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Semantic Computing

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Abstract: In general, semantics is about meaning (e.g. of a sentence or story). It is the meaning attributed to concepts and their relationships within the mind. Semantic computing is an emerging field that integrates several computing technologies (such as natural language, artificial intelligence, software engineering, signal processing, programming language, grid computing, and pervasive computing) and addresses their synergetic interactions. It is rapidly emerging as an interdisciplinary area full of promises. This paper provides a brief introduction to semantic computing.

Keywords: *Semantic Computing, Semantic Web Services, Cloud Computing, Social Computing*

I. INTRODUCTION

Semantics is the linguistic and philosophical study of meaning, in language, programming languages, and formal logics. It is a social topic that is grounded on intellectual activities in various communities in the human society. Conversations and stories are the main media for substantiating the semantic process in communities [1]. The task of interpretation is at the core of how computers and humans work together.

Semantic computing (SC) refers to the computational understanding of meanings of contents and their machine readable representation. It deals with designing and operating information systems based on meaning and vocabulary shared by people and computers. It relies on the fact that computers can be "taught" to tackle problems in a similar way to humans. It integrates many technologies such as software engineering, user interface, natural language processing, artificial intelligence, programming language, grid computing, and pervasive computing and addresses their synergetic interactions [2].

Semantic computing is closely related to social computing and the semantic web. It is promising web technology like cloud computing. In very general terms, semantics is supposed to be about meaning (e.g. of a sentence). Semantic computing combines elements of semantic analysis, natural language processing, and data mining.

Semantic computing addresses some major problems: Understanding the intentions (semantics) of users and expressing them in a machine-processable manner, (2) Understanding the meanings (semantics) of computational content and expressing them in a machine-processable manner [3]. It seeks to understand the meanings (semantics) of computational contents such as text, video, audio, network, and software and express them in a way that machine can process them.

II. ARCHITECTURE OF SEMANTIC COMPUTING SYSTEMS

The task of semantic computing is to explain the meaning of various constituents of sentences in a natural language. The five layers of semantic computing are illustrated in Figure 1 and explained as follows [4,5].

1. Semantic Analysis: It analyzes and converts signals such as pixels and words (content) to meanings (semantics). This is the foundation of semantic computing.

2. Semantic Integration: It integrates the content and semantics from different sources with a unified model. It also includes languages and methodologies needed for developing semantic applications. It integrates different kinds of services to provide more powerful services.

3. Semantic Services: They utilize the content and semantics to solve specific problems, and some applications may be made available to other applications as services.

4. Service Integration: It integrates different services to provide more powerful service. It integrates the information derived from the Semantic Analysis layer.

5. It allows the user intentions to be described in a natural form. It provides the information resources for semantic integration and semantic applications.

III. SEMANTIC COMPUING APPLICATIONS

Semantic Computing is applied in various fields such as business intelligence, robotic intelligence, data mining, text mining, big data analytics, computational linguistics, software science, computational intelligence, cognitive computing, sociology, psychology, cognitive sciences, biology, medicine, healthcare, manufacturing, engineering, education, finance, entertainment, science, and humanity. A detailed explanation on some of these will be provided for illustrative purposes.

• Healthcare: Semantics computing technologies may be profitably used to integrate technologies of content distribution with semantic processing and making decision support capabilities in the medical area. There is the need of performing semantics computing on mobile devices [6].

• Industry: A large number of companies have started to experiment with semantic computing technologies. Companies such as Microsoft and Dell are integrating semantic computing into their offerings for healthcare and other industries [7]

• Business Intelligence: Business intelligence is increasingly becoming necessary for business leaders to visualize, analyze, and prepare their strategic planning. The main objective of business intelligence is to enable business managers to have easy assess to data, be able to conduct analysis, allow them to convert data into useful knowledge, and then make faster, better decisions. An effective use of business intelligence will result in time savings, cost rationalization, and management efficiency [8]. Semantic analytical techniques and tools are applied for prediction analysis and decision support. By employing semantics, organizations will be able to leverage the increasing collections of data in their business. Semantics has some advantages over traditional enterprise technologies such as SQL [9].

