Chapter 11
Towards Web 3.0: A Unifying Architecture for Next Generation Web Applications

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ABSTRACT

While the term Web 2.0 is used to describe the current trend in the use of Web technologies, the term Web 3.0 is used to describe the next generation Web, which will combine Semantic Web technologies, Web 2.0 principles, and artificial intelligence. Towards this perspective, in this work we introduce a 3-tier architecture for Web applications that will fit into the Web 3.0 definition. We present the fundamental features of this architecture, its components, and their interaction, as well as the current technological limitations. Furthermore, some indicative application scenarios are outlined in order to illustrate the features of the proposed architecture. The aim of this architecture is to be a step towards supporting the development of intelligent Semantic Web applications of the near future, as well as supporting the user collaboration and community-driven evolution of these applications.

INTRODUCTION

Current trends in Web research and development seem to revolve around two major technological pillars: Social-driven applications, a main component in the Web 2.0 domain, and the Semantic Web. It is our firm belief that web semantics and Web 2.0 are complementary visions about the near future of the Web, rather than in competition: surely they can learn from each other in order to overcome their drawbacks, in a way that enables forthcoming web applications to combine Web 2.0 principles, especially those that focus on usability, community and

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collaboration, with the powerful Semantic Web infrastructure, which facilitates the information sharing among applications. Recently, the term Web 3.0 is used to describe the long-term future of the web (Lassila, 2007; Hendler, 2008). Web 3.0 will surely incorporate semantic web and Web 2.0 principles, but researchers believe that it will also include some more sophisticated concepts like artificial intelligence on the web.

Towards this direction, in this work we propose a 3-tier architecture for web applications that will fit into the Web 3.0, the next generation web. At the lower layer of the architecture, we introduce and describe an advanced semantic knowledge base infrastructure that can support integration of multiple disparate data sources, without requiring a concrete underlying semantic structure. In addition, the upper layers of the architecture provide greater flexibility in the user interactions with the underlying ontological data model. As a result, it supports user collaboration and community-driven evolution of the next generation web applications.

This architecture gives the developers the ability to build complicated web applications which combine the philosophy of Web 2.0 applications, and the powerful technical infrastructure of the Semantic Web, supported by applying Artificial Intelligence principles on the Web. Furthermore, this architecture is well suited for supporting enhanced Knowledge Systems with advanced knowledge discovery characteristics, towards the future implementation of an Internet-scale Knowledge System. For example, the proposed architecture could be used to enrich current wiki applications towards next generation semantic wiki platforms that will mash-up scattered data sources and provide intelligent search capabilities.

The following text is organized in five sections. In section 2 we start by providing some broad definitions and discussing the concepts of Semantic Web and Web 2.0. Furthermore, we discuss related work and the theoretical background of the research area. In section 3, we describe in detail the proposed architecture, its components, its fundamental features and the current technological limitations. In section 4, we outline some indicative application scenarios in order to illustrate the features of the proposed architecture and prove that it can be applied today and support modern web applications. Finally, we discuss future work and summarize our conclusions.

BACKGROUND

As Semantic Web and Web 2.0 were firstly introduced separately by groups with completely contrary beliefs on the evolution of World Wide Web, and even targeting different audiences, there has been a common perception that both are competing approaches for organizing and emerging the Web.

The Semantic Web, outlined by Berners-Lee (2001), becomes a revolutionary technological approach for organizing and exchanging information in a cross-application dimension. Strongly supported by World Wide Web Consortium and powered by heavy academic and enterprise research, Semantic Web can demonstrate standardized and well-defined approaches in language description, such as RDF (Manola, 2004), RDF(S) (Brickley, 2004) and Web Ontology Language OWL (Smith, 2004), as well as research background in ontology engineering and modeling tools, from SHOE (Hefflin, 1998) to Protégé (Knublauch, 2004).

Semantic Web is powered by a strong AI background through its foundation on the Description Logics (DL) formalism (Baader, 2007). DL languages have become in recent years a well-studied formalism, originating from Semantic Networks and Frames and, as such, they have been extensively used in formal Semantic Web specifications and tools.

These languages are of variable expressive strength which comes with the cost of increased computational complexity. Therefore, current research in this area is focused on efficient and
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