

# Analyzing the Role of Semantic Web in Social Networking Sites

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## **Abstract**

Over the years, a lot of research has been done on the concept of Semantic Web, which is focused on making data machine understandable while neglecting personal information and human relationships. The Semantic vision of the Web, which is a more conscious effort on behalf of the World Wide Web Consortium (W3C) to make the Web friendly to machines as much as it is friendly to human. This paper is consisting of two set of studies, my primary study is concern with Semantic Web Technology to aggregate the electronic data sets that collects about the social networks and in my secondary study is all about role of social networks within the architecture of semantic web. This paper correlates these two studies to bring more effective modern social networking websites with the help of semantic web tools and technologies.

**Keywords:** *Electronic data, Human Relationship, Personal Information, Semantic Web, Semantic Web Technology, Social Networks, World Wide Web Consortium(W3C).*

## **1 Introduction**

The semantic social networks have focused much of their attention on behaviors related to the use of social networking sites such as Facebook and Twitter. In constructing the semantic web, the majority of the work has been focused on describing the contents and relationships of documents, knowledge and information. In doing so, the importance and structure of human relationships have often been neglected. Meanwhile, in an attempt at leveraging the power of

social networking, several websites have been introduced in the recent years. Each has been aiming to act as a place where social relationships play a key role, an online community [1].

Information, as the foundation of web today, usually appears on the form of documents or data (articles, reports, texts, pictures etc). That can be searched, browsed and combined in various ways. It is difficult extract desired information in a reasonable time. The beginning of the World Wide Web has resulted in even greater demand for managing data, information and knowledge effectively [2]. Therefore the web is developing into what is now called the semantic web. The semantic web [3] is visions of an Internet in which web resources are improve with machine processable metadata that describes their meaning. This will enable computers to interpret and extract web content much more effectively and precisely than today's XML-based approaches to allow interoperability.



Fig. 1: Social Networking Sites.

## 2 Idea Behind the Semantic Web

The idea of the Semantic Web is to apply advanced knowledge technologies in order to fill the knowledge gap between human and machine. This means providing knowledge in forms that computers can readily process and reason with. This knowledge can either be information that is already described in the content of the Web pages but difficult to extract or additional background knowledge that can help to answer queries in some way [4].

The semantic web is characterized by a healthy environment of stable, broadly implemented core standard technologies complemented by a number of continually emerging new standards. Adopters of semantic web technologies can choose from a wide range of commercial and open source interoperable tools and systems. Enterprise semantic web projects are beginning to more beyond proofs of

serious production implementations. Community projects on the world wide have linked hundreds of public data sets into an emergent semantic web [5].

Adding semantics to the web involves two things [6]: allowing documents which have information in machine readable forms and allowing links to be created with relationship values. Only when we have this extra level of semantics will we be able to use computer power to help us exploit the information to a greater extent than our own reading.

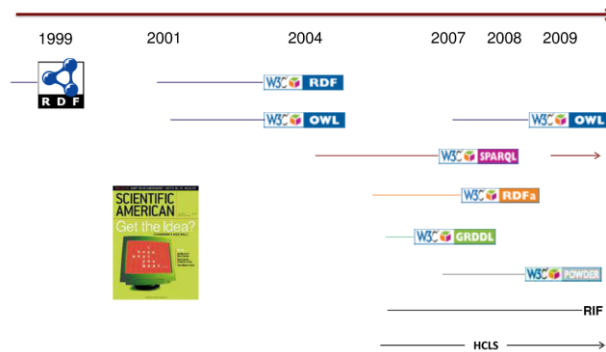


Fig. 2. Semantic Web Technology Timeline.

### 3 Aims of the Semantic Web

- i. Bridging the gap between a web of Documents to a web of data within typed objects and typed relationships.
- ii. Adding machine readable metadata to existing content, so that information can be parsed, queried, reused.
- iii. Defining shared semantics for this metadata to allow interoperability between applications and for advanced purpose such as reasoning.
- iv. Enabling machine readable knowledge at web scale making information easier to find and process.

