

# Finding experts using Internet-based discussions in online communities and associated social networks

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## Abstract

This position paper on expert finding presents a conceptual framework for the reuse and interlinking of existing, well-established vocabularies in the Semantic Web. Such a framework can be used to connect people with people, based on joint or complementing interests (e.g. the need to develop specific new or existing skills for upcoming projects). Driven by a requirement to find experts using the profiles of people in social networks and using the content they create in online communities, we are exploring the usage of vocabularies in these domains that have already gained considerable momentum and that have suitable concepts for this application area. We will present the relevant properties of the FOAF ontology for matching people and their skills in social networks, then detail the SIOC project and methods for identifying relevant discussion topics / individuals, and finally we will outline a combinatory scenario that will allow people to find individuals with the desired expertise in a particular domain of interest.

## Introduction

Even with the advent of the Internet, a common problem still occurs where two or more people are struggling to solve a particular problem in a specialised area when their combined skills could easily solve their mutual interests. The process of finding the right expert for a given problem (e.g. matching people's skills, interests, tasks or responsibilities) has long been of interest to computer scientists, and with renewed interest it is now being tackled in domains ranging from language modelling [Balog, 2006] to the Semantic Web<sup>1</sup>. A number of popular Semantic Web vocabularies have gained community acceptance for the areas of person description (FOAF) and Internet-based discussions (SIOC) [Breslin, 2005]. Using metadata provided from these vocabularies, the knowledge that is created in online communities can be made explicit and accessible to all members.

In this paper, we will describe how a combination of these vocabularies can be used to find particular expertise through one's social connections and memberships of community sites. By using the profiles of users from FOAF-enabled social networks and SIOC-exporting online communities, various connections become possible, including connecting people with people by tailoring available information and linking users based on their profiles and social networks (and in turn enhancing the connections between and within communities of interest).

We will continue by describing the properties of the FOAF (Friend of a Friend) ontology that make it particularly suited for matching people and their skills in social networks; then we will describe the SIOC (Semantically-Interlinked Online Communities) project and methods for identifying relevant topics and the individuals who have discussed them; and finally we will present a usage scenario for a framework that combines FOAF, SIOC and topic classification information using SKOS (Simple Knowledge Organisation System) that will allow people to find individuals with the desired expertise in a particular domain of interest.

## Finding experts using FOAF

FOAF [Brickley and Miller, 2000] is the foundation vocabulary for finding experts through one's extended social network. The FOAF ontology was developed to create machine-readable web pages for people, groups, organisations and other related concepts - in short, to

describe people, what they do and how they interact with each other. One of the most used properties of the FOAF ontology is the "knows" property: a simple way to create social networks through the addition of knows relationships for each individual that a person knows. For example, Bob may specify knows relationships for Alice and Caroline, and Damien may specify a knows relationship for Caroline and Eric; therefore Damien and Bob are connected indirectly via Caroline.

Aggregations of FOAF data from many individual homepages are creating distributed social networks; this can in turn be connected to FOAF data from larger online social networking sites such as LiveJournal or Tribe. In terms of definitions of expertise by an individual, the FOAF ontology has a number of properties of note: firstly, the foaf:interest property defines topics of interest to a person, and can be used directly to find those with an interest a particular domain; secondly, people can create foaf:publications or other foaf:Documents (via foaf:made/maker) which may have an associated foaf:topic or foaf:primaryTopic that can again be used to determine a person's domains of interest; and thirdly, foaf:currentProject/pastProject gives some information on some "some collaborative or individual undertaking" that a person may be involved in.

