ISSN 1512-1232

A CONCEPTUAL DESIGN OF A LOW COST IDENTIFICATION MANAGEMENT SYSTEM FOR NIGERIA

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Abstract

The National Identification program in Nigeria has faced numerous challenges over the years. Every attempt by government to make the program acceptable and functional has not been successful. The computer and data network, on which the program depends, needs to be well designed, developed, responsive and transparent to users. A low cost corporate system which could be easily implemented without too much investment on required infrastructure is adopted to marshal the benefit of information technology to design a viable identification management system for Nigeria. The system incorporates the concept of distributed computing with various interactive input devices at each points linked to centralized secured database via reliable broadband communication technology. This paper presents this low cost identification management system for the acquisition of citizens' data, verification of the data collected and distribution of the national identity card in Nigeria. The business and logistic implications of the system will be presented in future research publications. The system is sustainable and applicable for the Nigerian environment because it is built on existing infrastructures and would only need some customisation for it to work.

Keywords: *data, identification management, information technology, Nigeria*

1. INTRODUCTION

Nigeria, the most populous nation in African, gained independence in October 1st 1960 from the British and since that day, Nigeria remained a federation of distinct regions. According to National Bureau of Statistics (2008), Nigeria is situated between 3^0 and 14^0 East Longitude and 4^0 and 14^0 North Latitude; the area of Nigeria is 923,769 square kilometres and is made up of 909,890 square kilometres of land area and 13,879 square kilometres of water area. Located in western Africa, Nigeria borders countries namely Benin with a distance of about 773 km, Cameroon with a distance of 1,690 km, Chad with a distance of 87 km, and Niger with a distance of 1,497 km. With a population of over 150 million people, about 250 ethnic groups spread across the six geo-political zones; Nigeria has many languages such as Yoruba, Hausa and Igbo with English being the official language.

Having a reliable national identification system and citizens register is a good compliment for national planning, election, census board, law enforcement, banking, tax collection, pension board, education and in fact the judiciary (Akinlabi, 2006). Without functional identification systems, citizens of many developing countries miss out on the benefits of official identification. In many poor countries, not only is there no consistent identity system but at least half of the people don't have records of birth at all (MacDonald, 2011).

1.1. History of Identification System in Nigeria Page Layout

The idea of a national identification card system in Nigeria was originally conceived in 1977 but was eventually executed in 2003 after several controversies and bottlenecks (Obi, 2006). In 1978 under the Department of National Civic Registration (DNCR), which was charged with registering and issuing a National Identity Card to every citizen of Nigeria who was then 18 years or older, an attempt was initiated to

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document the identity of Nigerians and non-citizens using biographic data. The aim of this scheme then as stated in the National Identity Management System Handbook on Business Processes, Standards and Specifications (2011) was to use the program as an effective tool for controlling illegal immigration, to validate other civic documents like travel passports, and to set up a reliable personal identification system for securing commercial transactions with financial institutions and the like.

In 2007, National Identity Management Commission (NIMC), established by the NIMC Act No. 23 of 2007, was given the mandate to establish, own, operate, maintain and manage the National Identity Database in Nigeria. A key requirement of the National Identity Management System (NIMS) is the capture of biometrics and necessary demographic data in a standardized manner that would facilitate identity authentication and verification using the unique National Identification Number (NIN) (NIMC, 2011). National Identity Management Commission, in discharging of its duties, on July 2009 constituted a body to be known as the National Identity Management and Harmonization Committee (NIMHC) to become the custodian for setting standards for National Identity Management System. By the extension of the National Identity Management Commission Act, Section 5, part (j), NIMHC established rules and standards that shall be binding on all subjects, agencies, organizations, and entities that are collecting, disseminating, or consuming identity data in Nigeria (NIMC, 2011).

