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A USER REGISTRATION FRAMEWORK OF A WEB-BASED DATABASE SYSTEM

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ABSTRACT: The Corporate Affairs Commission (CAC) is saddled with the responsibility of registration of companies, business names and incorporate trustees. The government, the private, public businesses and individuals contract jobs to companies and businesses, sometimes without the knowledge whether such business is registered with the CAC or not. With the advent of the Web Technology, information can be accessed and retrieved anywhere in the world. This paper proposes a framework for client-server distributed database for CAC. The framework is customized for CAC in Nigeria and deployed over the internet.

INTRODUCTION

One of the greatest things that have ever happened to man is the advent of the Internet. The Internet has brought a lot of gains and has changed the ways man live, talk, walk and do things. Okonigene et al, (2008) stated that one the greatest investment in many organizations is the creation, maintenance, and retrieval of information. Information stored in the internet is stored in a database that is accessible and easily retrievable by all. The database in the internet is distributed in nature. According to Kay-Romer *et al,* (2006), a distributed system is an information processing system that contains a number of independent computers that cooperate with one another to achieve a specific objective. Navatha (2000) sees Distributed Database (DDB) as a collection of multiple logically interrelated databases distributed over a computer network, and a Distributed Management System as a software system that manages a distributed database while making the distribution transparent to the users. It is therefore correct to say that the basic and fundamental unit of a distributed system is the computer system that is interconnected in a network environment; thereby making the computer independent in its mode of operation.

Prompt access to information cannot be undermined. In the award of contracts to companies, it is expedient that the awardees (that is the government, private or public individuals, etc) must have first hand information as to whether the company is registered or not, as this will determine the next line of action. The increasing need to have a distributed database and client server applications is uprising as it will help in discouraging frauds, financial wastages and theft among government officials and private business; and promote transparency and accountability. Mitchell (2004) posits that distributed database system provides an improvement in communications and data processing due to their data distribution throughout different network sites. Not only is data access faster, but a single-point of failure is less likely to occur, and it provides local control of data for users.

A centralized database system increases security risk, data discrepancies, there is delay in access/retrieval of data, increases data redundancy and there is loss of data if system crashes, which makes it inappropriate. However, a distributed database system provides an improvement on: communication and data processing (i.e. data is distributed throughout different network sites), location transparency, performance transparency, copy transparency,

transaction transparency, fragmentation transparency, schema change transparency, and local database management transparency. Embracing this technology is very important for any organization that wants to be effective, efficient and innovative.

The need to convert to distributed database system is due to the attendant advantages. Distributed database system offers many advantages compared to centralized database and manual systems of records keeping. A distributed database system has been proposed for various reasons ranging from organization decentralization and economical processing to greater autonomy. Some of the advantages of distributed database system are location transparency, performance transparency, copy transparency, transaction transparency, fragmentation transparency, and schema change transparency (Navatha, 2000).

This paper proposes a framework for a client-server distributed system for the Corporate Affairs Commission (CAC) responsible for the registration of companies, business names and incorporate trustees. The system consists of a relational database that is distributed in nature so that it can be accessed by different states in Nigeria. The database system is deployed over the internet for wide access.

In Djam (2010) the design and implementation of a client-server distributed database for student results processing was presented. She opined that the inadequacies of the manual/centralized systems in handling student's results necessitated the use of a client-server distributed database system. Olatubosun and Olakunle (2008) proposed a framework for client-server distributed database system for licensing and registration of automobiles in Nigeria. They opined that the system is intelligent and capable of checking to detect multiple registrations, registration of stolen automobiles, malicious registrations, registration of damaged or reformed automobiles, and fictitious registration. The system is also capable of generating reports for decision makers to enable monitoring and enforcement.

ANALYSIS OF THE SYSTEM

The CAC in Nigeria was established and charged with the responsibility of registration of companies, business names and incorporated trustees. In the registration process, each states in the country deals with the registration of business names independently of the other states. A proposed business name submitted for registration has to be taken to the head office in Abuja for final approval, after which the local database has to be searched for the avoidance of duplication or resemblance of names. Once this is done, the business name is sent to Abuja for final approval before the name can be used. These challenges can be addressed if the commission introduce the concept of distributed database management systems with the application of web technologies.

MATERIALS AND METHOD

Preliminary investigations about the existing systems (centralized system and manual record system) were carried out. A detailed study of 'notes for customer guidance' used by the Corporate Affairs Commission was also carried out. The inadequacies of the existing system were identified and a prototype of a distributed database system was proposed, designed and implemented using PHP scripts, Apache web server, MySql database system and a web browser as a client.

The Web Database Systems:

The development and deployment of the web based system is driven by the three-tier application using database on the internet (Figure 1).

