India, a proposed E- Governmental cloud project was discussed to provide a complete infrastructure for the implementation of government services including administrate and regulatory and social welfare [11].

In the proposed cloud model for government of India, there are three categories of cloud in different security requirement levels, which are:

1: The high assurance part, where a physically computing resources are only used by government to provide its high assurance requirements.

2: The medium assurance part, where a resource pool for cloud computing used by non-government cloud users with a security control in the hands of the government.

3: The basic assurance part, where a computing resource of cloud computing based on public cloud offerings [15].

The layers of cloud computing proposed by these researchers is shown in figure (4) [15].

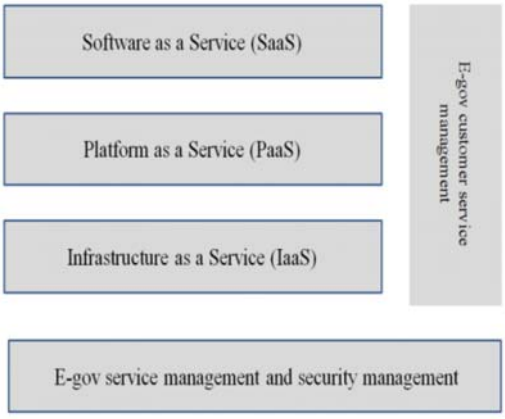

Figure (4): The cloud computing layers proposed for Indian e-government [15]

Hiragana proposed cloud computing prototype was for Indonesia's e-government to solve its problems. As the researcher sees that the implementation of Indonesia's e-government has

many difficulties in infrastructure and the high expenses of computer resources and network and he proposes a cloud computing solution for the e-government in Indonesia to overcome these problems [12].

The researcher suggests that Service Oriented Architecture (SOA) is a suitable methodology to be applied for this prototype and could be implemented both in government sector and for general public as an extension of identity cards, permits and licenses rights establishment, renewal of driving licenses and other.

Saudi Arabia has already established its e-government program system which they called Yesser in 2005 with a cooperation with the Communication and Information Technology Commission (CITC) and Ministry of Finance. As a grown country, there will be a definitely incensement in citizens and demand of new technologies over the next few years, which will lead to more system complexities and high cost to provide all mentioned factors [4].

For that, the researcher proposed a private cloud architecture model using SOA for the Saudi Arabia e-government. By choosing SOA, there is no need to reengineer the existing system. Instead, the existing system will grow and meet along new capabilities so that a new library of services is reached which can be used afterwards as solutions for many subjects. In other words, the web services can be developed by using different programming languages, protocols or platforms as loosely coupled.

Table (2) shows the ranking of some Arabic countries which have already started the projects of e-government [13].

Table (2): E-government development ranking for Arab countries [13]

Country	*Globally rank*	*Arab rank*	*Index value*
United Arab Emirates	28	1	0.7344
Bahrain	36	2	0.6946
Qatar	48	3	0.6405
Kuwait	63	4	0.5960
Oman	64	5	0.5944
Lebanon	87	6	0.5139
Jordan	98	7	0.4884
Tunisia	103	8	0.4833
Egypt	107	9	0.4611
Morocco	120	10	0.4209
Syrian Arab Republic	128	11	0.3705
Algeria	132	12	0.3608
Iraq	137	13	0.3409
Sudan	165	14	0.2610
Yemen	167	15	0.2472

Jordan, already have its own e-government system, the new proposal was to apply several steps to move towards implementing a cloud e-government in Jordan [6]. The researchers identified the need for cloud environment where different kinds of cloud (private, public, community, and hybrid) are needed for this project. Figure (5) shows the proposed deployment cloud environment model for Jordanian government. It shows the need for three different kinds of cloud deployment models: private, community, public and hybrid clouds.