1.2. Present State of Identification System in Nigeria

Presently, Nigeria has a national identity programme that is incomplete because not every Nigerian participated in the last National identity (ID) Card project which means that not everybody is uniquely identified. That is why the critical private sectors are doing their own identification (Obi, 2006). The NIMS Handbook stated that there is currently no centralized national identity database and no system of National Identity Management which efficiently links public and private sector identity schemes. While the financial services sector has been most proactive in the deployment of identification schemes for delivery of its services, several different identification schemes and databases by the various institutions offering services to that person has led to the duplication of an individual's identity. Government agencies also hold a number of databases with no viable integration of access or interoperability to enhance the delivery of services within these government institutions. A reliable national identification system for verification and secure authentication of an individual's identity is still being fashioned out with the plan introduction of the NIN project, which is a means of having a dependable data base of its citizens (Omoniyi, 2012). Therefore, there is need for contributions to have viable national network architecture (deployment map) for an identification management system in Nigeria.

For the national identification management system, a low cost deployment map that allows building on existing technology to create highly efficient, integrated systems that collect, manage, organize, and disseminate information throughout different sectors in both public and private organization is proposed by this paper for the nation.

2. LITERATURE REVIEW

There have been different intended approaches to achieve the national identification project among which is the talked about synergy among Nigerian Communications Commission (NCC), NIMC and the Federal Road Safety Commission (FRSC) to deliver a national database, which will effectively capture the details of Nigerians (Aginam, 2008). The outcome of this has not been seen, though NCC is to transfer the data compiled during the SIM card registration to NIMC. Other approaches are highlighted in Table 1.

Table1: Highlights of the Nigerian Experience

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S/N	Projects/Sector	Biometrics included	Type/Number of Card issued	Year implemented
1.	INEC Electronic Voters Register	Finger prints (2x)	Paper/58.6m Plastic cards	2003
2.	NHIS Patient Cards	Finger prints (2x)	2D Bar code/>500,000	2005
3.	National ID Cards	Finger prints (6x)	2D Bar Code/>15m	2001/still ongoing
4.	FRSC	Finger prints (1x)	Mag stripe 2D Bar Code (by 2006)	1990
5.	University Students ID	No biometrics	Smart/200,000	2001
6.	ValueCard	No biometrics	Smart/1,300,000	1998
7.	PenCom National Databank	Finger prints	Smart	In-progress
8.	ECOWAS Harmonized E-Passport	Finger prints (4x)	Smart	In-progress
9.	State Governments	Some- Finger prints Others- No biometrics	2D Barcode/140,000 Others- Smart>150,000	2003/2004

(Source: Onyemenam, C. E., Identity Management Systems in Africa: Nigeria's Experience, www.nimc.gov.ng)

2.1. Processes to have Identification Card

The idea of national ID card is now matured as NIMC has initiated processes for the issuance of the unique NIN and General Multipurpose Smart Cards (GMPC) to all Nigerians and Legal Residents (NIMC, 2011). This will now serve the purpose of national ID card. There have been many challenges delaying the take off of the project which has led to series of postponement. The process, which was planned to begin by August 1, 2011 but was later shifted to May, 2012 then to September 2012 is yet to take off (Oketola, 2012). The NIMC had engaged two consortia, Chams and Onesecurecard, in July 2010 to serve as the Front End Partners to the project to carry out data capture, personalization of smart ID cards and deployment of smartcard verification devices for the National Identity Management campaign and also responsible for the financial and other risks in relation to the design, financing, construction, completion, commissioning, maintenance, operation, management and development of the works and registration centres for the purpose of the national ID project (Oketola, 2012). However, after signing the agreement, the consortia had been unable to raise the necessary funds to execute their mandates (Oketola, 2012).

