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Moving from E-Government to Semantic E-Government

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***Abstract*— The information access from web is a common practice in every area. End users are looking for more precise information from the web. As technology has affected all the fields, government also cannot be spared from it. E-government is increasing its impetus. There are various challenges for E-government societal, behavioural and technical as well. At the technical end interoperability, integration and resource sharing are the challenges. This paper will discuss how the Semantic Web Model will bridge the gap and try to overcome the technical challenges that E-Government faces. Semantic Web adds meaning to the information available on the web.**

***Keywords*— Semantic Web, E-Government, Semantic E-Government., Ontology, URI**

I. INTRODUCTION

Information Retrieval in today's age is a synonym for web. Accessing information from web is very handy. People rely so much on web for every kind of information. But, many a time's information retrieval process goes into vain and end user returns with no useful information. Despite of availability of such a huge volume of information on the web, end users are not able to get meaningful and structured information. One of the reasons of the above mentioned problem may be the unavailability of structured and highly semantic information. The another reason is that information retrieval systems are still not smart enough to exploit the available semantic knowledge and give precise results to the end users.

The variety of semantic technologies is available but industry is still not able to exploit these technologies fully. For this reason, many research efforts focus on showcasing semantic technologies in various domains, such as e-business, e-health, e-learning, telecommunications, transport and e-Government.

E-Government, like other mentioned areas, is facing several problems in information integration, information extraction, and information representation across heterogeneous organizations. In particular, E-Government faces big challenges to achieve interoperability and integration, taking into account differences in laws, regulations, services, administrative processes, and different languages across regions and countries.

The Semantic Web can be one of the solutions to tackle such problems of information integration, extraction and representation in the E-Government scenario. Researchers are trying to find out the solution of the mentioned problems. Efforts are still going on to improve government-citizen interaction by the concept of E-Government facilitating it with the concept of Semantic Web.

II. SEMANTIC WEB

Information in Web should be more machine process able and understandable. SW can be the goal (mesh of information) as well as a tool (language for expressing). It seems to be the main paradox of the SW: to bean egg and a chicken in the same time.

The Semantic Web Stack is an illustration of the hierarchy of languages, where each layer exploits and uses capabilities of the layers below. It shows how technologies that are standardized for Semantic Web are organized to make the Semantic Web possible. It also shows how Semantic Web is an extension (not replacement) of classical hypertext web.

The overall architecture can be classified in two parts-

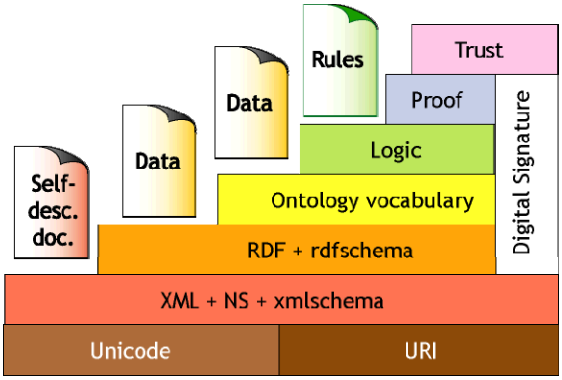

Fig 1. Semantic Web Architecture

A. Hypertext Web Technologies

This part is a collection of IRI (Internationalized Resource Identifier) , Unicode, XML and XML Namespaces. IRI provides means for uniquely identifying semantic web resources. These resources are composed of structured data using XML.

B. Standardized Semantic Web Technologies

This part is a collection of RDF (Resource Description Framework), RDFS i.e. RDF Schema, OWL (Web Ontology Language) and SPARQL (Query Language). RDF is a framework for creating statements in a form of so-called triples. It enables to represent information about resources in the form of graph. RDFS provides basic vocabulary for RDF. OWL extends RDFS by adding more advanced constructs to describe semantics of RDF statements. It allows stating additional constraints, such as for example cardinality, restrictions of values, or characteristics of properties such as transitivity. It is based

on description logic and so brings reasoning power to the semantic web. SPARQL is a query language for RDF.

As mentioned in the SW stack above mentioned languages or technologies create the SW. Though the SW has gone through lot of research work still implementation of top most layer of semantic web is not clear.

III. E-GOVERNMENT CHALLENGES

E-Government is in itself not at all an easy goal. There is lot of challenges at various levels of implementation of E-government. However the most difficult is to make people believe on machine. Besides all legislative challenges and financial challenges here are some technological challenges which are necessary to focus. E-government faces numerous obstacles such as bureaucracy, compliances, capacity and enforcement. Such barriers produce the gaps in progress towards achieving the goal of E-Government.

