Adopting Cloud Computing for the Iraqi E-Government to Achieve High Services

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Abstract: *Information and Communication Technologies (ICTs), become an important tools that allow the movement of information from one computer to another within the same or different departments that are related to the government organizations. Cloud computing been introduced recently to allow the information to be upload or accessed or exchanged or traced in a systematic way. Cloud computing is considered as an interactive and user friendly web applications, where the information can be accessed through the Internet either privately or publically. The information could be located at different government organizations, where the location is unknown to the public. The main goal of this study is to identify the suitable e-government deployment model that suite the government structure of the republic of Iraq and also to identify the type of cloud computing to support the government's application and purpose.*
Keywords: *E-government, Private cloud, Public cloud, Hybrid cloud, Maturity model.*

I.   Introduction

Information and Communication Technologies (ICTs), referrer as a collection of technology resources that are made to communicate between users. ICT become important tools in our everyday life, as it used to generate, distribute, collect and manage information in a fashion way. ICT are consist of hardware, software, and networks infrastructure, which are used for collecting, storage, process, transmission and presenting the information. ICT is been used to improve efficiency and effectiveness, transparency and comparability of exchange information within the government, between the national government, between government and citizens, and between government and the private sector, which it is called e-government [1]. E-government system can be defined as the use of emerging information and communication technology services (web-based Internet applications) to deliver information and services to citizens [2]. E-government can improve the working procedure of government mechanism by providing better services, and instant response to the citizens. It also provide better information dissemination by providing accessibility of different web services of e-government regardless of the geographical and language barriers [3]. The performance and reliability of e-government system depends upon the standardization of data center. Where the data center is a secured place where all relevant data of government is stored [4]. The government of any country is consider as the biggest producer of data [5]. Managing and processing data of large center is become more important to the organizations and to the government services. Big data processing engines have experienced a tremendous growth, as the main challenge with large data center is to provide a suitable infrastructure that demand huge investment [6]. Thus, cloud computing is been introduced recently to provide information by using the computer resources (hardware, software, and network infrastructure) to deliver the service over the Internet to the end users [7]. The services will provides flexibilities, availabilities and scalabilities to the data without any concerns of efficient storage mechanisms and maintainability issues, additional to that, the users can easily access the data from any geographical region [8]. The users do not need to know for any specific knowledge of how the systems are operates [7].Cloud computing will allow the governments, public and privet organizations to communicate in a systematic and easy way to serve their citizens. In this work, the discussion of an integration services over the cloud is been highlighted. The citizen's information will be able to be accessed by the government through a single window interface and from any location. Where, the ultimate goal of this study is to increase the efficiently of the public services and to reduce the effective cost for the government infrastructure management services.

II.   Overview of Cloud Computing

Cloud computing is used to combine different computing resources and services like, applications, networks, servers, and data storages, to be shared with minimal management [9]. The benefits of cloud computing, it is according to their flexibilities and availabilities [10]. The users will able to access the information at different physical location and at different time. The cloud will allow to access and share the

same resources simultaneously, while another important benefit it's the cost. Traditional organizations will take care about their local network infrastructure, by managing and upgrading their software and hardware to fit their business requirements. The organizations that adopt their system to cloud computing, will reduce the cost of managing, upgrading the infrastructure services. The type of services will be transferred to the service provider, where the service provider will be responsible for maintaining these services.

A. Cloud Services Types
Cloud computing provides different types of services as explained below [10-12], and as shown in **Figure 1**.

- Software as a Service (SaaS): The users do not know about the infrastructure and platforms. The users can access the software applications without the concerns of installation and maintenance. SaaS could delivers a single application through the browser to multiple users by using a multitenant architecture. SaaS is important due to its scalability, compatibility, accessible worldwide, where the users do not need to do or worry about scaling, configuration and updating.

- Platform as a Service (PaaS): The users do not know about the processing unit, memory, and storage, which are used for their applications. The service providers will be responsible about the platform that include software, hardware, operating system, servers, and development tools. PaaS provides a full "Software Lifecycle" since it's allow the application developers to be directly implement on the cloud.