### 4 The Technologies Details

The common use of the Semantic Web is to identify a set of technologies, tools and standards which form the basic building blocks of a system that could support the vision of a Web imbued with meaning. The Semantic Web has been developing a layered architecture, which is often represented using a diagram first proposed by Tim Berners Lee, with many variations since. Figure gives a typical representation of this diagram.

## **4.1 Unicode and URI**

Unicode, the standard for computer character representation, and URIs, the standard for identifying and locating resources, provide a baseline for representing characters used in most of the languages in the world, and for identifying resources.

## **4.2 XML**

XML and its related standards, such as Namespaces, and Schemas, form a common means for structuring data on the Web but without communicating the meaning of the data. These are well established within the Web already.

## **4.3 Resource Description Framework**

RDF is a simple metadata representation framework, using URIs to identify Web-based resources and Standards Watch Semantic Web Technologies graph model for describing relationships between resources. Several syntactic representations are available, including a standard XML format.

## **4.4 RDF Schema**

A simple type modeling language for describing classes of resources and properties between them in the basic RDF model. It provides a simple reasoning framework for inferring types of resources.

## **4.5 Ontologies**

A richer language for providing more complex constraints on the types of resources and their properties. Ontologies can play a crucial role in enabling the processing and sharing of knowledge between programs on the Web. Ontologies are generally defined as a "representation of a shared conceptualization of a particular domain". They provide a shared and common understanding of a domain that can be communicated across people and application systems. They have been developed in Artificial Intelligence to facilitate knowledge sharing and reuse.

## **4.6 Logic and Proof**

An automatic reasoning system provided on top of the ontology structure to make new inferences. Thus, using such a system, a software agent can make deductions as to whether a particular resource satisfies its requirements.

## 4.7 Trust

The final layer of the stack addresses issues of trust that the Semantic Web can support. This component has not progressed far beyond a vision of allowing people to ask questions of the trustworthiness of the information on the Web, in order to provide an assurance of its quality.

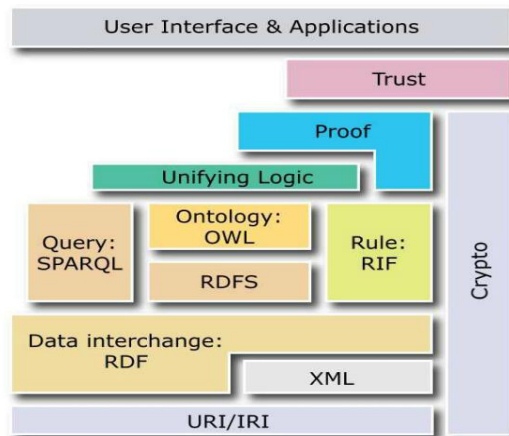


Fig. 3. Tim Berners Lee specified layers for Semantic Web.

I will not go into the details of these languages here. For an introduction see particularly the primer and guideline material [7], [8], or one of the books which are appearing, for example [9], [10].

The Semantic Web initiative has an ambitious program to bring existing work on knowledge representation and reasoning to bear on the Web. These concepts were traditionally developed within the Artificial Intelligence community, and this has given the impression that the activity is of largely academic interest. A common misconception is that it is an attempt to bring AI to the Web. However, the Semantic Web has a less ambitious and more immediately realizable goal of making the Web machine processable, making it in practice more like database and information systems management, but extended to the database of the whole Web. The application and potential of this work is enormous [11].

## 5 Overview of Social Networking Websites

Social networking websites are online communities of people who share interests and activities or who are interested in exploring the interests and activities of others. They typically provide a variety of ways for users to interact, through chat,

messaging, email, video, voice chat, file-sharing, blogging and discussion groups. As World Wide Web grew in popularity, social networking moved to web-based applications. In 2002, social networking era really started. In 2006, anyone with an email address could sign up in social networking sites [12].