There are various technical issues for E-Government like interoperability, privacy, security and multimodal interaction. E-Government application should be interoperable, both as far as newly developed are concerned, as well with the existing legacy applications. Another obstacle is to maintain the privacy of the citizens on the E-Government applications. Security is also one of the challenge and E-Government applications should be able to cope up with variety of devices.

One of the largest costs invested in infrastructure while implementing technology, beside this the rapid development of new technology added the economic demand day by day. Adoption of whole-of-government standards, software integration and middleware technologies can help to handle this barrier someway.

Semantic Web has started out with a document oriented approach; the basic idea was to annotate Web pages with semantic markup. This has been challenged by requirements from knowledge management, suggesting focusing on knowledge items which might be structured and codified in much more detail [Staab et al. 2001].

Semantic interoperability remains a big obstacle in e-government. In fact, as recalled by [Klischewski 2003], "lack of interpretation of the meaning of data objects and interfaces in focus is the key obstacle for networked computer applications in administrative processes and services".

Semantic Web technologies, [Signore 2003] are promising to overcome these difficulties. It is very probable that next generation e-government applications will heavily rely on these technologies (RDF, OWL) as they will become more common and mature, to achieve maximum vertical and horizontal integration.

E-Government websites consists of variety of information elements for ex multimedia content, forms, client applications, documents to download, services, links etc. All this information is meaningful to the variety of end users who access these websites. All this information needed to be semantically marked. Web users are companied by machine actors searching for "meaningful" resources and seeking to use/compose seamless services. It is state-of-the-art to use ontologies to structure and guide the markup process, i.e. to codify information, as well as to support semantic interoperability [Kim 2002].

The road ahead for Semantic E-Government is still not easy there is lot of gaps required to be filled from moving to E-Government to Semantic E-Government.

IV. SEMANTIC WEB AND E-GOVERNMENT

Semantic Web is about representing data, but this is done with the expectation of processes operating across borders of systems and organisations to integrate available data in applications. The semantic markup and semantic links are to "allow machines to follow links and facilitate the integration of data from many different sources". [Berners-Lee & Miller 2002].

As discussed in the previous section E-Government has lot of challenges and shortcomings too. In order to improve the status of E-Government Semantic Web can be one of the solutions which can be a basis for effective and efficient information exchange platform. Various researchers have justified the role of SW in the improvement of Government and citizens communication. The researchers have tried to integrate the E-Government systems with Semantic Web. Most of the researchers got the promising results. Their work has been discussed in this section.

[Roberto V. et. al., 2005] proposed a semantically-enhanced architecture to address the issues of interoperability and service integration in E-Government web information systems. Architecture for a life event portal based on Semantic Web Services (SWS) is described. The architecture includes loosely-coupled modules organized in three distinct layers: User Interaction, Middleware and Web Services. They focused on the second layer which defines an explicit conceptual model in terms of three domain ontologies: the E-Government, the Life Event and the Service Ontology, each of which grounded on the upper ontology D&S, and an infrastructure for interoperability and integration in terms of Semantic Web Services, based on the IRS-III framework. Their architecture applies semantic web technology at the data and service level.

[Grandi F. et. al. 2009] designed and implemented Web information systems supporting personalized access to multi-version resources in an e-Government scenario. Personalization is supported by means of Semantic Web techniques and relies on an ontology-based profiling of users (citizens).

[Goudos S.K.. 2007] presented a generic Public Administration (PA) domain ontology. They defined a formal model for a Public Administration service on the basis of the WebService Modeling Ontology (WSMO). For this purpose they used the generic public service object model of the Governance Enterprise Architecture (GEA) providing PA domain specific semantics. They claimed that PA domain reference ontology will play an important role in a semantic web services environment for e-government.

[Hreňo J et.al. 2011] developed a project with the goal to improve accessibility and connectivity of governmental services for citizens and businesses by means of creating integrated scenarios and providing guidance to users while following this scenario. The scenario helps the user to

identify and fulfil any needed electronic or real governmental services in a selected life situation. The Access-eGov project has developed software tools enabling service integration using semantic technologies. Making services accessible by using semantic technologies also meant to agree on the semantics of public administration services.

[Saekow A et. al. 2010] proposed a pragmatic approach to bridging the gap by adopting repository services, support tools and collaborative activities. They defined the existing gaps in e-Government interoperability implementation and proposed a pragmatic approach to bridging them. Our approach concentrated on the adoption of UN/CEFACT standards: UMM, CCTS, XMLNDR, repository services and support tools. They developed patient referral information exchanges to implement their approach.