- Infrastructure as a Service (IaaS): It allows users to deploy and run both operating systems and applications. The main benefit of that, users do not take any responsibility on deployment, administration, and maintenance. IaaS will provides the infrastructure that support user's applications and the necessary computational resources, such as storage space, processing unit, and bandwidth.
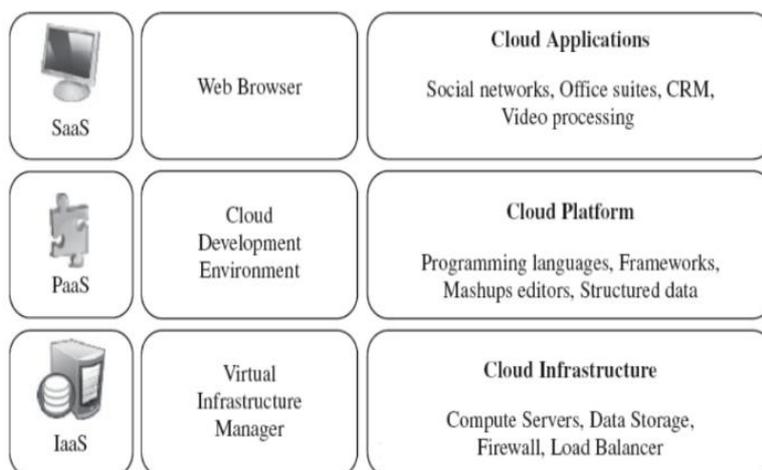

Figure 1 Cloud computing services model [6].

B. Cloud Deployment Models
As been identified in the National Institute of Standards and Technology (NIST) cloud computing standards. The cloud infrastructure can operated in one of the following deployment models [13, 14]:

- Private Cloud: The cloud infrastructure is provisioned for exclusive use by a single organization. It may be owned, managed, and operated by the organization or by a third party, or may be hosted or outsourced to a hosting company.

- Community Cloud:The cloud infrastructure is provisioned for exclusive use by a specific community of users that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations), rather than serving a single organization as does a private cloud. Cloud users can access the local cloud resources, and also the resources of other participating organizations through the connections between the associated organizations.

- Public Cloud: The cloud infrastructure and computing resources are available to the public over a public networks. A public cloud is owned by an organization, for selling cloud services, and serves as a diverse pool to the clients.

- Hybrid Cloud: The cloud infrastructure is a composition of two or more cloud infrastructures (private, community, or public) that remain unique entities, and they are bound together by standardized or proprietary technology that enables data and application portability.

C. Data Distribution overthe Cloud

The evolution of data, that are been adopted by government and industry, will expands the contents and the meaning of the big data. The data itself, can be used to generate, collect, store, manage, process, analyse, present and utilize the data [15]. The opportunities associated with data in different organizations will helped to generate significant interest in business intelligence and analytics, which is referred to techniques, technologies, systems, practices, methodologies, and applications [16], that could help the organizations to analyse the data for better understand and to make timely or daily decisions. In addition to that, the underlying data processing, analytical technologies, and methodologies that could be applied to various high-impact applications such as e-government, e-commerce, e-healthcare, e-market intelligence, and security, etc.[15, 16]. The data could be distributed to different data centers that are located in the cloud. Where the cloud will be able to connect multiple geographically distributed database centers [17]. The idea of distributing the data among many centers (storage) in the cloud will avoid the access to all contents of the data, and the access will be on that specific storage center that hold the requesting information.

III.Overview on E-government Models and Relationship

The government needs a sophisticated information system for collecting, organizing and disseminating its data on all its process stage. Governments around the global have recognized the roles of ICT, which is considered as an important resources for planning and implementing government's application. Governments worldwide start planning to moves towards adopting of e-government applications to server their purpose. E-government applications is expected to tremendously change in the ways of governments to deliver their core of business services [18-20]. E-government considered as a powerful tools that can change the ways to conduct and deliver business services to citizens and how the citizens can interact with their government. Implementing e-government application could improve efficiency, effectiveness, accountability, and transparency of government delivery service [18].

A.   Categorise of E-Government

Traditionally, the interaction between government departments, citizens, and business will took place in the government offices. With the emerging of ICT, it is now possible to move forward to e-government application services. The e-government services are categories into three different interaction relationship, as been listed and explained below [1], [19-21]:

*   Government-to-Government (G2G) Interaction: It is an interaction and integrated services between federal government and state governments. The aim is to deliver online cooperation and communication effectively. It is involves exchange of information between governments organizations, departments, and authorities.

*   Government-to-Citizen (G2C) Interaction: It is an interaction between the state government and citizens. The aim is to deliver government services to citizen in efficient and reliable way through multiple ways. It is also allow the citizens to access government information and services instantly, conveniently, from everywhere.

*   Government-to-Business (G2B) Interaction: It is an interaction between the government and commercial/non-commercial business sector. The aim is to provide businesses information and advice to the citizens. It is also provide an easy way to access public information, land and property records, taxes payment, renewing licenses, applying for domain benefits, etc.

B.   E-Government Development Models

The main purpose of e-government is to provide a good delivery of services that will create a better relationships between citizens and government [2,20]. Many researchers, consultants and academics proposed different types of e-government maturity models. The maturity model, consider as a set of stages that are used to identify and to improve the level of e-government services [18],[22-23].

