The SIOC Project: Semantically-Interlinked Online Communities, from Humans to Machines

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Abstract. The SIOC project — Semantically-Interlinked Online Communities — is aimed at expressing information about the nature, structure and content of online communities using Semantic Web technologies. Then, information created and maintained *via* human-centric social interactions becomes processable by autonomous software agents for advanced purposes, such as enabling interoperability between applications from the Social Web. In this paper, we describe the various components of the SIOC project (*i.e.* the SIOC Core ontology and its different modules as well as the SIOC ecosystem and some related applications) in this context of online communities, both on the Web and in more restricted virtual environments, also taking into account human-agent communications in such environments.

1 Introduction

While the new paradigms, tools and services introduced by the Social Web — also referred to as Web 2.0 [20] — are now widely accepted in both public and scientific communities (for instance blogs, wikis, tagging practices, etc.), their popularity has also led to various issues. Indeed, due to the heterogenous nature of data models used to represent Social Media Contributions (for instance various APIs or database structures, generally depending on the application provider), finding, interlinking and querying such data within and between online communities is a complex issue. Moreover, such tools generally act as independent data silos where the information is being locked with a lack of machine-readable meta-data; hence, reusing information from these applications is not straightforward, and most of Web 2.0 services can be seen as *"walled gardens"* where information cannot be extracted and reused by users nor software agents.

However, online communities would greatly benefit from better ways to provide machine-readable description of their nature, content and structure, enabling among others interoperability in and between various distinct online communities. For example, it would allow to retrieve content created in different communities but sharing a similar topic, enabling a way to follow and navigate

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through distributed conversations across the Social Web — such as following a discussion starting on a bulletin board and continuing on a separated forum.

To that extent, another recent trend with regards to Web technologies concerns the Semantic Web [3], which provide standards and models to build a *Web of Data*, with unified models to represent typed and interlinked data from different sources, where we are currently browsing a *Web of Documents*, with simple pages and hyperlinks. Hence, the vision that we follow consists in combining Semantic Web technologies and paradigms from the Social Web. This leads to *"Social Semantic Information Spaces"* (Figure 1) [8], where information from online communities is created and maintained through social interactions but is at the same time interlinked and machine-readable. Thus, new ways to exploit these online communities can be envisioned, for example using SPARQL to uniformly query data from different communities (Section 5). Such integration of these two fields would thus lead to a Social Semantic Web [10], a vision that has been researched during the past few years [1] and defended by Tim Berners-Lee himself [2].

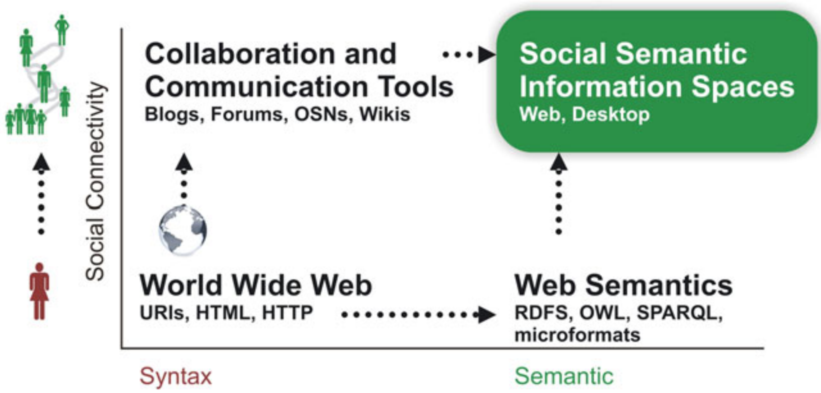

Fig. 1. Social Semantic Information Spaces

Focusing on that integration, the SIOC project[1] — Semantically-Interlinked Online Communities [9] — aims to be a building block of these Social Semantic Information Spaces, solving the aforementioned issues by providing a comprehensive data model (as well as related tools and applications) used to represent online communities and their activities in an homogenous way. To achieve this vision, the SIOC project relies on two main components that are to be discussed in this paper: (1) the SIOC Ontology, composed of the SIOC Core Ontology and various modules; and (2) a set of applications, covering the creation, integration and use of SIOC data in online communities, and that form a SIOC eco-system.

[1] http://sioc-project.org

In the next section of this paper, we will detail the SIOC Ontology, *i.e.* the SIOC Core Ontology and its related modules. Then, we will discuss the uptake of SIOC on the Web and describe the SIOC Eco-system. We will continue by presenting various initiatives and applications using SIOC, in online communities. In that section, we will also focus on the ability to use SIOC to represent communities formed not only by humans, but also comprised of both humans and software agents (such as bots on IRC — Internet Relay Chat). We will then present how such data can be queried and reused in order to make sense of online communities thanks to SIOC data, before concluding this paper.

2 The SIOC Ontology

In order to allow agents to process machine-readable data uniformly across different applications, the Semantic Web vision relies on the use of ontologies [13] as models to provide shared semantics between applications on the Web. Hence, to achieve the aforementioned goal of the SIOC project, *i.e.* making information from online communities available to software agents, the first requirement is to provide a comprehensive ontology covering the various artifacts and actions that are created and that happen in these communities.

