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Development of a Business Intelligence Portal Framework in a Cloud Computing Environment for Enhanced Distribution and Billing System of Electricity in Nigeria

Usman-Hamza F.E. and **Salau-Ibrahim T.T**
Department of Physical Sciences (Computer Science Unit)
College of Natural Sciences,
Al-Hikmah University
P. M. B 1601, Ilorin, Kwara-Nigeria.
talk2tima@yahoo.co.uk, taofeekatsalau@gmail.com,
Tel+2348035856551 +2348034825810

*Corresponding Author

ABSTRACT

The evolution of Cloud Computing architecture has produced cost effective, quick and efficient computing platform. The new phenomenon of business intelligence (BI) is transforming the way businesses handle data. BI environment require large capital layout to implement and support the large volumes of data as well as massive processing power, which inflicts tremendous pressure on corporate resources. In Nigeria, there is irregular electricity supply and the electricity consumers are faced with very high monthly bill which is usually inaccurate. Thus, it is essential to have an efficient and effective system for such purposes via electronic platform with consideration to proximity. This paper presents the framework of a Business Intelligence Portal in a Cloud Computing Environment that will help in making sure there is a good distribution of electricity across the country and a billing system that will be in proportion to the customers' consumption. The Business Intelligence Portal framework when embedded in Cloud Computing environment consist of web-based clients, integrated data, tools for data warehousing, tools for business intelligence, software and hardware. Therefore, the resulting framework can help enhance the productivity of electricity in Nigeria.

Keywords: Cloud Computing, Business Intelligence, Data warehouse, Framework, Electricity Distribution.

Aims Research Journal Reference Format:
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1. INTRODUCTION

Cloud Computing is an internet- based computing in which shared resources are provided to computers and other devices on demand. Cloud Computing customers do not own the physical infrastructure. The infrastructures are rented from third party provider and customers pay only for the resources they consume. Cloud Computing can be classified into private, public and hybrid cloud depending on the owner of the cloud data centres. Cloud Computing offers three levels of services: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) (Chawla, 2011).

Intelligence can be defined as an ability to deal with new situations; the ability to solve problems, to answer questions and to devise plans. Business Intelligence (BI) refers to the computer based techniques used in analysing data and providing various views of business operations. Business Intelligence is defined by Hannula and Pirttimäki (2003) as organised and systematic processes used to acquire, analyse and disseminate information vital for business activities. The information and knowledge

generated are used to operate and make strategic decisions. Some of its functions are data mining, text mining, business performance management, predictive analysis just to mention a few.

Implementing business intelligence in the cloud for the purpose of improving electricity supply in Nigeria will make available the hardware, networking and software needed to create data warehouses on demand while paying for the resources only used. The framework that will be developed will provide an environment to ensure daily electricity consumption is equally spread across the country, up-to-date consumers' details, appropriate bill charges, efficient payment channels and improved performance information (Chawla, 2011).
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2. STATEMENT OF THE PROBLEM

Electricity is the science, engineering, technology and physical phenomena associated with the presence and flow of electric charges. Electricity gives a wide variety of well-known electrical effects, such as lighting, static electricity, electromagnetic induction and the flow of
electrical current in an electrical wire. In addition, electricity permits the creation and reception of electromagnetic radiation such as radio waves. In electricity, charges produce electromagnetic fields which act on other charges (Adegboyega et al, 2013).

The **Power Holding Company of Nigeria** (PHCN), formerly the National Electric Power
Authority (NEPA) is an organization governing the use of electricity in Nigeria and has been faced with a lot of problems. These problems include irregular electricity supply and when there is, it is most cases of low voltage. Although, the PHCN introduced the use of prepaid meters for billing system which is intended to replace the old post payment meters. The replacement was supposed to improve the billing system by charging consumers only for actual electric power consumed. However, the problem with this prepaid meter is availability and as a result, only one – eight of the population is using the prepaid meter, so the problem of bad billing system still persists.
Enormous amount of data is being generated daily when consuming electricity nationwide, collecting and analysing these data is getting complex due to the increase in data and complexity of analysis. Business Intelligence is usually flexible enough to changing business needs and objectives, thus, in order to make its services readily available, business intelligence is implemented in the cloud.

