

Integrated Educational Information Systems for Disabled Schools via a Service Bus using SOA

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Abstract

Background/Objectives: Schools for the disabled are distributed across countries the world over and it is vital for all schools to share information equally to integrate their systems for effective research and an effective learning system. An academican or a student in need of information from these schools can simply do research on the learning system of various people with multiple disabilities. This research work is aimed toward integration of information systems of schools across countries via a service bus. **Methods:** A centralized service bus was accustomed to facilitate the ability of applications across platforms and enhance communication at intervals in the school infrastructure enabling atmosphere for the brand new layer of abstractions to be accessories without modifying the complete system. **Conclusions:** Concepts of service oriented architecture with web services was used for speedy integration, resolution in determining the challenges faced throughout the integration of multiple incompatible applications.

Keywords: Information, Integration, School for the Disabled, Service Bus, SOA, Web Services

1. Introduction

To achieve the goal of the world national e-health strategy that intends to produce a practical, standardized and secure platform for all concerned partners in supporting aid services, one has to specialize in the ability to integrate all distributed enterprises having access to the proper information within a specified period of time in the most economical ways. Hess et al. and Venkatesh et al.^{1,2}, states that GIS, as a part of information systems, is often employed in generating geographical reports for effective analysis and decision-making.

Service Oriented Architecture (SOA) has radically modified the appliance integration landscape. SOA is often thought about as a business-centric approach for facultative integration. Visibility, interaction and result are the key ideas in any SOA implementation suggest³. Visibility refers to the capability of these to ascertain those with a capacity to service the requirements.

As people in companies are dependent on technology nowadays, the requirement for a technique of integration of different applications into a unified set of business processes has emerged as a priority. Users are exacting that seamless bridges be designed to affix them. In effect, they're exacting that a way be found to bind these applications into one unified enterprise application. The event of Enterprise Application Integration (EAI), that permits several of the stovepipe applications that exist nowadays to share each process and knowledge, permits the U.S. to finally answer this demand suggest⁴.

Service Oriented Architecture (SOA) has gained quality in recent years, attributable to its facultative practicality or services to upgrade and extend existing software package applications. SOA related degree beaux arts approach to create and deploy software package applications. SOA has fully developed as corporations endeavor to leverage their existing consumer base and to integrate their non-inheritable software package with their clients' existing ERP system and

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conjointly it makes software package property capabilities terribly straightforward. Unlike EAI, no middleware is required as adoption of standards alter services to move directly⁵. It conjointly enhances reusability capability of software packages, ensuing longer lifetime of existing assets. A flourishing SOA implementation makes it easier to customize and upgrade existing applications, thereby reducing the total value of possession.⁶⁻⁹ suggest the adoption of service oriented architecture and web services give a fast resolution to resolve integration issues faced by organizations. The paper has the subsequent structure: section 2 is the literature review, section 3 offers information on the research methodology, section 4 discusses the approach used for the integration, section 5 discusses implementation as well as results and section 6 concludes the paper.

2. Literature Review

In this development model, requesters and suppliers act through messages. Services are designed to be autonomous, but however, may be combined to create even larger services and applications. Service orientation provides tips and principles that govern the creation, implementation and management of services.

Primarily, services are enforced as Web Services (WS) that are outlined by the W3C as “software systems designed to support practical machine-to-machine interaction over a network”¹⁰. It has an interface delineate in a very machine-processable format. Alternative systems act with the web service in a very manner prescribed by its description victimization SOAP-messages, usually sent victimization HTTP with an XML publication in conjunction with alternative Web-related standards¹⁰. Extensible Markup Language (XML) has emerged as a strong self-describing language to alter businesses to share data and conduct transactions on the web. Hess et al¹. presented that the emergence of XML as a typical, to an oversized extent, has driven the evolution of application integration technologies.