The SIOC Ontology [4] is composed of a Core Ontology and of a set of modules. The main motivation that lead to splitting the ontology in several parts is to provide an easy integration of SIOC in existing applications by Web developers, that consequently do not have to apprehend a complex schema but can focus on simple models, generally considering first the use of the SIOC Core Ontology, and then using additional modules if required.

In July 2007, the SIOC Ontology was published as a W3C Member Submission[2]. This submission ensures higher visibility of the ontology as a format for representing online communities and offers a way to bootstrap the model and consequently provide more content using it on the Web, as we will see in Section 3. That way, it creates a network of interlinked Social Data at Web scale, augmenting its global value as also discussed in [15].

A comprehensive overview of the SIOC ontology is provided in [7]. We shall also mention that, while being a mature model, the SIOC Ontology still evolves based on the needs of the community and some particular applications that emerge and require new features in the ontology, for instance the concept of *followers* in microblogging applications.

2.1 The SIOC Core Ontology

The main classes and properties in the SIOC Core Ontology[3] are shown in Figure 2. As we introduced earlier, while relatively small and simple, this model is yet powerful enough to represent the content produced and exchanged within online communities. For instance, a `Forum` represents a space in which discussion

[2] `http://www.w3.org/Submission/2007/02/`
[3] `http://rdfs.org/sioc/spec`

happen (not necessarily a bulletin board, in spite of its name, but any virtual space that hosts discussion), and contains different (instances of) `Posts`, written by (instances of) `UserAccounts`. In order to represent more abstract containers (such as a personal information space that to not necessarily hold discussions), the more general `Container` and `Space` classes can be used. Based on the SIOC Core Ontology, the following example (using RDF N3 serialization[4]) describes how we represent that Alice has created a post in a particular forum (*i.e.* an area of discussion) and that Bob replied to it. In addition, we shall mention that with an emphasis on standardized Semantic Web technologies since its beginning (*i.e.* relying on W3C specifications), the whole ontology has been designed using RDFS and recently was adapted as an OWL-DL model.

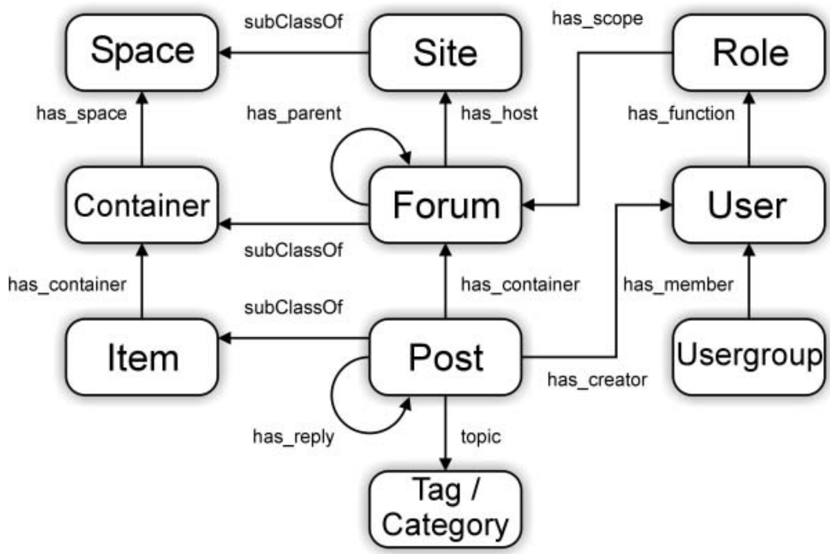

Fig. 2. Main classes and properties in the SIOC ontology

In addition to the ones represented in Figure 2, other classes and properties are provided in the SIOC Core Ontology. For instance, the `previous_version` and `next_version` properties can be used to link versioned items (which is particularly useful in wiki communities), while the `has_modifier` one is used to identify the modifier(s) of any content. Considering once again the use-case of wikis, this property can be used to represent modifiers that are both humans, *i.e.* people editing wiki pages, and autonomous agents, such as both automatically reverting pages edited by vandalism. To that extent, SIOC is then suited not only to human-human online interactions but to any community involving agents, either they are human or machines.