2.2. National Identification Number

The unique NIN is principally meant to give the country a dependable data base of its millions of citizens, a process that has never been entirely completed in any programme in the past. The NIN is a non intelligent set of numbers assigned to an individual upon successful enrolment. Enrolment consists of the recording of an individual's demographic data and the capture of the 10 fingerprints, head to shoulder facial picture and digital signature which are all used to crosscheck existing data in the national identity data base, to confirm that there is no previous entry of the same data. Once this process is completed the data is then stored with the unique number known as NIN (Omoniyi, 2012). When the numbers are issued, they will be uploaded on chip-embedded multifunctional smartcards alongside citizens' personal information (Oketola, 2012). This number when issued to a person cannot be used again, even if the person to whom it is issued dies. It is the number that ties all the relevant records of a person in the data base and is used to verify diverse identities. Access to the database is secure and graduated and that every resident from 16 and above would soon be mandated by law to register their NIN or they would be deprived of access to basic day to day commercial transactions (Omoniyi, 2012).

It is a unique identification number that every citizen and legal permanent resident must have. It helps the government to plan. It is to differentiate two or more people with the same names. This makes identification easier. A lot of other information like home address, phone number, date of birth, parent's information, DNA information, criminal record, driving record, marriage information and even employment

ISSN 1512-1232
record of people are stored with the number. Hence, a complete life history of a person can be pulled from the computer (by authorized government officials) with his social security number (Omoniyi, 2012).

2.3. Present Attempt to Have Identification System

Presently, Nigeria Interbank Settlement System (NIBSS) is working in collaboration with NIMC to integrate the Nigeria Central Switch, NCS, operated by NIBSS with the NIMS. This integration will enable banks to conduct identity verification on NIMS through NIBSS to issue NIN as well as a General Purpose Identity Card (Komolafe, 2012).

The front-end partners (FEP), of the NIMC had agreed with NIMC, CBN, and NIBSS that starting from 1st of September 2012, they would commence an enrolment exercise for all banks' customers nationwide with a view to capturing their biometrics, issuing them the National Identity Numbers (NIN) and the General Multi-purpose Identity Cards (GMPC), as well as providing verification infrastructure for linking their bank accounts to the issued NIN within the NIMC data base. This enrolment exercise was planned to be completed by the 31st December 2012 (Komolafe, 2012). This is yet to take off.

2.4. Identification Management in Other Countries

Many countries around the world have either implemented, or are in the process of embarking on national ID projects. The key motives behind such initiatives is to improve the identification and authentication mechanisms in order to reduce crime, combat terrorism, eliminate identity theft, control immigration, stop benefit fraud, and provide better service to both citizens and legal immigrants (Al-Khouri, 2006). Many countries around the world have national identification cards, although the type of card and the purposes for which it is used varies (Wang, 2003). The majority of cards in developed nations contain name, sex, and date of birth and some with photographs and fingerprints (Wang, 2003). Some nations have much more data on their cards. Wang (2003) cited examples and the purpose of identification card management in some countries. In Korea, the card has name, birth date, permanent address, current address, military record, issuing agency, issued date, photograph, national identification number, and prints of both thumbs. The Italian card contains identity number, name, photo, signature, fingerprint, date and place of birth, citizenship, residency, address, marital status, profession, and physical characteristics. In Spain, when someone works under contract the identification must be used to demonstrate work eligibility, and it also is used for the health care system. In Kenya, the national identity card is required to get a job, get married, purchase or sell land, or register to vote. In Belgium, everyone over the age of fifteen is required to carry the identification card at all times. The card is used for banking, billing, rental agreements, proof of age when buying alcohol and cigarettes, or entering an adult-only business. A police officer can ask to see the card of anyone in a public space and does not need to have any particular justification *(*Wang, 2003*).* As a result of the rapid growth of the economy as well as the population over the past few years in the United Arab Emirates (UAE), the project which was kicked off in June 2003, aimed to develop a modern identity management system with two strategic objectives addressing security and economical requirements (Al-Khouri, 2006).

3. METHODOLOGY

This work was carried out using qualitative analysis on available information and personal experience with the various national identification card registration program of the country. The network design being proposed is based on existing infrastructures that are functional in the country as at the time of this study. The National Identity Management Commission (NIMC) is made to be the central coordinating agency as it has the mandate and established Acts as stated earlier to handle matters relating to national identity management issues. The study also uses human psychological and sociological concepts in the design of the architecture. The architecture has a three layer structure as shown in Figure 1.

