Formation of Peer-to-Peer Communities of Knowledge

Xi Bai
School of Informatics, University of Edinburgh
xi.bai@ed.ac.uk

Abstract

Many systems exist for community formation in extensions of traditional Web environments but little work has been done for forming and maintaining communities in the more dynamic environments emerging from *ad hoc* and peer-to-peer networks. From the perspective of choreography, this paper proposes an approach for forming and evolving the peer community based on peers' interactions. OKBook, a system allowing peers to publish, discover and subscribe or unsubscribe to Interaction Models (IMs), is implemented in accordance with our approach as a sister system of the OpenKnowledge system. Our approach complies with principles of the Linked Data and is capable of both contributing to and benefiting from the Web of data.

Introduction

Service providers care more about how social communities rank their products and services than how search engine giants rank them. Service requesters trust recommendations from other peers in social communities more than advertisements from service providers. Therefore, the community plays an important role within the service discovery. We proposes an approach for forming and evolving peer-to-peer communities based on peers' interaction in the form of the IM which is a set of clauses defining the behaviors associated with roles within peer interactions. In accordance with this approach, OKBook has been built on top of the OpenKnowledge system [1], which is an open online platform for peer-to-peer knowledge sharing. The framework of OKBook is depicted in Figure 1.

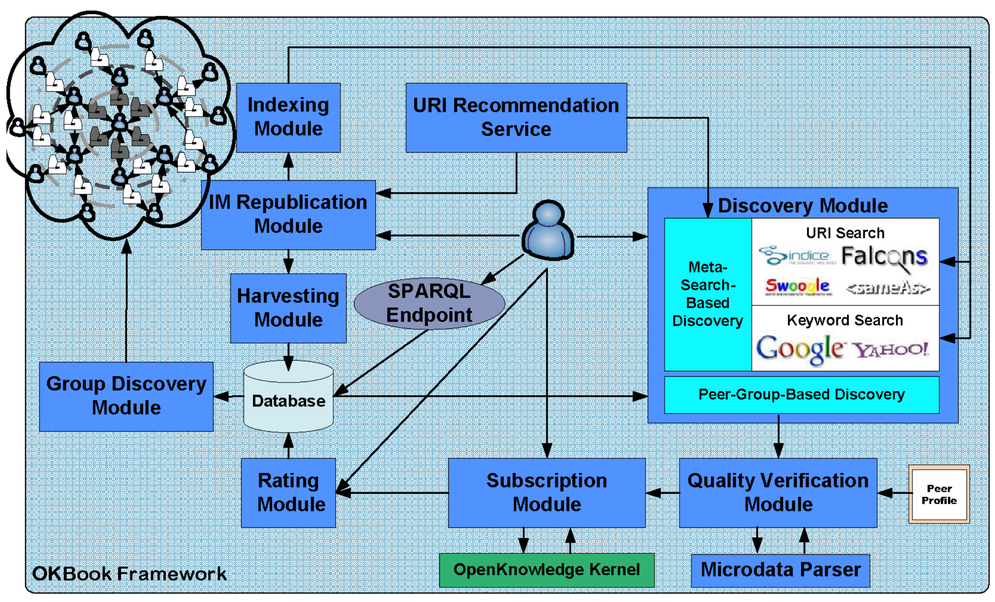

Figure 1. OKBook Framework

Two mechanisms for discovering IMs and collaborative peers are given based on our meta search engine and dynamic peer grouping algorithm respectively. A method of integrating and re-ranking search results returned by different Semantic Web search engines is also designed. This allows peers to discover IMs from their group members based on our Extended Open Graph Protocol (EOGP), thus reducing the burden on the meta-search engine. As more interactions occur inside the community, will evolve based on inferences on triples not only parsed from peers' profiles but also gleaned from republished IM pages. Both profile updates and IM updates have been done using a pushing mechanism instead of the traditional pulling mechanism.