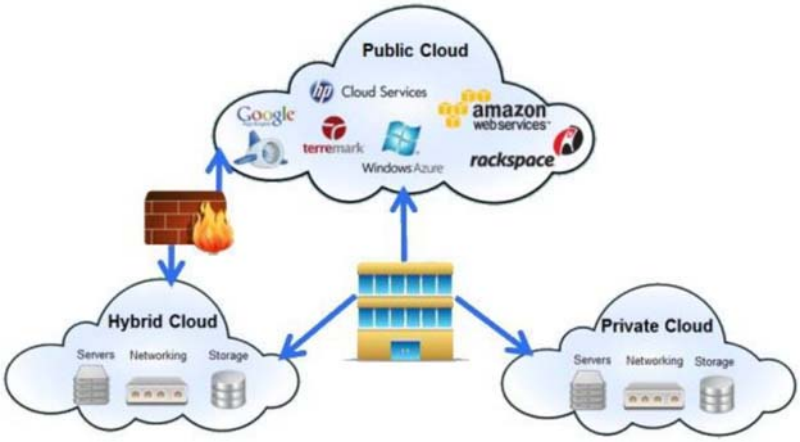

Figure (5): Cloud models for Jordanian e-government [6]

The researchers in this study also suggested stages that may be followed by the government to transfer the current Jordanian e-government to be Cloud e-government in three steps. The first step is information publishing which they suggested to share knowledge between citizens and different government agencies, the second step is about establishing citizen portal, where government agencies are able to share infrastructure using public cloud and the final step is integration, where the agencies starts to integrate between them in a strategical plan[6].

Related Work

E-government systems are electronic systems work together with cloud computing, many researchers worked in this area; as follows:

To study the situation of Iraqi e-government, [18] went through a full description of it and its challenges to main parities; government, employs, citizens, and some other privet sectors. While another research was made as a comparison between e-government in Iraq and e-government in Jordan was made upon surveys to know the citizens satisfaction about e-government system in each of them. The results were that most of Iraqi citizens were not satisfied about e-government in Iraq while most citizens in Jordan were satisfied about their e-government system. Upon that a new framework was proposed for e-government in Iraq taking into consideration the factors that may affect e-government based on this work results. Beside that a DBMS was designed and new strategies in dealing with official documents electronically. Figure (6) shows the proposed conceptual e-government model [21].

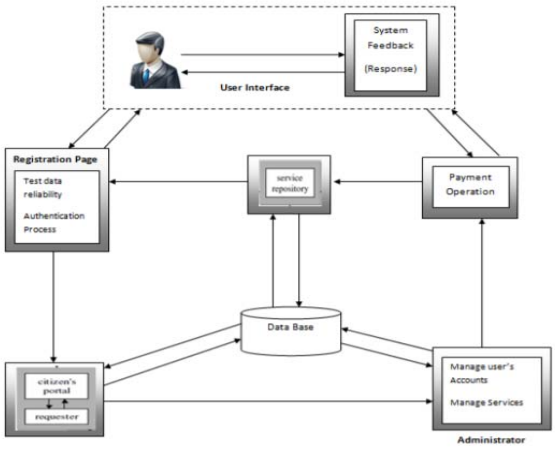

Figure (6): Proposed e-government conceptual model [21]

To explore the services and application of cloud computing that are suitable to be adopted in e-government among other adoptions, a research was made about that and went through analyzing the cloud computing systems and the available services which cloud computing providers are offering right now for users and which of these services are suitable for e-government. The research reaches a conclusion that cloud computing is an attractive field for individuals, organizations and companies. There are many services that an e-government project can get benefit from cloud computing, also there are some challenges if this technique is adopted. The researcher also shows the services that could be provided by cloud computing for e-government as shown in figure (7) [32].

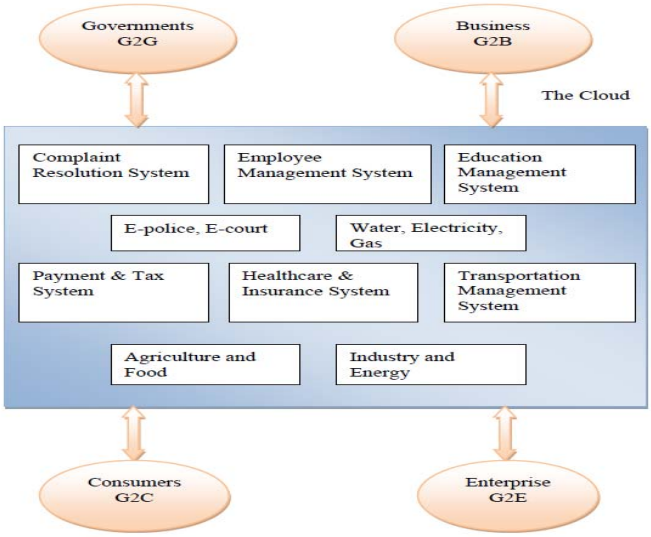

Figure (7): Services provided by an e-governance cloud [32]

To sightsee the importance of cloud computing and examine the adoption of cloud computing in seven different e-governments (USA, UK, China, Japan, New Zealand, Vietnam and Thailand), the researcher reached that shifting to cloud computing within e-government needs six-steps which he called "cloud migration strategy"[34]. These steps are: learning, organizational assessment, cloud pilot, cloud-readiness assessment, cloud rollout strategy and continuous cloud improvement. He said also that the cloud models, in the end will serve to transform all IT applications in the world.