[4] Prefixes omitted for space reasons.

```
:post a sioc:Post ;
  sioc:has_creator :alice ;
  sioc:has_container :forum ;
  sioc:has_reply :reply .
:forum a sioc:Forum .
:reply a sioc:Post ;
  sioc:has_creator :bob .
:alice a sioc:UserAccount .
:bob a sioc:UserAccount .
```

Listing 1.1. Example of RDF data modeling a post and its reply using SIOC

2.2 The SIOC Modules

Several SIOC modules have been defined (i) on the one hand to extend some terms from the SIOC Core Ontology (and to avoid making it too complex to apprehend) and (ii) on the other hand to focus on particular features of online communities. Among its different modules, SIOC provides[5]:

– **SIOC Access module:** In order to define access control in online communities and in particular discussion spaces, the SIOC Access module[6] provides simple classes and properties regarding the notions of Role and Permission. Such properties could be combined with authentication schemes relying on Semantic Web technologies, especially FOAF-SSL [28] that provides a decentralized and user-owned authentication scheme based on FOAF, which complements well with the use of SIOC. In addition, one could rely on SIOC-related initiatives, such as the concept of *Faceted Online Presence* [27], as well as work based on policies presented in [25] to enable the management of norms and responsibilities in online communities;
– **SIOC Argument module:** As many people in online communities not only share data but also agree and disagree between them, there is a need to represent these argumentations in a machine-readable way. The SIOC Argument module[7] defines classes and properties to represent simple argumentative discussions in online communities websites [17]. Another fine-grained module aims at representing argumentative discussion is the SWAN/SIOC module, describe later in that section;
– **SIOC Types module:** The SIOC Types module[8] defines advanced content-types to be used when defining user-generated content from online-communities. While the Core Ontology simply defines classes such as `sioc:Post`/ `sioc:Item` to represent online contributions and `sioc:Forum` / `sioc:Container` to defines online communication spaces, the Types module goes further to provide

[5] See `http://rdfs.org/sioc/spec/#sec-modules` for an up-to-date list of modules, since new ones are regularly designed to enable the use of SIOC in new applications or domain-areas.
[6] `http://rdfs.org/sioc/access`
[7] `http://rdfs.org/sioc/args`
[8] `http://rdfs.org/sioc/types`

more accurate descriptions of the items that are shared. For instance, it includes classes such as `sioct:BlogPost` and `sioct:WikiArticle` to represent the shared items as well as `sioct:Blog` or `sioct:Wiki` for the container, that respectively subclass the `sioc:Post` and `sioc:Forum` classes discussed previously. That way, using the SIOC Types module, the previous example can be refined as depicted in Listing 1.2.

- **SIOC Services module:** Another feature of main Web 2.0 applications is the way they provide access to their content for developers, so that they can build mash-ups, etc. The SIOC Services module[9] defines classes and properties to represent Web services related to online communuties (*e.g.* API endpoint and return format, etc.). We shall note that it aims to be and stay lightweight, and do not compare with webservices description languages and ontologies such as WSDL[10]. However, thanks to this module, agents could figure out how to access an endpoint to retrieve machine-readable description of the community.
- **The SIOC/SWAN module:** Finally, one of the recent development of SIOC is a module defining alignments between SIOC and the SWAN — Semantic Web Applications in Neuromedicine — ontology [11][11], providing a complete model for fine-grained argumentative discussions in online scientific communities through the SWAN/SIOC module [24].

```
:post a sioct:BlogPost ;
  sioc:has_creator :alice ;
  sioc:has_container :forum ;
  sioc:has_reply :reply .
:forum a sioct:Blog .
:reply a sioct:Comment ;
  sioc:has_creator :bob .
:alice a sioc:User .
:bob a sioc:User .
```

Listing 1.2. Example of RDF data to model a post and its reply using the SIOC Core Ontology and the SIOC Types module

2.3 Relationships with Other Vocabularies

SIOC reuses and aligns with various ontologies from the Web. The main goal of such approach is to avoid reinventing new classes and properties, and to benefit from past work from other communities in terms of ontology engineering. Especially, SIOC reuses the Dublin Core model to define various attributes of created content (such as the creation date of an item, using `dcterms:created`),

[9] http://rdfs.org/sioc/services
[10] http://www.w3.org/TR/wsdl
[11] http://rdfs.org/sioc/swan

FOAF — Friend Of A Friend [12] — to model personal identity and related attributes and has ties with SKOS — Simple Knowledge Organization System[13] — to model discussion topics (Figure 3). By interlinking FOAF and SIOC, one can have different user profiles on different websites (represented as instances of `sioc:UserAccount`), all related to the same physical person (`foaf:Person`) using the `foaf:account` property. Moreover, we shall note more precisely that each `sioc:UserAccount` is actually related to the `Agent` class from FOAF (and not directly to a `foaf:Person`). Consequently, an instance of `sioc:UserAccount` can be associated with both software agents and human users, which may be useful when dealing with wikis or IRC bots.