3. LITERATURE REVIEW

3.1 Review of Cloud Computing

Cloud Computing involves large number of computers connected through a network in which shared servers provide resources, software, and information to computers and other devices on demand. It is a style of computing, which caters for the computing needs of dynamism, abstraction and resource sharing. There are various cloud services which includes Software as a Service (SaaS), Platform as a Service(PaaS) and Infrastructure as a Service(IaaS) and so many deployment models such as Public Cloud, Private Cloud, Community Cloud and Hybrid Cloud. This has helped solve the problems of managing data such as network management, hardware acquisition, energy efficiency and the inability to change with business demands. (Usman-Hamza, 2014).

Businesses stand to gain immensely from Cloud Computing because there is economies of scale as a result of low-costs of IT infrastructure, low maintenance costs and low IT administration costs. Cloud Computing provides good way to watch data; one can easily see whenever data is sent or received. It also offers quick & effective interaction and access with resources anytime and anywhere in the sense that anyone can have easy access to data in any country and at any time of the day as long as there is connection to the internet. When using Cloud Computing, performance is enhanced as a result of having access to dynamic and scalable computing, thus producing a very high rate of resource optimization.

In Cloud Computing, the provider takes care of security and deployment it is very easy to achieve. (Usman-Hamza, 2014).

3.2 Review of Business Intelligence

Over the years, business intelligence has gained tremendous popularity for making strategic decision in many organisations. During its early years, Luhn (1958) defined business as a combination of actions performed for specific reasons in any field such as law, government, industry et cetera. Intelligence on the other hand was referred to as apprehension of interrelationships of facts to guide actions for achievement of goals. From the two definitions, business intelligence system can be defined as dealing with acquisition of new information, its distribution, storage, retrieval and dissemination to concerned recipients timely and effectively using state of the art technologies.

A more recent definition by Loshin (2003) is the activities, technologies and tools required to transform data into information, information into knowledge and knowledge into strategies that promote profitable cost effective business action. In general, business intelligence embodies data warehousing, business analytics tools and knowledge management.

Business intelligence merges products, technology and procedure to organize important information that executives need to improve profit and performance. For business intelligence investment to have business value, strategic alignment, management process engineering and change management are the important pre- conditions. Business Intelligence when properly implemented help achieve increased profitability, decreased cost, improved customer relationship management, risk reduction, improved timely decision making just to mention a few (Nagesh, 2004).

3.3 Advantages of Implementing Business Intelligence in Cloud Computing for Enhanced Distribution and Billing System of Electricity in Nigeria

Implementing business intelligence in cloud computing enables users to have access to information from all over the world which brings business opportunities and enhances decision making on sales. The main advantage of Implementing business intelligence in the cloud is mainly to reduce cost. The PHCN company will not have to invest large amount of money on hardware, license and software in order to keep Business Intelligence running. Other benefits derived from implementing business intelligence in the cloud include easy maintenance of the PHCN resources, fast deployment of electricity, scalable provision of electricity, improved performance, effective and efficient electricity bills and so on (Chawla, 2011).

Having reviewed the potentials of both business intelligence and cloud computing, the use of business intelligence technologies in the cloud will lead to development of a robust and portable system for PHCN. Adopting the strategy proposed by Mircea, Ghilic-Micu and Stoica (2011) for the successful implementation of Business Intelligence in the cloud referred to as Cloud BI, this present study aims to develop a Business Intelligence portal framework in a Cloud Computing environment for enhanced distribution and billing system of electricity in Nigeria.

4. METHODOLOGY

4.1 Business Intelligence Architecture

Figure 1 below is the business intelligence architecture, it shows that data is retrieved from different databases such as Oracle, mySQL, Microsoft Access, etc. These type of resources are integrated in one format and stored in data warehouse for analysis, after analysis, report are generated in graphical representation.

