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Using SOA with web services for an effective integration approach of Rural Banks and existing mobile communications infrastructure in Providing Mobile Money Services

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***Abstract*— The rapid spread of mobile phones means that the number of mobile users may already exceed the number of banked people in many low income countries. Mobile phones can also offer a communications channel for initiating and executing on-line financial transactions. This channel may not only reduce the cost of financial transactions for provider and customer, but also allow new entrants to the financial sector, and new relationships to be formed for distributing services. These changes hold the prospect of accelerating access to financial services on the back of the mobile infrastructure.**

Mobile telephony offers tremendous promise to facilitate the flow of money among rural and poor families at much lower transaction costs, bringing the bank to those currently unbanked. Realizing this promise will require close collaboration among all stakeholders.

But most rural banks do not have mobile banking services for their customers. This made it difficult for the full potential and benefits of mobile money financial services to be realized. Most telecommunication service providers run mobile money service solely for their subscribers without an integrated approach of incorporating and integrating rural banking systems into their existing services this makes it difficult for a full fledge exploitation of the mobile financial market.

This paper proposes an effective integration approach of integrating the Rural Banks and existing mobile communications infrastructure as well as proposing a model for such integration. This will make it possible for the full potential of the mobile money services to be exploited so that the rural banks can perform transactions via mobile. Using SOA with web services will enhance effective interoperability between the banking systems.

***Index Terms*—Mobile money, rural banks, mobile communications, integration, on-line financial transactions**

I. INTRODUCTION

The rise of mobile network operators globally opened the door for mobile applications that render services for people across geographical areas. They provided services such as text messaging, MMS, email, Internet access, short-range wireless communications (infrared, Bluetooth), business applications, gaming, mobile money transfer, photography and others.

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Mobile payment, also known as mobile money, mobile money transfer, and mobile wallet generally refer to payment services operated under financial regulation and performed from or via a mobile device. Instead of using cash, check, or credit cards, a consumer can use a mobile phone to pay for a wide range of services and digital or hard goods. [1]

According to Cameron Peake (2012), there are more than 130 live mobile money deployments tracked globally by the GSMA, the mobile telecom industry body, and another 87 in development. 2 Of bank-led initiatives, there are 236 agent banking deployments in Brazil, Peru, Colombia and Mexico alone, with a total of more than 43,000 combined agents. As the market is further defined and developed, payment actors such as Visa, MasterCard and Western Union are positioning in this space as well.[2]

With reference to a publication by Daily Guide (2011), the International Telecommunications Union estimates mobile subscriptions across Africa have more than tripled to 333 million since 2005 and in South Africa, the DRC, Zambia and Kenya, mobile phone banking has offered services to remote areas where conventional banks have been physically absent.[3]

Mobile telephony offers tremendous opportunities for rural communities in developing countries and have promising goal to facilitate the flow of money among rural and poor families at much lower transaction costs, bringing the bank to those currently unbanked. Realizing this promise will require close collaboration among all stakeholders.

In the midst of these prospects that mobile money offers, most rural banks do not have mobile banking services for their customers, currently. This made it difficult for the full potential and benefits of mobile money financial services to be realized in rural communities. One major challenge also is that most telecommunication service providers run mobile money service solely for their subscribers without an integrated approach of incorporating and integrating rural banking systems into their existing services, and this makes it difficult for a full fledge exploitation of the mobile financial market.[1]

Most of the rural folks want to move to anywhere of their country and still do business with their money at the rural banks using their mobile phones without necessarily having money on their mobile wallets. They still want to be able to pay bills and send money directly to their rural bank accounts

using mobile money services without the money residing in their mobile wallet. They want to be able to purchase and sell goods through these services. And the mobile money systems provide such an opportunity for the rural folks to join the banked communities.

Most of the rural banks do not have the capacity to build a nationwide infrastructure with branches to carry out the above transactional operations on their own. The rural banks are not permitted by legislation in some countries to have branches in the cities. And this is a barrier for financial transactions to be easily conducted.

With the concept of SOA and web services as well as the existence of mobile money services, these barriers can easily be broken and rural folks can trade with their banks at anywhere and at anytime. These rural banks can build new services for their banking systems to make the system more effective without doing away with their existing IT infrastructures. Hence SOA with web services will provide the solution for such an effective integration.