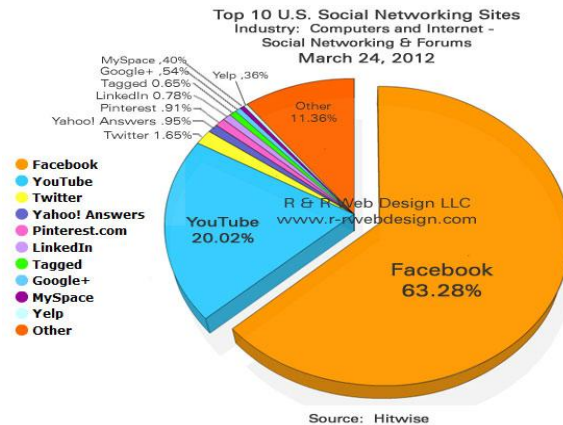


Fig. 4. Social Network used worldwide.

Social Networks started as a means for people to have a social connection with other people with similar interests. A social networking site creates network communication among the user community. Though social networking site serves for communication purposes among special interest groups, the marketing strategy has also entered this medium for its reach. People get exposed to various kinds of brand communication through this media. They tend to interact with the brand and also get awareness about the brand and its service in an interesting way [13].

Table 1: Prominent examples of Web 2.0 & social networking sites

<p><b>Facebook</b> – a social networking service where users create personal <i>profiles</i>, add other users as <i>friends</i> and exchange messages, including automatic notifications when they update their own profile. Additionally, users may join common-interest user groups, organized by common characteristics (e.g. workplace).</p>
<p><b>Twitter</b> - a <i>microblogging</i>* service enabling its users to send and read publicly visible messages called <i>tweets</i>. Tweets are text-based posts of up to 140 characters displayed on the user’s profile page. Users may subscribe to other users’ tweets.</p>
<p><b>LinkedIn</b> – a business-related social networking site mainly used for professional networking. Users maintain a list of contact details of people with whom they have some level of relationship, called <i>connections</i>. This list of connections can then be used to build up a contact network, follow different companies and find jobs, people and business opportunities.</p>
<p><b>MySpace</b> – an online community of users’ personal profiles. These typically include photographs, information about personal interests and <i>blogs</i>*. Users send</p>

one another messages and socialize within the MySpace <i>community</i> .
<b>YouTube</b> – a video-sharing website on which users can upload, share, and view videos. A wide variety of <i>user-generated</i> video content is displayed, including film and TV clips as well as amateur content such as video <i>blogging</i> *. Media corporations including the BBC also offer some of their material via the site. Most videos enable users to leave and exchange comments.
<b>Wikipedia</b> – a collaborative web-based encyclopedia project; its 18 million articles have been written collaboratively by volunteers around the world, and almost all articles are freely editable by any visitor. A prominent web 2.0 site but not an example of social networking site.
*A <i>blog</i> is a type of website or part of a website usually maintained by an individual with regular entries of commentary and descriptions of events ( <i>blogging</i> ). The content of a micro blog is simply smaller in size.

## 6 Problems and Constraints of Social Networking

Online social networks introduced a new organizational framework for online communities, and an exciting new research context. The following are key constraints related to the social networking websites [14].

### 6.1 Digital Identities

Social identities are the names, nicknames, or aliases that users create to identify themselves on online social networking sites. Users adopt different nicknames or aliases in groups they belong to and usually each one of these groups has different privacy concerns, there are public profiles and private or closed profiles.

### 6.2 Trust Management

Trust is a key concept to determine when to establish relationships with profiles from known people or strangers, much like in the real world. To build new relationships, users must be confident that are connecting to whom they expect. Reputation management and tagging technologies help users to assess trustworthiness of third-party information online. Global tagging and aggregation is a great way to build trust on the web and to find resources within a trusted social network.

### 6.3 Privacy

The availability of personal information on social networks provides ideal conditions for actors to abuse such information and leverage it. The inappropriate

exposure of sensitive information might represent a good opportunity for criminals and terrorists to conduct criminal data mining. Bad actors could use unflattering material or personal information from social networks to select their targets, profile their victims, and plan and execute their activities.

## 6.4 Current Security Threats

As the popularity of social networks started to increase, hackers, fraudsters and malicious users started using them to run illegal activities, either by using the social networks as attack vectors to traditional cyber crimes, by creating specific threats to social networking users or by running direct attacks to disrupt social networking sites. Social networks have by nature some intrinsic properties that make them ideal to be exploited by an online criminal: a huge and highly distributed user-base made of clusters of users sharing the same social interests, thus developing trust with each other.