Mukherjee and Sahoo propose a framework for e-Governance which is based on cloud computing concept. The framework was based on Hadoop, which is an open source cloud computing environment. Hadoop can carry on many tasks like checking user's authentication, fetch web services, schedule jobs and according to volunteer nods [35]. Figure (8) shows the proposed framework. The user request is handled by Hadoop and after computation the result is sent back to user using UGI or Mobile interface. The proposed system includes a knowledge base and interface engine that could be considered as expert system.

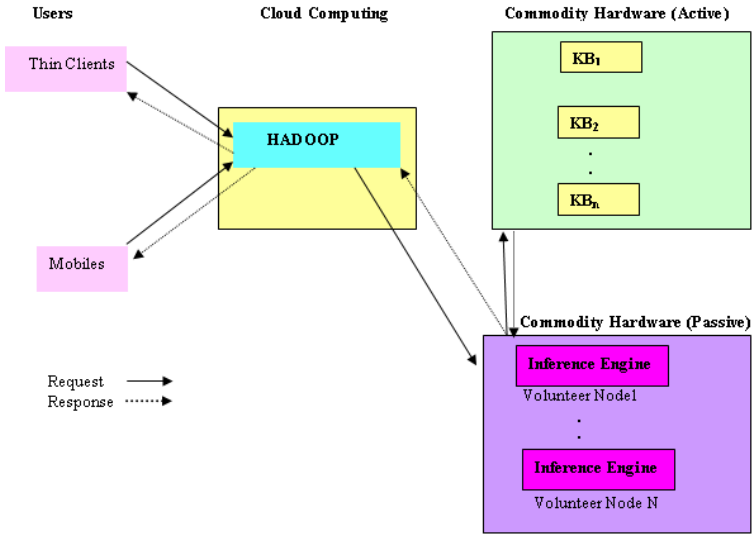

Figure (8): The proposed framework [35]

To enhance the performance of e-government, Chanchary and Islam recommend a similar way to that mentioned by Mukherjee and Sahoo framework with a knowledge base expert system to limit manual work and reduce processing time [36]. Figure (9) shows the e-government system using cloud computing and expert knowledge-base model presented by Chanchary and Islam.

