

# E-Service and the Nigerian Banking Sector: A Review of ATM Architecture and Operations

Bashir A. Yauri, Aliyu R. Yauri

**Abstract**—With the introduction of cash-less society policy by the Central Bank of Nigeria, the concept of e-banking services have over the years' experience a significant improvement. Today quite a number of people are embracing e-banking activities especially ATM, thereby moving away from the conventional banking system. This paper presents a review of the underlying Architectural Layout of Intra-Bank and Inter-Bank ATM connectivity in Nigeria. The paper further investigates and discusses factors affecting the Intra-Bank and Inter-Bank ATM connectivity in Nigeria. In addition, as well possible solutions to these factors affecting ATM Connectivity and Operations are proposed.

**Keywords**—Architectural layout, automated teller machine, e-services, interswitch.

## I. INTRODUCTION

OVER the years, the concept of e-services in Nigeria has witnessed growth at an exponential rate. E-services are services that are produced, provided, and/or consumed through the use of ICT-networks such as Internet-based systems, ATMs, and mobile solutions among others [1]. ATM in particular has revolutionized the banking system and other economic activities in Nigeria over the years. For example, in Nigeria today there are over 12,000 interconnections of ATMs [2].

An automated teller machine also known as an automated banking machine is an electronic telecommunications device that enables customers of a financial institution to perform financial transactions without the need for a human cashier, clerk, or bank teller [3].

On most modern ATMs, the customer is identified by inserting a plastic ATM card with a magnetic stripe or a plastic smart card with a chip that contains a unique card number and some security information such as an expiration date or CVVC (CVV). Authentication is provided by the customer entering a personal identification number (PIN) [3].

Automated Teller Machine (ATM) has no doubt eased the burdens embedded in the banking operations. The ATM has made it possible to carry out transactions such as cash withdrawals, cash deposits, payment of bills, Point of Sale (PoS) and Air Time recharge etc. at customers own convenience in or outside the banks operational hours. Life

becomes easier with the introduction of ATM services 24/7 as customer can access the identified services above even at banks close of business (COB). In 2013 for instance, the value of transactions has increased to N1.286 trillion as against the N1.046 trillion recorded in 2012, showing a percentage increase of 22.9% [2]. However, despite its important and ever increasing patronage by customers, ATM connectivity and operation has some mitigating factors that affect its operation in Nigeria.

This paper presents a review of the Architectural layout and connectivity of ATMs in Nigeria. The paper further investigates and discusses some factors affecting ATMs operation in Nigeria. Additionally, the paper proposed possible solutions to the identified factors affecting the ATMs operation in Nigeria.

The paper is organized in the following manner; Section I introduced the paper, Section II presents a literature review of Intra-Bank and Inter-Bank ATM connectivity and operation in Nigeria. Section III highlights the problems affecting ATMs operations and Section IV proposes possible solutions. Finally, Section V presents the conclusion and future work.

## II. LITERATURE REVIEW

ATM Machine can be seen as an “electronic banking outlet, which allows customers to complete basic transactions without the aid of a branch representative or teller” [4]. There are two primary types of automated teller machines (ATM), which constitutes the Basic and Complex ATMs. Basic ATM units allow customers to only withdraw cash and receive an update about current account information. Complex ATM machines accept deposits, facilitate credit card payments, and report account information. To access the advanced features of the Complex units, user usually needs to be a member of the bank that operates the machine [4]. However, in Nigeria today there are fewer numbers of complex ATMs in operation operated by few banks.

### A. Conceptual Model of an ATM Machine

Fig. 1 depicts the pictorial representation of the basic construct components of an ATM machine. Meaning the most basic components need for an ATM to function smoothly. These components are: PS – Denotes Power Supply, PC – Personal Computer that houses the OS and Cash Processing Software, EPP – Encryption PIN pad through which instructions are issued in an encrypted format, PRT – Printer. There are basically two printers: Receipts printer and Journal printer, CMD – Cash Media Device. This is where the Cash and the reject cassettes are housed, OTHERS – Denotes other

B. A. Yauri is with the Department of Computer Science and Information Technology, Kebbi State University of Science and Technology Aliero, PMB 1144, Kebbi State, Nigeria (phone:+2348-0359-84165; e-mail: bashaliyuu@yahoo.com).

A. R. Yauri is with Information and Communication Technology Department, Kebbi State University of Science and Technology, Aliero, PMB 1144 Birnin Kebbi Kebbi State, Nigeria (e-mail: rufaialeey@yahoo.com).

peripheral devices, IDCU – Identity Card Unit. This is where the ATM card is slotted.