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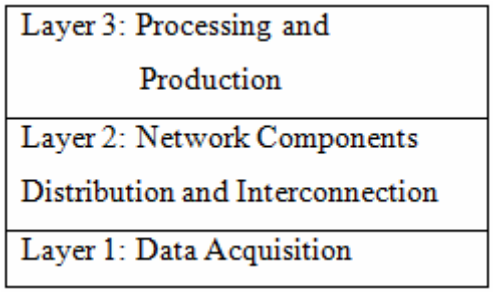

Figure 1: Layer Structure of the Architecture

Layer 1 is the access point where bio-data and other necessary documents are acquired; layer 2 is the distributing layer for the network facilities for acquiring peoples' data from each of the affiliated branches (in layer 1) of institutions partaking in the processing of ID card. Also, layer 2 interacts with layer 3 in a coordinated and controlled manner to exchange information and authenticate connections. Layer 3 is where the processing of data and production of NIN and GMPC takes place; it also, has facilities to authenticate every connection to it.

The following assumptions were taken in this work: (1) Nigeria is interested in having a national identification management system, (2) a communication system will be used for data transfer, access, verification and authorization (3) data acquisition can be carried out using a variety of information technologies and (4) there is a data verification mechanism available.

The design depends on different computer networks and communications technologies available at different input centres with the integration at NIMC. At every data collection point, network devices to capture citizens' biometric data, photographs, their ten finger prints as well as scanners to scan any supportive documents submitted should be available. Most agencies and financial institutions suggested as participants in the process might have the computer network and communication technology infrastructures needed. However, for others without such facilities, and for interoperability between different agencies or institutions, a distributed computing system that ensures that government can collect the knowledge that resides within the country to respond with creativity and speed to changes in the citizens' data for up to date information stored for every individual. Distributed computing is needed because the process requires the use of a communication network that connects several computers and also the data produced in one location will be needed in another location. The system is designed to have multiple contact points and offline capability in case there is any problem with the system connection.

The relationship/communication between various sectors for the national identification management is shown in Figure 2.

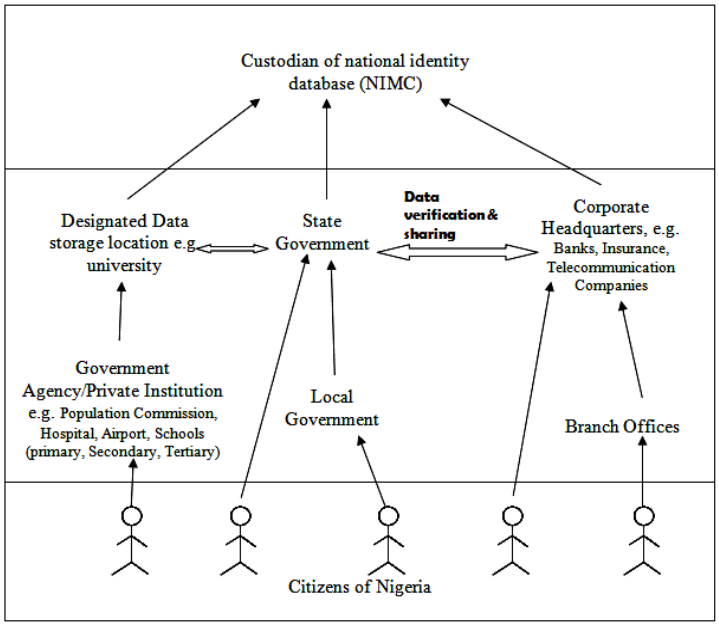

Figure 2: relationship/communication between various sectors

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The figure shows that citizens of Nigeria at layer 1 of the architecture could submit their biometric data to anyone of government agencies or private institutions. The local government being the closest level of government to the people and also rendering services like birth registration and the likes is also recommended for citizens' data collection points. Bio-metric data could also be collected at state government level and also at corporate headquarters of financial institutions and their branches. In these contact points, the system would allow citizens' data to be sent through web pages, e-mail anytime from anywhere to head offices of agencies or institutions.

