Selected Aspects of Interoperability in One-stop Government Portal of India

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ABSTRACT

E-governance based services are largely routed through government portals that bring in some inherent advantage one which is one stop services to citizens, business and government's own employees. This would mean all these users will be able to access integrated public services through a single point even if these services are actually provided by different departments or authorities. This, however is very demanding proposition since it would require achieving integration of processes, data and technology at the backend. This would also decide the level of e-government maturity. The higher the level of e-government maturity in a country, the easier it would be to achieve a one-stop government portal. Integration and Interoperability (vertical and horizontal) are two vital technical issues of the one-stop portal. This paper highlights selected aspects of interoperability in the one-stop government portal for India.

Keywords: Integration, Interoperability, e-government

1. Introduction

"Electronic Government" has become one of the most important issues in the transformation of the public sector in many countries (Sahu, 2005). As a first step, information about services is published on a web site and citizens can interact with the site to download application forms for a variety of services. The next stage involves the use of ICT (Information and Communication Technology) in the actual delivery of service such as filing a tax return, renewing a license, etc. More sophisticated applications include processing on-line payments (Bhatnagar, 2003). Many developed (USA, UK etc.) and developing (Malaysia etc.) countries are moving towards e-governance.

India is also adopting the e-government agenda:

- The Government approved the National e-Governance Plan (NeGP), comprising of 27 Mission Mode Projects (MMPs) and 10 components, on May 18, 2006 (Ministry of Communication and Information Technology, Government of India).
- The National Action Plan on e-governance has an ambitious outlay of over Rs.23,000 Crores involving public and private investments over the next four years (Ministry of Communication and Information Technology, 2006)).
- Eleventh Five Year Plan (2007 – 2012): Over the next five years, domestic spending on outsourced IT services is projected to more than double, from Rs. 103 billion in 2004 to over Rs. 238 billion in 2009 (Planning Commission, Government of India, 2007).

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The evolution of e-government has been characterized (Hiller & Bélanger, 2001; Layne & Lee, 2001; UN & ASPA, 2002) by providing stages of development: catalogue; transaction; integration (vertical and horizontal). The stages of development outline the structural transformations of governments as they progress toward electronically-enabled government and how the Internet-based government models become amalgamated with traditional public administration, implying fundamental changes in the form of government. In order to understand how systems of rules affect the evolution of e-government, it is necessary first to comprehend the way in which the evolutionary approach examines e-government stages: from developing a Web page to integrating government systems behind the Web interface. In this view, governments evolve from one stage to the other (Schelin, 2003). Each of the stages represents different levels of technological sophistication, citizen orientation, and administrative change (Holden et. al, 2003; Moon, 2002).

In Government there are multiple diverse data sources: Unstructured data that lies in the form of rules, procedures and concepts, guidelines etc; Data referring to facts and figures treated as operational idea; and Structured data which is derived from information that can be stored in computerized form database and further be used for decision making (Gupta et. al, 2005). Technology is the key challenge for e-government solution development as Government's concern is to maintain the data, develop integral, scalable and robust e-government solutions (Gupta et al. 2005). Re-usability of the some standard applications is required to make it cost effective. Information Technology support covers the issues related to the system security, technological components, network technology, support system, Application Development Platform and overall standardization for integration, scalability and re-usability.

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. The following countries are working towards one-stop web portal for their respective Governments:

- The Government of Singapore: (http://www.gov.sg/) a portal where citizens can access government departments, get information and carry out transactions.
- The Government of US: (FirstGov.gov) is intended to serve as a portal to all of the federal government's publicly available, on-line information and services and links the government's more than 20,000 web sites and 500 millions of web pages (See Figure 1)
- United Kingdom: (http://www.e-envoy.gov.uk) has launched e-Envoy that covers all public services available online by 2005 with the objective of setting "standards of service" and also involve the citizen in the decision making process.
- The Government of Austria: initiative towards an e-Government portal (www.help.gv.at) considers life-events in design where the services offered in a one-stop government should be easily understandable for any citizen or business partner.
- The Dutch portal: (www.government.nl) allows citizens to customize the site by postal code; this enables local and regional information to be displayed upon request.