Inherently, a service may be a package part that contains a group of connected package functionalities reusable for various functions¹¹. It delivers such operations as information storage, processing, mathematical and scientific computations, and networking. It's ruled by a producer-consumer model during which a service is delivered by a service supplier, referred to as the producer that owns the facilities for hosting, running, and

maintaining the service, and the consumer, referred to as the buyer, that connects and uses service functionalities. Much of the research concerning SOA tackles a lot of granular technical problems with the development and implementation of web services, which can be a result of the said misconceptions. A few papers, e.g.,¹²⁻¹³, traumatize the abundant larger downside of shaping what SOA suggests that to the organization and the way this definition ought to then give the steering for the event of parts to satisfy business data needs¹⁴. The IT adoption literature targeting a technique for developing states that there is a unit five classes of things influencing the choice to adopt SOA (i.e., environmental, structure, individual, technology, and task characteristics¹⁵. These same factors ought to be self-addressed by the methodology for implementing SOA¹⁶. We tend to currently discuss two SOA methodologies that arrange to represent some or all of those factors.

Teti et al.¹⁵ provides a technique, which entails making a vision, construction, and execution. He suggests that this model is applicable to several cameos, but however, specifically addresses SOA. The vision creation is driven by a variety of inter- and intra-structural problems that outline tasks necessary to the people and therefore the firm (i.e., the constituency); the development addresses the technology needed to accomplish the tasks; and execution seeks to make sure that SOA can facilitate data exchange within the atmosphere.

Bell provides an SOA methodology that takes a lot of technical approach. It professes that each one package are often thought about as services that are designed to support the informational tasks of the organization, designed for transmission within the operating environments, created with offered technologies, and deployed to be used by people. The methodology represents an abstract structure that brings along distributed services that support the practicality¹⁷.

3. Research Methodology

SOA, along with web services, guides all aspects of making and victimization package services throughout the package life cycle from their conception to their retirement. And conjointly in the process and learning the IT infrastructure that enables totally different applications to exchange information and participate in business processes separately the operating systems or programming languages underlying those^{7,8}.

This research work is aimed toward integration of education information systems of disability schools via a service bus. A centralized service bus was deficient to facilitate the ability of applications across platforms and enhance communication at intervals the school infrastructure furthermore as making facultative surroundings for the brand spanking new layer of abstractions to be intercalary while not modifying the whole system. The whole integration method supports the ideas of SOA with web services. The shape of approach used was to change alternative disabled services at intervals and out of doors schools to speak and exchange information.

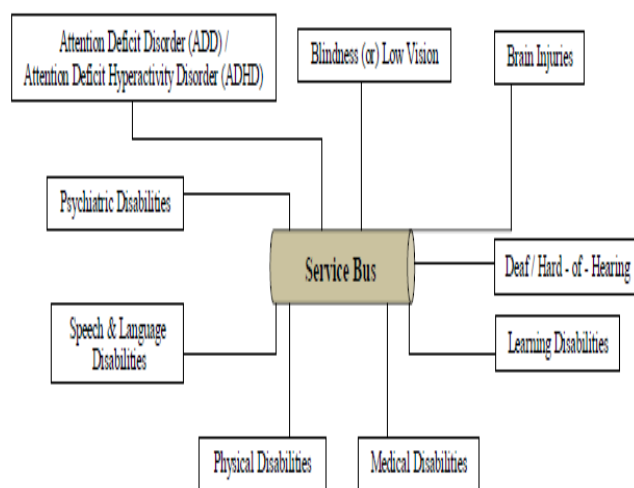


Figure 1. Service integration model for disability schools.

In the above Figure 1, the services of the disabilities were connected via a central service bus for information exchange and effective digital communication between software applications. This conjointly enabled ability for heterogeneous applications wherever multiple systems share information. This additional makes information migration and usage straightforward from one system to a different.

4. Integration Approach

A multi-tier design was used in making the answer. The design consists of the infrastructure layer, data layer, integration layer, application layer, communication layer and user layer. The data and integration layer reside at the service providers' finish. The data would be created in the market to requesters through the data layer, whereas the integration layer is wherever the business rules that verify