Many maturity models have been used to assess e-government portals to provide services to the citizens. Hamad et al. [24] make a comprehensive study to the maturity models that been proposed by different researchers and organizations. The maturity model have several common features and similar stages. Hamad et al. [24], categories the model into three main stages that capture presences, communication, and integration.

IV.The Proposed of E-Government Services in Iraq's Government

Building an e-government in Iraqi cannot be far from the reality, especially the network infrastructure become available and the users/citizens are able to access the networks by using different type of devices (e.g. desktop computers, laptops, tablets, and smartphones). Recently, the Iraqi government start realising a new identification document with a unique number which it's called (English: National ID Number, Arabic: البطاقة الوطنية او البطاقه الموحده), which is going to replace the old documents {(English: National Certificate, Arabic:

شهادة الجنسية), and (English: Civil Identification Document, Arabic: هوية الأحوال المدنية}, for government services as a main identity for the Iraq's citizen, which give the privilege to move one step forward to the e-government system in Iraq.

The National Identification (ID) number is been used in many countries around the global for tracing their citizen status in different sectors that are related to the government services. While many countries start using the national ID number as a key access to their citizens records either, for uploading their information or for checking purpose. One of the leading countries in this field is the Kingdom of Sweden [25], they start using the Personal Identification Number (Swedish: personnummer) in the 1st of July 1991. The following personal information that are included in the National Registration File are: " name, personal ID number, address of residence, partner, children, parents, caretaker, adoption (as applicable), place of birth and place of residence at time of birth, citizenship, marital status, migration to Sweden, and deregistration from the population file due to death, emigration or other".

The Iraqi national ID number is going to be used as a main key to access the citizen's records, and allow the Iraqi citizen to use their ID number for their business transaction process. The e-government architecture can be categorized into three layers [19]:

1. Front end layer: The front end layers contains all the end users (citizens) interfaces windows, such as agency web sites and e-government portals.
2. Interaction layer: The interaction layers allow the user interaction and integration to different gateways to establish a communication between the end users (citizens) with different e-government services.
3. Back end layers: The back end layers it's consider the networks infrastructures that will provide data services to the end users (citizens).

A.   Type of Cloud Models

Accessing the citizen's information relations, it should be designed in a way that could serve the purpose, and the level of communication. Therefore, the proposed system that could be used to access the citizens records are divided into two levels, as shown in **Figure 2**.

1.   The communication mechanism between authorities could be private. The communication mechanism between the authorities (that belong to different government organizations/departments) through the requested servers to achieve a fast and secure mechanism, therefore a private connection is considered.
2.   The communication between citizens with the related organizations/departments could be public. The users (citizens) can access their information through their own personal devices through the Internet. The communication between the users (citizens) with the centre data that hold their records (the level of accessing the information will depend on the authorities and the type of information that been assigned to be retrieved), therefore a public connection is considered.
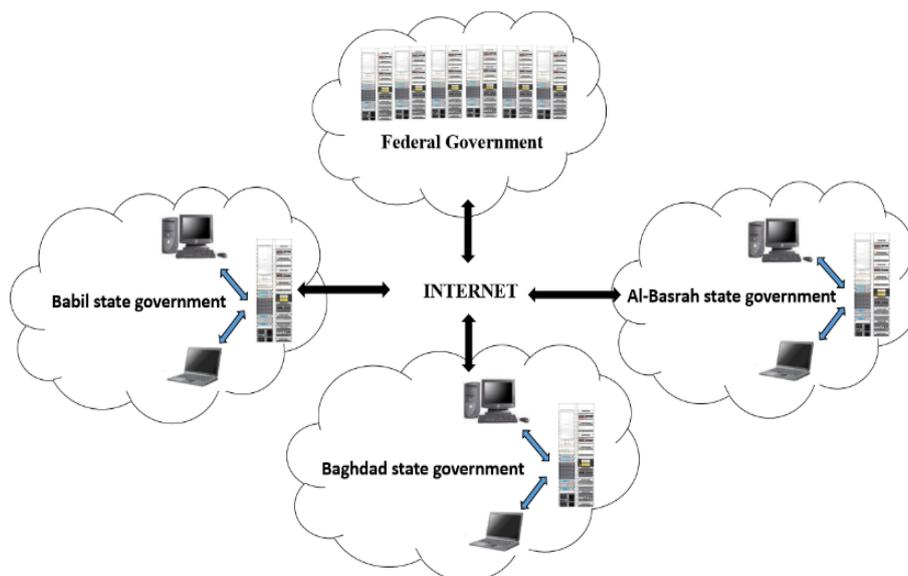

Figure 2 An overview example of distributing the data centers for local and federal governments over the cloud. For the above reasons, a hybrid cloud (private and public) computing is suggested to be used for distributed the citizen's records among the country organizations and allow the information to be accessible among each other. Private cloud will be used for government organizations to hold the information as they are responsible for

uploading, saving, exchange and tracing all the citizen's records. While a public cloud will be used to allow the users (citizens) to view the details or partial information via the Internet over a public connection, and according to the rules and regulation that been set by the government. The users (citizens) will be able to view their related information for checking purpose or according to their needs, and from any location.