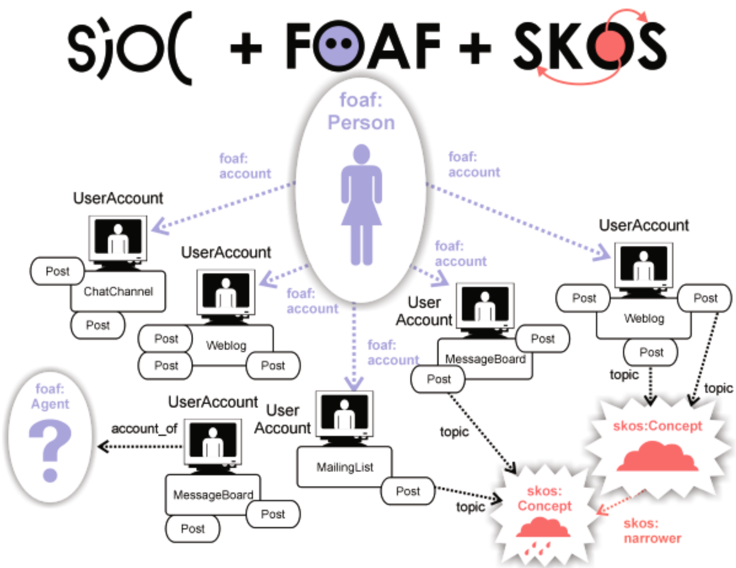

Fig. 3. Combining SIOC with FOAF and SIOC in online communities

3 Current Status and Uptake of SIOC

Since the goal of SIOC is to provide interoperability between communities on the Social Web, one way to evaluate it is to consider its uptake on the Web. To illustrate the amount of SIOC data on the Web, according to the PingTheSemanticWeb (PTSW) service[14] there were 132'475 documents which contain data described using the SIOC ontology by June 2009[15] (Figure 4). Large amounts of

[12] `http://foaf-project.org`
[13] `http://www.w3.org/2004/02/skos/`
[14] `http://pingthesemanticweb.com`
[15] The full amount of SIOC information on the Web is larger than described here as PTSW indexes only a part of available RDF data.

SIOC data are provided by wrappers to existing Social Web sites (*e.g.* wrappers for Flickr[16] or MediaWiki[17]). Thus, the Billion Triple Challenge 2009 dataset [18] contains more than 15 million RDF resources described using SIOC. In addition, SIOC is now widely accepted as a core ontology to describe Social Web communities using Semantic Web technologies, alongside with FOAF. Hence, the use of SIOC is suggested by the Yahoo! SearchMonkey developer documentation[19] (SIOC data being indexed by SearchMonkey to improve presentation of search results) and by various best practices documents describing data publishing on the Semantic Web such as [5].

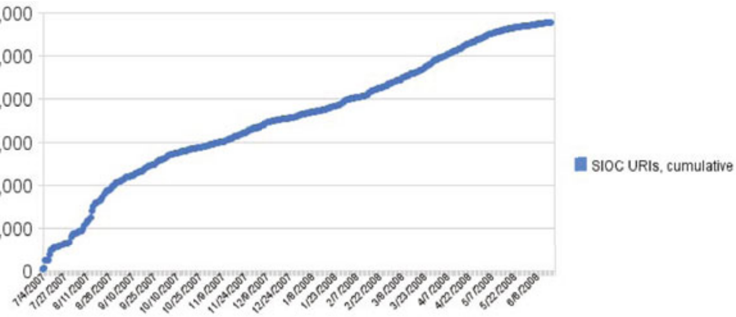

Fig. 4. The amount of SIOC data on the Web (PingTheSemanticWeb data)

Moreover, we shall mention recent initiatives using SIOC that should help sustain its growth, notably its integration as a core vocabulary in Drupal 7, that supports native RDF output *via* RDFa annotations embedded in web pages[20].

3.1 The SIOC Eco-system

Various SIOC-enabled services have been created[21], forming an *eco-system* of applications (Figure 5) that implement the SIOC ontology and that participate in various stages of SIOC information life cycle (from data creation and integration through to its storage and use). The creation of an application ecosystem around an ontology helps to overcome the *"chicken and egg"* problem of the Semantic Web and to facilitate the uptake of the ontology on the Web.

These applications typically belong to one of the following types:

- *data producers* — that allow us to generate SIOC RDF data from various applications;

[16] http://apassant.net/home/2007/12/flickrdf/
[17] http://ws.sioc-project.org/mediawiki
[18] http://vmlion25.deri.ie/
[19] http://developer.yahoo.com/searchmonkey/smguide/profile_vocab.html
[20] http://groups.drupal.org/node/16597
[21] http://rdfs.org/sioc/applications/

– *data collectors* — that help with the discovery, crawling and indexing of this data;
– *data consumers* — that allow to browse and analyze the knowledge contained in SIOC data, to visualize and to reuse this data;
– *libraries and utilities* — for supporting the SIOC applications described above.