The above mentioned researchers tried to overcome the shortcomings of E-Government and succeeded to some extent also. The overall improvement in E-Government scenario will be when all the separate systems work in integration and interoperable manner. In the next section Semantic E-Government Model is suggested to improve the overall performance of the E-Government applications.

V. INTEGRATION OF E-GOVERNMENT AND SEMANTIC E-GOVERNMENT MODEL

Information access in an existing E-Government model was not at all a problem. But accessing precise information is one of the problems. Semantics added to the existing information definitely leads towards the precise information access. Semantics provides the capability to model and represent knowledge within a given domain by means of explicit formalization of key domain concepts, their attributes and relations, as well as workflow sequences and structures. Considering the heterogeneous and distributed nature of the e-Government domain, semantics can be effectively used as a common background platform for describing processes and services provided by governmental institutions on various levels. The common platform then enables to integrate the services, make them interoperable and transparent for end users. [Hreňo J et.al. 2011]

A. E-Government Model

*T*he effort is been made to integrate the basic e-Government architecture with semantics and making it semantic e-Government architecture. The basic e-Government model is depicted in Figure 2. It's the basic model of information retrieval in any of the web applications. It works with basic layers Access Layer, E-Government Layer, E-Business Layer and Infrastructure Layer as well.

The layers interact with each other using infrastructure and the database repository to fulfil end users requirements. But as already discussed, adding semantics to the information will improve the preciseness of the information retrieved by the end users.

B. Semantic E-Government Model

Integrating semantics with the basic model requires lot of extra efforts at implementation level. The more structured information should be stored in the form of XML data repository. XML is capable of making information more meaningful. XML and RDF are the "official language" of the Semantic Web, but by themselves they're not enough to make the entire Web accessible to a computer. Figure 3 shows the Semantic E-Government model.

Another issue with semantic web is that computer does not have its own vocabulary. Hence, the information is not able to be processed by machine itself. In order to make sense of the words and their relationships computer must be supported by some in-built documents. Ontologies serve that purpose in semantic environment. The semantic web applications are supported by metadata information which is called as "Semantically Defined Information". This information is in the form of metadata. Each application would have text and pictures (for people to read) and metadata (for computers to read).

The metadata, using RDF triples and XML tags, would make all the attributes of the DVDs (like condition and price) machine-readable. When necessary, businesses would use ontologies to give the computer the vocabulary needed to describe all of these objects and their attributes. Here the applications work as an agent itself and try to find out more meaningful information in comparison to the normal web applications scenario.

VI. DISCUSSION

Let's take an example where a citizen or an end user wants to query about a piece of land in any area. Let's see how it will work in Semantic E-Government and normal E-Government model.

A. E-Government model

In the normal web portal when end user puts up the query, the query is fired on the backend database and the details about the land like price, locality, legal aspects owner name etc. will return to the end user.

B. Semantic E-Government model

In this scenario when the end user puts up the query firstly it will check for the metadata about that query. The metadata, using RDF triples and XML tags would make all the attributes of that land (owner's name, locality etc.) machine-readable. For detailed, information the system would use ontologies to give the computer the vocabulary needed to describe all about the objects and their attributes. Computerized applications or agents would read all the metadata found at different sites. The applications could also compare information, verifying that the sources were accurate and trustworthy. So in this case end user will get information not only about the piece of land, its previous history, to whom it belong originally and how later on it is transferred to some other party. Land is genuine or not.