however information is formed, hold on and accessed square measure enforced. The information technologies and business logic implementations vary across service suppliers. As a result of the service-oriented architecture being enforced, external access to these databases is provided via services. The services enforced victimization web service technology. The selection of web services technology is due to its support for open technologies and protocols like HTTP (Hypertext Transfer Protocol), XML (Extensible Markup Language) and WSDL (Web Service Definition Language), among others. These open technologies offer a desired level of ability and straightforward suggests that of access. The web services offer practicality to access the databases whereas implementing the integration at the backend. The individual services registered during a repository from wherever they will be accessed. Users will access services directly in repositories; during this, access is going to be through a middleware. Disabilities enterprise service bus is that the middleware between service requesters and also the services suppliers. Since the requests have to access varied services to induce comprehensive information from the schools, the ESB performs the task of deciding what service to access and also the order in which they are accessed. In other words, the ESB performs service orchestration. Service consumers cannot access the ESB directly. Thus an additional interface is needed. Service consumers request services nowadays via disabled array of devices starting from desktop computers and laptops to mobile devices like smart phones and tablets. A universal mode of access is needed for of these devices, thus the selection of a web interface. More recent devices contain a web browser that may be accustomed to access a web page no matter in operation platforms. As a result, a web server is needed to produce a presentation layer in the form of web content to the consumers via which they will access the services and examine the results.

This selection of design is efficient. As a result, it provides access to a good variety of consumers and devices as a result of the ever present technologies used within the user layer whereas conjointly providing a high level of separation of concern. However, the consumer is loosely coupled to the individual services. This provides flexibility as a result of which the service suppliers will switch information technologies or business logic implementation while unaffected the supporter as long because the exposed services adjust to a predefined contract that the

supporter is conversant in. Implementation of services by suppliers is additionally comparatively low cost as the services are engineered on existing infrastructures while not restructuring the total system.

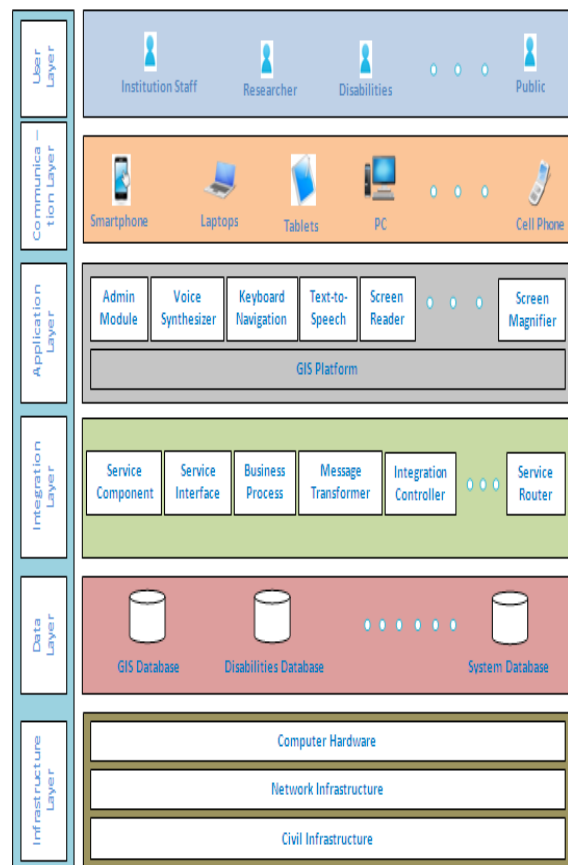


Figure 2. Layer architecture of educational information system for disabled schools.

In Figure 2, the infrastructure layer consists of the PC hardware (Servers, desktops, peripheral devices, UPS, etc.); civil infrastructure designed for (server rooms, management centers, etc.) and network infrastructure (Structured cabling, switchers, routers, fiber optic channels, etc.). The data layer consists of a needed information's sort of a GIS database (reference maps, road maps, high resolution imaginary); An information to store logs and records of past and current records; different connected information's and a system database to manage records etc. The integration layer exposes functions to each external and entomb user. The appliance layer integrates functions into modules that are made on the market to communication carrier's outline within the communication layer. User's layer represents the users of the system.

The usage of the integration layer for schools as shown in Figure 3 provides a level of indirection between the supporter of practicality and its supplier. A service consumer interacts with the service supplier through the integration layer. Therefore, every service interface is just exposed via the integration layer (e.g., Enterprise Service Bus), never directly, and point-to-point integration is completed at the integration layer rather than consumers/requests doing it themselves. Consumers and suppliers square measure decoupled; this decoupling permits integration of disparate systems into new solutions.

