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Editorial

# Special issue on Semantic Technologies for Collaborative Web

Collaborative systems have been evolving fast in the last decade. Nowadays, collaborative mechanisms are highly present on the Web, and collaboration can be seen as an inherent part of the Web essence. Numerous technologies, frameworks and development tools are now on the field to facilitate the fast development of core communications mechanisms and the reuse of predefined components. In this context, research about collaborative systems has been shifting from technologies and theories about how to provide basic communication support, to complex computational and interactive solutions, which can elevate the Web to a provider of a new level of collaboration.

In this perspective, and under the pressure of the commercial and organizational needs, a "fully" Collaborative Web today must entail the creation and maintenance of common layers where applications and people can share information, functionalities and services. Accordingly, collaborative systems are now wider than simple providers of data storage and communication functionalities, and encompass a new era of advanced technologies to assist human and computational agents in managing, discovering, visualizing and representing shared knowledge.

Sharing knowledge on the Web is no longer restricted to a specific domain setting, and the role of Semantic Technologies in the Collaborative Web has become more relevant and widespread. This requires the investigation of different alternative methods and dynamic techniques for knowledge representation, reuse and integration, as well as the construction of complex and yet manageable knowledge representation models. In turn, Collaborative Web Systems are evolving to cope with more flexible, distributed, adaptive, data intensive and quality-oriented environments and demand new approaches to knowledge representation models, reasoning and visualization methods, and semantic interoperability of agents, systems and organizations improvement.

## Aims

The aim of this Special Issue on "Collaboration using the Semantic Web" is to report recent research on Semantic Technologies for Web-enhanced collaboration and to present papers related to advances in improving the quality of collaboration through the Web. The issue comprises research works with significant theoretical and practical outcomes as well as case studies presenting issues and solutions to implement existing knowledge engineering techniques, to structure knowledge, and to capture information from various Web resources.

## Contents

This special issue includes selected papers drawn from an Open International Call for Papers and extended peer-reviewed versions of the papers presented at *Web2Touch*, a track of IEEE WETICE 2014 (IEEE International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises), held in Parma, Italy, from 23rd to 25th of June, 2014 (http://Web2touch2014.tudor.lu/) [1]. In particular, aim of the edition of Web2Touch, which has been a workshop or a track since 2008 in IEEE conferences, such as IEEE NOTERE and IEEE WETICE, has been to present alternatives to address interoperability and distributed knowledge management problems for Web systems. In particular, Web2Touch wants to provide a view on the field of secure and knowledge-intensive Web collaboration using semantic techniques to share experiences, challenges and opportunities, and to cope with frequent evolution of knowledge during cooperative processes based on Web-based collaborative platforms. In 2014, Web2Touch brought together applications, engineering issues, conceptual models and methods to provide a multidisciplinary view over knowledge organization systems based on the Web.

The Call for this Special Issue received 23 submissions, of which 10 from the Web2Touch track and 13 from international authors. The papers were reviewed by three referees each, in a two-step review process. We collected more than 60 international referees well known in areas of ontologies and knowledge representation, cooperative systems, artificial intelligence, semantic Web, Web services and other affine research areas, such as security and privacy, information systems and databases. Referees were invited trying to balance between the academic and the company environments, so as to have available a set of expertises and skills in both advanced research and in current practices regarding the semantic Web and cooperative environments. In fact, while some papers directly address advances and proposals about the near and future research trends in support to cooperation via semantic methods for knowledge sharing in a controlled way, other papers were overviews of state-of-the-art in given specific issues, or reports on use cases and practical applications of knowledge merging, shared data usage, privacy management during sharing, and the like. Some submissions also tackled social approaches to constructing and mediating concepts for knowledge sharing where the Web is selected as the enabling platform.

Wrapping up, the contents of this Special Issue consist of 10 papers presenting advances on key issues on the new generation of collaborative systems, such as: collaborative knowledge management, cooperative management of environmental risks using Web tools, security and privacy in knowledge sharing, knowledge engineering, performance indicators, machine learning, semantic interoperability, crowdsourcing, and collaborative semantic annotation.

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**Details about this issue**

Globally, the aspects tackled by this Special Issue regard ontology engineering, which includes thinking of an ontology, putting it at work and creating it practically under the general idea of developing such ontology in a cooperative manner and, from the other side, in maintaining a coherent set of concepts during ontology evolution done "four handed". This occurs for instance when large sets of concepts describing federated systems have to cooperate to give an overview of the resources of a State or a Territory, as exemplified in some papers.

In general, the problem of merging concepts while maintaining the autonomy of the participants in defining and operating with local ontologies can be tackled in several manners. For example, a way is using an overall shared schema abstracted from local ones and referenced when global access is performed while keeping local schemas of concepts for local accesses. An alternative is to have a virtual view of the global level and routing request for knowledge to local systems using translators into the local knowledge system language and model.

Recommendation systems are other issues emerging in the area of semantics, where annotations of concepts need be maintained by ontology specialists as well as by operative users and domain experts. The use of dictionaries is the most popular approach; however, current dictionaries are far from being semantically rich, since semantics means complexity which runs against usability. Therefore, enhancing the semantic annotation of dictionaries is a main direction.