Layer 2 of the architecture makes use of the existing functional infrastructures of institutions partaking in the program for data sharing, transfer, access, verification and authorization.

At the top level of the architecture is the processing and production of the National ID card. National Identity Management Commission provides the NIN that is unique to each Nigerian that has registered with the Commission. Only NIMC can assign the NIN which cannot be re-assigned to a subject once it is assigned to a subject and it can never be changed or altered in any form. NIN does not expire and is valid for the entire life span of the subject biometrics that it was assigned to. NIN shall be the basis of which the Federal, State, and Local government shall interact with a citizen of Nigeria. Each Ministry, agency, regulatory body, and entities must tie an individual to a NIN before services can be rendered to the individual.

Direct access to the NIMC Gateway by any third party shall only be after obtaining proper credentials from NIMC. The NIMC Core Database, also referred to as the NIM Super Structure is the only authoritative database recognized by the Federal Government to provide Personal Identification Verification (PIV) services in Nigeria (NIMC, 2011). All access to the system as shown in figure 3, shall be through the Gateway and all access to data in NIMC Core must be predetermined and approved otherwise shall be prohibited.

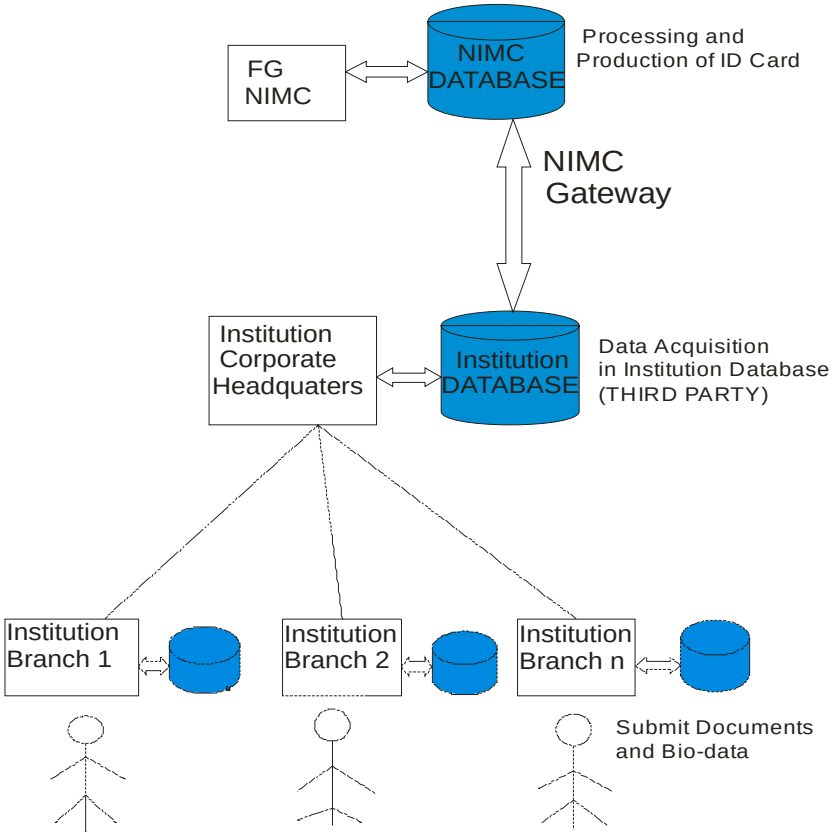

Figure 3: Hierarchical Structure of Database Server

3.1. Proposed Implementation Plan

For implementing a National ID card system it is necessary to a have a database containing the personal information of all those bearing the ID cards. When such a lot of private information is kept in one database it leads to a lot of questions from privacy advocates about the security of the database, the departments that have access to it and the cost of implementing such a system (George, 2005). The