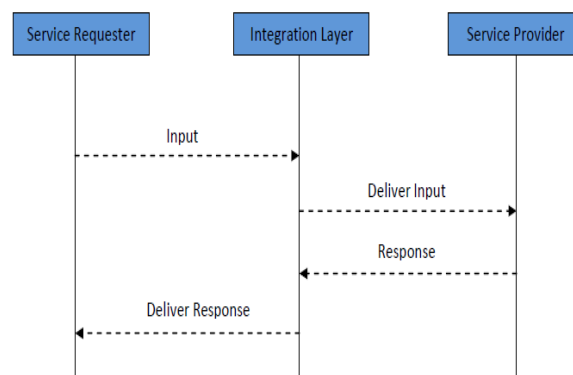


Figure 3. Usage of the integration layer by schools.

Consumers seek to use a service supplied with a forefront website through which they will explore for information. The search input is denoted back to the web server on submission and so the input is transferred to the enterprise service bus via the acceptable adapter. The ESB features an assortment of approved web services exposed by the varied vendors in its written record. The ESB passes the input parameters to the acceptable services within the written record. These services successively transfer the input parameter to their remote applications on which their business logic resides. The applications question the databases victimization the equipped parameter and also the results square measure passed back to the ESB. The results are accumulated and transferred back to the web server where they are formatted and presented the tip user during a website.

In the Figure 4, languages and protocols were standardized to eliminate the requirement for several totally different middleware infrastructures and also the interactions were supported protocols redesigned and also the internal practicality settings were created on the market as a service. Service-oriented architecture has standardization as a key policy in implementing web services for

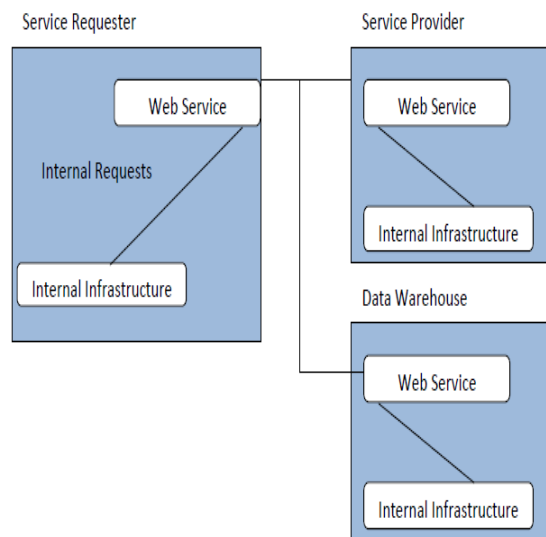


Figure 4. Web enabled systems for provider and requester.

straightforward integration of multiple incompatible applications⁶. Web services offer associate in disabled entry purpose for accessing native services and with homogenized parts that reduces the difficulties of integration. Web services were exposed through the interface. Homogenized parts were engineered to cut back the difficulties of integration. Service descriptions were created richer and additional elaborated, covering aspects on the far side the service interface.

The architecture of this paper is predicated on the Open cluster SOA Reference architecture as seen in Figure 5. The SOA reference architecture provides a baseline that shows the essential layers concerned during a typical SOA react. This diagram shows the various layers of the reference model and the way they match along to produce a regular service orienting response. The open cluster SOA metaphysics provides a taxonomy and metaphysics for SOA¹⁸

Figure 6 illustrates, however varied disparate information sources of educational information systems for disability schools connected via a service bus. Establishments and people will access services victimization Smartphone and different devices.

5. Implementation and Results

The implementation was done by building the N-tier database application that uses Java servlets and therefore the Java Database Connection (JDBC). The tiers incorporate

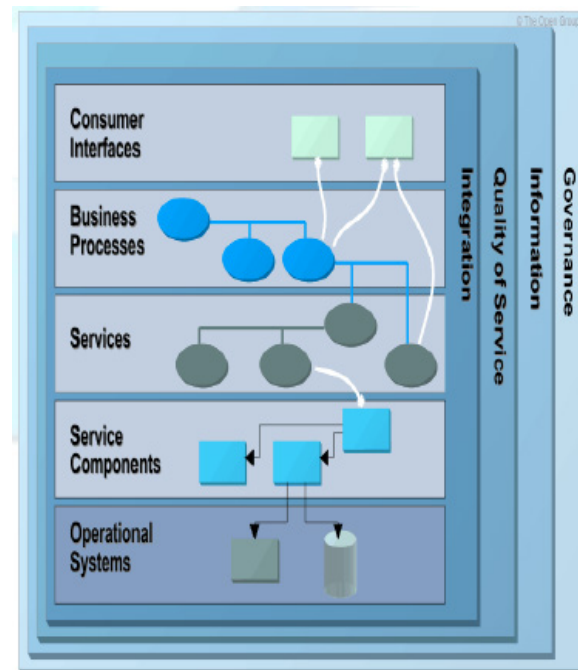


Figure 5. Open cluster SOA Reference Architecture.