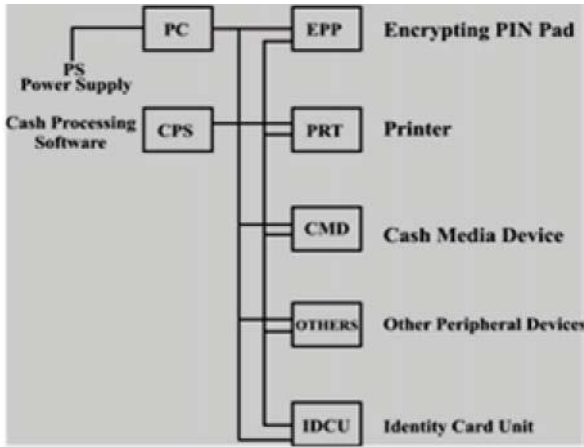


Fig. 1 A Conceptual Model of an ATM Machine

*B. Architectural Layout/Operations*

Fig. 2 presents a typical Intra-Bank ATM architectural layout and connectivity. The concept of Intra-Bank ATM connectivity and operation involves ATM transaction within the same Bank. In this model Bank (i.e. Bank A) there are two branches: Bank A Branch 1 and Bank A Branch 2 each of which is housing two ATM terminals ATM1 and ATM2. Presented there in also is a PoS terminal issued by Bank A to a shopping mall. Transactions traffic from these ATM terminals is routed through the Branch gateway to Postilion at the Bank's Head Office. The work of the postilion is to convert this ATM request signals into a language understandable by the Bank's Enterprise Application server (EAS). Similarly, the response from the EAS is converted by the postilion to a format that the ATMs understand.

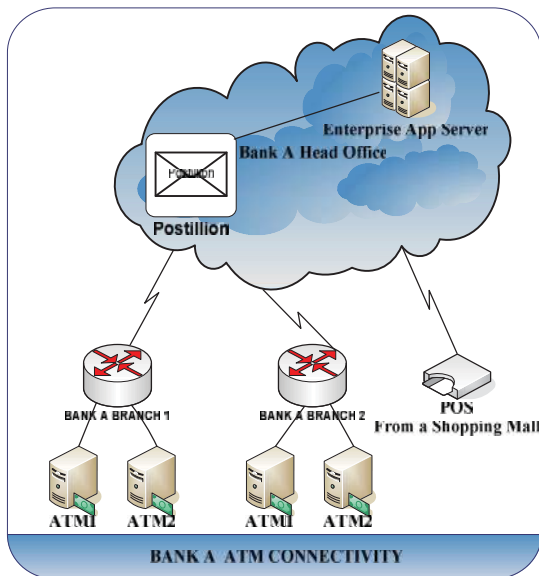


Fig. 2 Typical Bank ATM Connectivity Intra-Bank ATM Transactional Traffic Flow

Fig. 3 shows the sequence of activities in a typical Intra-Bank ATM transaction by way of transition state diagram.

