Semantic Web in E-Government

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INTRODUCTION

Today, in many countries, looking for government information, filing taxes, renewing a driver's license, obtaining a certificate and notifying of a new address anytime, anywhere are becoming mundane online operations. For the satisfaction of their constituents, local governments are striving to deliver more effective and efficient online services through the use of innovative information and communications technologies.

E-government also known as "digital government" can be defined as the civil and political conduct of government using **information and communication technologies** (ICT) (McIver & Elmagarmid, 2002). The most accepted picture of e-government is that of a provider of online services to citizen (G2C), businesses (G2B) and the administration (G2G). The real value of an e-government rests on the effectiveness of its programs, the broad availability of its enhanced online services, the satisfaction of customers and the tangible savings in time, money and human resources (Koné, 2005).

E-government expansion and adoption by communities, citizens, businesses, and public administrations in most countries is generally seen as a four-step process: presence phase, interaction phase, transaction phase, and transformation phase. The goal of the last transformation phase is to integrate several internal services at the vertical and horizontal levels, into a one-stop, whole-of-government with innovative services operating seamlessly across departments, agencies and programs. To address the problems of **seamless integration** and **interoperability** (D'Auray, 2001), some actors in e-government are experimenting with the **semantic Web** promoted by **Tim Berners-Lee** (Berners-Lee et al., 1999, 2001), **Web service** technologies (McIlraith et al., 2001) as well as **service oriented architecture** (SOA) as a means for achieving integration and inter-operation in the service transformation phase.

Scope and Structure of the Article

This chapter aims at presenting the semantic Web technology applied to the transformation and advancement of e-government. After this introduction in the first section, we expose in the second section the nature of the semantic Web and e-government. Then, we explain in the fourth section, how semantic Web technologies can contribute to solving known issues in the transformation of e-government. Given this background, we are able to propose a simple illustration of our ideas: Web services and semantic Web-based architectures within the e-government project of Québec, Canada. We then give a glimpse of some future trends in the fourth section and the conclusion in the fifth and last section.

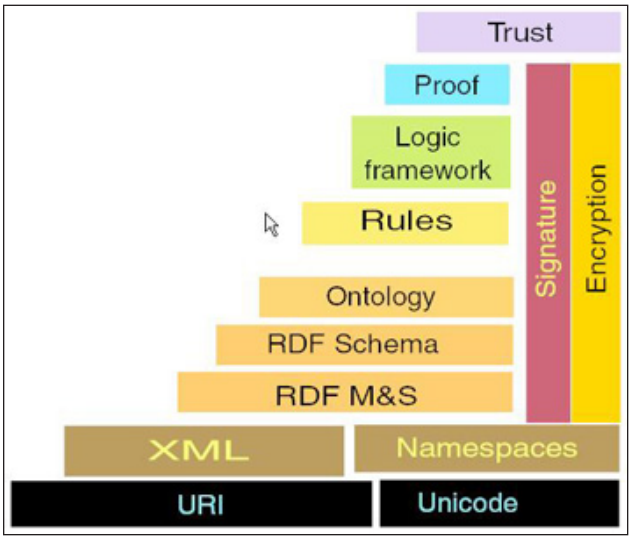
BACKGROUND

Semantic Web Technology

If the **Internet** is said to be "*the place where one can find anything,"* there are still concerns about really finding what one is looking for. In this context, Berners-Lee proposes (Berners-Lee et al., 1999, 2001) a whole new vision of the Web called the **semantic Web**. This semantic Web is "*an extension of the current Web, in which information is given well-defined meaning, better enabling computers and human to work in cooperation*" (Berners-Lee *et al.*, 2001). In line with this vision of the semantic Web, the **World Wide Web Consortium** (W3C) has developed a number of ontological languages for specific purposes. The following languages (Asuncion & Corcho, 2002) displayed in Figure 1 are called ontology languages because they can formally describe the meaning of terms and relations in Web documents.

- **The resource description framework** (RDF) is a flexible data model for resources described as objects and the relations among them. It provides a simple semantics for this data model, and these data models can be represented in XML syntax;
- **RDF schema** is a vocabulary for describing properties and classes of RDF resources, with semantics for hierarchies of such properties and classes;
- The **Darpa agent modeling language** (DAML) has been developed as an extension of XML and RDF. It

Figure 1. The Semantic Web 'layer cake' as proposed by Berners-Lee



is used to explicitly represent the meaning of terms in vocabularies and the relationships between these terms;

- The **ontology Web language** (OWL) is intended to provide a language suitable for describing the classes and relations inherent to Web documents. OWL has more facilities for expressing meaning than XML, RDF and RDF-S.

A more detailed and in-depth description of the semantic Web technology is given in "Semantic Web fundamentals" by Antoniou and Plexousakis in the Encyclopedia of Information Science and Technology, 2005.

E-Government

Considerable progress has been made in e-government over the past decade. A recent major study, in which 21 governments were surveyed, showed that e-government has created major changes along several dimensions: services, modes of operation, and organizational structures (Accenture, 2006). In particular, unified contact centers have been created to help government provide single entry points for citizen services.

Two broad classes of e-government technologies exist (Ashley, 1999). As seen in Table 1, one class comprises externalizing systems which provide interfaces to government entities through which citizens and other government entities can obtain services. The level of service of this range from one-way information delivery to complex transactional interactions, whereby legally-binding tasks, such as vehicle registration, can be completed. Another class comprises systems which provide:

Table 1. A summary of e-government characteristics

• Civil and political conduct of government using ICT; • Provision of online services to citizen (G2C), businesses (G2B) and the administration (G2G); • Two broad classes: externalizing and internalizing systems; • Evolution through presence, transaction and transformation phases.

1. Integrative communication functionality to improve intra-governmental workflows;
2. Domain-specific processing and knowledge management, such as data mining for public health or support for law enforcement investigations.

The needs and trends in e-government parallel those of the broader computing community with respect to semantic Web research. The current generation of research in e-government reflects an effort to make:

1. Services more widely accessible;
2. Services more integrated within organizations; and
3. Information more "intelligent" (Cencioni & Bertolo, 2006).

In a government context, the accessibility and integration of services is being addressed through Web services and business processes. Bringing intelligence to information has involved the injection of semantics into content as meta-data, largely XML-based, and corresponding processing techniques that allow those meta-data to be interpreted.

SEMANTIC WEB IN E-GOVERNMENT

There is a need within e-government services to provide information whose format and methods of delivery are adapted to users and situations (Accenture, 2006). In its evolution, e-government is expected to format information from a given knowledge domain in different ways when presented to senior citizens, youth, or government officials.

E-Government Evolution

E-government expansion and adoption by communities, citizen, businesses and public administrations in most countries is generally seen (Government of Canada, 2003) as a four-step process: presence phase, interaction phase, transaction phase and transformation phase.

The initial **presence phase** is implemented through the publication on the Web of static information on government operations and services. Starting with few services, the initiative expands to a broad range of services with basic