# Semantic Web Framework for Improved E-Governance

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***Abstract* - Semantic Interoperability community of Practice (SICoP,2005) under the leadership of Brand Niemann was established for the purpose of achieving semantic Interoperability and semantic data integration in the government sector. The researches on these areas are at an early stage. The implementation of regional based web services semantically enriched and the use of ontologies to semantically enable web service and structuring knowledge are the critical technical issues. An important challenge faced by the e-government is the development of systems that can easily be integrated and interoperated to provide infinite services to citizens. Recently semantic web technologies based on ontology have seemed to provide solutions to these problems. This papers presents a literature review of the works going on the semantic web based e-governance.**

***Keywords* - *E-governance, interoperability, semantic web, ontology, Resource Description Framework, OWL, Semantic Web Services***

## I. INTRODUCTION

For some recent years, e-government has been one of the most active areas of Semantic Web development. A lot of researches are going on the Semantic Web technologies based ontology in e-government. They show the use of various ontology models in e-government researches and projects to describe and specify e-government services, aiming at their semantic integration and interoperability. A variety of e-Governance projects have demonstrated that improved access to information and services can result in economic and social development opportunities, facilitate participation and communication in policy and decision-making processes, and help to empower the weakest groups.

## II. E-GOVERNANCE

E-governance is the application of Information and Communication Technology (ICT) for delivering government services, exchange of information communication transactions, integration of various stand alone systems and services between government-to-citizens, government-to-business and government-to-government.

The impact of e-governance is a better government which is more trustworthy and more reliable, secure as it offers a variety of advantages such as higher quality services, greater engagements with citizens, greater collaboration between agencies, high productivity and financial benefits for all. The user can interact government through internet and mobile devices.

The delivery of e-government services needs some requirement inherent in the mission of the government itself.

Several project, vendor and ICT-related challenges in India must also be addressed, with the key aspects being as follows:

- Project approval and funding through different departmental budgets will yield wide variations in the approach to project objective setting, without a clear focus on outcomes or on building sustainable services. The service needs of citizens tend to be either overlooked or given lower priority in relation to internal needs.

- Project objectives tend to be unseen in ICT terms that are specified in great detail, while government business process outcomes either are absent or are vaguely defined and don't lend themselves to post-implementation measurement.

- The current system of project formulation which is based on budgetary allocation or grant places little or no pressure on departments to develop arrangements that can attract private capital and resources, a necessity that has been identified for the NEGP. To achieve this, greater focus and rigor will be needed at the formulation and development stages of projects.

- A further specific challenge relates to the localization of ICT solutions that have mostly been developed with an English-language interface. In India, most people will want to use their local language, but this consideration does not yet appear to figure strongly in the NEGP's implementation strategy.

## III. THE DRAWBACKS OF CURRENT E-GOVERNANCE

As mentioned above the present e-governance is suffering from lack of interoperability, resource sharing, operation integration and concept of collaborative work. The

important drawbacks of the present scenario can be considered as listed here.

- Interoperability and service integration in e-government web information system
- Differences in semantics related to the scattered, heterogeneous data
- Lack of sharing and re-use of data
- Lack of knowledge system

So a citizen has to wait to fulfill particular requirements, since it is a time consuming and tiresome process.

## IV. SEMANTIC WEB

Semantic web is an extension of the current web in which the meaning of information to be precisely described in terms of well defined vocabularies, understood by people and computers. In this technology, the information is described using a new W3C standard called the Resource Description Framework (RDF). One of the most important concepts used in semantic web is the Ontology.

RDF and Web Ontology Language (OWL) are the two W3C recommended data representation models used for ontology representation. Ontology is defined as an explicit specification of conceptualization which includes the model of the domain with possible restriction. Conceptualization is specified by using particular modeling language and particular terms. Ontology describes a domain where as a knowledgebase based on ontology describes a particular state of affairs.

Several methodologies for building ontology have been proposed in the literature. These methodologies vary in the steps and tasks that they propose to do when building ontology. In the e-government domain it is important to delimit the scope and coverage of the desired ontology as a government service for which ontology is being developed may be related to other services within the same department or across other departments.

The ontology engineering field prescribes three layers of ontology development. From a form that can be understood by human beings to one that can be processed by computers. These layers are informal ontology, semi-formal ontology and formal ontology. The domain ontology which is the base ontology model for the development of the formal ontology, its semantic consistency is to be evaluated. This is done by creating the semi-formal representation of the domain ontology using the Description Logic formalism. The UML class diagram and Description Logic are the commonly used formalism to represent a semi-formal ontology.