Over the course of many years, businesses find themselves in need of comprehensive enterprise integration solutions and turned to using products developed specifically for that purpose. The adoption of service oriented Architecture and web services provide a rapid solution to solving this problems faced by organizations [4] [5] [6]. In many organizations solicitation of custom enterprise software and web applications from independent software developers and software companies are common. Unfortunately, these custom enterprise application integration (EAI) products prove to be expensive, consume considerable time and effort and are subject to high project failure rates. Additionally, because these custom applications are proprietary, many of the projects result in additional difficulties. Importantly, modifications to such applications require developing almost the entire system from scratch. Recent experience shows that a better answer is available by using Web services standards [7].

This paper looks at the existing mobile money services and takes critical look at the positive advantages of effective integration approach of Rural Banks and existing mobile communications infrastructure as well as proposing a platform model for such integration. The model proposed will use an integration approach that will interconnect Rural Banks and existing mobile communications infrastructure via a service bus based on the concept of Service oriented architecture. This will link mobile money service providers effectively as well as making possible future integration solution and interoperability of systems for effective service delivery. Using SOA with web services will enhance effective interoperability between the banking systems as well as reducing development costs for the rural banks.

The paper has the following structure: section II consist of related works, section III gives information on the methodology, section IV discusses the approach used for the integration, V talks about implementation as well as results and concluded the paper.

II. Related works

According to Cameron Peake (2012), Infrastructure changes in rural areas are external factors that may force new models for the mobile services. Mobile phone and Internet penetration are typically lower, which may severely raise costs and/or inhibit the provider's ability to introduce mobile or Internet-based services. For bank-led models, it may be wise to team with an MNO for rural development or look at more human-centered solutions where transaction data may not be real time, but regularly synched as the network allows. One thing to keep in mind is that technology infrastructure is rapidly expanding, and though a system may not be in place today, it may be completely functional in six months. [1]

Enterprise application Integration enables an enterprise to integrate its existing applications and systems and to add new technologies and applications to the mix. Enterprise organizations must weigh the cost of replacing existing systems with new systems against the cost of merging existing systems with new systems. Discarding existing systems is never an easy choice: companies have invested huge sums of money to install, use, and customize these systems. Not only are their personnel comfortable with using these systems, even if the software is rife with drawbacks, but often the company's way of doing business has evolved to fit with these systems. It is difficult to just walk away from such an investment. Likewise, bringing in a replacement system has its costs: there's the purchase price of the new system, plus the training and customization costs. The investment in the new system can be as large, if not larger, than the investment in the existing system [8].

Hence dynamics in business processes and expansion of infrastructure to meet the current demands and competition within the competitive market needs rapid and dynamic system integration approaches. With service oriented architecture and web services solutions can easily be provided in solving these problems. With the rural banks, services can easily be built for mobile phones transactions which will have the capability of meeting today's demands as well as the future. The services provided will be platform independent and mobile phones that do not have internet connectivity can still do banking with other systems that are internet or extranet dependent via SMS gateway.

One other thing that Cameron Peake(2012) identified again was that, regulations also force new models to emerge for the mobile services. In countries where bank account opening is not allowed at the agent level and rural banking penetration is low, typical (that is, transactional) agent models will be of limited use, and the value proposition for rural clients will be reduced. Some banks may introduce roaming employees to register clients, thus avoiding the restrictions. It should also be kept in mind that agent regulation is rapidly expanding as governments become more familiar with nontraditional models.[1]

With the proposed integrated systems, once a mobile customer has a registered mobile line and has been registered on the mobile service officially by a Mobile service provider, financial service transactions of banks will be made readily available based on service level contracts. Which means can

receive and transfer money for any transactions that fit into the domain at the service contract level.

According to Jenkins, B. (2008), As Hans Wijayasuriya, CEO of Sri Lanka's Dialog Telekom, asserts, "for something to be ubiquitous, the foundations need to be very strong." 16 Without doubt, scalable, robust technology will be required. Fundamo's Hannes van Rensburg asks, "How do we build a system that would scale from hundreds of transactions a second to thousands a second? What does it do under adverse conditions and how quickly can it recover? What we can't afford in this infant industry is major catastrophes." What other foundations do growing mobile money ecosystems need? Their leaders identify three that stand out: utility, capacity, and an enabling environment.[9]

Jenkins, B. (2008) further explained that some degree of interoperability will be required if a critical mass of mobile money services is to develop. Mobile network operators and other companies are conscious of their core competencies and often, quite rightly, want to focus on their core businesses. As a result, some interoperability, in the sense of collaboration or partnership, will be needed to "expose [consumers] to a broad range of players so collectively they can get the full package of financial services." [9] As Alex Ibasco, Group Head of New Business Streams at Smart Communications, says, "Smart has no illusion it can build everything. Instead, we take a strategy of inclusion, inviting people to come in and create businesses out of areas where there are gaps. We think of ourselves as a horizontal infrastructure enabler and we look for people that think vertically. Creating businesses out of the gaps – that is the only way" [10]

As mobile money services spread across geographical areas, there is a need for systems that can accommodate the rapid growth of transactions and the system should also have the capability of interoperability as well as accommodating future changes without a negative effect on the existing system. Hence this paper provides a solution to solving this problem.