Communicating Layer

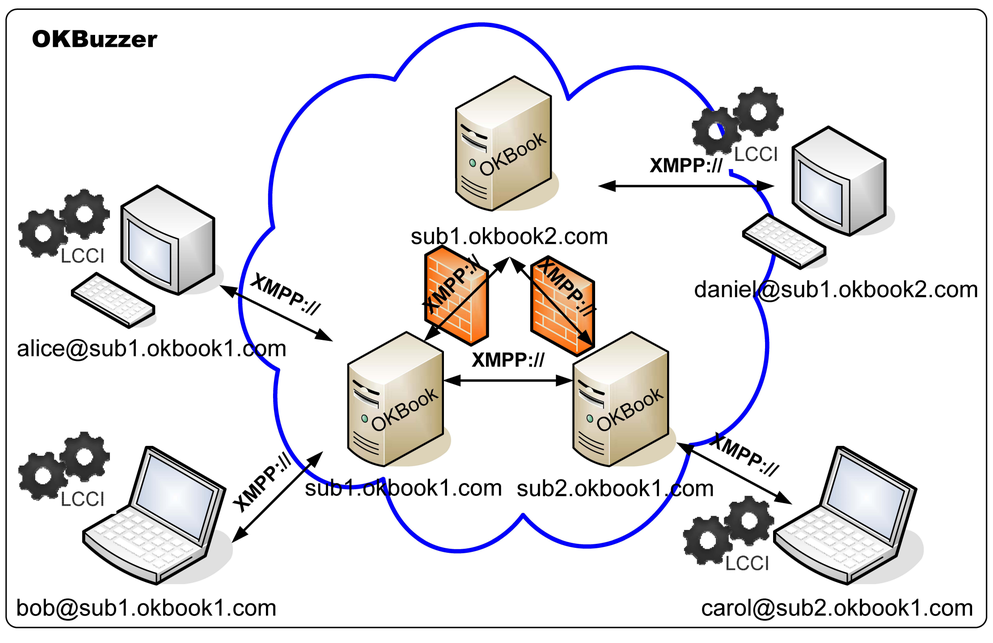

Figure 2. OKBuzzer Framework

Knowledge Representation

In the OpenKnowledge-based peer-to-peer community, each peer has a profile which contains a peer's public information such as which roles it can play, which constraints it can solve and corresponding OpenKnowledge Components (OKCs) it owns and how many times it has been involved in a specific IM. Moreover, since peers can make friends with others, a profile also describes the relationships between the holder and its friends.

Peers' profiles may be stored in RDF repositories or plain databases. Compared with plain databases, RDF repositories are easier to merge because of the unified triple structure of data sources compared with variety of database schemas. Moreover, in order to make them comply with our microdata-based IM republication, we store the profiles in an RDF data model rather than a table.

Updating of Peer Profiles and IMs

The Publish/subscribe model is used for updating profiles and IMs. The protocol is implemented using Pubsubhubbub [2] which is shown in Figure 3.