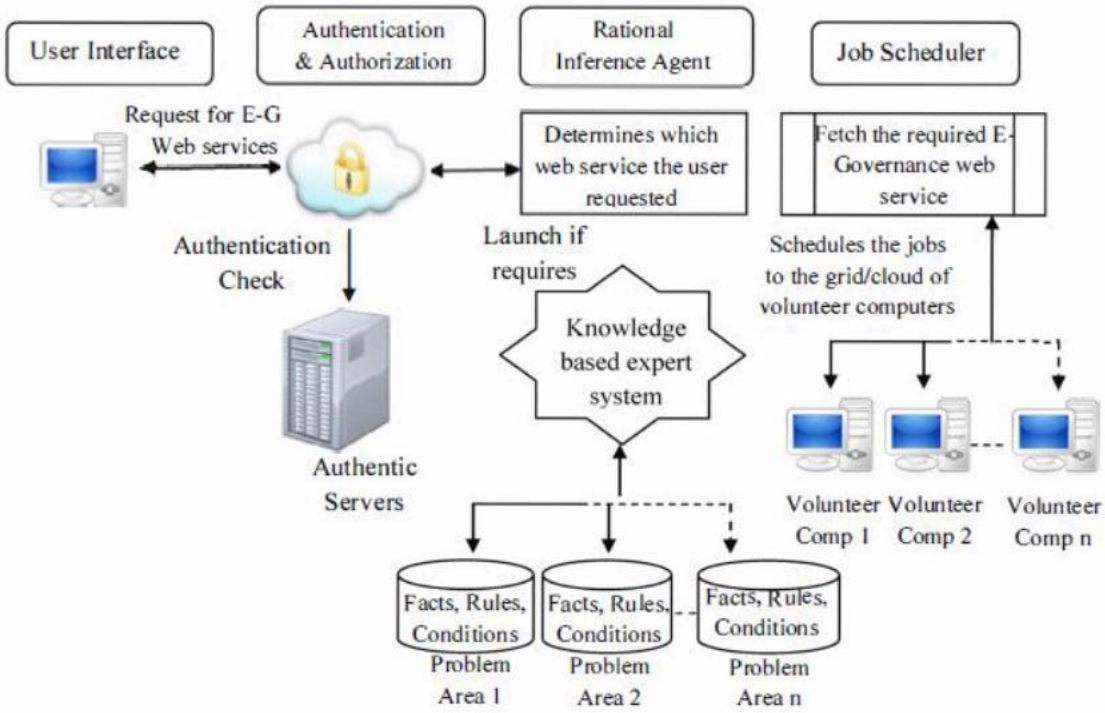

Figure (9): E-government based on cloud computing with knowledge-based expert system [36]

The proposed Model

The proposed model is new that is constructed base on the previous related works in an enhanced way, it contains the following layers:

Layer-1: User interface layer; its responsible of inputs to cloud and output from the cloud. The input may be directly online in one session or by downloading specific forms to be submitted later. The output would be the replay back from the cloud and this could be either online, or by email, or mail box through social media; i.e. face bock; twitter etc. or by cell phone in SMS form.

Layer-2: Secured transmission layer, used for data transmission between user interface and the cloud. This layer contains two types of transmission media WiFi and mobile AdHoc for mobile cell phones.

Layer-3: Request processing layer: this layer is responsible of authentication for user request. This layer ensures the authentication of the user request, by checking if the person is having ID-no.

Layer-4: Data base layer: this layer acts as a channel for all databases in the cloud, so it needs scheduling method to manage all the requests. This layer receives all the types of requests from all users and classifies them with scheduling according to some priority issues then send them to their related databases.

Layer-5: Knowledge base layer: responsible for information retrieval and knowledge extraction from the stored data. This layer is important for future expert systems for reusing answers to some frequented asked questions. The layers (3, 4, and 5) are all inside the cloud computing area. Figure (10) shows the proposed EGPCM model for this work.