III. Methodology

As elaborated by Paul A. Strassmann(2007), SOA with web services changes the way businesses are undertaken and it is a technique of design that guides all aspects of creating and using business services throughout their lifecycle Thus, from their conception to their retirement. And also in defining and conditioning the IT infrastructure that allows different applications to exchange data and participate in business processes regardless of the operating systems or programming languages underlying those applications. [11]

For mobile money to achieve its full potential, interoperability of systems services of different banks and telecommunication industries is the key. This research work focuses on the design of architectures to illustrate the model of integration between banking systems and communications infrastructure within the mobile money industry and then propose a model for its effective integration. Effective integration approach will be achieved based the concept of service oriented architecture and all services will be connect to a service bus.

The paper seeks to achieve two main aims, the first aim is to integrate systems such that they can interoperate and provide services to each other. This will be possible for all rural banks operating on the mobile money services to interoperate and perform such transactions irrespective of the platform upon which their systems are running on.

The second aim is to provide an avenue for addition of new services in the future by interconnecting with other services without changing the entire systems or building the entire system from the scratch.

However in high hopes of achieving these aims, the existing IT infrastructure will not be replaced by a new one due to extensive investments made in the existing systems. It's more cost-effective to evolve and enhance the systems. The approach will also facilitate the composition of services across disparate pieces of software systems to streamline IT processes and eliminate barriers to IT environment improvements within and outside organizations operations.

IV. The Approach

The approach used was to get all the independent systems residing within and outside each organization's system connected so that they can easily exchange data irrespective of the platform upon which they are running on and make the services available for usage by external systems during transactions. A multi-layer architecture approach was used to develop a model to make information processing possible within and outside the organizations and also making some services accessible. Back-end database servers were set up and Web services were modeled to make it possible for external and internal organizations to request and provide services through the service bus.

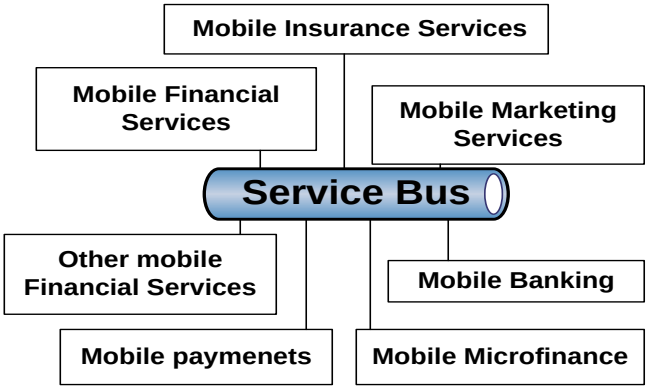

Fig 1 The Mobile Services level Integration model

Figure 1 represents a Mobile Services Integration Model via a service bus: This model interconnects all services through a services bus by making it possible for service contracts to be made easily as well as providing a platform for easy integration, interoperability and addition of new layers of abstraction. Which means that phones with or without internet connectivity can perform the same transactions. Laptops, desktops, other mobile and non mobile devices with internet browsing capability can also have access to such services. And also systems running on different hardware and software platforms can also easily exchange data and interoperate among themselves irrespective of the vendors of the systems

and the languages in which the software were written in.