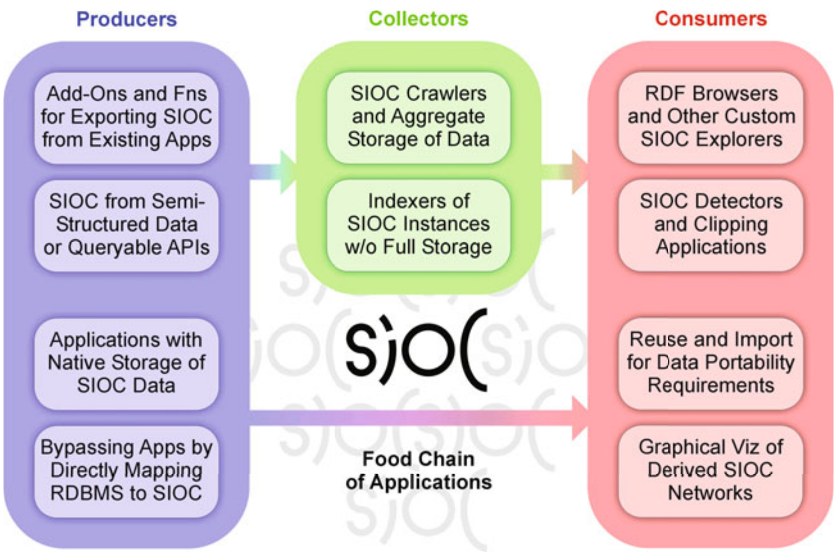

Fig. 5. The SIOC eco-system

In order to bootstrap usage of SIOC and to facilitate its adoption we initially created a small set of *"seed"* applications covering main areas of the ontology ecosystem. Examples of initial SIOC applications include the WordPress SIOC export plugin[22], the Semantic Radar extension for Firefox[23] and various applications for exploring SIOC data. Then, thanks to contributions from the developer community, outside the core team, the size of the SIOC eco-system has grown to over 50 applications. To aid with the production and use of SIOC data in Social Semantic Web applications by the community, reusable APIs, covering various parts of SIOC data life-cycle, have been created for languages such as PHP, Ruby on Rails and Java.

4 Initiatives Using SIOC

Since the goal of SIOC is to enable interoperability of social data on the Web, having applications that address different system and communities is a mean to

[22] `http://sioc-project.org/wordpress`
[23] `https://addons.mozilla.org/en-US/firefox/addon/3886`

achieve this goal. Thus, within the aforementioned ecosystem, various applications have been developed either to produce, collect and consume SIOC data[24] and we describe some of them in this section.

4.1 Expressing IRC Conversations

Instant messaging is one major form of social interaction and online collaboration, but it is traditionally disconnected from the Web, especially when happening on IRC. The SiocLog application[25] [14] addresses this issue and provides a record of IRC conversations using SIOC and FOAF ontologies. Participants of these conversations may include both human users and automatic agents (called *bots*). Bots are often used on IRC channels for various administrative tasks, to interface with web services or to facilitate teleconferences [12].

The SiocLog logger is provided as in IRC bot. The linked data interface provided by it may use data from another bot — *mttlbot*[26] — which enables users to define their Web IDs and thus enrich IRC logs with relevant user profiles. In terms of future developments, a useful addition to this application would be the ability to identify bots separately from users and to define metadata for describing them. Since users and bots interact with one another on IRC, logs of such conversations could provide insights into the patterns of communication on IRC, *i.e.* how users interact with such bots.

4.2 Interlinking Collaborative Work Environments

The Ecospace Integrated Project[27] is addressing issues of interoperability in the area of Collaborative Work Environments (CWE) like Lotus Notes, Microsoft SharePoint and BSCW. The SIOC ontology has been adopted in the project[28] to provide the basis for the much-needed multi-platform integration and to allow cross-project querying and access to this semantically-interlinked information [19]. This was achieved in three stages: (1) concepts that exist in the CWE domain and that appear in the platforms involved in the project namely, BSCW and Business Collaborator (BC) were mapped to the SIOC ontology; (2) SIOC exporters were developed for these platforms. These tools, based on the conceptual mappings created in the previous stage, annotate the internal data and export them as SIOC RDF data; and (3) a specialized SIOC4CWE explorer was developed for navigating and querying aggregated SIOC data from heterogeneous shared workspaces in a unified way.

Another similar effort, focused more on interoperability issues between Enterprise 2.0 [18] applications (combining blogs, wikis, tagging, RSS feeds) is the

[24] An up-to-date list is available at
`http://wiki.sioc-project.org/index.php/Category:Applications`

[25] `http://github.com/tuukka/sioclog`

[26] `http://buzzword.org.ok/2009/mttlbot/#project`

[27] `http://www.ip-ecospace.org/`

[28] `http://www.ami-communities.eu/wiki/ECOSPACE/SIOC`

SemSLATES proposal, in which SIOC has been deployed to provide a foundational layer of integration between these applications, in combination with other services such as semantic wikis and a semantic tagging platform [22]. Figure 6 exemplifies how data from various applications from an Enterprise 2.0 ecosystem (blogs, wikis, RSS feeds) is automatically translated to SIOC to provide a unified representation of social content from these various services in enterprise settings that can be then reused for advanced and cross-application querying purposes.