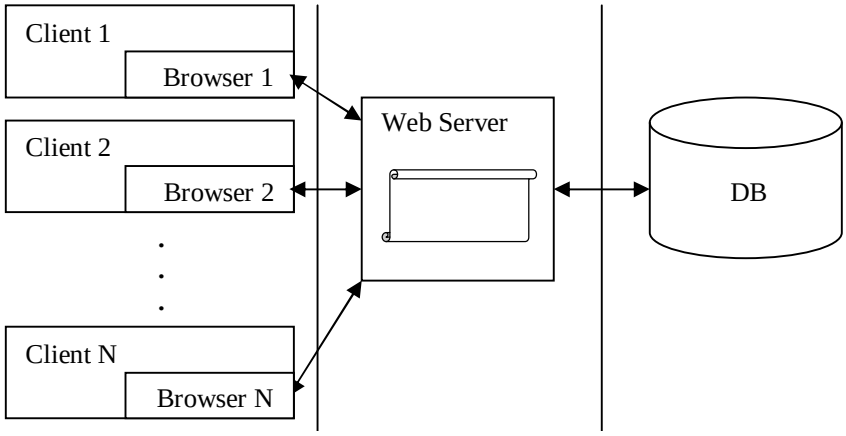

Figure 1: A Typical Three-Tier Web Architecture

The three-tier architecture is described as follows:

1. **Front-tier:** A front-end web server serves static content, and potentially some cached dynamic content. In web based application, Front End is the content rendered by the browser. The content may be static or generated dynamically.
2. **Middle-tier:** A middle dynamic content processing and generation level application server, for example Ruby on Rails, Java EE, ASP.NET, PHP, ColdFusion platform.
3. **Back-tier:** A back-end database comprises both data sets and the database management system or RDBMS software that manages and provides access to the data.

In the proposed distributed database architecture, the three-tier concept was adopted.

Framework for the Distributed Database Architecture:

The distributed database system consist of multiple database management systems running on multiple servers (sites or nodes) connected by a network. The distributed database system allows applications to access data both from local and remote databases. The distributed databases is made up of homogeneous and heterogeneous nodes. Each of the databases is the same in the homogeneous while in the adopted heterogeneous distributed database system at least one of the databases is not the same with other databases. The databases use client/server architecture to process information requests. According to Oracle, a distributed database application processing system is more commonly referred to as a client/server database application system (Oracle, 2012). In this system, each state, sites or node may have some level of autonomy – that is, it can accept transactions locally while still participating as a node in the distributed database system. Figure 2 shows each State with its own local applications and databases in the distributed database architecture.

Figure 2 offers more flexibility, higher performance and greater levels of independence to the commission. The system is designed such that each states can independently carry out full registration of business names, remotely verify the authenticity of names through the central database resident in Abuja without making calls or sending the names for verification process which is time consuming and other activities without delay. This can be achieved through communication networks (wired or wireless) powered by web technology. The system is also designed with some security features.

The Distributed Database System includes the following components:

- Computer workstation that form the network system.
- Network hardware and software components that reside in each workstation.
- Communication media that carry the data from one workstation to another.

- The Transaction Processor (TP), which is the software component found in each computer that requests data
- The Data Processor (DP), which is the software component residing on each computer that stores and retrieves data located at the site.

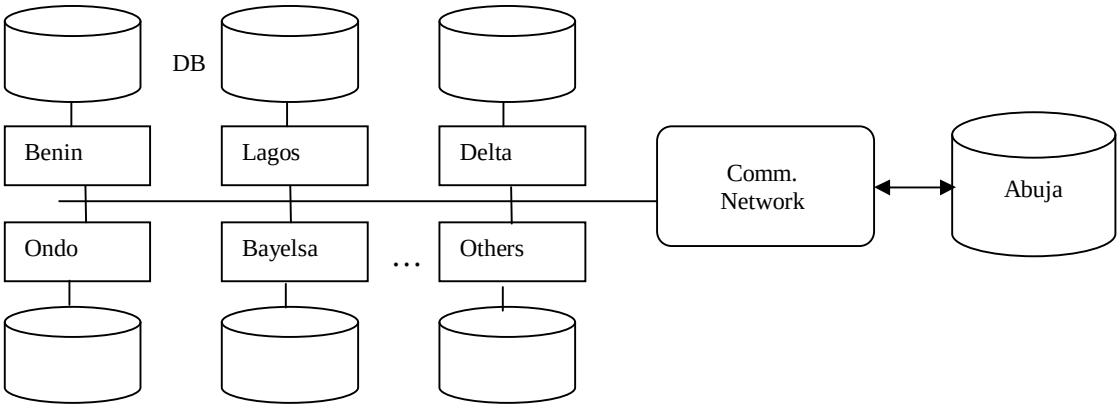

Figure 2: Distributed Database Architecture

According to (Djam, 2010) these are the minimum requirements of a distributed database system.

The Web-based Relational Database Structure:

The structured web-based distributed information system consists of a relational database of different tables or records that can be accessed by all connected systems in the network (Codd, 1970). Each State has its own database and can inter-relate and access other databases through a secured network. Data is organized and stored in two dimensional tables. Each table is assigned a unique name and a row in a table represents a relationship among a set of values. A table consists of a heading defining the table name, column names and a body containing rows of data. The following are the structure of some of the relations and CREATE TABLES statements in the database:

$R_0 = \{A_1, A_2, A_3, \ldots, A_{n-1}, A_n\}$ (1)

where R represents a relation and A_1, A_2 represents the attributes contained in the relation R.