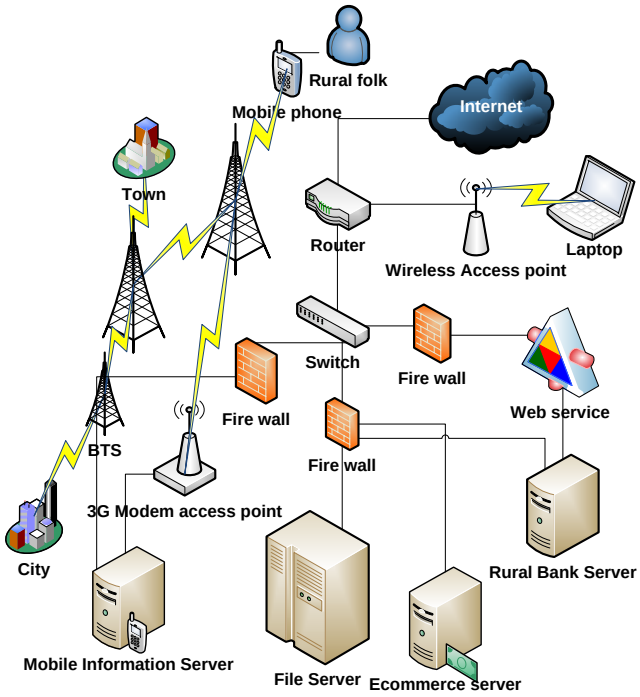

Fig 2 Integration of Mobile Money services into Rural bank systems

In figure 2, illustrates architecture of a rural bank system that has integrated mobile money services into their existing banking system. Here, a rural folk can send a defined short code to the rural bank and then send money from his account onto his mobile wallet to transact a business. Transfer of money can also be done into another person's account in another rural bank through the mobile money system. The rural folk can move from village to city and town and still enjoy such services as long as there is availability of the mobile telecommunications network present. The internet can also be used to perform such transactions. In this case too, the rural banks can decide to build a service to interoperate and send money to different network at their level to satisfy their customers even if the Telco systems does not permit transfer of money say from network A to network B. This approach expands the rural bank's network coverage because it is dependent on the mobile network coverage. The rural banks have to build their enterprise systems in other to share resources for transactions to be done effectively.

Figure 3 showed Service Oriented Integrated architecture of the Enterprise system resources. The Enterprise Resources and Operational Systems consist of existing applications, legacy and COTS systems, CRM and ERP applications, and older OO implementations. Integration Services provide access to the resources and systems of Enterprise Resources and Operational Systems and the components wrap integration services and provide a 'single point of contact' for integration services. Business Services represents a logical grouping of component, integration services and operations and also provides high level business functionality throughout the enterprise as well as provides a 'service interface' layer of abstraction to the functionality of components and Integration Services. Business Processes as a series of activities executed in an ordered sequence according to business events and a set of business rules called choreography or business process model.