There are projects going on in India on integrating the government services at national level, state level as well as local level (Bhatnagar et. al, 2007). At national level: MCA 21, Income Tax online and Customs on-line are working on providing a one-stop portal for their respective departments. The current objective

of these projects is to integrate their departments vertically. At state level (IIM-A, 2007): Property registration (CARD, KAVERI, SARITA); Bill payment (eSeva: One stop shop for many services in Andhra Pradesh have been operational for three years); Land records (BHOOMI: Karnataka); eProcurement (Online tendering in Andhra Pradesh); SmartGov (AP); Khajane (Computerization of treasuries in Karnataka). At local level: Municipality (Ahemdabad, Vijyawada) - 'One Stop Civic Shop' for availing various civic services in the Municipal Corporation premises; Lokvani (Sitapur) - Service Oriented e-Governance system which attempts to provide efficient and responsive online services to the common people and seeks to increase transparency and accountability in Government procedures (Ministry of IT) ; Rural Telecenters: e-Chaupal, Akshaya (district wide e-literacy project of Kerala Government), n-Logue, Drishtee.

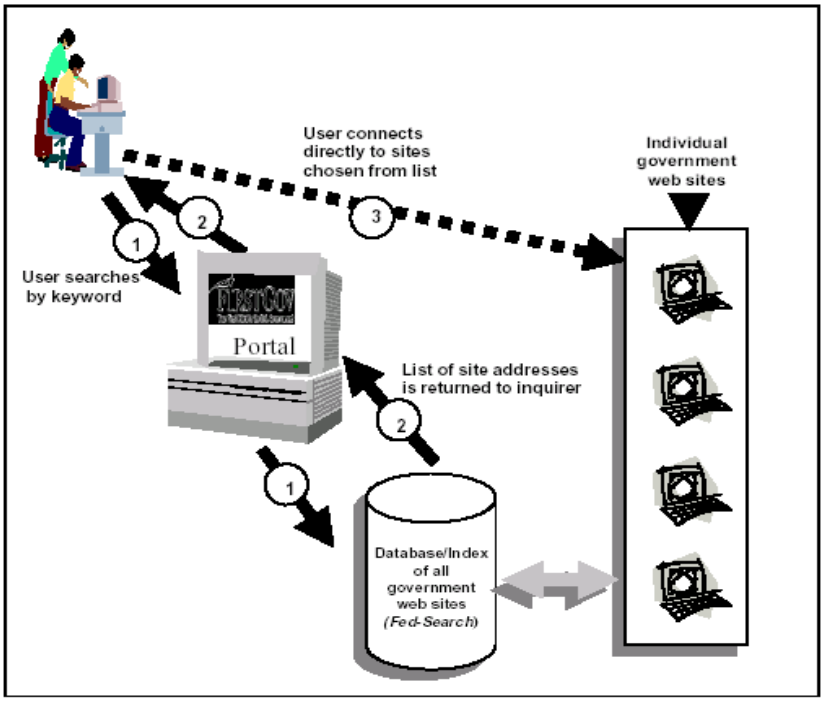

Figure 1: Typical FirstGov.govSearch Process (McClure 2000)

However these projects are not specifically planned to get integrated for one-stop portal. 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. This paper discusses the technical issues of interoperability in India.

The paper is organized as follows: Section 2 discusses one-stop government portal that includes its definition and technologies to achieve it: Integration and Interoperability. Section 3 briefly describes interoperability and its frameworks developed globally (including India). The key technologies for interoperability are discussed in Section 4 Also this section gives a review on the work done globally on these technologies. Section 5 states the various challenges of interoperability with a focus on the semantic interoperability. Finally, concluding remarks are stated in Section 6.