CONCLUSION

Semantic computing essentially focuses on assigning meaning (semantics) to data and enabling computers to process and

integrate it. It brings together the disciplines that are concerned with connecting the intentions of humans with computational content. There has been a growing interest in the field of semantics and semantic computing. More information about semantic computing can be found in books in [4,10] and the journal exclusively devoted to it: International Journal of Semantic Computing.

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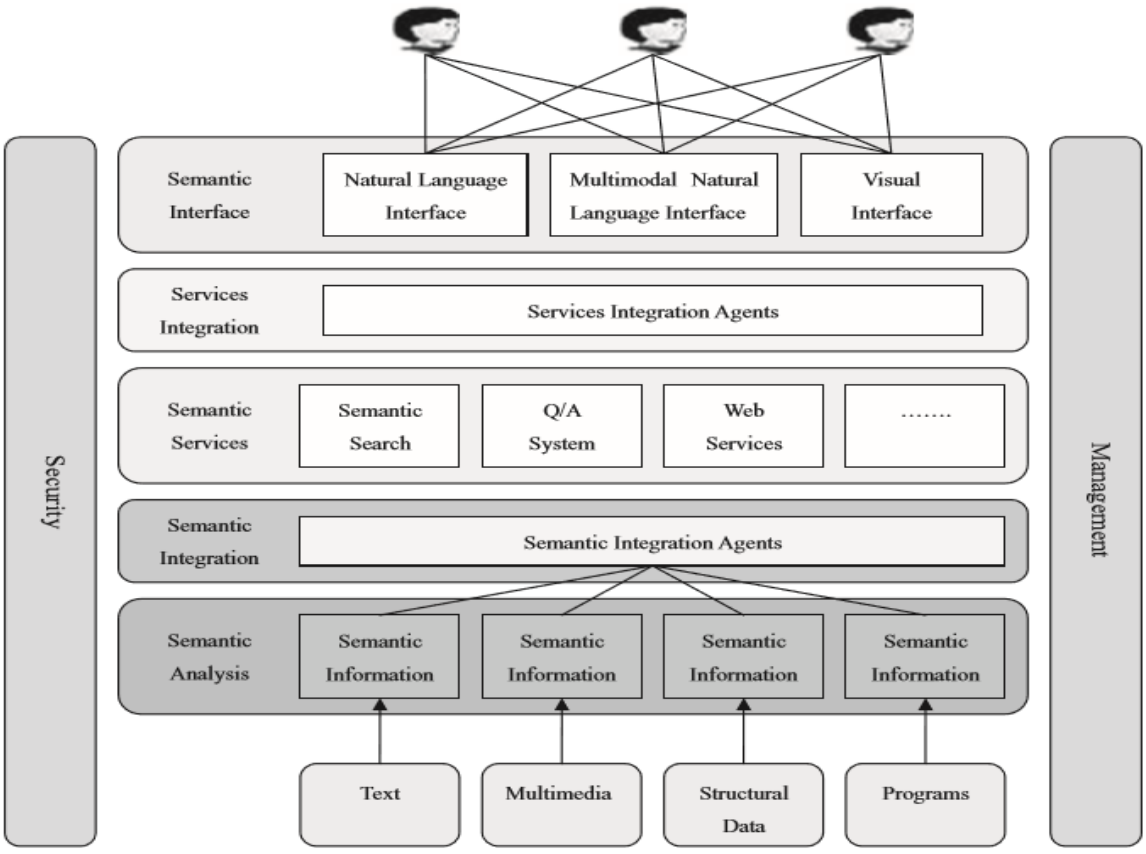

Figure 1 Architecture of semantic computing [4]