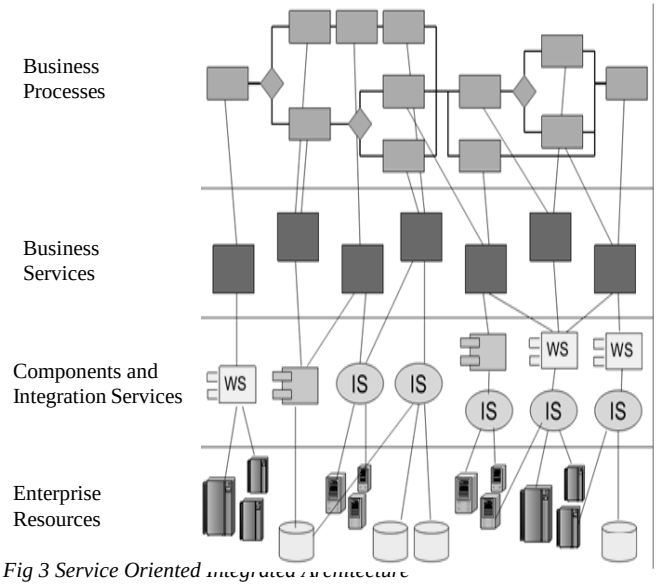

Fig 3 Service Oriented Integrated Architecture

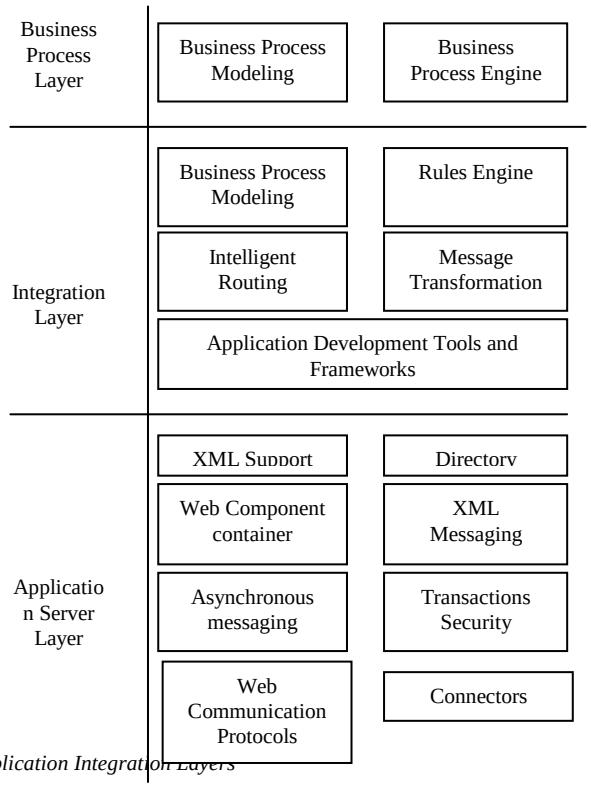

Fig 4 Application Integration Layers

Figure 4 showed web services exposure through the interface functionality performed by the internal systems and this makes the services discoverable and accessible through the Web in a controlled manner as well as the service bus. Homogeneous components were modeled to reduce the difficulties of integration and standardized. From the architecture Service descriptions were made richer and more detailed, covering aspects beyond the service interface. The application integration environment encompasses three layers: a business process layer, an integration layer, and an application server layer. Each layer, in turn, holds technologies that serve as the application server integration

building blocks. The application server layer enables an application integration project to link not only with existing enterprise systems but also with the Web. The application integration platform adds an integration layer on top of application server. This integration layer provides support for application development tools and frameworks. These development tools and integration frameworks are based on the application programming model, and they rely on metadata for generating and providing services. The integration layer also adds support for such functionality as a rules engine, intelligent message routing, and message transformation, all on top of the base functionality provided by the application server. The business process layer serves as the top-most layer for the platform and represents an enterprise's unique way of doing business. This business process layer exposes business process level abstraction by providing support for business process modeling and for the business process engine.

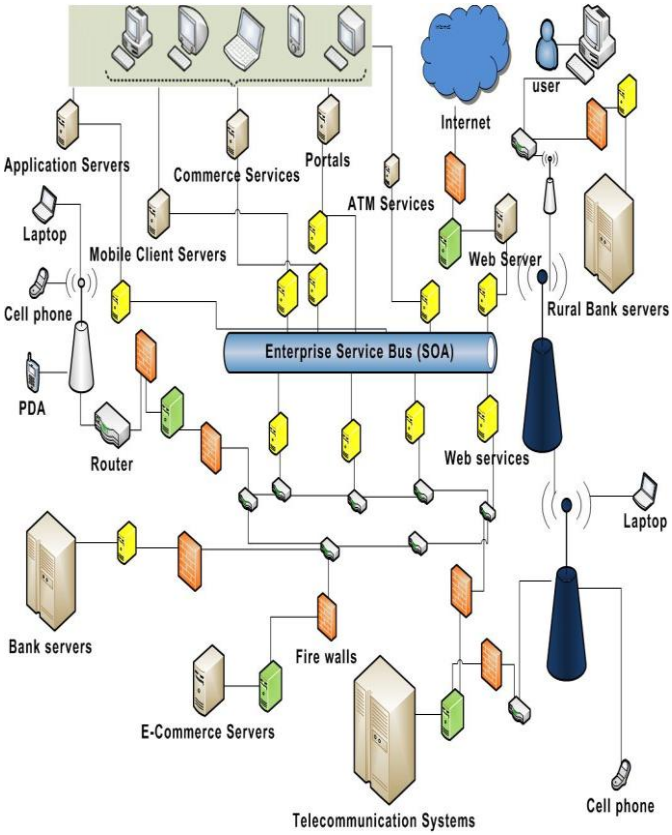

Fig 4 Integrated Systems architecture via a Service Bus

The service bus implements, integrates, manages, shares and distribute the services. Through the service bus end users and heterogeneous devices, can interconnect, interoperate and provide services to each other irrespective of the end users' location, device platforms and programming languages. As the business logic layer is service-enabled, the presentation logic of a particular system can be separated from the business logic thereby making it easier to interconnect with various types of Graphical User Interfaces and devices. For the services to reflect and correlate with business processes, the business process engine exists at the business logic in the architecture to describe business processes, automate, modify and enforce business rules and drive an automatic flow of execution across the multiple services.

V. CONCLUSION

With the proposed model, architectures, SOA Concepts and Service oriented development approach, an effective integration approach of Rural Banks and existing mobile communications infrastructure can be achieved. This approach is less expensive to implement and has less work during the system integration stage.

Rural banks then can now implement this approach to exploit the full benefits of mobile banking. Money can be easily transferred from one account to the other from different rural banks account to the other. One can also now send money from one's mobile money account from a network say Vodafone to the other say MTN without going through any difficulty.

International and national transfer of money can easily take place for any form of mobile money transaction services. Payment can be done effectively using mobile money and withdrawals can be done from banks and any mobile money agent.

Future works will be based on how detailed implementation of the project can be done at the rural bank level for transactions to be done via an SMS gateway. This will help the banks to provide an avenue for the rural folks do business using money from their accounts at the rural banks at anytime.

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