Unified Modeling Language (UML) is a standardized general-purpose modeling language in the field of object-oriented software engineering. The Unified Modeling Language includes a set of graphic notation techniques to create visual models of object-oriented software-intensive systems. It combines techniques from data modeling (entity relationship diagrams), business modeling (work flows), object modeling, and component modeling. It can be used with all processes, throughout the software development life cycle, and across different implementation technologies.

The Unified Modeling Language (UML) offers a standard way to visualize a system's architectural blueprints, including elements such as:

- activities
- actors
- business processes
- database schemas
- (logical) components
- programming language statements
- reusable software components

Description Logic is a formal language for knowledge representation, its syntax uses basic mathematical logic symbols such as subset, union, intersection, universal and existential quantifications etc to represent the relationships between the constituents of a domain.

The semantic web domain provides various languages for the formal representation of ontologies including XML, RDF and OWL. OWL ontologies allow the composition, searching, matching, mapping and merging of e-government services and facilitate their integration, maintenance and interoperability. So generating OWL ontology from a government service domain is an important step towards the development of semantic web applications as e-government applications.

## V. ADVANTAGES OF SEMANTIC WEB IN E-GOVERNANCE

Semantic web technologies are ideal platform to achieve the vision of a knowledge based, user-centric, distributed, interoperable and networked e-government.

The benefits of web services is that users need no longer think in terms of data but rather services they wish to receive. But the major draw backs of the web services technologies are their inability to enable automatic discovery, composition, selection and therefore human intervention and effort is required. These problems of web services are solved using semantic web technologies. A combination of semantic web technologies and web services is resulted as semantic web services (SWS).

One of the important benefits of SWS is that it can aggregate and reuse diverse information resources relevant to a given situation in a cost effective way and to make this available as a basis for transparent interactions between community organizations and individual citizen.

The issue of service integration in e-governance was addressed in Xiao et al and Subcede et al by proposing specific e-government domain ontologies. The various researches in this area demonstrate the interest in semantic web technologies based on ontology in e-government. They

provide an overview of using various ontology models in e-government researches and projects to describe and specify e-government services that enforce semantic integration and interoperability.

Lijiljana Stojanovic et al [12] support how the usage of semantic technologies for describing e-government services can improve the management of changes.

Semantics is used to provide information not just the data. This implies that the semantic introduces meaning into the data in order to allow computers to deal with this information in a more interoperable manner.

## VI. CONCEPTUAL ARCHITECTURE OF A SEMANTIC WEB

It is an architecture proposed by Ujjal Marjit et al [8] which depicts the SWS based e-governance that follows the semantic driven web service application. The architecture consists of three layers namely front office, SWS layer and back end/service provider. Front office is the access point for the citizen, allowing them to model, deploy and simulate semantic based web services. SWS layer is the core component of the SWS based e-governance which provides the required functionality such as discovery, composition, invocation, selection, mediation and orchestration of services. There are different component for the SWS such as service requestors, semantic repository, semantic transformation, discovery mechanisms, composition, centralized coordinator, tracking, execution engine and security. Each component is well defined with a specific function.

Service requestors are the citizens who are allowed to move their data and information within the domain of e-government. Semantic repository maintains a collection of resources for services, pre-defined goals rules and ontologies. Discovery mechanisms are used to find suitable services that satisfy the requestor goal by searching these repositories. The composition is a process by which several services are added to provide a single service. The various service providers and consumers are tracked properly. The various components are called to control and execute the SWS. The authorization and authentication of the users are checked by storing the user profiles and other credentials by means of the security component.

The Back end/Service providers provide the web services after making legacy system to web service. This legacy system is exposed as government web service.

