



Effective Service Oriented Architecture for Interoperability of e - Services

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Abstract --- *Interoperability between e-government web services is an important as interoperating e-government services provides many benefits like efficiency improvement, transparency, accountability, and access, as well as coordination between services at lower cost. Its importance is not only to link up backend information systems but also to provide meaningful services to citizens. However, repeated failures to build working systems show that the task is not only difficult but also poorly understood. This is because due to the heterogeneities at data, hardware and operating system level should be resolved so that a single access point to government services via web can be provided without having to modify the existing functionalities of information systems. Using developed system, interoperability between two e-services has been established by constructing service oriented architecture to enable integration between heterogeneous systems so that the user will be able to access integrated government services through a single point even if these services are actually provided by different departments or authorities. The application designed here is banking system service used by two clients CARD system and Personal Information System.*

Keywords --- *Interoperability, Service Oriented Architecture*

I. INTRODUCTION

The concept of E-service (short for electronic service), represents one prominent application of utilizing the use of Information and communication technologies (ICTs) in different areas. E-services are defined as: "...deeds, efforts or performances whose delivery is mediated by information technology. Such e-service includes the service element of e-tailing, customer support, and service delivery". This definition reflects three main components- service provider, service receiver and the channels of service delivery (i.e., technology) [1]. For example, as concerned to public e-service, public agencies are the service provider and citizens as well as businesses are the service receiver. The channel of service delivery is the third requirement of e-service. Internet is the main channel of e-service delivery while other classic channels (e.g. telephone, call center, public kiosk, mobile phone, television) are also considered. Such an e-service is a public service mediated electronically through a user interface that is generally available. The concept e-service is used for a great variety of services. This should probably mean that there is some common service component in such services [2].

E-Government is defined as 'The employment of the Internet and the world-wide-web for delivering government information and services to the citizens. Essentially refers to 'The utilization of Information Technology (IT), Information and Communication Technologies (ICTs), and other web-based telecommunication technologies to improve and/or enhance on the efficiency and effectiveness of service delivery in the public sector [4]. Interoperability is the ability of a collection of communicating entities to (a) share specified information and (b) operate on that information according to an agreed operational semantics [6]. In order to ensure interoperability across the public sector, the e-Government Interoperability Framework (e-GIF) has laid down the Technical Policies covering four key areas:

- Interconnection
- Data Integration
- Content Management Metadata
- e-Services Access

The ultimate test of interoperability is the coherent exchange of information and services between systems [7]. This means that it should be possible to replace any component or product used within an interface with another of a similar specification while maintaining the functionality of the system. To be e-GIF compliant, a system must satisfy both requirements.

India has been harnessing the benefits provided by the Information & communication Technologies (ICT) to provide integrated governance, reach to the citizens faster, and provide efficient services and citizen empowerment through access to information. The aim is to redefine governance in the ICT age to provide SMART GOVERNANCE. Several significant initiatives have been taken at the Centre and the State level in this direction. The applications that

have been implemented are targeted towards providing G2B such as CARD, G2C such as e-seva and B2C services with emphasis on use of local language.

A number of issues, some old and some new have arisen in e-governance Application, for example:

- The project implementation is generally vendor driven.
- Lack of standardization (for example, similar projects are carried out by different state agencies using incompatible file formats and application standards).
- Reverse compatibility of application with legacy systems are missing in several projects.
- The IT infrastructures are procured before building the application or digitizing the data.
- Physical security is emphasized, whereas the Logical and application security is left to vendors in many cases.
- Lack of understanding by the departments, for the components of e-governance applications, which can be outsourced or can be carried out in-house [5].

Despite the success of the project, the e-governance initiative face several hindrances like delay in project implementation, spiraling cost, financial feasibility and financial sustainability along with technical bottlenecks and Integration with Government departments and states. To conclude, the current e-government practice in India is project-specific and implementation and integration differs from state to state and are not nation-wide.