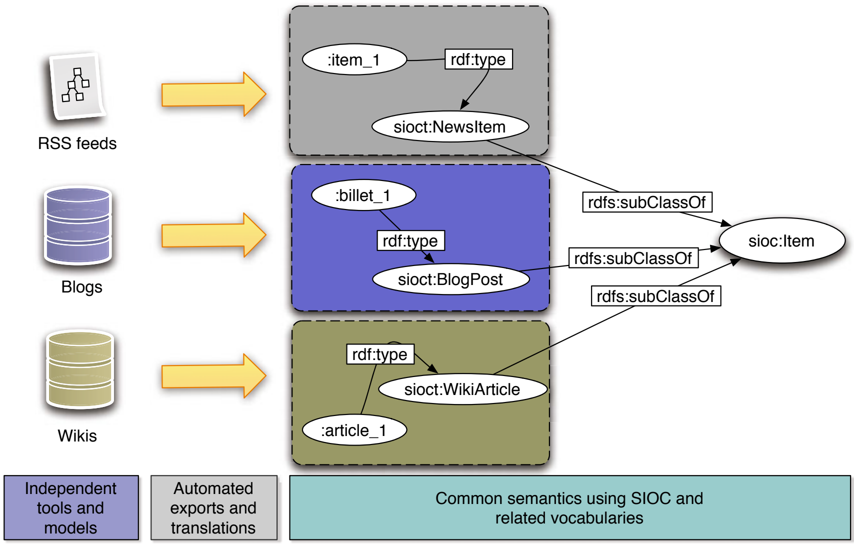

Fig. 6. Using SIOC to unify information from corporate online communities

4.3 Exposing Wiki Structure with SIOC

Another recent area in which SIOC was introduced is the modeling of wiki features, especially with regards to versioning and multi-authoring. To that extent, new properties were introduced in the SIOC ontology and we also developed a SIOC exporter (available as a Web service[29]) for any MediaWiki instance, hence being able to provide a complete SIOC export of popular wikis such as Wikipedia including pages revisions, internal and external links, etc. [21][30] Moreover, once wiki data is exposed to SIOC, it allows to interlink various wikis together, and also to combine wiki data with other SIOC-enabled content (such as blog data or the aforementioned IRC conversations).

[29] `http://ws.sioc-project.org/mediawiki`

[30] The majority of information in the billion triples challenge dataset (including 14,133,700 instances of `sioct:WikiArticles`) is generated by this wrapper applied to WikiPedia.

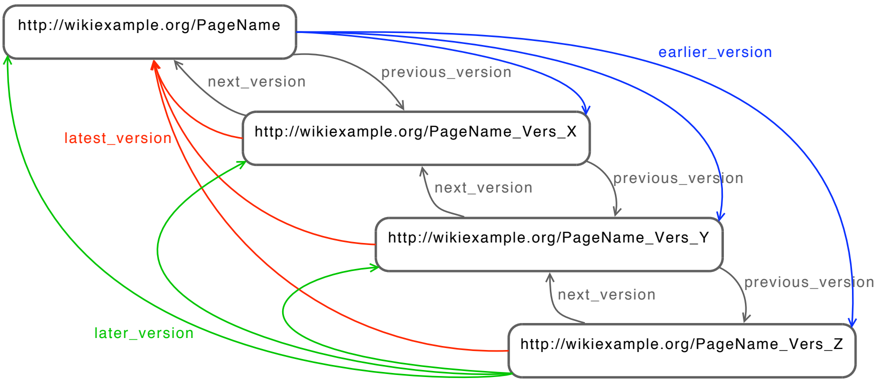

Fig. 7. Modeling versioning of wiki pages with SIOC — From [21]

Interestingly, this SIOC exporter exports both contributions from real people as well as from bots (*e.g.* agents automatically moderating content) while there is unfortunately no way to formally differentiate both (since Wikipedia API does not provide this information) from users. This exporter also features relationships between different versions of the same Wiki page, using the `next_version` and `previous_version` properties that we mentioned earlier. These properties are defined as subproperties of `later_version` and `earlier_version`, which are transitive properties (*i.e.* defined as instances of `owl:TransitiveProperty`). It allows agents that can exploit these transitivity axioms, such as Pellet [26], to identify immediately all the previous versions for a given page, as we can see in the Figure 7. While only links to the (immediately) previous pages are present, new information about online communities are discovered thanks to inference capabilities, consequently augmenting their value for querying and integration purposes.

4.4 Semantic Microblogging

Another important trend in the Web 2.0 world is the use of microblogging, in order to exchange status updates to an update audience, notably using Twitter[31]. In addition to several initiatives that provide SIOC export of microblogging data, such as the Chisimba Tweet aggregator[32], we developed the SMOB framework (for Semantic MicrOBlogging [23]), another example of how Semantic Web technologies can enhance applications from the Social Web. SMOB provides an open platform for decentralized and distributed publishing and aggregating of microblog content, using notably FOAF and SIOC, as well as standards protocols to exchange and query information between publishers and aggregators.

Any content generated with SMOB is available in RDF using the aforementioned vocabularies, and can be combined with other SIOC data, such as blog

[31] `http://twitter.com`

[32] `http://tweetgator.peeps.co.za/`

posts and wiki pages, in order to get a real-time overview of activity around a particular topic. Indeed, SMOB also provides interlinking capabilities with other Linking Open Data sources, enabling real-time object-centred sociality [16] for microblogs.