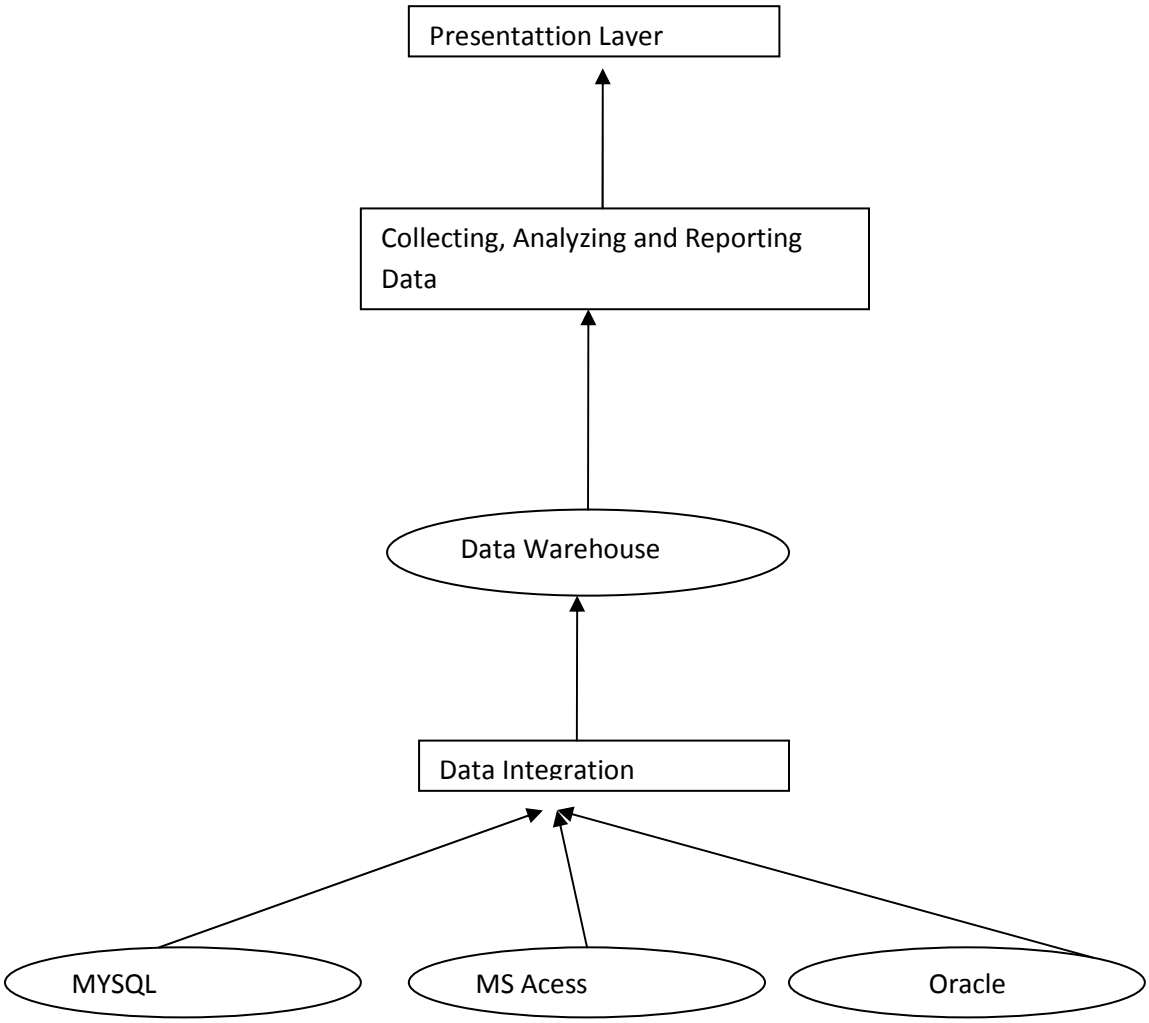

Figure 1: Business Intelligence Architecture

4.2 Business Intelligence Architecture in a Cloud Computing Environment

The basic architecture needed to run business intelligence in a cloud computing environment is shown in figure 2. The hardware and software form the lower levels which are the elements that have been offered by the cloud computing provider. The hardware refers to the network, storage and processing resources required while the software is the operating system needed to run the hardware. The database is the information needed to create an enhanced distribution and billing system of electricity in Nigeria, data integration is the data cleansing process. Data warehousing tools are the set of applications that creates and maintain a data warehouse. The tools for Business Intelligence enable a platform to be created for the new users to access and analyse data.