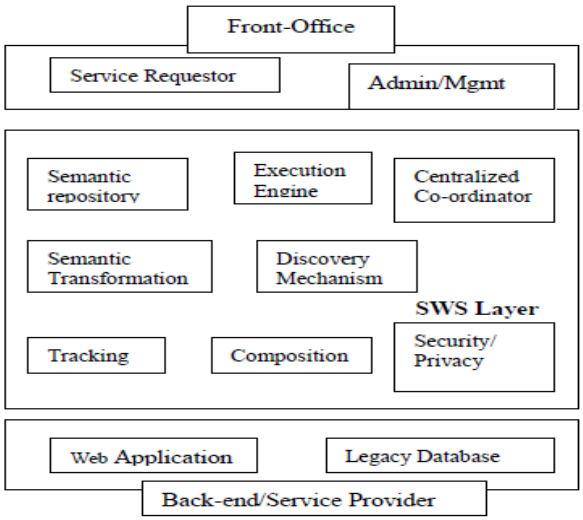


**Fig 1: Conceptual Architecture**

## VII. THE FEDERAL ENTERPRISE ARCHITECTURE REFERENCE MODEL

By representing the reference model in a semantic-rich language like RDF/s and OWL, much of the interpretation and enforcement of the reference model can be automated. The ontological relationships can answer questions about aspects of an enterprise. An executive manager or employee can discover the activities of the business supporting business goals, the capabilities supporting those activities and the systems that enable the capabilities. Some questions which can be answered by the ontology based systems are:

- Who is using what business systems to do what?
- What systems and business processes will be affected if we upgrade a software package?
- What technologies are supporting a given business process?
- What components are being re-used or could be reused?

These leads to the development of FEA Reference model ontologies in 2004.it is a number of ontologies built using the W3C standard web otology language OWL.

An important application of the FEA-RMO is a system that needs the FEA-RMO, an ontology about the agencies, programs and capabilities. The starting point of the e-gov was a model of the US agencies and their bureaus and offices. A small RDF graph with 3 concepts and 4 properties placed at each agency was designed. By placing a server at each agency, this RDF graph can be populated with instance triples. Aggregating these triples would produce the all offices of all agencies of government. The ontology model actually goes beyond this graph. In the real model, relationship naming and relationship qualification such as inverse, transitive etc are very important to support inferencing. In this model, some relationships have been simplified to simple ‘has’ links.

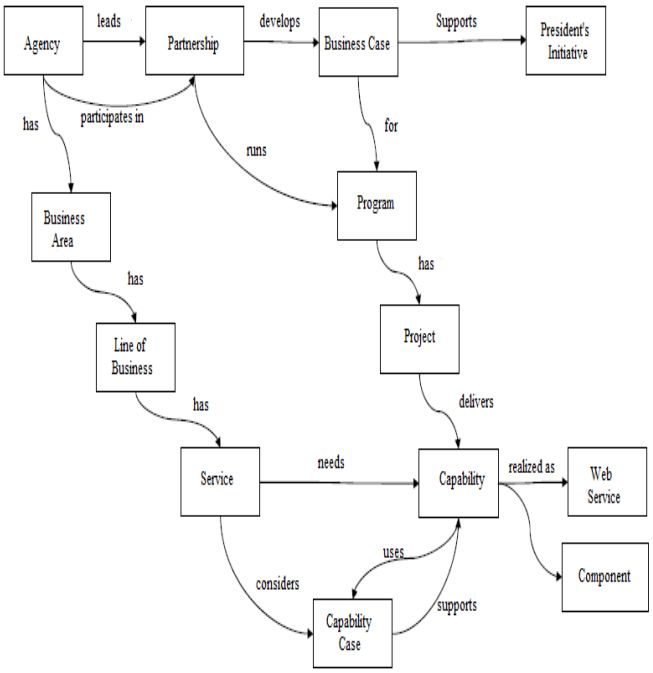


Fig 2: Some classes in the Ontology Model

The conceptual architecture of the SWS based integrated model for developing the e-governance insfrastructure which provide interoperability,integration and sharing of web services is given here.

The jUDDI registry system is used to store and maintain the discovery information of the web serrvices and also their correspondanding WSDL files. We added the semantic description into the stored web services to convert them into semantic web services sing WSML for interoperability.

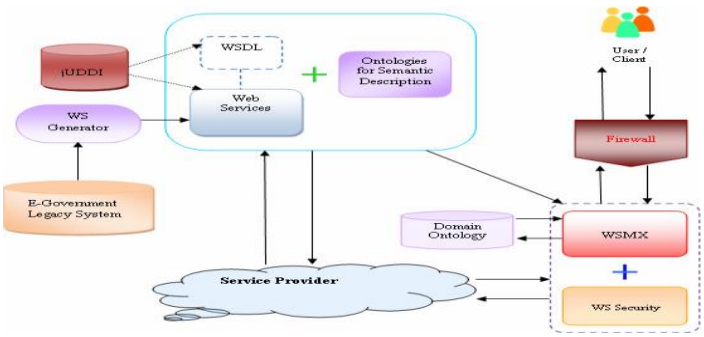


Fig. Architecture for Service Discovery using Ontology

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