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infrastructure used to make identification system simple and secure should have centralized and integrated population database with government trusted identity verification services to prevent identity theft and protect the privacy of citizens. A digital nervous system (DNS) that has a spontaneous response to changes in environment is considered in this design for quick response to changes in citizens' information. The system has the following characteristics:

1. Multiple access points with interactive devices that allow users to actively participate in a technological process instead of just reacting to it.
2. Communication networks with offline capabilities to ensure that system continues to function in case of connection problems.
3. Broadband communication technology for high speed connection.
4. Internet services.

DNS is similar to a biological nervous system in that they both have multi-sensory inputs, intelligent filtering, ability to correlate information in real time and response to various inputs (Jespersen, 2010). It involves a simple idea of getting the right information to the right people at the right time though it depends on the power of latest information technologies to make data flow faster and more cost-effectively than ever before. Data needs to be accessible no matter where a person is, and DNS will enable such like the movement, collection, storage and retrieval of all that information, no matter where one is located whether in a rural or urban areas. The whole concept is to let the people participate in the process of national identification management, no matter the technology available to them.

4. RESULTS AND DISCUSSION

Figure 4 shows the network architecture based on the framework given in Figure 1. The architecture makes use of existing resources and infrastructures such as telecommunication links of financial institutions, electricity supply and buildings for servers and other equipments.

At layer 1, the grass root access points, use interactive devices such as smart phones, biometric reader, scanner, digital cameras, etc. to acquire bio-data and other necessary documents. These points could be branch offices of Banks, Insurance companies, Telecommunication, Airports, academic institutions, hospitals, local government etc. Layer 1 connects to layer 2 through different available transmission channels. As moderate to high network traffic is expected here, communication media for connection to upper layer suggested are microwave radio if a line of sight communication could be established, Very Small Aperture Terminal (VSAT), digital subscriber lines (DSL), Optical Fibre Cable. Each of the branches connects to their corporate headquarters via these broadband technologies at layer 2. These headquarters may use microwave radio in a limited distance of line of sight, communication satellite, or fiber-optic cable. Fibre-optic is recommended in this design because of higher data rates, non susceptibility to electromagnetic interference, lower error rates, and more secured against wiretapping compare to other means of transmission. Firewall mechanism is needed to facilitate authentication during data sharing. At the last layer, edge delivery architecture is used to distribute information and services to end users. In edge delivery, the content of NIMC database is available from multiple servers located at the edge of the NIMC network. In other words, an organization would be able to find all requested content on a server within its home network.

Co-location is one of the principles on which this network architecture is built. Servers storing national identification data and records can be located in other institutions using a memorandum of understanding (MOU) to ensure security, accessibility by authorized personnel and availability of electricity.

The involvement of financial providers in the network architecture is to provide credible data acquisition points that citizens are most likely to use on a daily, weekly or monthly basis. The previous program implementation made use of ad-hoc staff spread across the country using temporary shelters for the data acquisition. The merit of that idea was to reach as many people as possible. With a stable and semi-permanent location for the national identification registration more people will be covered and the need for ad-hoc staff will be reduced. Other locations such as hospitals, university, airport and government ICT units could be used as contact points for potential national identification providers.