B.   Stages of E-Government
Each country around the world have different government model that are used to achieve their objectives. The e-government model is been design in the way that could monitor the government procedures by providing services to the citizens. The proposed of a maturity model for Iraq will follow the three stages that been considered by Hamad et al. [24]:

I.   **Presence stage:** The "**Web Presence**" it is considered the first stage, where all the static information that supplied by the government organizations will be structured and posted on the web to make it available to the end users (citizens) [18],[22],[24],[26]. The information on the web will guide the citizens of Iraq to follow the right procedures and according to the government rules.
II.   **Communication stage:** This stage is divided into two sub-stages:
   - **Interaction**: It is the online interaction tools between the citizens and the government, which allow the use of the search engine, the communication by e-mail, download forms and documents. Where the forms and documents, will be reach under different government organizations/departments section [18],[22],[24],[26].
   - **Transaction**: It is the online transactions tools between the citizens and the government that allow to complete and secure transactions, such as renewing visas, passports application process, payment transaction, updating personal information record through a single government web, as shown in **Figure 3**, where all the transaction been posted in the related organizations/departments section [18],[22],[24],[26].
III.   **Full Integration Service stage:** This stage will provide services at different levels to the end uses (citizens):
   - **Integrated government**: In order to save the government resources, and to avoid the risk of data replication. The integration of e-government systems into various government organizations/departments at different levels (vertically and horizontally):
   o   Vertical Integration: It is an integration across different levels within similar functionality.
   o   Horizontal Integration: It is an integration across different functions and services.
   - **Joined-up government**: In order to allow the citizens to execute services without knowing which government organizations/departments is responsible and to integrate the service delivery for both vertical and horizontal. The user (citizens) can be served across different organizations/departments to provide seamless service without to know about the responsible organizations/departments [26].

The authorized person will be responsible for uploading the citizens detail information and save the information on the organization data center that could be belong or located in different department, as shown in **Figure 3**. For example; the personal information can be update based on the changes of the citizen statues, where some information are static to the citizen like national ID, full name, gender, date and place of birth, photos, eye scan, and fingerprints, etc.. While, the dynamic information could be changed during the life time of the citizen and his statues like marital status, home address, passport number, education, health, properties, etc..
The under line for each section will lead the authority/citizen to another web page that hold that specific information which could be in different data center, as shown in **Figure 3**. For example, father name will link to the father related detail information. The Home address section will linked to the addresses where the citizen was residents (currently or previously) and so on. While the tab will take you to another page that are related to another organization that hold a particular information of citizen, where all the information can be viewed or updated.

Citizen Information

| HOME | Personal Info. | Education | Health | Properties | Log out |

National ID Number   :   XXXXXXXXXXX

Full Name   :   Son Father Grandfather
Gender   :   M
Date of Birth   :   xx/xx/xxxx
Place of Birth   :   State/Country

E-mail address   :   xyz@mail.com
Telephone Number   :   xxx ooooooo

Passport Number   Home Address   Marital Address

Photos   Fingerprint   Eye Scan

Figure 3 The proposed interface window.

V.Conclusion

E-government become an import service for both government and citizens. The government will keep records for all citizens' activities, while the citizens can access their records for business process. With the availability of the ICT infrastructure, the government process become more reliable, ease to access with fast respond. Cloud computing been used to distribute the citizens records among different organizations/departments data centre. A hybrid cloud computing will suite the Iraqi government process. As the record can be accessed privately if the transaction been made between the government organizations/departments, while the citizens can used their personal devices to view their records through the public connection.

The proposed of maturity model for the Iraqi government will make the e-government more available to all the users in the system. The information can be viewed in signal window interface and can be retrieved from different organizations/departments data center. The advantage of this study is to reduce the human traffic on government's offices as well as reducing the citizen expensive, with greater flexibility and less hierarchical organization. While maintains the cloud system will be less than a traditional system.

The Iraqi citizen can get their official information from any government office location that are located near to their home address, while the government will have a fully backup information about their citizen's records. In this way, all the information that are related to the citizens can be viewed in a signal window interface and it can be processed from any organizations/departments and it can be accessed or upgrade from anywhere.

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