II. RELATED WORK

E-Seva project has been based on single location for the citizens by allowing them to make payments for using Governmental utility services. Through this service common citizens can now avail these services by walking into one of the centre across the cities or using the Internet at their residence. Online payments have been facilitated by means of payment gateways for which the state government has already tied up with several banks. It is being used for the payment of water, electricity, phone bills, municipal taxes, and issuing of certificates for birth and death registration, passport applications and providing the transport department services. CARD (Computer-Aided Administration of Registration Department) project included the complete computerization of the land registration process in the state.

FRIEND project has been used to provide benefits of Information Technology to the day to day transactions of common man. It is a “Single Window Scheme” in which the consumer can pay for the utility services rendered to him by the various Government departments/ agencies, under a single roof. The Gyandoot project has been initiated in January 2000 by a committed group of civil servants in consultation with various gram panchayats in the Dhar district of Madhya Pradesh. Gyandoot is a low cost, self-sustainable, and community-owned rural Intranet system. These are managed by rural youth selected and trained from amongst the unemployed educated youth of the villages [13].

An illustrative list with details of some significant e-governance initiatives / projects implemented is given below. One of the key objectives under the e-government agenda in many countries is to achieve a one-stop government portal (Dias and Rafael, 2007). Also, India has announced development of an India portal under National E-governance Plan approved in 2006. The objective is to integrate and provide access to government services to the citizens (NeGP, 2007). The portals encapsulate the size and complexity of government, which for so long have been barriers to easy access of government services to citizens. It provides people with a single door (web interface) into government. It allows for self-service, whether the citizen is looking for information, check property assessments or pay a fee to use the local recycling center. The services offered in a one-stop government should be easily understandable for any citizen or business partner.

TABLE 1
EXISTING E-GOVERNMENT PROJECTS [13]

Project Name	End User / Beneficiaries	State Where Implemented
E - Seva (Electronic Seva)	Populace	Andhra Pradesh
CARD	Populace	Andhra Pradesh
FRIENDS	Populace	Kerala
Gyandoot	Rural People	Madhya Pradesh
LOK MITRA (Integrated Citizen Service Centre / e-Kiosks ICSC)	Populace	Rajasthan
Bhoomi	Rural People	Karnataka