## 6.5 Social Networks under Attack

Social network providers, as with any other Web application, might be vulnerable and become the target of a direct attack. Security vulnerabilities could provide hackers with a means to attack providers and cause service failures unauthorized access to user's credentials or could be used by a virus to be spread amongst user accounts.

# 7 Friend of a Friend (FOAF)

At the basic technical level, FOAF is just an RDF (Resource Description Framework) vocabulary [15]. The goal of FOAF is to provide a means for describing people and their personal information such as name, e-mail address as well as social linkage to their friends by using XML and RDF. Some of the most common properties are the following:

- 1) **foaf:name**, **foaf:surname**, and **foaf:firstname** all provide information on the individual's name. The first is assumed to be the full name of the person while the surname and firstname properties contain only the family name or the first name, respectively.
- 2) **foaf:nick** provides a nickname for a particular person, e.g. Bill.
- 3) **foaf:homepage** specifies a link to the persons homepage, e.g. <http://www.doe.com/john/>
- 4) **foaf:phone** is the individuals phone number, typically identified using the tel: URI scheme.
- 5) **foaf:schoolHomepage** provides a link to the school homepage this individual is studying at.

- 6) **foaf:gender** provides gender information
- 7) **foaf:knows** specifies a person that this person knows. It does not give a link to their homepage directly, but instead a person-structure is expected (which can, in turn, include a link to the homepage of the known person).
- 8) **foaf:depiction** points to a URL of an image of the person in question.

The description of relationships is specified with the foaf:knows property. This property is somewhat vague as it's not specified what is actually meant by "knowing" a person [1].

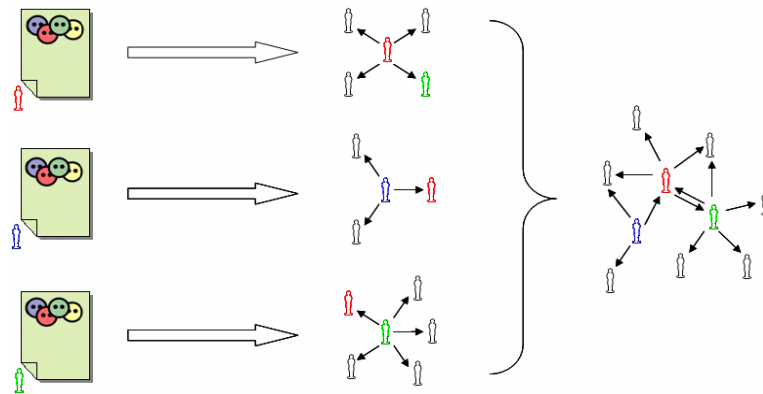


Fig. 5. Integrating social networks by using FOAF as a common representation format and having unique URIs for people.

## 8 Friend Network (XNF)

The XFN profile specifies the allowed attributes for describing relationships [16]. They are categorized under friendship, physical, professional, geographical, family, romantic and identity categories. In the specification below, a symmetric relationship of "A -> B" implies that "B -> A" also holds true while a transitive relationship means that relationships "A -> B" and "B->C" imply "A->C".

### i. Friendship

- a. **Contact:** Someone you know well enough get in touch with.
- b. **Acquaintance:** Someone who you have exchanged greetings and not much more maybe a short conversation or two.
- c. **Friend:** Someone who is your friend. A compatriot, buddy, home that you know.

### ii. Physical

- a. **Met:** Someone who you have actually met in person.

### iii. Professional

- a. **Co-worker:** Someone a person works with, or works at the same organization as. Symmetric. Usually transitive.
  - b. **Colleague:** Someone in the same field of study/activity.
- iv. **Geographical** (at most one should be picked from this category)
- a. **Co-resident:** Someone you share a street address with.
  - b. **Neighbor:** Someone who lives nearby, perhaps only at an adjacent street address or doorway.
- v. **Family**
- a. **Child:** A person's genetic offspring, or someone that a person has adopted and takes care of. Inverse is parent.
  - b. **Parent:** Inverse of child.
  - c. **Sibling:** Someone a person shares a parent with. Symmetric.
  - d. **Spouse:** Someone you are married to.
  - e. **Kin:** A relative, someone you consider part of your extended family.

