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-governance 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>
<thead>
<tr>
<th>Project Name</th>
<th>End User / Beneficiaries</th>
<th>State Where Implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>E - Seva (Electronic Seva)</td>
<td>Populace</td>
<td>Andhra Pradesh</td>
</tr>
<tr>
<td>CARD</td>
<td>Populace</td>
<td>Andhra Pradesh</td>
</tr>
<tr>
<td>FRIENDS</td>
<td>Populace</td>
<td>Kerala</td>
</tr>
<tr>
<td>Gyandoot</td>
<td>Rural People</td>
<td>Madhya Pradesh</td>
</tr>
<tr>
<td>LOK MITRA (Integrated Citizen Service Centre / e-Kiosks ICSC)</td>
<td>Populace</td>
<td>Rajasthan</td>
</tr>
<tr>
<td>Bhoomi</td>
<td>Rural People</td>
<td>Karnataka</td>
</tr>
</tbody>
</table>
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).

![Service oriented Architecture](image-url)
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 corroborating 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.

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 shows the login page for the insert option of the second service. If the admin enters correct username 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.

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

Figure 8 shows the Application form in the Banking system.

Figure 9 shows the 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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