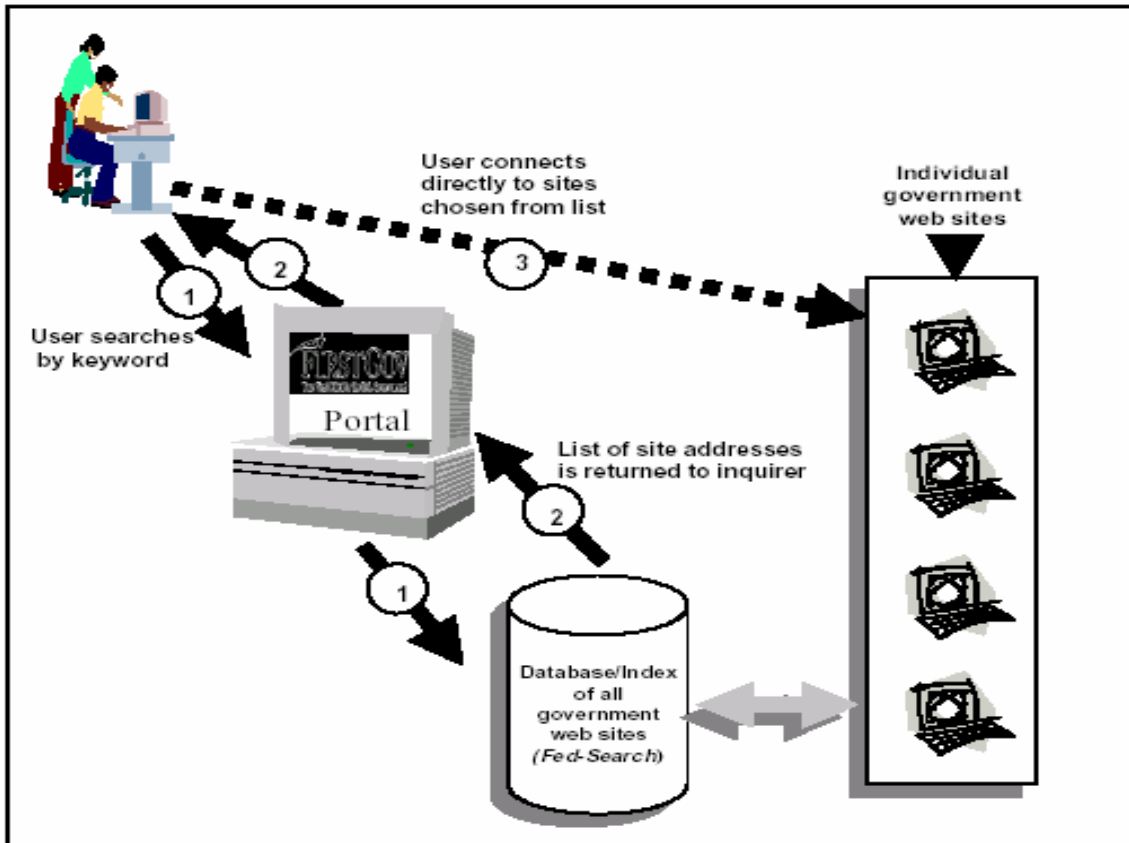


Figure 1. Typical First Gov.gov Search Process (McClure 2000)

One-stop government portal would require complete interoperability between all the departments of India both vertically and horizontally. Issues in developing such a portal may include: technical; organizational; legal; social; and political. The technical issue comprises the problems of integration and interoperability. As the level of e-government maturity rises the need for interoperability will increase [10].

A. *Challenges of Interoperability:*

Interoperability is essential for achieving one-stop government portal. The following challenges arise:

1. *Technical Interoperability:*

Technical Interoperability covers the technical issues of computer systems. It includes also issues on platforms and frameworks. Frameworks are complex and many times provide conceptual differences to working approaches; e.g. understanding and relying on classes in an object-oriented system. In addition, at times frameworks are duplicative and contradicting with multiple levels.

2. *Organizational Interoperability:*

Organizational interoperability is concerned with organizational processes and cooperation of agencies. The processes are not enough flexible and adaptive to be integrated and be interoperable. Here the requirements of decentralized agencies have to meet the central needs on coordination. The top level management plays a vital role. Leadership and strategic direction of management are cited as the most important factors for corporate adoption of Web technology.

3. *Semantic Interoperability:*

Interoperability or integration efforts are about making information from one system syntactically and semantically accessible to another system. Syntax problems involve format and structure. Semantics being an important technical issue is one that is almost invisible outside technical circles. Such differences normally make it more difficult to make systems work together. The differences can be minimized if systems are designed using agreed data formats. Semantics relate to the understanding and integrity of the information.

Semantic interoperability includes both the data interpretation, by means of XML schemas, and the knowledge representation and exploitation, by means of ontologies and agents. Semantic interoperability is an enterprise capability derived from the application of special technologies that infer, relate, interpret, and classify the implicit meanings of digital content, which in turn drive business process, enterprise knowledge, business rules and software application interoperability.

III. SYSTEM IMPLEMENTATION

A. Technologies for Interoperability

There are various technologies that help in achieving the objectives of the one-stop government portal by solving the problem of interoperability. Key technologies are discussed below:

➤ **Service-oriented Architecture (SOA):**

SOA is an architectural style whose goal is to achieve loose coupling among interacting software agents. A service is a unit of work done by a service provider to achieve desired end results for a service consumer. Both provider and consumer roles are played by software agents on behalf of their owners. SOA is mainly focused on the problems of interoperability. It provides new systems and wrapping the existing systems so that they can work together.