5 Querying and Browsing SIOC Data

Since SIOC data is RDF data, one can simply relies on existing standards to query it, especially SPARQL[33]. The main interest of such approach is that, by exposing data from online communities as SIOC data, the same query pattern can be applied by software agents to any community data. Thus, retrieving the last contributions in Forum X can be done similarly as retrieving the last ones from Wiki Y. In addition, by exposing this data openly on the Web, agents can benefit from Semantic Search engines such as Sindice[34] to find this information, originally distributed on the Web, in a single place.

```
SELECT ?post ?creator ?agent
WHERE {
    ?post a sioc:Post ;
      sioc:has_creator ?creator .
    ?agent foaf:holds_account ?creator .
    !BOUND(?creator rdfs:type foaf:Person)
}
```

Listing 1.3. Example of SPARQL query using SIOC data

Focusing on human-agent conversations, Listing 1.3 shows a SPARQL query retrieving posts created by agents that are not defined as persons, relying on the principles of negation as failure, due to the Open World Assumption of the Semantic Web[35].

To enable human navigation of SIOC data, hence providing a complete human-machine-human chain for information management in online communities, various applications have been built, such as the SIOC browsers defined in [6]. One of them is depicted in Figure 8, representing how SIOC information has been used to identify social networks across distributed conversations, based on the reply patterns of users. It shows once again how common semantics to represent data from online communities can be used to extend the usages we can get from them.

[33] http://www.w3.org/TR/rdf-sparql-query/

[34] http://sindice.com

[35] Hence, that query cannot ensure that the identified agent is not a person, which would require a specific class subclass of `foaf:Agent`, being disjoint of `foaf:Person`, for instance `ex:Bot`.

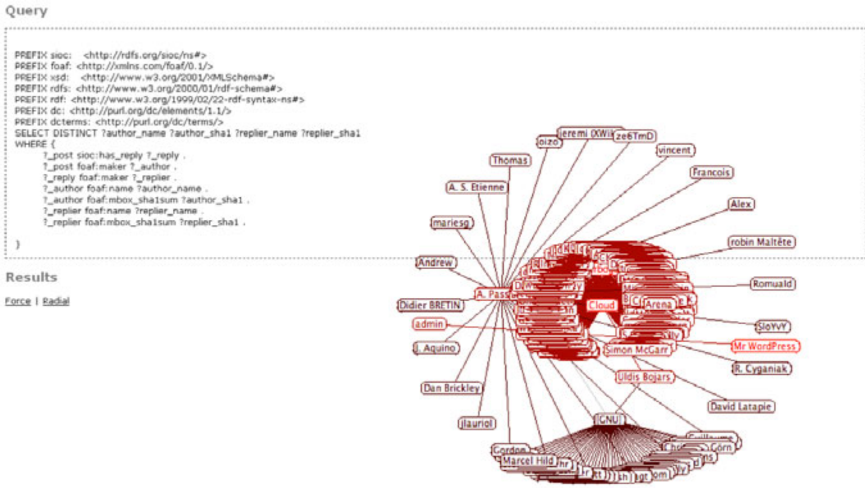

Fig. 8. Identifying social networks from SIOC-based information

6 Conclusion

In this paper, we described the SIOC project, its goals and means as well as related uptake and overview of some of the services exposing or using SIOC information. We detailed the SIOC ontology (both the Core and its modules) as well as various applications and initiatives using SIOC, describing how they provide machine processable data from online interactions in various contexts, ranging from wikis, IRC conversations and microblogging applications. Our current work focuses on extending the ontology for specific domains and use-cases, as we have described in this paper in the context of Wikis and microblogging applications. Indeed, as new Web 2.0 services appear, with new paradigms and features, there is a need to provide new modules (or enhance the SIOC Core Ontology) to represent interactions happening within these services in a machine-readable way, so that data can be processed and integrated with other SIOC data.

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References

1. Ankolekar, A., Krötzsch, M., Tran, D.T., Vrandecic, D.: The Two Cultures: Mashing up Web 2.0 and the Semantic Web. Journal of Web Semantics 6(1), 70–75 (2008)