2. Issues of One-stop Government Portal

Many definitions of one-stop government have been proposed over the last few years (See Table 1)

Table 1: Definitions of One-stop Government

Author and Year	Definition: One-stop Government
Hangen and Kubicek (2000)	One-stop government refers to the integration of public services from a customer's point of view
Wimmer (2002)	One-stop Government refers to a single point of access to electronic services and information offered by different public authorities where all public authorities are interconnected and that the citizen is able to access public services by a single point even if these services are provided by different public authorities or private service providers. It further requires that the citizen is able to access these services in a well structured and well understandable manner meeting his/her perspectives and needs.
Dias and Rafael (2007)	The citizens, businesses and other authorities have 24 hours access to integrated public services through a single point even if these services are actually provided by different departments or authorities from their home, their offices or even on the move.

Wimmer's definition not only gives the meaning of one-stop but also explains its benefits for the users. One-stop government portal needs automatic data interchange at a very large scale and therefore, usually requires great effort in achieving interoperability across processes and data. It requires addressing two main issues i.e. integration and interoperability. To achieve one-stop government portal it is very important to have both horizontal and vertical integration. And often it is found that Government portals are still far behind the stages of either of their integration steps. It is therefore, essential to understand means and ways to be able to identify the various steps involved in achieving these integrations (Figure 2).

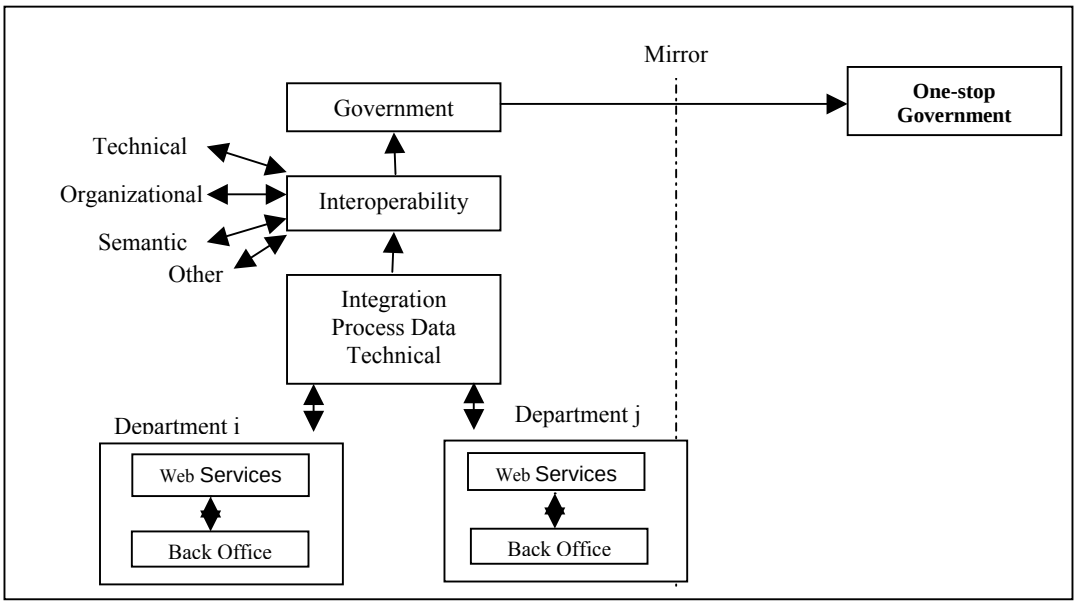

Figure 2: Towards one-stop Government Portal

Integration

In general, the term integration is an act or instance of combining an organization, place of business, school etc. into an integral whole (Oxford dictionary). Hence, in the government's perspective integration is a process of making two departments or organizations as a whole.