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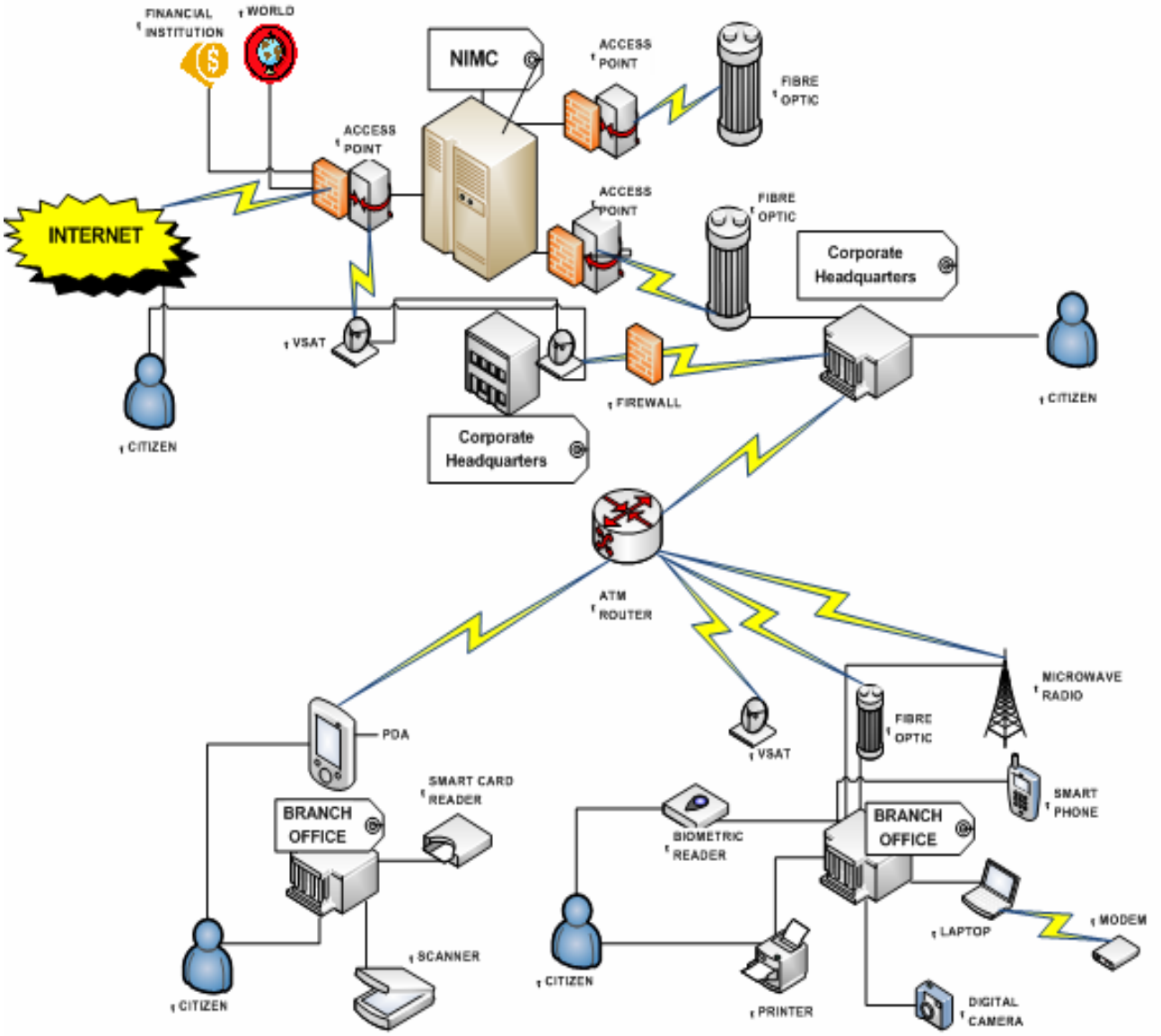

Figure 4: Network architecture for national identification programme

The network architecture provides data sharing and redundancy at each level of data storage. This means that two or more centralized database servers in a state are configured to respond to Identification requests. The implementation may allow the database servers to contain the same information or allow each server to be updated by a server higher up in the hierarchy.

Citizens are more likely to feel better about releasing personal information to data acquisition points such as the bank because the financial institutions already have this information. Financial institutions can use the data acquisition process to market their products to citizens of the country. The buy-in for financial institutions and other participating units would be the acceptance of the produced national identification card. If the process or management of the data and records is not secured enough for financial institutions to rely on it for identification then the success of the national program is at stake.