Service Oriented Environment is based on the following key principals:

1. SOA is not just architecture of services seen from a technology perspective, but the policies, practices, and frameworks by which we ensure the right services are provided and consumed.
2. With SOA it is critical to implement processes that ensure that there are at least two different and separate processes—for provider and consumer.
3. Rather than leaving developers to discover individual services and put them into context, the Business Service Bus is instead their starting point that guides them to a coherent set that has been assembled for their domain.
4. Organizations are now turning to SOA based on Web Service and semantic technologies to make existing applications, components, and data available for reuse and to simplify the consumption of these reusable assets [11].

➤ **Web Services (WS)**

The W3C Web Services Architecture Working Group defines a Web service as “a software application identified by an URI, whose interfaces and bindings are capable of being defined, described and discovered as XML artifacts. A web service supports direct interactions with other software agents using XML-based messages exchanged via Internet-based protocols”. The Semantic Web infrastructure of ontology services, metadata annotators, reasoning engines and so on will be delivered as Web services. In turn Web services need semantic-driven descriptions for discovery, negotiation and composition. Web Services have entered the research agendas of many research communities and are being proposed as the means for remote interoperable access of components and software systems (Bell and Bussler, 2006).

B. Proposed System

A service interacts with other services through a message-based communications model. Common communications models include:

1. Web services using Simple Object Access Protocol (SOAP) and Web Services Description Language (WSDL).
2. Message-oriented middleware (MOM) such as IBM WebSphere MQ.
3. Publish-subscribe system such as Java Messaging Service (JMS).

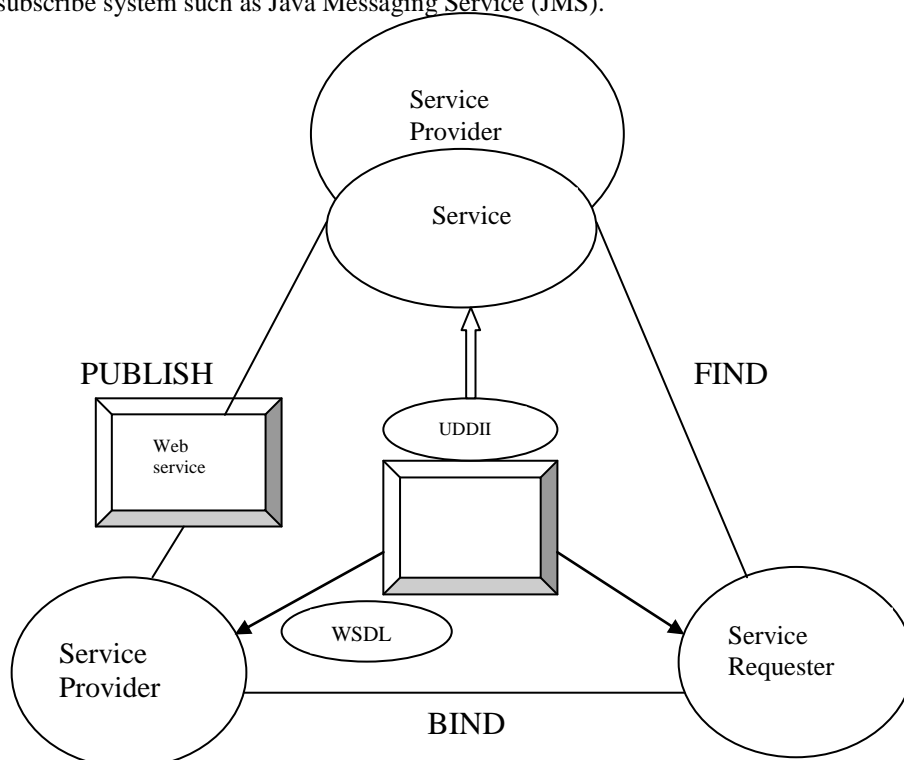


Figure 2. Service oriented Architecture [16]

SOA based on the web service technologies is a software architecture that focuses specifically on the problems of interoperability. It is an approach to developing new systems and wrapping existing systems in such a way that these systems can work together.

