Chapter 4

Deploying Decision Support Systems Using Semantic Web Technologies

Lars Ludwig
National University of Ireland, Ireland

David O’Sullivan
National University of Ireland, Ireland

ABSTRACT

Decision support systems are deployed in a wide variety of business applications using a variety of core technologies and programming languages. One of the more promising technologies to evolve in recent year has been the semantic web. The semantic web aims to create more intelligent and machine readable web pages and online applications. The technologies, programming languages and methods of the semantic web are now maturing and standards have emerged that allow semantic web technology to be deployed broadly across information technology industry and the programming community in particular. This paper outlines a set of requirements for programmers considering the development of decision support systems using semantic web technology. Current strategies across the research community are surveyed that deploy semantic web applications. From the discussion of these strategies, ten basic requirements are derived. These requirements combine technological, psychological and philosophical research ideas. By crossing traditional research boundaries, a broad perspective on deploying decision support systems that utilize semantic web technologies is created.

INTRODUCTION

The semantic web is predicted to cause a major disruption to the ways future industries will conduct their business. Industry strives to continuously add value to customers through more effective product innovation, the processes that produce them and the services that deliver them along the extended supply chain. In the same way that the internet disrupted each of these facets of business over the last ten years, the semantic web promises to bring the next major step change in industry efficiency and growth. The semantic web is about adding more meaning to the vast amount of information stored on computers and shared between processes over the internet and
Deploying Decision Support Systems Using Semantic Web Technologies

over industrial intranets. This information ranges from knowledge associated with collaboration and social networking to information exchanged between computer applications as part of a workflow process. Core standards and robust commercial programming environments are now in place to be used by scientists and engineers in generating the next generation of intelligent information systems. Every facet of industry can be transformed by utilizing semantically rich information. Semantically rich information can be used to build ‘machine-friendly’ networks of knowledge where computers can access, store and reuse information automatically. Information systems build around formal ontology and laced with formal semantics offers the possibilities of executing a broad range of tasks automatically and presenting the human actor, often at the centre of industry processes, with timely and context sensitive information. This information is devoid of information noise and can be used in making more accurate and timely decisions. The semantic web can become a core enabler of decision support systems that facilitate decision makers by providing information from raw data, documents and personal in real time to the user.

This paper introduces a conceptual framework for the development of human-centred decision support systems called Semantic Personal Knowledge Management (SPKM). It discusses strategies for knowledge management in semantic annotations, in documents, and in ontologies/ontology bases. From a focused survey of research, ten critical basic requirements outlining SPKM are derived. In order to state these requirements unambiguously, a number of terminological clarifications had to be made. Most of these requirements are realized in an application called Artificial Memory and currently deployed in a number of decision support applications. This paper will present each of ten requirements in sequence. Each requirement is preceded by a discussion on some of the literature and key scientists behind the ideas. All ten requirements combine to create a check list of many of the key principles behind the deployment of semantic web technology in decision support systems.

SEMANTIC KNOWLEDGE MANAGEMENT

Semantic web technology such as the Resource Description Framework (RDF) and the Web Ontology Language (OWL) has been advocated in the research community for enabling electronic commerce (Fensel, 2001), and knowledge management (Decker, 2002). Electronic commerce is further supported by Semantic Web Services (SWS) providing mechanized service discovery, parameterization, composition, and execution of web services (Fensel, 2004). For knowledge management in semantic webs three principal approaches have been advanced: (i) semantic annotations, (ii) (semantic) document management, and (iii) ontology management. In this paper we use the terms ‘knowledge management’ and ‘decision support systems’ interchangeably.

Semantic Annotations

Knowledge management is associated with the original idea of the semantic web i.e. documents on the Internet that become readable both to humans and machines (Berners-Lee, 2001). Being machine readable means that semantic search services can be made available for providing precise and exhaustive information retrieval (Guha, 2003). To achieve machine-readability of natural language documents, semantic annotations have been found to be partially effective. Semantic annotations consist of metadata embedded into or pointing to natural language strings in documents. Ontologies support the necessary semantics to describe text strings (Gruber, 1993; Studer, 1998). Examples of extensions to HTML to semantically annotate HTML documents include SHOE (Heflin, 2000) and HTML-A which has developed into...