There have been a number of extensions or modules for the FOAF ontology that are of interest to the expert finding scenarios previously mentioned. [Bojars, 2004] presented the "Resume" schema <sup>2</sup> for extending FOAF profiles with curriculum vitae-type information. This schema includes terms for work and academic experience, skills, courses and certifications, publications, references, etc. Another extension to FOAF, DOAC <sup>3</sup> (Description of a Career) can also be used to describe the professional capabilities of a worker. [Kruk, 2005]'s FOAFRealm <sup>4</sup> is a user profile management system based on FOAF, that provides authentication, access control and social networking features such as "semantic social collaborative filtering". The system allows users to share and annotate their personal taxonomies across a social network using WordNet, DDC and DMoz as base classifications. When implemented in document exchange systems such as JeromeDL <sup>5</sup>, a semantic digital library, users can classify their documents or bookmarks and allow others to access these resources using FOAFRealm's ACL-based social networking functionality. Each user's collection is assigned an expertise value that reflects the quality of the information that they provide; this value is calculated based on a PageRank calculation of their social network. Users are then also aware of the expertise level of others on given topics.

## **Finding experts using SIOC**

The SIOC project <sup>6</sup> aims to provide methods for the connection and interchange of information from Internet-based discussions and community portals. Such communities are primarily made up of users, the posts that they create, and the discussion forums that they subscribe to across a multitude of sites and discussion platforms.

The basis for SIOC is the SIOC ontology, an RDF-based schema which describes the main concepts found in online communities [Breslin, 2005]. With respect to finding experts in an online community, the main SIOC properties of interest are sioc:topic and dc:subject. sioc:topic defines a category resource that a particular discussion post is related to; by aggregating all the sioc:topics that are associated with a particular user's posts across a number of sites, a picture emerges as to where their topics of interest and related expertises lie. sioc:Forums or Sites may also have associated sioc:topics, and again a user with an interest in a particular topic may be a sioc:subscriber\_of a certain discussion channel.

SIOC concepts are loosely aligned with FOAF and SKOS so as to avoid any unnecessary duplication or term conflicts. The concept of sioc:User has been defined to be a sub-type of foaf:onlineAccount, so that existing properties from FOAF can be reused and so that new properties for users can be defined in SIOC without directly impacting on the FOAF ontology. Using SKOS to define topics under discussion and of interest leads to many possibilities when the relationships between the various taxonomy terms are formalised using the SKOS vocabulary.