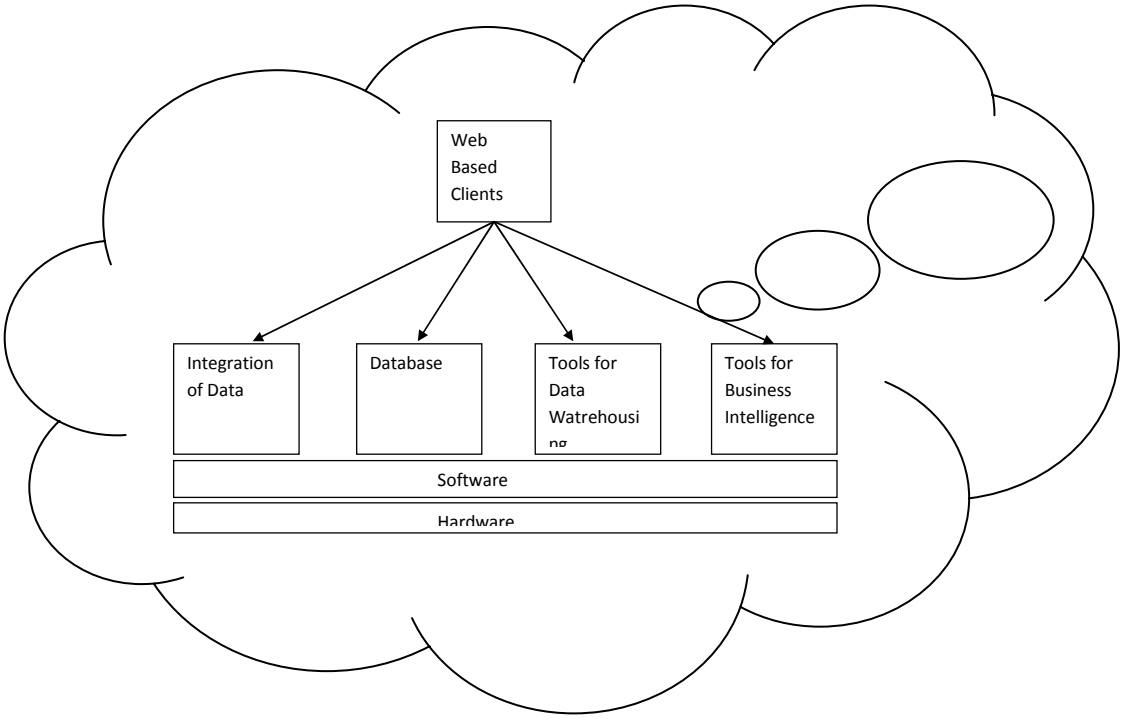

Figure 2: Business Intelligence Architecture in a Cloud Computing Environment

4.3 Data Flow Diagrams

Data Flow Diagrams are the graphical representation of the flow of data in an information system. The Data Flow Diagrams for designing a Cloud BI portal for distribution and billing of electricity in Nigeria are shown in Figure 3 and Figure 4.

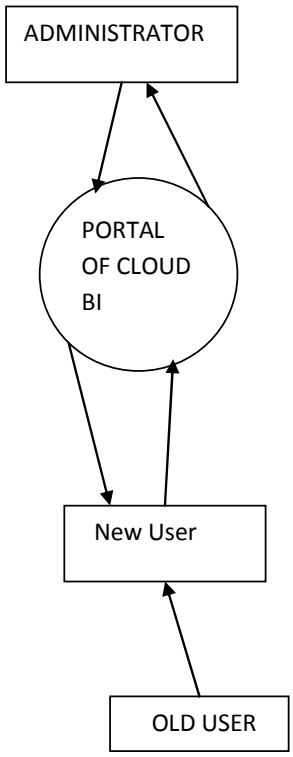

Figure 3: Data Flow Diagram for Cloud BI

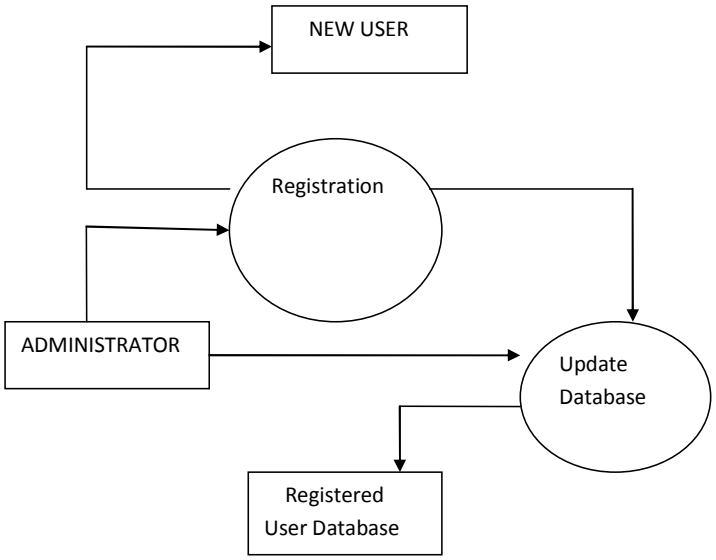

Figure 4. Data Flow Diagram for the New User

4.4 Use Case Diagrams

Use Case Diagrams present the graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases) and any dependencies between those use cases. It is used to gather requirements of the system including internal and external influences.