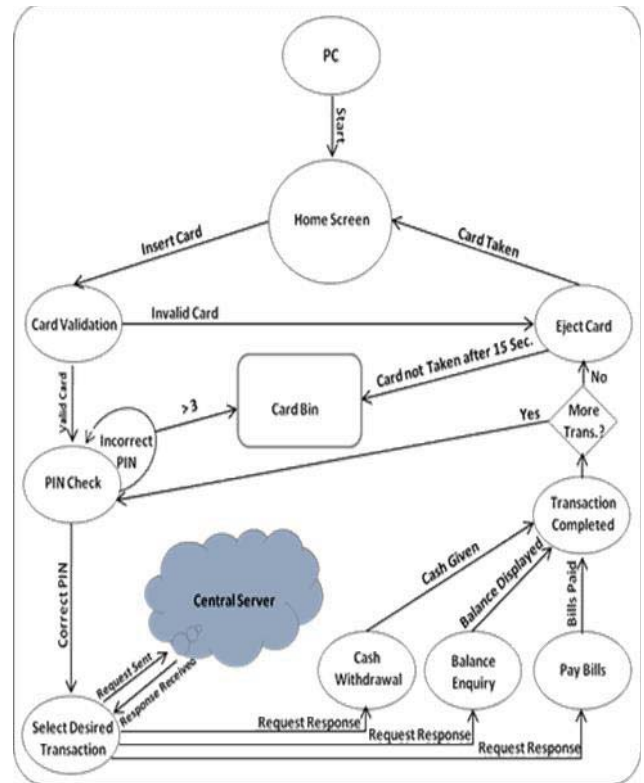


Fig. 3 Intra-Bank Transactional Transition State Diagram

*C. Inter-Banks Interswitch ATM connectivity*

Fig. 4 shows Interswitch model of a typical Inter-Banks ATM connectivity. The concept of Inter-Banks ATM connectivity and operation involves ATM transactions between two or more Banks. In Fig. 4 Presents Inter-Banks ATM connectivity and operation where three Banks: A, B and C are connected to each other via an Interswitch cloud. The Interswitch network provides interconnectivity platform for all the licensed commercial Banks in Nigeria. For example, when Bank A customer places his ATM card on Bank C ATM the request passes through Bank C head office cloud to the Interswitch cloud which uses the Financial Institutions Table (FIT) to identify which Bank the traffic belongs to and forward the request appropriately. Similarly, when the response comes back it passes through Interswitch back to the originating Bank for action to take place.

In the next section, we will see the history of ATM connectivity and operation in Nigeria.

*D. History of ATM in Nigeria*

The Automated Teller Machine (ATM) first emerged in the Nigerian Market space in the late 1980s to be precise in the year 1989. National Cash Registers (NCR) one of the leading ATM vendors in the country installed the first ATM machine for the then Societe Generale Bank of Nigeria in the year 1987 [5].

According to [5], the erstwhile Societe Generale Bank of Nigeria (SGBN) was the first bank to install the ATM machine in 1990. This is what one of the then new generation banks (SGBN) called “Cash point 24”, and from among the first generation banks, First Bank of Nigeria Plc (FBN) was the first to follow suite, as the second bank to install ATM nationwide in 1991 ending, calling their own product “FIRST CASH”. However, their Implementation approach differs; while SGBN implemented an in-lobby ATM the FBN implemented a through-the-wall ATM.

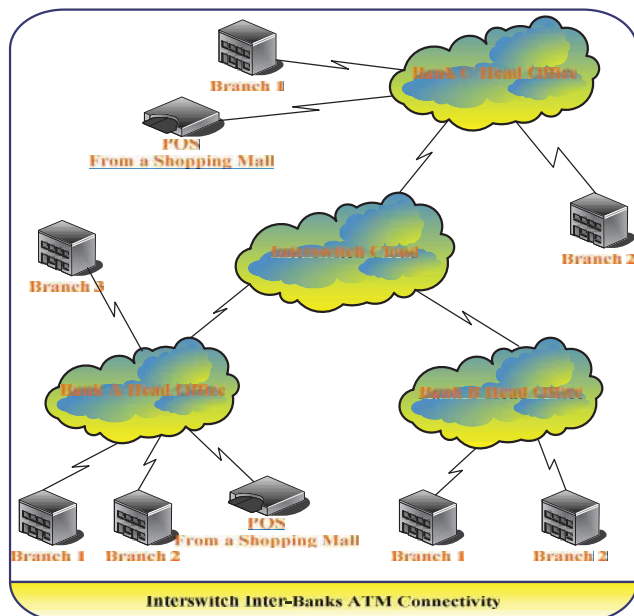


Fig. 4 Interswitch Inter-Banks ATM Connectivity

In the Nigerian banking industry today, there are over 12,000 interconnections of ATMs [2]. Virtually all the commercial banks have today deployed ATMs machines within and outside their premises to cater for their teeming customers' needs.

#### E. ATM Connectivity and Operations in Nigeria

ATM operation in Nigeria has been increasing right from its inception. Today, millions of Nigerians are using ATMs daily to perform transactions worth millions of dollars. ATM operations in Nigeria got boosted when the Central Bank of Nigeria (CBN) introduced ‘Cash Handling Charge’ policy on cash-based transactions. Hence any cash withdrawal of value worth N500,000.00 from individual customers and N3,000,000.00 from corporate entities attracts the cash handling charge policy. The cash-based transaction policy on withdrawal is targeted at reducing rather than eliminating the amount of physical cash (coins and notes) circulating in the economy, and by implication this encourages more electronic-based transactions (goods and services payments, transfers via ATMs, PoS, Mobile Phones etc.) [6]. The concept of encouraging electronic transactions by was tagged as The Cash-less Policy by CBN.

#### F. Anticipated Benefits of the Cash Policy

A variety of benefits is expected to be derived by various stakeholders from an increased utilization of e-transaction systems [6]. These include:

- **For Consumers:** Increased convenience; more service options; reduced risk of cash-related crimes; cheaper access to (out-of-branch) banking services, access to credit and financial inclusion.
- **For Corporations:** Faster access to capital; reduced revenue leakage; and reduced cash handling costs.
- **For Government:** Increased tax collections; greater financial inclusion; increased economic development. Increased tax collections; greater financial inclusion; increased economic development [6].