The most common (but not only) form of service-oriented architecture is that of web services, in which all of the following apply [23]:

- 1) Service interfaces are described using Web Services Description Language (WSDL),
- 2) Payload is transmitted using Simple Object Access Protocol (SOAP) over Hypertext Transfer Protocol (HTTP),
- 3) Universal Description, Discovery and Integration (UDDI) is used as the directory service.

Other than the above, the following three are required for work flow coordination,

- Web service transactions for corrodng results
- Web service security for identifying relate issues
- Web service reliable messaging

C. Decision Making

Information Required for Decision-Making:

1. Requirements from potential service users. It is important to know what applications would use the services and how they would be used. For example, what is the information expected to be exchanged? In what format?
2. Technical characteristics of the target environment. There are many technical underpinnings that must be understood, especially in proprietary environments, such as bindings, messaging technologies, communication protocols, service description languages, and service discovery mechanisms.
3. The architecture of the legacy system. It is critical to identify architectural elements that could be problematic in the target environment or that could increase the difficulty of the effort, such as dependencies on commercial products or specific operating systems, or poor separation of concerns.
4. The effort involved in writing the service interface. Even if it is expected that the legacy system will remain intact, there must be code that receives the request, translates it into calls to the legacy systems, and produces a response.
5. The effort involved in the translation of data types. Service interfaces usually prescribe a set of data types that can be transmitted in messages. For newer legacy systems and basic data types, this can be a small effort, especially if messages are XML documents. But, in the case of complex data types such as audio, video, and graphics, or in legacy programming languages that do not provide capabilities for building XML documents, this effort can be non-trivial.
6. The effort required to describe the services. In an SOA, services advertise their capabilities for other systems to use, and systems find the services they need by using the discovery mechanism prescribed by the target environment. The more detailed and precise the description of the service, the greater the chances it will be discovered and used appropriately.
7. The effort involved in writing service initialization code and operational procedures. Code that is deployed as services will need to initialize itself, announce its availability, and be ready to take requests. This will require the establishment of operational procedures for the deployment of services.
8. Estimates of cost, difficulty, and risk. The information gathered in the previous points should provide for realistic estimates [17].

IV. RESULTS AND OBSERVATIONS

In this paper, interoperability is established between the web services by constructing service oriented architecture. The first web service contains the personal information of citizens of a particular geographical location, like aadhar card details. The second web service contains the land registrations details of the citizens. In order to provide interoperability between these two services, service oriented architecture is constructed by means of an interface called banking system. Whenever a citizen approaches the bank for any loan transaction, the banking system validates the citizen details through the provided web services. If the citizen details are appropriate, the banking system will approve the loan otherwise the loan request will be rejected.

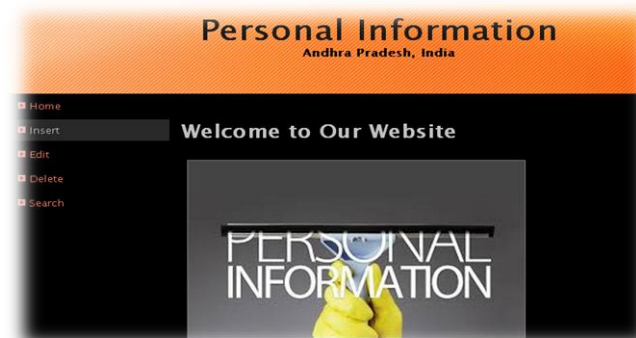


Figure 3: Personal Information System

Figure 3 shows the home page of personal information web service. In this we have insert, delete, edit and search options. Insert, edit and delete operations are performed only by the authenticated user. Search option is used by any user. If the insert option is selected, a login form will be displayed. By entering the valid username and password, a data entry form will be displayed.