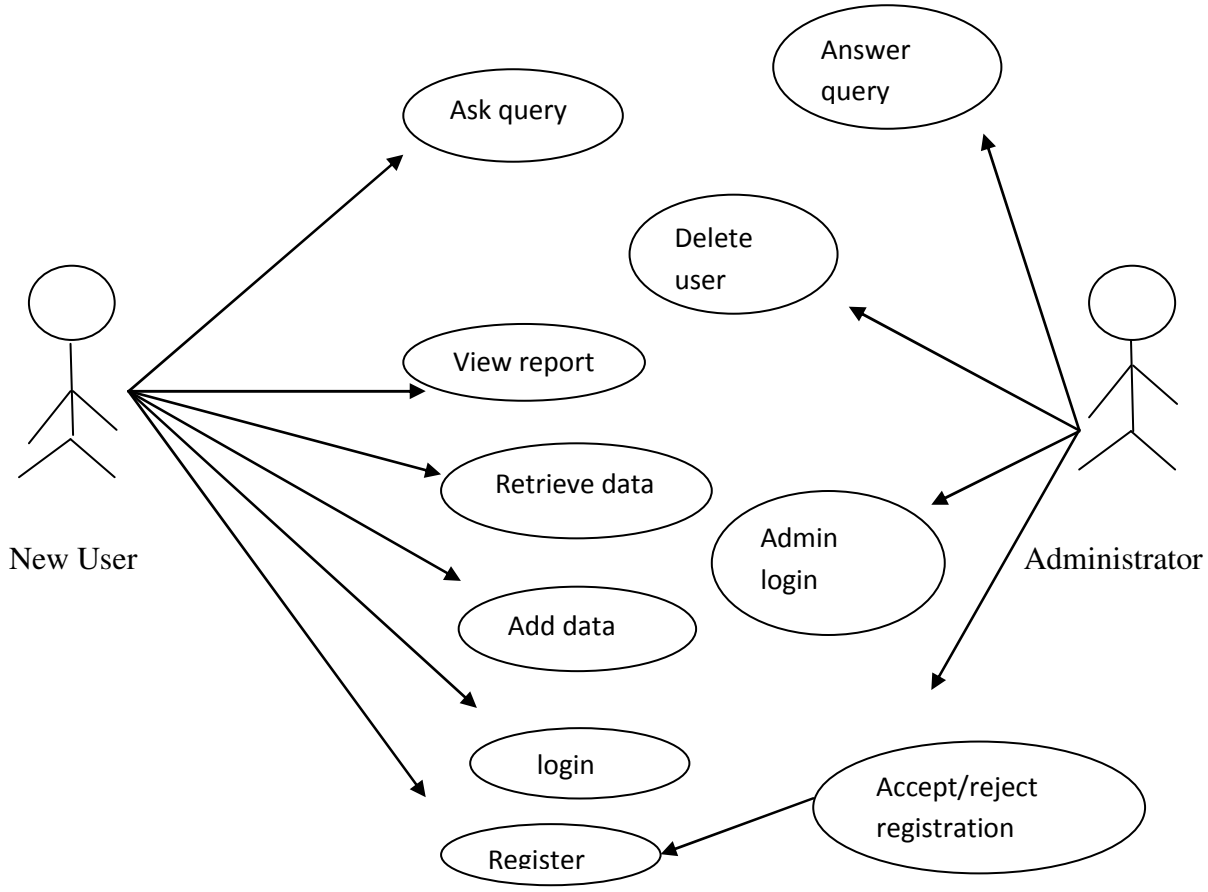

Figure 5: Use Case Diagram for Cloud BI Portal

5. DISCUSSIONS AND CONTRIBUTION TO KNOWLEDGE

The findings of the study showed that Business Intelligence and Cloud Computing have played an important role in the development of decision making systems and availability of shared resources on demand respectively. Therefore, the strength of both can be adequately embedded together to enable even distribution of resources and provide a better billing system.

6. CONCLUSION

The framework of business intelligence in the cloud for the use of electricity billing in Nigeria has been developed in order to enhance reliability, efficiency, flexibility of implementation and increased performance. This paper discussed the importance of cloud computing and business intelligence and the advantages of incorporating business intelligence into a cloud computing environment.

7. FUTURE WORK

Further extensions of the framework developed are possible. In particular, enhancement of performance and improved security of the framework. Also, the framework may be applied to other areas were strategic decision making is of utmost importance.

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