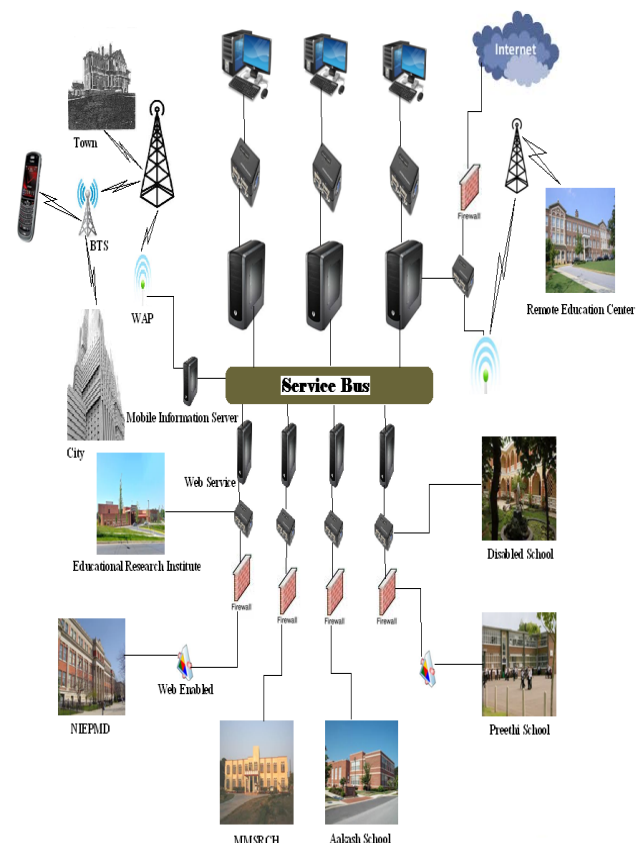


Figure 6. Integrated educational information Systems for disabled schools via a Service Bus.

consumer Tier or user interface, Middle Tier or business logic and knowledge Storage Tier. The logical tiers were enforced to correspond to a few varieties of hosts, namely: the browser or user interface Application to serve the consumer, Web Server or Application Server and therefore the Database Server (often Associate in school RDBMS or relative Database). Servlets was used for making hypertext mark-up language programme pages. The servlets JavaBeans were accountable for business logic and Java categories accounted for knowledge access. These objects used to be JDBC to question the database. The HttpServlet category provides ways, like doGet and doPost, for handling HTTP-specific services¹⁹.

The web consumer consists of 2 parts: Dynamic websites containing varieties of language like hypertext markup language and XML that are generated by web parts running within the web tier and a browser, which renders the pages received from the server. The applying consumers directly access enterprise beans running within the business tier. The consumers move with J2EE servers, facultative the J2EE platform to interoperate with inheritance systems, clients, and non-Java languages¹⁹.

The middle tier was developed with a web server running Java servlets that accesses a database associated with school returns a hypertext mark-up language page. Web browsers, and then communicate with the server by mistreatment HTTP. Java servlets requests through ways inheritable from the HttpServlet class: doGet(HttpServletRequest, HttpServletResponse) and doPost(HttpServletRequest, HttpServletResponse). The doGet() and doPost() ways have 2 arguments: An HttpServletRequest object and an HttpServletResponse object. The servlet communicates with the user by causing back an HTTP document, a graphics file, or different varieties of info supported by the web browser. It sends this information by line of work the ways of the HttpServletResponse category once the request is created and therefore the results square measure has been sent¹⁹.