## Scenario

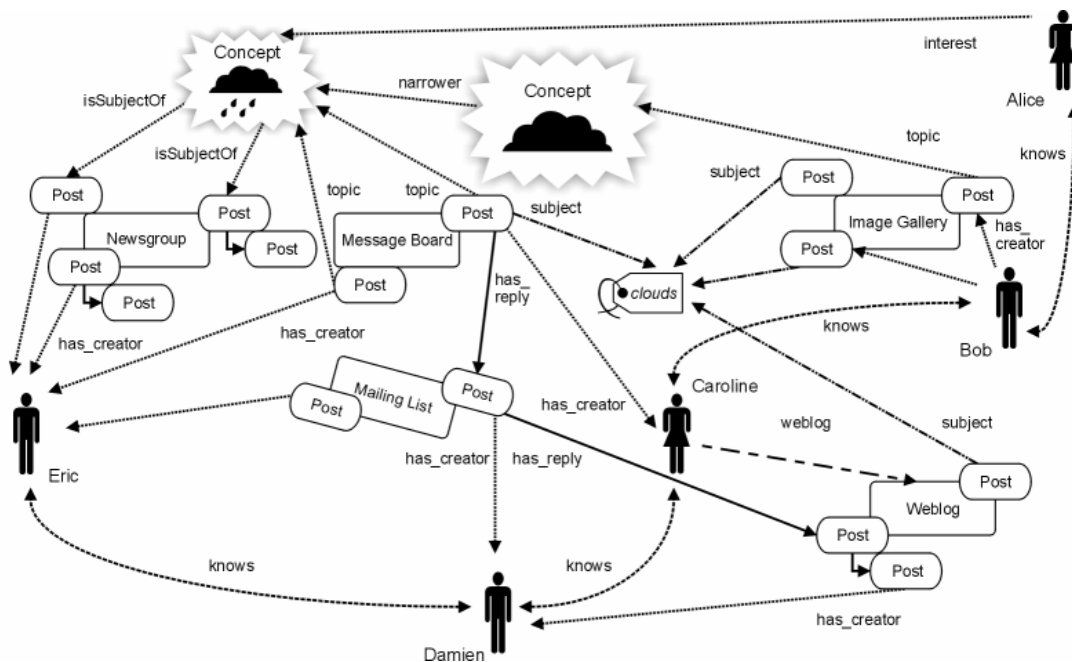


Figure 1: Expert finding using the concepts in FOAF, SIOC and SKOS

By combining the properties of the FOAF, SIOC and SKOS ontologies, we can construct some interesting scenarios that can be used when metadata is provided from semantically-enabled social networks and community sites. We will use a particular scenario illustrated in Figure 1, where Alice (top right corner) is looking for expertise in the area of rain clouds. Direct "knows" links between people represent bidirectional social relationships (e.g., Bob knows Caroline and vice versa).

Using the proposed framework, Alice has expressed an interest (using the foaf:interest property) in rain clouds, and wishes to find others with expertise in this domain. At the moment, she is only connected to Bob, who she knows is also interested in clouds (through his image gallery and comments that he has attached to his photos), but she does not know anyone directly who is specifically interested in rain clouds. She performs a search through her extended social network to find out if anyone else has defined a topic of interest in rain clouds, but does not receive any matches.

She then looks to see if anyone in her extended social network has created content relating to rain clouds (thereby indirectly expressing an interest in this topic), and via SIOC instance data, Alice finds a match in an individual named Caroline who has created a message board post that is on the topic of rain clouds and blogs about clouds from time to time. She is also shown a breadcrumb trail or shortest path between herself and Caroline, which happens to be through their common acquaintance Bob, and Alice then asks Bob if he can introduce her to Caroline.

While she is waiting for this introduction, Alice decides to further explore the message board where rain clouds were being discussed, and finds another individual called Eric who has made some posts about this topic. By browsing other posts by Eric, she finds a Usenet newsgroup that Eric frequents where this topic is being discussed in some more detail, and subscribes herself to it.

As shown in Figure 1, content that a person creates on a particular discussion site (e.g. a Weblog, Mailing List, Message Board etc.) can be linked using sioc:topic to a skos:Concept (e.g. in Figure 1, one post is talking about clouds and another post is referring to a narrower concept, that of rain clouds).

## Future Work

While a combination of FOAF, SIOC and SKOS leads to a number of interesting scenarios in the expert finding domain, an application to implement the required framework is necessary. The SIOC Browser [Bojars, 2006] and FOAF Explorer<sup>7</sup> are two open-source applications that can be tailored to provide such a framework. The SIOC Browser has already been programmed to provide both generic query interfaces (for use by developers) and simple wizard-type functionality (for use by end-users; for example, show me all current "hot topics" or display a social network of people who reply to each other's blogs). Similar functionality could be added to realise the scenario solutions outlined above, such as the query to find people who either have expressed an interest in or created content about a particular topic in one's extended social network or in sites that members of one's social network frequent respectively. We propose to develop a prototype application based on the SIOC Browser that will implement this and other expert finding functionality.

## Conclusions

This paper has proposed methods for finding experts through social networks and online communities, where people and content are linked by topics of interest through expressed preferences or created content. We gave an overview of what can be achieved, described a number of interesting properties in popular ontologies such as FOAF, SIOC and SKOS, and gave a detailed scenario where a framework making use of these properties could allow an interested party to locate an expert in a particular field of interest. We also presented a short description of how this framework could be realised, using existing Semantic Web browsers and query interfaces.

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- 3 <http://ramonantonio.net/doac/>
- 4 <http://www.foafrealm.org/>
- 5 <http://www.jeromedl.org/>
- 6 <http://sioc-project.org/>
- 7 <http://xml.mfd-consult.dk/foaf/explorer/>