2. Berners-Lee, T.: Tim Berners-Lee Podcast at ISWC 2005 (November 2005), http://esw.w3.org/topic/IswcPodcast
3. Berners-Lee, T., Hendler, J.A., Lassila, O.: The Semantic Web. Scientific American 284(5), 34–43 (2001)
4. Berrueta, D., Brickley, D., Decker, S., Fernández, S., Görn, C., Harth, A., Heath, T., Idehen, K., Kjernsmo, K., Miles, A., Passant, A., Polleres, A., Polo, L., Sintek, M.: SIOC Core Ontology Specification. W3C Member Submission June 12, World Wide Web Consortium (2007), http://www.w3.org/Submission/sioc-spec/
5. Bizer, C., Cyganiak, R., Heath, T.: How to Publish Linked Data on the Web. Technical report (2007), http://www4.wiwiss.fu-berlin.de/bizer/pub/LinkedDataTutorial/
6. Bojārs, U., Breslin, J.G., Passant, A.: SIOC Browser – Towards a Richer Blog Browsing Experience. In: Proceedings of the 4th Blogtalk Conference (Blogtalk Reloaded), Books on demand (2006)
7. Bojārs, U., Breslin, J.G., Peristeras, V., Tummarello, G., Decker, S.: Interlinking the Social Web with Semantics. IEEE Intelligent Systems 23(3), 29–40 (2008)
8. Breslin, J.G., Decker, S.: Semantic Web 2.0: Creating Social Semantic Information Spaces. In: Tutorial at the 15th International World Wide Web Conference, WWW 2006 (2006)
9. Breslin, J.G., Harth, A., Bojārs, U., Decker, S.: Towards Semantically-Interlinked Online Communities. In: Gómez-Pérez, A., Euzenat, J. (eds.) ESWC 2005. LNCS, vol. 3532, pp. 500–514. Springer, Heidelberg (2005)
10. Breslin, J.G., Passant, A., Decker, S.: The Social Semantic Web. Springer, Heidelberg (2009)
11. Ciccarese, P., Wu, E., Wong, G., Ocana, M., Kinoshita, J., Ruttenberg, A., Clark, T.: The SWAN biomedical discourse ontology. Journal of Biomedical Informatics 41(5), 739–751 (2008)
12. Froumentin, M.: Zakim — A Multimodal Software System for Large-Scale Teleconferencing. In: Bengio, S., Bourlard, H. (eds.) MLMI 2004. LNCS, vol. 3361, pp. 46–55. Springer, Heidelberg (2005)
13. Gruber, T.R.: Towards Principles for the Design of Ontologies Used for Knowledge Sharing. International Journal Human-Computer Studies 43(5-6), 907–928 (1995)
14. Hastrup, T., Bojars, U., Breslin, J.G.: SiocLog: Providing IRC discussion logs as Linked Data. In: 2nd Social Data on the Web (SDoW 2009) Workshop at the 8th International Semantic Web Conference, vol. 520 (2009)
15. Hendler, J.A., Golbeck, J.: Metcalfe's law, Web 2.0, and the Semantic Web. Journal of Web Semantics 6(1), 14–20 (2008)
16. Knorr-Cetina, K.D.: Sociality with objects: Social relations in postsocial knowledge societies. Theory, Culture and Society 14(4), 1–30 (1997)
17. Lange, C., Bojars, U., Groza, T., Breslin, J., Handschuh, S.: Expressing argumentative discussions in social media sites. In: First International Workshop on Social Data on the Web (SDOW 2008), vol. 405. CEUR-ws.org. (2008)
18. Mcafee, A.P.: Enterprise 2.0: The Dawn of Emergent Collaboration. MIT Sloan Management Review 47(3), 21–28 (2006)
19. Ning, K., Peristeras, V., Bojārs, U., Breslin, J.G.: A SIOC Enabled Explorer of Shared Workspaces. In: CSCW and Web 2.0 Workshop at the 10th European Conference on CSCW, Limerick, Ireland (2007)
20. O'Reilly, T.: O'Reilly Network: What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software (September 30, 2005), http://www.oreillynet.com/lpt/a/6228

21. Orlandi, F., Passant, A.: Enabling cross-wikis integration by extending the SIOC ontology. In: Proceedings of the Fourth Workshop on Semantic Wikis, SemWiki 2009 (2009)
22. Passant, A.: Technologies du Web Sémantique pour l'Entreprise 2.0 (Semantic Web technologies for Enterprise 2.0). PhD thesis (2009)
23. Passant, A., Bojars, U., Breslin, J.G., Hastrup, T., Stankovic, M., Laublet, P.: An Overview of SMOB 2: Open, Semantic and Distributed Microblogging. In: 4th International Conference on Weblogs and Social Media, ICWSM 2010 (2010)
24. Passant, A., Ciccarese, P., Breslin, J., Clark, T.: SWAN/SIOC: Aligning Scientific Discourse Representation and Social Semantics. In: Workshop on Semantic Web Applications in Scientific Discourse (co-located with the 8th International Semantic Web Conference), vol. 523. CEUR-ws.org (2009)
25. Passant, A., Kärger, P., Hausenblas, M., Olmedilla, D., Polleres, A., Decker, S.: Enabling Trust and Privacy on the Social Web. In: W3C Workshop on the Future of Social Networking (2009)
26. Sirin, E., Parsia, B., Grau, B.C., Kalyanpur, A., Katz, Y.: Pellet: A practical OWL-DL reasoner. Journal of Web Semantics 5(2), 51–53 (2007)
27. Stankovic, M., Passant, A., Laublet, P.: Directing status messages to their audience in online communities. In: Multi-Agent Logics, Languages, and Organisations Federated Workshops, vol. 494, CEUR-ws.org (2009)
28. Story, H.: FOAF & SSL: creating a global decentralised authentication protocol. In: W3C Workshop on the Future of Social Networking (2009)