From the definition, the design of the proposed database relations for the NHIS is given as:

BusName [BnID, BusName, BusType, BusDOF_Regtr, BusD_Lic_Issn, BusTelNum, BusLoc, Remark]

Reg_Officer [BnID, Officer_Name, Busname, DoRegtr, Regtr_Loc, Remark]

Station [Regtr_State_ID, No_of_RegdName, Officer_Name]

Table 1: BusName

BnID	BusName	BusType	BusDOF_Regtr	BusD_Lic_Issn	BusTelNum	BusLoc	Remark

Table 2: BusName Database Structure

Field Name	Field Type	Field Size
BnID	CHAR	10
BusName	CHAR	100
BusType	CHAR	50
BusDOF_Regtr	DATE	8
BusD_Lic_Issn	DATE	8
BusTelNum	NUMBER	11
BusLoc	CHAR	100
Remark	CHAR	150

Table 3: Reg_Officer

BnID	Officer_Name	BusName	DoRegtr	Remark

Table 4: Reg_Officer Database Structure

Field Name	Field Type	Field Size
BnID	CHAR	10
Officer_Name	CHAR	20
BusName	CHAR	100
DoRegtr	DATE	8
Remark	CHAR	150

Table 4: Station

BnID	Officer_Name	BusName	DoRegtr	Regtr_Loc	Remark

Table 1 – 4 shows the underlining primary keys, the foreign keys assist in ensuring data integrity. The SQL CREATE TABLE statement for the BusName database structure as:

CREATE TABLE BusName

```
(
BnID                CHAR(10)      NOT NULL
BusName             CHAR(100)     NOT NULL
BusType             CHAR(50)      NOT NULL
BusDOF_Regtr DATE()          NOT NULL
BusD_Lic_Issn DATE()         NOT NULL
BusTelNum           NUMBER(11)  NOT NULL
BusLoc          CHAR(100)     NOT NULL
Remark          CHAR(150)     NULL
Primary key (BnID)      )
```

where CREATE TABLE is a statement in SQL used to create the initial tables in the database. The statement with other Data Definition Language (DDL) and Data Manipulation Language (DML) commands were used to create, restructure and manipulate the database.

APPLICATION DEPLOYMENT AND USAGE STRATEGY

The Web-Based system can be deployed and hosted by common web hosting service providers like the Google, Yahoo, Alter Vista, hostmonster, etc. The service provider should be capable of hosting web pages designed with PHP/MySQL features and accommodate large database spaces because of the large amount of anticipated volume of data to be used and analyzed by the system. Once the system is uploaded into the Internet, it becomes readily accessible by all through the registered domain name. The system is relatively easy to use by anyone due to the user friendliness of the web pages.

DATA SECURITY AND AUTHENTICATION ISSUES

Web system security is a very crucial issue in deploying sensitive records/data into the internet. With the use of a reliable and modern dedicated server deployed, unauthorized access and data theft can be minimized or completely eradicated. Data authentication and security can further be strengthened by the use of professionals in handling the centralised database system. The application communication link between the application server and database must be able to guarantee message confidentiality and message Integrity. A well defined web service structure of the application will prevent data replication and validate data from only authorised data sources. To further develop a secure data access strategy, the use of Windows authentication to the database, secured connection strings, storing credentials securely in a database, protecting against SQL injection attacks and using database roles should be applied (Figure 3).

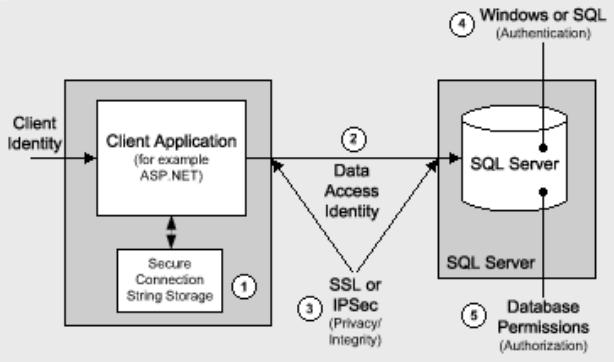

Figure 3: Data Access Security Key

CONCLUSION

The task of writing and maintaining a high-performance, fully functional relational DBMS from scratch is an enormous investment in time and energy. Many of the benefits in using relational DBMSs, however, translate over to new directions. These new directions raise a number of research problems in database management as well, and point the way to new interactions between the database community and other areas of computing. This paper presents a technology framework for improving the activities of the CAC in gathering users information through the use of a web-based database system. If the system is fully deployed in the internet, it will present an enormous benefit for the commission and the government for monitoring the activities of the commission vis-à-vis making informed and knowledgeable decisions in improving the well being of businesses in Nigeria. The importance of having a distributed database system cannot be overemphasised due to the attendant benefits from the usage of present web technology.

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