However, in spite of the above benefits of cash-less policy which boosted ATM operations in Nigeria, there exist problems that are affecting ATM connectivity and operations in Nigeria. The next section will be introducing these factors affecting ATM connectivity and operations in Nigeria.

#### III. FACTORS AFFECTING ATM OPERATIONS IN NIGERIA

Taking the X-ray of the ATM operations in the Nigerian Banking space there are unending list of bottlenecks associated with ATM Operations. This paper has identified six (6) major factors affecting ATM operations in Nigeria which are:

- i. **Lack of stable power supply.** The Unstable nature of the national power grid has inhibited the growth of a lot of sectors of the Nigerian economy to which the Banking Industry is not an exception, particularly the ATMs that operate 24/7.
- ii. **Literacy Level of the Citizenry.** Quite a chunk of the population of the ATM users cannot comfortably operate the ATM without calling for assistance from the next customer on the queue. This in turn exposes the customer to PIN compromise.
- iii. **Dispense errors.** This is mostly associated with technical faults with the ATM machine, causing the machine not to dispense cash after debiting customers' account. Dispense errors can as well be stemmed from human error, when an ATM custodian load wrong currency denomination into a wrong cassette. (For instance when ₦1000 notes are loaded into cassettes configured for ₦500 notes, the customers will laugh while the bank runs at a lost) and on the contrary when a cassette configured for ₦1000 notes is loaded with ₦500 notes the customers will now shout and quickly blow whistle calling the attention of the bank.
- iv. **Mutilated Notes.** Are quite unhealthy to the cassettes and the system in general. The dust/dirt associated with mutilated notes causes some sensors to be blocked and consequently the related services hindered. As the design of ATM, cash handlers/cash presenters are made to deal with the thickness and smartness of the notes, when ATMs are loaded with mutilated notes the machine becomes prone to frequent cash jams. According to Head of E-Banking United Bank for Africa (UBA) [2], apart

from the two obvious costs of security and power in maintaining ATMs another associated cost is that of sorting the notes to be loaded into the cassettes of the ATMs [2]. He further explained that when there are dirty notes among the pile, ATMs get jammed and rendered useless until there is human intervention.

- v. **Service Charge Policy.** Service charges introduced by the regulatory body on transaction carried out on other Bank's ATMs. This discourages Inter Bank Transactions.
- vi. **Influx of Cyber Attacks.** As Microsoft Corporation as at April 8, 2014 ceased to provide support for patches and updates for the 12-year old Operating System (MS Windows XP) all systems that are still running this moribund OS, ATMs not excluded are warned to prepare and face the wrath of Cyber-attacks [2]. In another warning issued by PCI Security Standard Council, said about 95% of the global ATMs are left susceptible to hackers attacks as a result of this support cut-off. Tim Rains Director of the MS Truthworthy Computing Group (TwC) added that businesses still running on XP are exposing themselves and their customers at high risks.

#### IV. PROPOSED SOLUTIONS TO THE FACTORS AFFECTING ATM OPERATIONS IN NIGERIA

The under listed are proposed to mitigate these factors affecting ATM operations in Nigeria:

- i. The Use of inverters – (electric and solar driven) has been identified herein as an alternative means of power back up to supplement the national grid.
- ii. Better grass root educational policies that are aimed at ensuring at least upper basic education is given to all and sundry.
- iii. Banks to ensure periodic preventive maintenance is carried out by the ATM vendors. They should also ensure dual check on the replenished cassettes loading into the machine to mitigate wrong notes loading.
- iv. Regulatory policies to regulate how the citizens should handle the Naira notes to protect it from the menace of mutilation.
- v. The Central Bank to remove the service charges, so as to encourage the Inter-Bank ATM operations.
- vi. The committee of e-Banking Industry Heads (CeBIH) in Nigeria is working with Microsoft Nigeria to ensure speedy upgrade of all ATMs OSs to Windows 7 and above in order to curtail for the envisage Cyber-attacks [5] which may affect the financial fortunes of the citizenry and the Banks.

#### V. CONCLUSION

This paper has presented a review on ATM connectivity and operation in Nigeria. The review has discussed Cash-less society policy and shows how it encourages e-banking services especially ATM. Operational challenges on ATMs were outlined and solutions were proposed. Future works will focus towards investigating possible ways in which a stable

and sustainable ATM connectivity and operations in Nigeria can be achieved.

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