Types of Integration (IBM, 2004):

- *Information Connectivity and Integration* (ICI) is the coupling of heterogeneous application information and data. Connectivity between applications is a fundamental starting point for Information Integration solutions. As connectivity configurations and topologies grow in complexity, additional considerations involve the management of information and data delivery from one application to another (for example, routing rules and data transformation). ICI provides routing and data integration functionality. It routes its information between endpoints, leaving decisions on what actions to take next to the senders and receivers. ICI focuses on *where* data is located and handles data normalization.
- *Process Integration* (PI) is the implementation of internal and external business processes in a way that fully utilizes IT systems to add efficiency and flexibility within an enterprise. Process Integration includes functions required for traditional business process management solutions. Typically, PI solutions begin with a focus on processes internal to the enterprise and evolve to include processes that fully integrate external partners. This external integration requires functions that support business-to-business interaction management. PI focuses on *what* data is needed and *how* that data is used.

Interoperability

IEEE (1990) defines interoperability as the ability of two or more systems or components to exchange information and to use the information that has been exchanged. Interoperation is often defined as a technical problem, to be addressed in terms of information, communications and computing standards, protocols, and middleware architectures (EURIM, 2002). But the technical problem of linking systems together is accompanied by an administrative problem, which is at least as important. When government requires computer systems to interoperate it must commit itself to constructing – and maintaining - an appropriate administrative environment for those systems.

3. Interoperability in One-stop Government Portal

Interoperability is the ability of ICT systems to work together. According to the e-GIF (Government Interoperability Framework) (Alexander, 2003) if the coherent exchange of information and services between systems is achieved then the systems can be regarded as truly interoperable. (Note that to be e-GIF compliant the system must not only satisfy this interoperability test, but also "it must be possible for any component or product used within an interface to be replaced with another of similar specification and the functionality still be maintained"). Further interoperability facilitates the re-use of the information (resources) once these levels of integrations are achieved.

The benefits of interoperability become clear in the following settings (Traunmüller, 2005):

- Bundling different services to the same customer.
- Need of an agency to get data from others in order to produce a service.
- Data interchange between geographical dispersed agencies.
- Exchanging metadata such as directories and descriptions.
- In particular services as identity management.

When dealing with pure technology, the interoperability concept may be defined according to the software discipline, which understands interoperability to be the "ability to exchange functionality and interpretable

data between to software entities." (Mowbray & Zahavi, 1995) Issues covered by this concept are usually grouped in two fields:

- Application interoperability, which includes the communications issues, both at the telecommunications network access level and at the network interconnection level; and the distributed applications issues, regarding the remote procedure call/method invocation mechanisms and the public interface exportation/binding.
- Semantic interoperability: discussed in next section.

There have been initiatives carried out by e-government agencies in the interoperability arena, which have produced the corresponding interoperability frameworks in different parts of the world (Guijarro, 2007). Though this concept of semantic interoperability for e-government is new but it's emerging very fast. Table 2 summarizes main features of the e-government initiatives.

Table 2: Interoperability Frameworks Developed Globally

Country	Interoperability framework	Agency	Year of release	Objective	Remarks
UK	e-GIF (E-government Interoperability Framework)	eGU (e-government unit)	2005	interconnectivity, data integration, e-services access and content management metadata	Semantic interoperability is not provided
France	CCI (Le Cadre Commun d'Inter- operabilite)	ADAE	2003	enabling multi-agency electronic service delivery	Data integration and semantic interoperability is not provided
Germany	SAGA (Standards and Architectures for e-government Applications)	KDSt	2003	orientation aid for decision-makers in the e-government teams	Data integration and semantic interoperability is not provided
Denmark	DIF (Danish e- government Interoperability Framework)	ITST	2005	guideline to public agencies as they develop IT plans and projects	Data integration and semantic interoperability is not provided
European Union	IDABC AG (Interoperable Delivery of European e-government Services to public Administrations, Business and Citizens)	IDABC	2004	supporting tool for the decision making	Semantic interoperability is not provided
USA	EAG (E-government Enterprise Architecture Guidance)	CIOC	2002	guiding the e-government projects across the federal government	Interconnectivity and semantic interoperability is not applied
Malaysia	MyGIF (Malaysian Government Interoperability Framework)		2003	Interconnection, data integration, information access, Security and metadata	Semantic interoperability is not provided
Hong Kong	(HKSARG) Hong Kong Special Administrative Region	IFCG	2005	Data integration, security	Semantic interoperability is not provided
Sri Lanka	LIFe	ICTA	2006	Data integration, metadata,	Semantic interoperability is not provided

We can see in Table 2 that in the entire above interoperability frameworks there are various areas for instance, interconnection, data integration, content management metadata, telecommunication network access, workflow management, group working, security, document archiving, and so on are covered but none of the frameworks provide semantic interoperability.