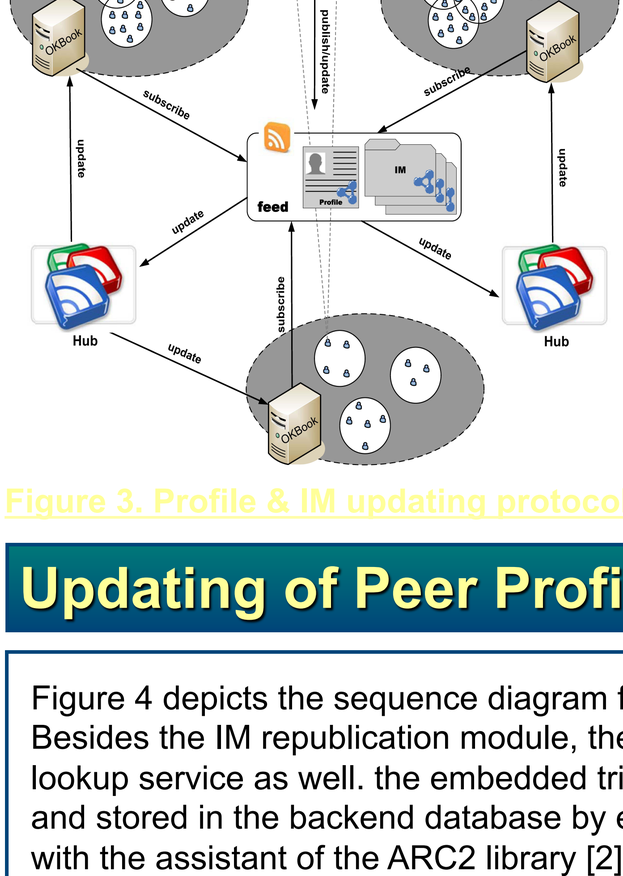

Figure 3. Profile & IM updating protocol

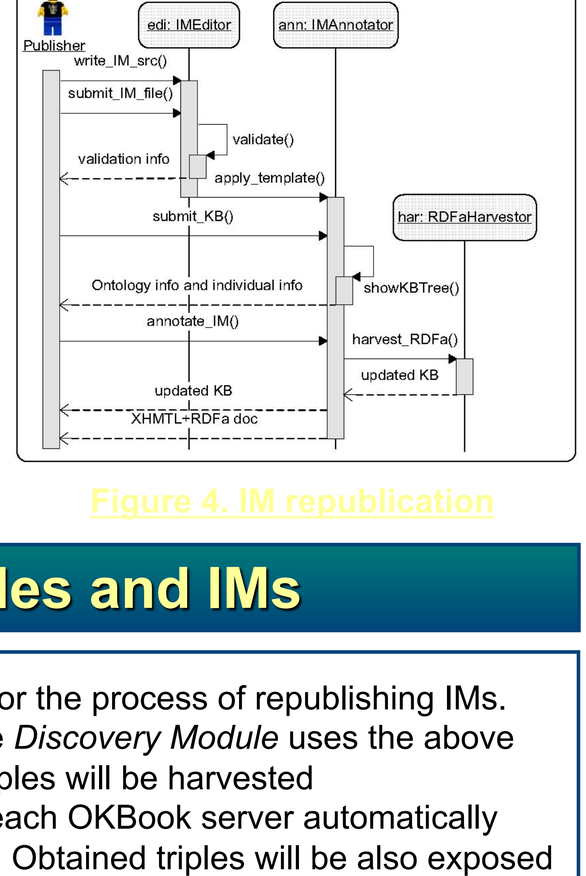

Figure 4. IM republication

Updating of Peer Profiles and IMs

Figure 4 depicts the sequence diagram for the process of republishing IMs. Besides the IM republication module, the *Discovery Module* uses the above lookup service as well. the embedded triples will be harvested and stored in the backend database by each OKBook server automatically with the assistant of the ARC2 library [2]. Obtained triples will be also exposed to users via a SPARQL endpoint based on HTTP bindings. So developers can reuse our RDF repository created from republished IMs and establish their own applications of interests (e.g., IM mashups)

Experiments

100,000 peers and 10 IMs were generated for our experiment. Since each interaction involves at least two peers, we assumed each IM owns two roles and 80,000 interactions occurred in the end. Then we make each peer randomly select an IM to subscribe and calculated how many peers can find desired IMs making use of our peer-group-based discovery instead of the assistance of the meta-search engine on OKBook. This proportion, also called Winning Proportion (WP), is probably related to the parameters such as the number of peers, the number of IMs and the number of interactions, so we did experiment and changed one parameter gradually and kept other two fixed in order to figure out what percentage of all peers the peers that can get desired IMs from their group members (winning peers) account for. Finally, we got results for three cases in Figure 5, Figure 6 and Figure 7 respectively.

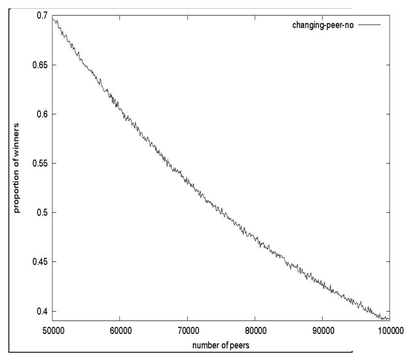

Figure 5. WP change with peers

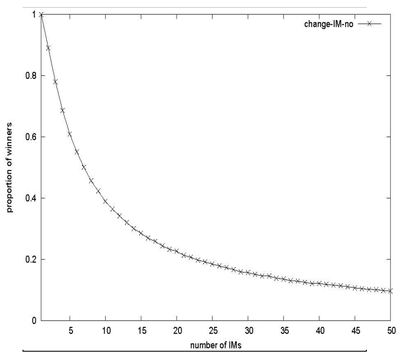

Figure 6. WP change with IMs

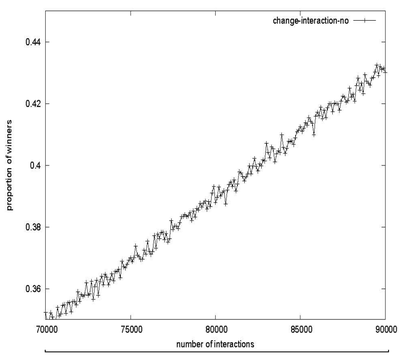

Figure 7. WP change with interactions

Summarization

Nowadays, more and more service providers begin to look for customers instead of waiting for customers to look for their services. So we believe that in near future, we will not search for services but services will find us in one way or another (e.g., through the peer community). OKBook is a preliminarily prototype trying to achieve this goal in the peer-to-peer environment.

References

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2. http://pubsubhubbub.appspot.com
3. http://arc.semsol.org

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