Six Challenges for the Semantic Web

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The Semantic Web has attracted a diverse, but significant, community of researchers, institutes and companies, all sharing the belief that one day it will have as big an impact on life as currently the WWW/Internet has. We share that vision, based on the ever-increasing need to reduce information overload, and to increase task delegation to software agents. However, there is still a long way to go before the Semantic Web dream comes true. We identify some of the major challenges the community faces in the coming years, and we outline solution directions. The major challenges concern: (i) the availability of content, (ii) ontology availability, development and evolution, (iii) scalability, (iv) multilinguality, (v) visualization to reduce information overload, and (vi) stability of Semantic Web languages.

The problem of Information Overload can be partly tackled by adding intelligence to the web. Software agents could manifest various levels of intelligent behaviour from simply reactive to adaptive and learning behaviour, where agents actually learn what users like and dislike. This would shield users from irrelevant information, who would only be 'bothered' for information of real value. Instead of the current ubiquitous *pull* paradigm that requires users to actively look for information and to execute programs, we should work towards delegating those tasks to autonomous software agents. Finally, the tasks users will want to execute will become increasingly complex. Software agents should 'learn' to function in 'social' environments and where necessary collaborate, compete or negotiate with other agents. The quality and usability of the Semantic Web infrastructure will depend on advances on all three dimensions

In spite of the big advantages that the Semantic Web promises, its success or failure will -as with the WWW- be determined to a large extent by easy access to, and availability of high-quality and diverse content. There are still several problems to solve before making this happen, including, but not limited to:

The availability of content. Currently, there is little Semantic Web content available. Existing web content should be upgraded to Semantic Web content including static HTML pages, existing XML content, and dynamic content, multimedia and web services.

Ontology availability, development and evolution. Ontologies will become a key piece, as they allow expliciting the semantics of Semantic Web content. A big effort must be made in the creation of common widely used ontologies for the Semantic Web, on the provision of adequate infrastructure for ontology development, change management and mapping, and, in this distributed web environment, on the adequate control of the evolution of ontologies and the annotations referring to them.

Scalability. A significant effort must be made to organize Semantic Web content, store it and provide the necessary mechanisms to find it. All these tasks must be performed and coordinated in a scalable manner, as these solutions should be prepared for the huge growth of the Semantic Web

Multilinguality. This problem already exists in the current Web, and should also be tackled in the Semantic Web. Any Semantic Web approach should provide facilities to access information in several languages, allowing the creation and access to SW content independently of the native language of content providers and users.

Visualization. Intuitive visualization of Semantic Web content will become more and more important to solve the increasing amount of information overload, as users will demand the easy recognition of relevant content for their purposes. New techniques must be explored that differ from the usual hypertext structure visualization of the current web.

Stability of Semantic Web languages. Finally, standardization efforts must be performed urgently in this emerging field, in order to allow the creation of the necessary technology that supports the Semantic Web

Recently, the US and EU governments have recognized the importance of the Semantic Web and have established dedicated programs (DAML and IST Action Line III.4.1) to fund research aimed at developing the core technology for the Semantic Web.