The repository of all citizens in the country should be stored in a data warehouse owned and managed by the government or its representative i.e. NIMC. The warehouse is the apex of the hierarchy where all verified and acquired data are kept.

The multiplicity of data communication media available should be incorporated into the architecture to ensure that it is always available. In Nigeria, there are fibre optic cable in some paths of the country, most financial institutions own VSATs for satellite communication, and telecommunication operators provide frequencies for data transfer. All these media are incorporated into the network architecture to ensure accessibility and availability of the identification databases.

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The point of acquisition is also the point of collection. Data verification would be carried out before authorization is given for the production of the card.

5. CONCLUSION

The national identification program in Nigeria will have astounding success if the deployment map proposed in this paper is adopted. The architecture takes care of data acquisition, data updating and distribution of identification cards to citizens of the country. The network architecture is the basic infrastructure needed for the success of the national identification program. The deployment map developed is sustainable and applicable to the Nigerian environment.

6. REFERENCES

1. Akinlabi, A. 2006. *Nigeria National Identification Card -Its Costs and Benefits.* Accessed on May 10, 2011 at www.gamji.com/article6000/NEWS6202.htm
2. Aginam, E. 2008. *Mobile Fraud - NCC to Collaborate with National ID Commission on SIM Card Registration.* Vanguard Newspaper. Accessed on May 10, 2011 at *allafrica.com/stories/200808181274.html*
3. George C. Paul, 2005. *Concerns about National ID Cards.* Accessed on May 10, 2011 at http://www.frost.com/prod/servlet/market-insight-top.pag?docid=38947972
4. Hans Jespersen, 2010. *Evolving the Digital Nervous System.* http://solacesystems.com/blog/company/news-release/evolving-the-digital-nervous-system/
5. Komolafe Babajide 2011. *Customers to provide National Identity Number at banks – CBN.* June 1, Vanguard Newspaper.
6. MacDonald, L. 2011. Leapfrogging Technology, the Case for Biometrics: Alan Gelb Accessed on May 10, 2011 at *http://blogs.cgdev.org/global_prosperity_wonkcast/2011/01/11/leapfrogging-technology-the-case-for-biometrics-alan-gelb/.*
7. National Bureau of Statistics, Facts and Figures about Nigeria, 2008. Accessed on May 10, 2011 at *http://www.nigerianstat.gov.ng/ext/latest_release/Fact08.zip*
8. National Identity Management Commission, 2011. National Identity Management System Handbook on Business Processes, Standards and Specifications 6th January, 2011. Accessed on May 10, 2011 at *www.nimc.gov.ng/hic/Handbook_on_Business_Processes.pdf*
9. National Identity Management Commission, 2011. Public Notice on the Proposed Adoption of Biometrics and Demographics Data Standards and Verification Procedure for the National Identity Management System (NIMS). Accessed on May 10, 2011 at *http://www.nimc.gov.ng/downloads/adverts/Public_Notice_on_Proposed_Biometrics.pdf*
10. Obi, E. U. 2006. National Identification Policy for Nigeria: An Action Agenda. Accessed on May 10, 2011 at *www.dawodu.com/obi6.htm*
11. Oketola, Dayo 2012. Nigerians to get national identity numbers in May: March 26, Punch Newspaper.
12. Omoniyi Tosin, 2012. National Identity Number: A rainbow of views. Monday, 02 April. Daily Trust online
13. Onyemenam, C. E. Identity Management Systems in Africa: Nigeria's Experience Available online at *www.nimc.gov.ng*.
14. Wang, T.V. 2003. The Debate Over a National Identification Card. The Century Foundation Homeland Security Project, Issue in Brief. Accessed on May 10, 2011 at *http://tcf.org/publications/pdfs/pb284/National_ID_Card.pdf*

Article received: 2013-06-27