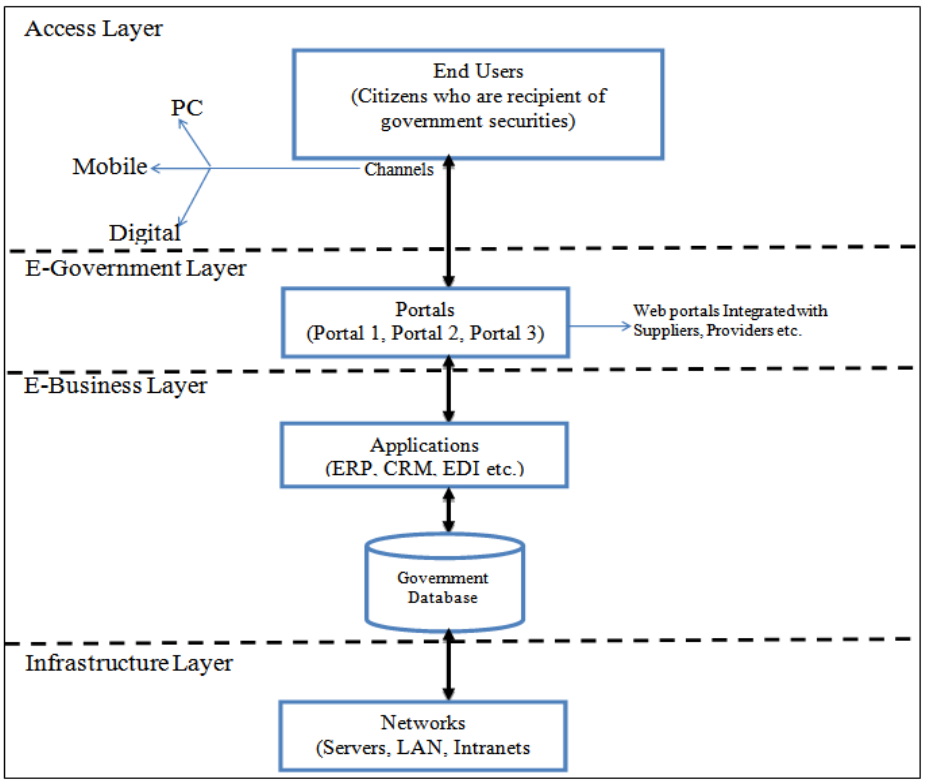

Fig 2. E-Government Basic Model

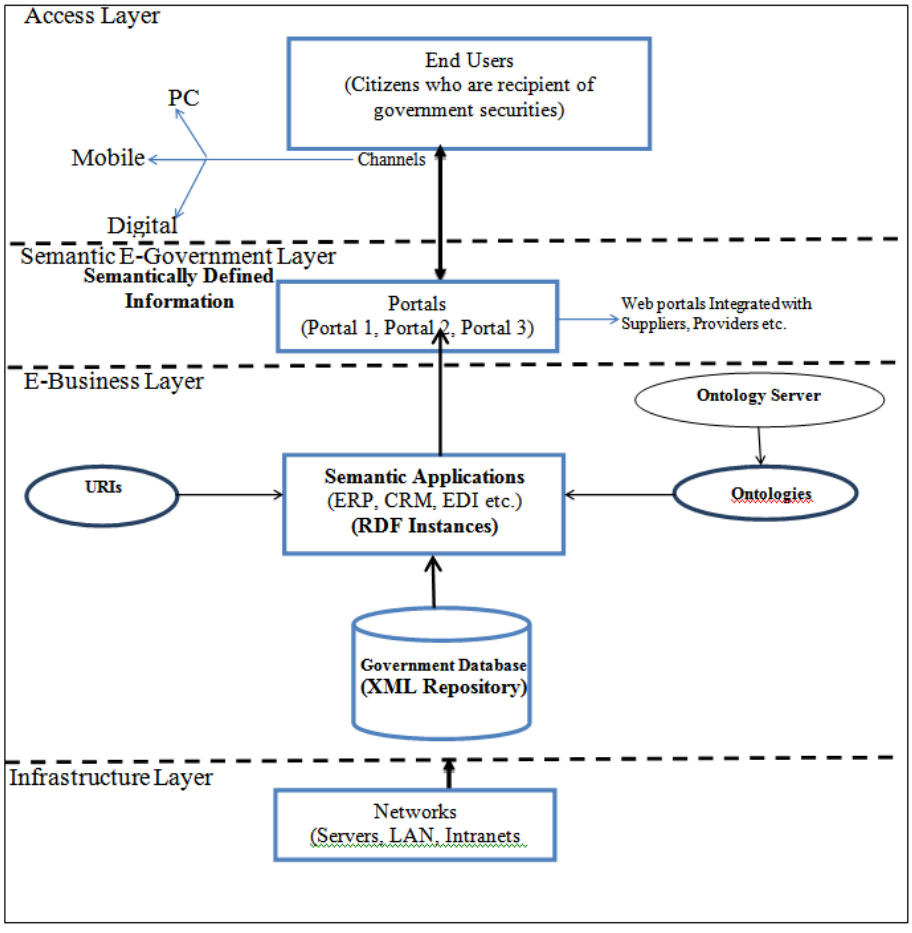

Fig. 3. Semantic E-Government Model

VII. CONCLUSION

Moving from E-Government to Semantic E-Government model is not at all an easy task. Researchers are putting their best efforts to exploit the benefits of Semantic E-Government. The suggested semantic model can be a solution to access the services of E-Government in a best possible way. The benefits of E-Government can be twofold by converting it into Semantic E-Government. Implementing semantic model has lot of technical issues. Not even technical issues there are lot of societal and behavioural aspects as well. Though there are few success stories but still there is a long road to go ahead.

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