Socio-Semantic Web for Sharing Knowledge

Cristian Peraboni
Università degli Studi di Milano, Italy

Laura A. Ripamonti
Università degli Studi di Milano, Italy

INTRODUCTION

The study of knowledge fascinated humanity since remote times (Wiig, 2000): the first "western" traces of this study dates back to the works of important Greek philosophers (e.g., Socrates, Plato, and Aristotle). On the same vein, Indian and eastern philosophers (e.g., Lao Tzu and Confucius) focused their attention on knowledge as an essential learning process to obtain a fulfilling spiritual and concrete life. From a more practical point of view, we could also observe that humanity has always (un)consciously, but effectively, used knowledge as a mean of survival.

Along the centuries, many different disciplines have focused on the *knowledge* concept for different purposes: religion and philosophy have tried to understand the role and nature of knowledge, psychology has tried to understand the role of knowledge in human behavior, economic and social sciences have studied the role of knowledge in the society, business theories have analyzed the role of knowledge in work and organizations, and so forth. Anyway, the awareness of the importance of an *appropriate use* of knowledge has gradually grown in time. In order to increase organizational effectiveness, the 20th century in particular assisted to a systematic study of knowledge, heavily pushed, especially during the last decades, by three major socio-economic trends (Prusak, 2001; Wiig, 2000):

1. The globalization of business, and the consequent increase in competition (marketplaces are submerged by an increasing number of substitutive products, and customers are becoming more and more demanding)
2. The information and communication technologies (ICT) skyrocketing diffusion, that has made real-time, ubiquitous access to information suddenly affordable to (quite) anyone
3. The understanding of human cognitive functions, that bud a growing interest in a knowledge-centric view of organizations

In this panorama, the knowledge management (KM) discipline was "officially" born in the 1980s, as an application of the systematic studies on knowledge. It is important to underline that KM focuses on the study of "knowledge" intended as the appropriate collection and pragmatic use of information, connections and comparisons (Ackoff, 1989), where "knowledge is possessed by humans or inanimate agents as truths and beliefs, perspectives and concepts, judgments, and expectation, methodologies and know-how"(Wiig, 2000, p. 26), and is a "fluid mix of framed experience" (Davenport & Prusak, 1998, p. 5). Karl Wiig (1999) first used the term knowledge management as "the systematic, explicit, and deliberate building, renewal, and application of knowledge to maximize an enterprise knowledge-related effectiveness and returns from its knowledge assets" (Beckman, 1999, pp.1-6). His definition first emerged in the business world reflecting the point of view typical of economic disciplines, and the necessity to exploit assets generated by a better management of knowledge as a mean for facing the more and more compelling aspects of competition. In spite of its economic origin, the study of KM requires a *multidisciplinary* approach, able to gather productively hints from very different disciplines, such as: religion, philosophy, psychology, economy, sociology, business theories, cognitive sciences, and artificial intelligence (AI).

KM underpinning ideas are rooted into several well identifiable philosophical concepts related to *knowledge*: in 1967 Michael Polanyi introduced the distinction between two major types of knowledge (Polanyi, 1967) *implicit/tacit knowledge* (that people posses in their minds, difficult to access and to formalize) and

explicit knowledge (formal, systematic knowledge, easy to capture, represent, transfer and process). This distinction is particularly relevant, since it bud two different streams of research: one concerning *externalization of implicit knowledge*, and the other related to *explicit knowledge management*.

This double evolution has been paralleled in the computer science field by the development, on one hand, of technologies aimed at effectively supporting (tacit/implicit) knowledge sharing in cooperative environments, and on the other hand of techniques supporting the management of formal representation of explicit knowledge (upon which focused especially knowledge engineering (KE) a specific branch of AI). Recently, this latter field of research found a new application in the broader semantic Web (SW) environment, where ontologies coupled with automated reasoning tools in order to produce powerful complex search engine and information retrieval and cataloguing systems (De Cindio et al., 2004).

Although SW represents an indubitable improvement in managing information, a really effective support to knowledge workers' activities can be achieved only through dynamical and participative knowledge representation mechanisms. For this reason, we claim that the SW environment should be further empowered, enriching it with a *social* approach aimed at describing Web resources through collaboratively built knowledge representations.

It is therefore necessary an enrichment of the knowledge representation building methodologies, and an integration with the knowledge creation collaborative processes that typically take place in communities.

BACKGROUND

Explicit Knowledge Management and the Semantic Web

As we stated, Polanyi's categorization of knowledge into tacit and explicit heavily influenced research in the knowledge management field, originating theories, and technologies for both type of knowledge.

Explicit knowledge is the formal and systematic knowledge residing into documents, manuals, written procedures, and so on. According to how it is described, explicit knowledge can be structured (in order to simplify retrieval) or unstructured (that is to say embedded into resources without being indexed and referenced for retrieval). It is in its nature to be easily captured, represented, communicated, transferred and shared with a high degree of accuracy.

Explicit knowledge has been studied since a quite long time by the knowledge engineering (KE) branch of AI that focuses on designing, representing and managing complex (explicit) knowledge-related artefacts, with the aim of enabling computers to act with a certain degree of autonomy. After an initial enthusiastic phase, during which KE techniques have been employed in industrial environments (expert systems, knowledge based systems, etc.), the discipline went through a period of crisis, mainly due to the impossibility to fulfill the expectations it generated. The Web advent, especially in its "semantic" version, restored some strength to KE, underlining the need of representing knowledge in a symbolic way in order to guarantee software applications interoperability and resources management in networks.

The semantic Web's (SW) main aim is to "bring structure to the meaningful content of Web pages, creating an environment where software agents roaming from page to page can readily carry out sophisticated tasks for users" (Berners-Lee, Hendler & Lassila, 2001, p.36). To achieve this result, software agents should be able to process automatically and to "understand" data contained into Web resources, hence we need to couple data with some information describing the data meaning, to make this additional information accessible to agents, and to supply agents with appropriate set of inference rules supporting automatic reasoning. To address this problem, computer readable representations of explicit knowledge (ontologies) are used to add semantic meaning to the information scattered on the Web.

Ontology is a representation of knowledge borrowed from philosophic disciplines that focuses on the nature of existence and of everything that exists. It has been applied in the AI and SW fields to indicate a formal, explicit specification of shared conceptualizations (Gruber, 1993) that allows combining a group of symbols (a word) with a real entity (the object referred by the word). Thus, an ontology describes a concept through the meaning of other concepts: it establishes among them specific semantic relations and introduces axioms and constraints formalizing which ones, among all the possible combinations of concepts and relations, are admissible. Moreover, an ontology supports the