4. 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.

Service Oriented Environment is based on the following key principals:

- 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.
- With SOA it is critical to implement processes that ensure that there are at least two different and separate processes—for provider and consumer.
- 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.

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.

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).

The encountered problems with development of Web Services are:

- Its ontology building in itself is *time consuming*.
- The *dynamic nature* of the field. The exponential rise in the number of bioinformatics Web services over the past year required a further two months effort to maintain and extend the ontology.
- *Lack of guidelines* on how to build the domain specific ontology, or indeed how to relate it to upper level ontologies.
- Differing interpretation of the myriad of standards – SOAP, WSDL, UDDI, XML Schema etc.; and how they relate

Numerous e-government solutions in European countries are widely supported by Web Services and ontologies as a way for agencies, other associations, businesses and citizens to make queries and discover

the information available in their systems (Bradier, 2005; e-Government Unit, 2005). Efforts such as the (Terregov project, 2005) adopt the principles of a SOA based on interoperable components with dynamic support for finding services. The idea is strengthened by the fact that information, services and administrations are spread over several information systems. The architecture contains a set of collaborative tools for e-government Web Services that are semantically enriched. Another significant effort is the Ontogov—Ontology-enabled e-government service configuration project (ONTOGOV, 2006) that aims to develop, test and validate a semantically enriched (ontology-enabled) platform that will facilitate the consistent composition, re-configuration and evolution of e-government services.

Although SOA and Web Services go a long way towards providing interoperability in distributed, heterogeneous environments, managing semantic differences in such environments remains a challenge (Votisa et. al., 2006).

5. Challenges of Interoperability

Interoperability is essential for achieving one-stop government portal. In order to apply Interoperability to the Government portal the following challenges arise:

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.

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.

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. What it boils down to is that the meaning of apparently identical terms can differ in significant ways between systems. 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 (Guijarro, 2006).

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 (Pollock and Hodgson, 2004). According to IDABC, Semantic interoperability is concerned with ensuring that the precise meaning of exchanged information is understandable by any other application that was not initially developed for this purpose. Semantic interoperability enables systems to combine received information with other information resources and to process it in a meaningful manner. Semantic interoperability is therefore a prerequisite for the front-end multilingual delivery of services to the user.

Let us take an example where the same phrase can give different results from different departments:

A farmer needs to irrigate his land due to unexpected monsoon. For this he requires a tank of water but he does not know the amount of water required and therefore wants to know the amount of water and hence, the size of the tank. He enters the portal of Govt. of India (where all the departments are integrated) and searches for "size of a <tank> to irrigate five acres of land of sugarcane <plants> for three months". Though it's clear that the question is asked to the department of agriculture but the word tank itself has different meanings e.g. water tank, army tank or oil tank. As the department not being semantically interoperable even though being integrated can give the result "size of the army tank to irrigate five acres of land of sugarcane <plants> for three months is…". This can mislead the farmer.

As we can see in the above example the same phrase can be interpreted differently thus generating confusion for the potential users. Hence, here the key challenge is to be able to understand the context and attaching a meaning to it so that the users get the appropriate results.

6. Concluding Remarks

This paper is an attempt to elaborate the selected aspects of interoperability related to the one-stop government portal for India. One-stop Government portal demands integration and interoperability. Though various technologies like SOA and web services help in achieving interoperability, yet there are several issues such as technology; organisation; semantic; legal and political matters in which the researchers are facing challenges and that need to be solved over the coming years.

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