Figure 4. Personal Data Entry Form

Figure 4 contains the personnel information details like name, gender, address, photo, aadhar id. After entering all the details, click on register button.

sid	fullname	gender	dob	dno	strname	location	city	mobile	photo	aadharid	email
3	Adhikari Sujatha	Female	16-1-1973	2-14	kasi	near bank	vaddeswaram	7895623456	0x4465736572742E6A7067	698923654208	asd@gmail.com
4	Lenin Babu	Male	12-3-1970	2-16	jammu	near temple	vaddeswaram	4567891234	0x54756C6970732E6A7067	936210542826	hgh@gmail.com
5	Rama Krishna	Male	22-9-1981	2-30	ijghjghgh	hghghgh	vijayawada	4567891234	0x469F616C512E6A7067	836489936053	ghghgh@gmail.com
6	Haseena Shaik	Female	24-12-1980	2-32(1)	hghfgh	egdbngfh	dgdfghgh	1472383691	0x4465736572742E6A7067	447046924047	fghgh@gmail.com
7	Raji shak	Male	28-12-1988	2-32(1)	hghghgh	ghfghgh	khjghgh	9632581471	0x4368727973616E7468656075602E6A7067	297865339778	bmvh@yahoo.com
8	Shak Bajji	Female	9-2-1972	2-56	abdfgh	dfghgh	dfghgh	2583691473	0x44656C6C79666973682E6A7067	96695458242	hghgh@gmail.com
9	Nagesaram	Male	30-5-1989	2-30	hghghgh	fghgh	ghfgh	1230456987	0x48796472616E576561732E6A7067	394586961742	hghgh@gmail.com
10	Pandi Nagababu	Male	27-10-1963	2-46	hghgh	veeruvay	khjgh	1203654789	0x4C69676874686F7573652E6A7067	23842284797	hghgh@gmail.com
11	Bhargya Lakshmi	Female	9-6-1993	2-50	fghgh	ghfghgh	ghfghgh	4569632381	0x469F616C512E6A7067	985921938531	pkjgh@gmail.com
12	Kishore Babu	Male	31-10-1961	2-52	hghgh	fghghgh	hghghgh	8521473692	0x4368727973616E7468656075602E6A7067	546946966952	hghgh@gmail.com
13	Vijayalakshmi Uyyuru	Female	18-1-1980	2-56	ghhhuukhu	loukkg	fghghgh	6554871230	0x50556E5775696E732E6A7067	635880207542	oukgh@gmail.com
14	Padma Potthuluri	Female	1-12-1954	2-57(1)	oivuyouu	dhfgh	oukghgh	9874563210	0x4465736572742E6A7067	290234235102	hghgh@gmail.com
15	srinivasa Rao	Male	21-10-1970	2-56	uyughgh	hghghgh	ghfghgh	2587945612	0x4465736572742E6A7067	70544495336	hghgh@gmail.com
17	Ravi Babu	Male	21-8-1993	2-57(3)	ghghgh	ghfghgh	fghghgh	4569874569	0x50556E5775696E732E6A7067	577701707106	ououu@gmail.com
18	Mastani Shaik	Female	2-3-1961	2-62	khjgh	ghfghgh	dhfghgh	9874563210	0x44656C6C79666973682E6A7067	704063099015	ouh@gmail.com
19	Janna Shaik	Female	18-4-1976	2-68	khjgh	rttau	dfghgh	6547891230	0x48796472616E576561732E6A7067	617439399015	ououu@gmail.com
20	Rajya Sanyad	Female	29-4-1982	2-64	hghgh	ghfghgh	fghghgh	3682581470	0x48796472616E576561732E6A7067	54243130960	pkhgh@gmail.com
21	Satyad Nagur	Male	7-4-1995	2-64(8)	ghfghgh	hghghgh	hghghgh	7418520369	0x4C69676874686F7573652E6A7067	28497662647	ououu@gmail.com
22	Ashabi Shek	Female	15-6-1973	2-66	ghghgh	ghfghgh	rdhghgh	3658974120	0x54756C6970732E6A7067	26080271682	ouuy@gmail.com
23	Nagur Shaik	Male	22-4-1969	2-65	ough	fish	ghfghgh	9541236874	0x50556E5775696E732E6A7067	807677509806	ghghgh@gmail.com
24	Nagur Sada Shaik	Male	15-10-1976	2-68(6)	hghghgh	dhfghgh	xhghghgh	98745621365	0x4368727973616E7468656075602E6A7067	709223825727	ouyghgh@gmail.com
25	Mastani Shaik	Female	28-4-1952	2-69	khjghgh	hghghgh	hghghgh	2587456321	0x54756C6970732E6A7067	830288573622	Fhghgh@gmail.com
26	Mouali Shaik	Male	28-3-1975	2-69(1)	khjgh	ghfghgh	ghfghgh	6542236589	0x48796472616E576561732E6A7067	286476090486	fghghgh@gmail.com
27	haseena Shaik	Female	15-10-1981	2-66	ghghgh	ghfghgh	ghfghgh	8700567773	0x50556E5775696E732E6A7067	617676707546	ououu@gmail.com