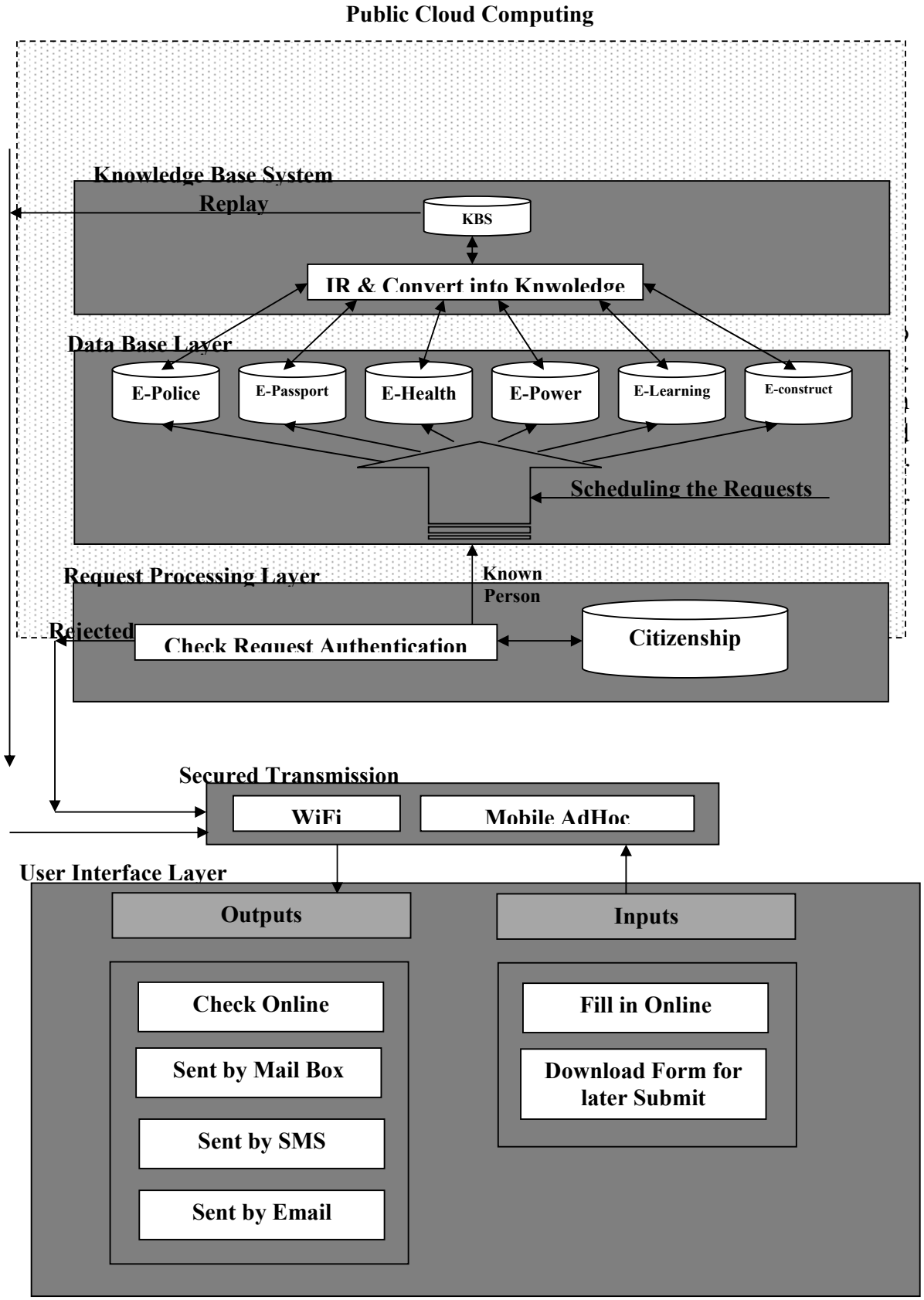

Figure (10): the proposed (EGPCM) model

References

J.F. Affisco and K.S Soliman, "E-government: a strategic operations management framework for service delivery. Business Process Management Journal, 12(1),.13-21. 2006.

AGIMO., Benefits of E-government - E-government Benefits Study. http://www.agimo.gov.au/publications/2003/03/egovt_benefits_study/benefits. 2003

A.A. Al-Rashedi,. "E-Government Based on Cloud Computing and Service-Oriented Architecture. International Journal of Computer and Electrical Engineering, 6(3),.201. 2014.

S. Alsharafat; B.M. Alfawwazand and A.M., Al-shatnawi. Jordanian Cloud-Government between Implementation and Challenges. International Journal of Computer Applications, 102(5), 2014.

F. Al-Sobhi and V. Weerakkody. The role of intermediaries in facilitating e-government diffusion in Saudi Arabia, 2010.

Australian Government, Department of Finance and Deregulation, "Cloud Computing Strategic Direction Paper, Opportunities and applicability for use by the Australian Government, Version 1.0, page 5-10, 22, 31, April 2011.

C. Ciborra; Interpreting e-government and development: Efficiency, transparency or governance at a distance? Information Technology and People, 18(3),.260-279. 2005.

T. ed. Field, "OECD E-Government Studies the E-Government Imperative. OECD Publishing, 2003.

/P.R. Gupta and D.K. Jain, "Road map for E Governance. Proceedings of ASCNT–2010, CDAC, Noida, Indiapp.91-100, 2010.

T. Hariguna.,. Prototype cloud computing for e-government in Indonesia. International Journal of Engineering and Technology-International Journal of Engineering and Sciences IJET-IJENS, 11(06).156. 2011.

A.A. Hassan, Status of E-Government in Iraq and What the Challenges of Development and Implementation,2016.

R. Hicks, Thailand hatches plan for private cloud. FutureGov, , 25, May, 2009.

M. Kumar, M. Shukla; S. Agarwal andG.N. Pandey, January. An E Governance model using cloud computing technology for Developing Countries. In Proceedings of the International Conference on e-Learning, e-Business, Enterprise Information Systems, and e-Government (EEE) (171). The Steering Committee of the World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp) 2013.