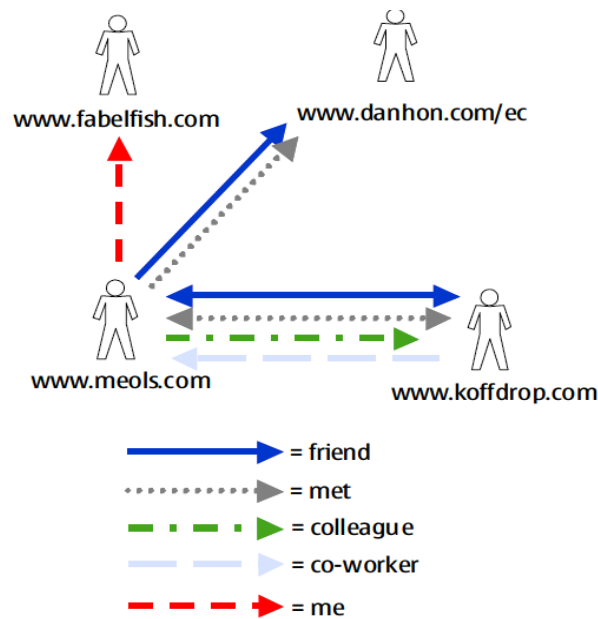


Fig. 6. XNF Linkage Example.

- vi. **Romantic**
- a. **Muse:** Someone who brings you inspiration.
  - b. **Crush:** Someone you have a crush on.
  - c. **Date:** Someone you are dating.
  - d. **Sweetheart:** Someone with whom you are intimate and at least somewhat committed, typically exclusively.

**vii. Identity**

- a. **Me:** A link to yourself at a different URL. Exclusive of all other XFN values. There is an implicit "me" relation from a subdirectory to all of its contents.

## 9 Semantically Interlinked Online Communities (SIOC)

The goal of the SIOC ontology is to address interoperability issues on the social web.

The aims of SIOC are:

- 1) To semantically interlink online communities.
- 2) To fully describe content/structure of social websites.
- 3) To create new connections between online discussion post and items, forums and containers.
- 4) To enable the integration of online community information.
- 5) To browse connected social web items in interesting and innovative ways.

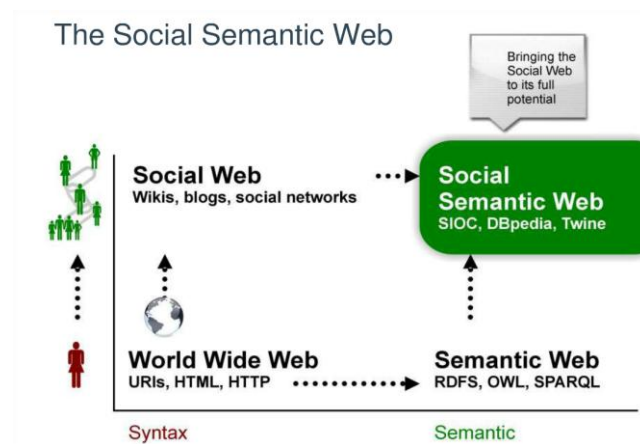


Fig. 7. Social Semantic Web.

## 10 Representation Models for the Social Semantic Web

Semantics can help social websites by using agreed upon semantic formats to describe people, content objects and the connections that bind them all together, social media sites can interoperate by appealing to common semantics. Developers are already using semantic technologies to augment the ways in which they create, reuse, and link profiles and content on social media sites. In the other

direction, object centered social networks can serve as rich data sources for semantic applications.

## 11 Conclusion

This paper has described the detailed study of the Semantic Web with the help of the explanation of Semantic Web architecture, tools, technology and its basic aim. It has provided an overview of a role that semantic web has placed in the development of the social networking websites. However, it has been a long time in development and does require an investment of time, expertise and resources. Social networks are growing rapidly and users want to express their identities and share information in restricted virtual communities.

Regardless of the standard, it is becoming clear that personal and social aspects of the semantic web is an area of great interest and one that is bound to increase in importance over the coming years.

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