Figure 5 Mysql database

Figure 5 shows the mysql database, which stores the personal information details that are entered in the personal information system service.

Figure 6 Admin form in Card service

Figure 6 shows the login page for the insert option of the second service. If the admin enter correct user name and password then the data entry form for land registration process is displayed otherwise an authenticated error message will be displayed. The data entry form contains the details of a land of a particular citizen like survey no, land area, market value and aadhar no.

EDIT	SURNO	TYPE	MARVAL	LANMAR	ADHARID	NAME	ADDR	MOB	ID	LANDAREA
	61/2	Building	500000	near petrol bunk	936210542826	Lenin Babu	hjjghh	7889456122	9	1120
	1-152	Building	2500000	nvjhghth	655880207542	Vijayalakshmi Uyyuru	jhghghk	4567889123	12	300
	36/3	Commercial	450000	jhghk	612265029569	Yenumala S Brahmam	hghghk	9703512615	13	226
	99/5	Building	900000	jhghkug	200806663567	Subba Rao M T V	jhghkhiu	9705217228	14	1500
	53/1	Agricultural Land	5236900	kgfkhj	541007959364	srinivas M V	fjghghk	9885887125	17	800
	36/56	Agricultural Land	300000	kjhghghj	282701803764	Srinivasa Rao G	jhghghk	9032591532	15	1.5
	12/12	Agricultural Land	200000	Near BankofIndia.klanka	608932654528	Adhikari Sujatha	vijayawada	8989898989	8	2000
	33/4	Commercial	1000000	near temple	394586961742	Nagasairam	gdghfjghlthgdjh	4569321478	10	150
	99/6	Agricultural Land	450000	near hill	966954892424	Shaik Bajibi	hgdfhjghk	1236547890	11	1000
	63/5	Building	862300	jhghkug	848005464320	Sambasiva Rao A	fjghghk	8143240456	16	220
	12/14	Commercial	782300	jhghghghk	688247968266	Nageswara Rao S	hgghghk	9989533752	18	200

Figure 7 Oracle Database for card service

Figure 7 shows the data entered in the card service. It is stored in oracle database.

BANK SYSTEM
Welcome to Loan Issuing System

HOME
APPLICATION
ABOUTUS

Enter Name:
 Enter Aadhaar Id:
 Enter Survey No:
 Enter Loan Amount:

Figure 8 Application form in Banking system

BANK SYSTEM
Welcome to Loan Issuing System

HOME
APPLICATION
ABOUTUS

Enter Name:
 Enter Aadhaar Id:
 Enter Survey No:
 Enter Loan Amount:

Aaahar and Survey Details are Valid:::

Loan Sanctioned, come to the bank with original documents and for paper work

Figure 9 Loan Sanction message

V. CONCLUSION

Service oriented architecture has emerged as the computing paradigm for developing large scale, distributed application by integrating existing pieces of software exposed as services. Most e-governance services employ a variety of disparate applications that store and exchange data in dissimilar ways and therefore cannot 'talk' to one another productively. Given this situation, in this system work, interoperability is provided as a cost – effective solution for uniting information distributed between different web services with heterogeneous databases. Furthermore, this system can support the convergence and reusability of the three categories of e-services (Web, P2P, Grid) by providing appropriate models and platforms.

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