V. Kundra, State of Public Sector Cloud Computing. Federal Chief Information Officers Council,2010.

Mohammed Abdulameer Mohammed, Burhanuddin Mohd. Aboobaider, Huda Ibrahim, Azam Harith Abdullah, Mohammed Hassan Ali, Mustafa Musa Jaber and Aymen Shawkat, E-government and its Challenges in Developing

Countries: Case Study Iraqi e-Government. The Social Sciences, 11: 4310-4319. , 2016.
M.J. Moon, "The evolution of e-government among municipalities: rhetoric or reality? Public administration review, 62(4) 424-433. 2002.
R.S. Naoum and Z.A Nadhim, An Enhanced Model for e-Government (A Comparative Study between Jordanian and Iraqi Citizens). International Journal of Advanced Computer Research. 4(1), 11. 2014
N. Nkwe, E-government: challenges and opportunities in Botswana. International journal of humanities and social science, 2(17) 39-48,2012.
S.L. Pan, C.W.Tan,. and E. T. Lim, Customer relationship management (CRM) in e-government: a relational perspective. Decision Support Systems,42(1), pp.237-250., 2006.
J. W. Seifert and K. Chung, Using E-Government to Reinforce Government–Citizen Relationships Comparing Government Reform in the United States and China, Social Science Computer Review Volume 27 Number2009, 1 February 2009 3-23.
S. Shin, S., Implementing e-government in developing countries: Its unique and common success factors. American Political Science Association,2008.
Shivani Sharma and Dhanshri Parihar, "A Review on Resource Allocation in Cloud Computing," International Journal of Advance research, Ideas and Innovations in Technology, (1) (3), 2014.
S.J.C. Smith, An Empirical Study of Information Systems Security, Understanding and Awareness in E-government:(a Case Study of NSW Government). University of New South Wales,2005.
R.W.O. Ukot-Uma, Electronic Governance and Electronic Democracy: Living and Working in the Connected World. The Commonwealth Centre for Electronic Governance, New Delhi,2014.
UN, E., Government Report "Benchmarking E-Government: A Global Perspective-Assessing the UN membestates". UN Publication, [online] http://www. upan1. org/egovernment2. asp. 2001.
A. T. Velte, ,T. J. Velte, R. C. Elsenpeter, and R. C. Elsenpeter, Cloud computing: a practical approach (pp. 1-55). New York: McGraw-Hill,2001.
N. Vijay Kumar, Role of ICT in e-governance: Impact of cloud computing in driving new initiatives. SET Labs Briefings, 9(2),.43-52. , 2011.
World Bank, E- Governments. Retrieved From; http://web.worldbank.org/ Yong, J. and Koon, L. E-Government: Enabling Public Sector Reform. http://www.worldbank.org/en/topic/ict/brief/e-government,2012.
D. C. Wyld, " The cloudy future of government IT: Cloud computing and the public sector around the world. International Journal of Web & Semantic Technology,1(1),.1-20. , 2010.
B. Zwattendorfer, K. Stranacher, A. Tauber and P. Reichstädter, August. Cloud computing in e-government across europe. In International Conference on

Electronic Government and the Information Systems Perspective, Springer, Berlin Heidelberg. 181-195, 2013.
J. W. Seifert, K. Chung, Using E-Government to Reinforce Government–Citizen Relationships Comparing Government Reform in the United States and China, Social Science Computer Review Volume 27 Number 1 February 2009.
A. E. Youssef, Exploring Cloud Computing Services and Applications, Journal of Emerging Trends in Computing and Information Sciences Journal of Emerging Trends in Computing and Information Sciences, VOL. 3, NO. 6, July 2012.
T. Almarabeh; Y. KH. Majdalawi, and H. Mohammad, "Cloud Computing of E-Government, Communications and Network, 2016, 8, 1-8, Scientific Research Publishing Inc, Published Online February 2016 in SciRes
Y. Chemerkin; G. Mateescu; M. Vladescu;M. Nasr, Number; P,Date, P.and Bott, R. The loudy Future
Of Government IT: Cloud Computing and The Public Sector Around the World. 2011 First ACIS/JNU Internat Conference on Computers, Networks, Systems and Industrial Engineering. ,2013.
[35] K. Mukherjee and G. Sahoo, Cloud Computing: Future Framework for e-Governance. International Journal of Computer Applications, 7(7), 975–8887. https://doi.org/10.5120/1262-1613,2010.
[36] F. H. Chanchary and S. Islam, " E-government Based on Cloud Computing with Rational Interface Agent. Proceedings from HONET. High Capacity Optical Networks and Enabling Technologies. 2011.