The general steps taken in fixing the back-end database server square measure as follows:

- Importing the packages
- Registering the JDBC drivers
- Opening a relationship of the database
- Creating an announcement Object
- Executing a question and Returning a Results Set Object
- Processing the Result Set

- Closing the Result Set and Statement Objects

- Closing the association

At the tip web services were exposed through the interface and therefore the practicality performed by the internal systems and this makes the services ascertainable and accessible through the web in a controlled manner. Uniform parts were designed to scale back the difficulties of integration and standardized. The applying integration in atmosphere encompasses 3 layers: a data layer, integration layer, an application server layer. Each layer, in turn, holds technologies that function applying server integration building blocks. The applying server layer allows application integration projects to link not solely with existing enterprise systems but conjointly to the web. The applying integration platform adds integration layer on prime of the application server. To integrate applications at the data layer, the systems were enabled to consume and supply XML-based web services¹⁹.

6. Conclusion

With the proposed system, people as well as institutions for the disabled will be able to hunt for information from databases that are web enabled and their services registered at intervals the service repository that is ascertainable via the service bus. Reports on the gesture of learning will simply be copied from databases from schools supported according cases still as different statistics will still be obtained. Researchers may currently use information obtained from school databases easily and in time. Mistreatment SOA with web services makes it straightforward for heterogeneous database platforms to be integrated and inter-operate. Services created will be reused in multiple ways and conjointly new services and applications will be created quickly and used with a mix of the latest and previous services.

7. References

1. Hess RL, Rubin RS, West LA. Geographic information systems as a marketing information system technology. *Decision Support Systems*. 2004; 38(2):197–212.
2. Venkatesh J, et al. GIS in Indian retail industry - a deliberate tool. *IJCSITS*. 2012; 2(3):535–41.
3. Tun NN. Semantic enrichment in ontologies for matching. *AOW '06: Proceedings of the second Australasian workshop on Advances in ontologies*. 2006; 72.

4. Linthicum DS. Enterprise application integration. 1999. p. 6
5. Enterprise Application Integration & Service Oriented Architecture. 2012. Available from: <http://www.managementstudyguide.com/enterprise-application-integration-service-oriented-architecture.htm>
6. Kester QA, Gyankumah GN, Kayode AI. Using web services standards for dealing with complexities of multiple incompatible applications. *International Journal of Information Technology*. 2012; 4.
7. Paul SA. What is a Service Oriented Architecture. George Mason University; 2007.
8. Qusay MH. Service-Oriented Architecture (SOA) and Web Services: The Road to Enterprise Application Integration (EAI). 2005. Available from: <http://www.oracle.com/technetwork/articles/javase/soa-142870.html>
9. He H, Haas H, Orchard D. Web Services Architecture Usage Scenarios, W3C Working Group Note. 2002 Feb 11. Available from: <http://www.w3.org/TR/2004/NOTE-ws-arch-scenarios-20040211/>
10. Web Services Glossary, W3C. 2004. Available from: <http://www.w3.org/TR/2004/NOTE-ws-gloss-20040211>
11. Builder C, Bankes S, Nordin R. Command concepts: a theory derived from the practice of command and control. RAND Corporation; 1999.
12. Papazoglou MP, Georgakopoulos D. Service-oriented computing. *Communications of the ACM*. 2003; 46(10):24–49.
13. Ren M, Lyytinen K. Building enterprise architecture agility and sustenance with SOA. *Communications of the Association for Information Systems*. 2008; 22(1):75–86.
14. Schulte S, Repp N, Berbner R, Steinmetz R, Schaarschmidt R. Service-oriented architecture paradigm: major trend or hype for the german banking industry? *Proceedings of the 13th Americas Conference on Information Systems (AMCIS)*; 2007.
15. Teti F. Develop a service-oriented architecture methodology. *Database Advisor Magazine*. 2006. Available from: <http://websphereadvisor.com/doc/17991> (current 2007 Oct 15).
16. Kwon T, Zmud R. Unifying the fragmented models of information systems implementation. In: Boland RJ, Hirschheim R, editors. *Critical Issues in Information Systems Research*. New York: Wiley; 1987.
17. Haines M. The impact of service-oriented application development of software development methodology. *Proceedings of the 40th Annual Hawaii International Conference on System Sciences (HICSS)*; 2007.
18. Using TOGAF to Define & Govern SOAs. 2013. Available from: <http://pubs.opengroup.org/architecture/togaf9-doc/arch/chap22.html>
19. Kester Q-A. Using SOA with web services for an effective integration approach of Rural Banks and existing mobile communications infrastructure in Providing Mobile Money Services. *International Journal of Science Engineering and Technology Research*. 2013; 2(4):979–84.