The problem of privacy of data during knowledge sharing is also a relevant one, as the various submissions on this aspect, also addressing malware and attacks/threats testify. Security and privacy are critical when cooperation occurs via the Web and one would like to trust the interoperability platforms that only needed data are conveyed to the right user for the needed time of usage, possibly with no information leakage. Moreover, the security systems at hand should not penalize usability and performances; hence, an access control system is more and more required to be flexible and adaptive to the cooperation needs, filtering out the requests through protection views on the data. Security and trust, together, surely play a role. Trust of Web platforms, and particularly of semantic Web platforms, is far from being solved, even if being faced more and more seriously.

Other issues regard the usability and the performance of complex semantic Web platforms. Therefore, some papers address the issue of constructing indicators of responsiveness, of data and process quality, of response time and of other non-functional parameters. A panel of Key Performance Indicators is highly demanded in the area of semantic Web, and some papers advance proposals for some categories of indicators that are worth being set up.

Some papers posed the question of combining concepts of shared folders of documents as occurs in the cloud, also for the semantic collaborative networks involving various user roles and tasks. This brings about questions of how to structure such folders, how to allow deep semantic search on the catalogues and on the single folders, and how to keep an aligned set of versions of documents spread on the Web rather than concentrated on the cloud. Security and privacy again play a role in this respect.

Finally, we mention the common factor issue of evaluating the effectiveness, usability, responsiveness, precision and so on of Web cooperation. This opens a broad spectrum of research possibilities, which our authors have proposed in various papers trying to tackle the non-easy aspect of validation and assessment of platforms. Some do this by showing practical use cases and reporting on their usage, also with the help of structured mining tools, others do so experimenting evaluation schemas on large repositories of varied data types, such as multimedia data.

In some more detail, the accepted papers are as follows.

The paper titled "Social psychology insights into ontology engineering" [2], authored by X. Aimé and J. Charlet, investigates social influences on ontology engineering process. Based on the perspective of the various fields of psychology, this paper makes an inventory of the different leverages that influence such process and its related resulting bias. From the inter-individual point of view, an ontology is the result of all group members influences (normalistic approach) or of the influence of part of the group over other group members (conformist approach). From the intra-individual point of view, personal conceptualizations are subject to many influences such as culture, emotions or standards. These inter and intra-individual variations are observable, according to this paper, in terms of categorization and of typicality. The authors hence consider the ontology in its wholeness and complexity by taking the most "ecological" approach. Specifically, since an ontology has a higher chance of appropriation by its users when it integrates the ecosystem where it has been developed, the paper discusses such appropriation, either direct, as a form of internalization of the modeled conceptualization, or indirect, with a good recall and high precision in semantic query extension as part of an information extraction process. The article contributes to the process of knowledge representation and shared conceptual models. The authors argue that ontologists should be aware of their influences and minimize them. Building ontologies is in the core of Collaborative Web systems and the first steps of the cooperation among ontologists and experts require from ontologists the comprehension of the domain and the willing to share from the specialists. The authors conclude by recommending a set of steps of construction process based on this approach.

The paper "SemPI A semantic framework for the collaborative construction and maintenance of a shared dictionary of performance indicators" [3], by C. Diamantini, D. Potena and E. Storti, considers collaboration at strategic level, which entails the sharing of Performance Indicators (PIs) to measure the achievement of common objectives and evaluate performances. PIs are synthetic measures computed starting from transactional data. Their compound nature makes it difficult to reach an agreement on their definitions and heterogeneities when sharing and exchange is needed. Semantic techniques can address these challenges by providing a common layer of formal definitions and automatic reasoning tools to maintain its consistency. In this paper, a semantic framework is given to represent PIs that supports the construction and maintenance of a minimal and consistent dictionary. A feature of the approach is the logical representation of formulas defining PIs, allowing one to make algebraic relationships among indicators explicit, and to reason over these relationships to derive PIs identity and equivalence and to enforce the consistency of the dictionary. A Web application implementing the framework for collaborative construction and maintenance of the dictionary is presented, and experimental evidence of the efficiency and effectiveness of the approach on synthetic and real data is illustrated.

The paper entitled "A machine-learning approach to ranking RDF properties" [4], authored by A. Dessì and M. Atzori, addresses the problem of organizing the information needed to support the retrieval and visualization of relevant information in huge datasets, by providing an order of relevance, or ranking, among the properties of entities used in RDF datasets, Linked Data and SPARQL endpoints. The relevance of ranking RDF properties is described with the help of two "killer" applications for the tackled problem, i.e., property tagging and entity visualization. Then, the authors propose to apply Machine Learning to Rank (MLR) techniques to the problem of ranking RDF properties. Their solution is based on a deep empirical study involving all the dimensions: feature selection, MLR algorithm and Model training. The advantages of the approach are its flexibility and personalization, since the relevance can be user-specified by personalizing the training set in a supervised approach, or set by a novel automatic classification approach based on the swipe paradigm. Moreover, speed is improved, since the approach can be applied without computing frequencies over the whole dataset, leveraging existing fast MLR algorithms.

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