ISICIL: Information Semantic Integration through Communities of Intelligence onLine

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Abstract: this is a collective position paper presenting the vision, motivations and approaches of the ISICIL project. This project proposes to study and to experiment with the usage of new tools to assist tasks of corporate intelligence and technical watch. These tools rely on web 2.0 advanced interfaces (blog, wiki, social bookmarking) for interactions and on semantic web technologies for interoperability and information processing.

Keywords: semantic web, social web, web 2.0, enterprise 2.0

1 Introduction

Recently, online communities of interest have emerged and started to build directories of references in their domains of interest at an impressive speed and with very agile responses to changes in these domains. One of the forces of the tools enabling these communities is their ability to turn usually passive users into active participants and producers. The diversity and the mass of users are used to tackle the diversity and the mass of information sources.

Monitoring, market, science and technological changes is a vital ability of today's organizations, yet the growing diversity of sources to track in each domain of interest remains a challenge for any organization. Therefore there is a growing interest in importing the tools and practices that made the success of these online communities inside corporate information systems. Blogs and wikis are being set up in more and more intranets.

But, on the one hand, Web 2.0 tools exhibit limits when it comes to automating some tasks or controlling some processes, as usually required in a corporate environment. On the other hand, more structured information systems often suffer from usability and knowledge capture issues. In addition, in the context of intelligence, corporate structures can also provide assistance at different stages of these processes to ensure that corporate quality standards and rules are met.

Thus a challenge of the French national ISICIL project is to reconcile viral new web applications with formal representations and processes and to integrate them into corporate practices for market, technological and scientific monitoring.

More specifically, ISICIL proposes to study and to experiment with the usage of new tools for assisting corporate intelligence tasks. These tools rely on web 2.0 advanced interfaces (blog, wiki, social bookmarking) for interactions and on semantic web technologies for interoperability and information processing.

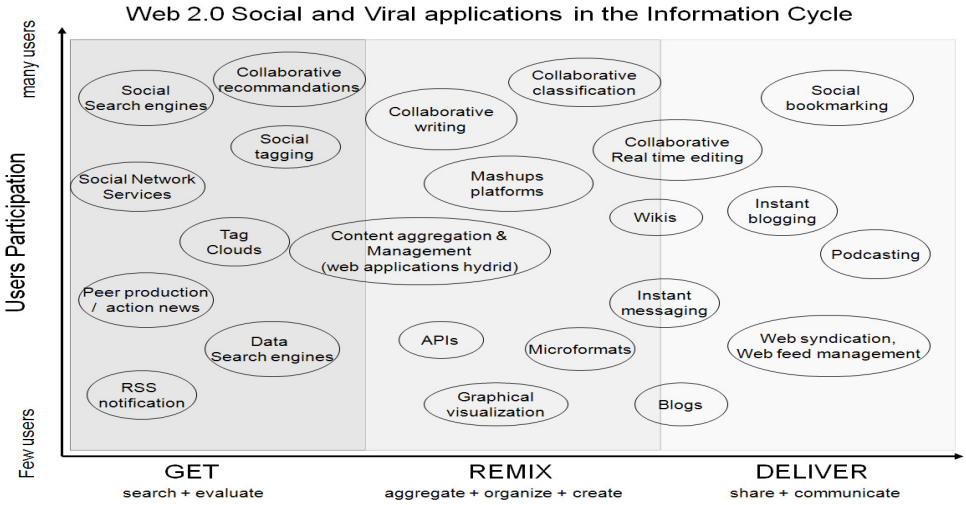
This article really is a position paper capturing the vision that federated the different partners of ISICIL and that will be pursued in the next two years. Section 2 will summarize the kind of application scenarios we will target. Section 3 will look at contribution to integrate web 2.0 and semantic web approaches. Section 4 will focus on specific innovation of the project to integrate ontology-based modeling and reasoning into social networks representations and analysis. Section 5 will stress the fact that the project goes beyond a technical contribution and integrates studies and solutions to ensure the usability and the corporate deployment of the tools we design.

2 Motivating scenario

The development of telecommunications infrastructure and the increasing availability of information and communication technologies in recent years, are forcing organizations to anticipate opportunities and threats concerning their profession. Organizations actively look for "weak signals" and value-adding information and knowledge and try to manage networks of experts in their field of excellence.

In this context, structured and unstructured information from the web has become a key factor of economic development and innovation. The competitiveness of firms is related to the adequacy of their decisions, which depends heavily on the quality of available information and their ability to capitalize, to add value and to distribute this enriched information to people who will make the right decision at the right moment. The scenarios on which we base our project address exactly the core of this competitive intelligence cycle. We assume that the new 2.0 technological and social trends are transforming totally the classical Knowledge Management and Competitive Intelligence Process inside the firms. While the latter are actually based on data flow analysis, top-down approaches, business process driven, “subject matter experts” location, Communities Of Practice management, the social data and network Software and Services (depicted in Figure 1) are reversing the whole process. We are just at the beginning of discovering what will be the consequences on enterprises, small or big.

Figure 1 APIs atomizing Business Intelligence Process.



The project is motivated by two scenarios in technology and science monitoring from two end-users, Orange (France Telecom) and Ademe (French Environment and Energy Management Agency). Both scenarios are intended to assist technological and scientific monitoring through new approaches to capturing and integrating information on the internal web of an organization. Current problems shared by both scenarios include:

- the multiplication of heterogeneous query interfaces, engines and information sources; the absence of guidance in the querying process;
- the use of informal and non explicit networks of acquaintances to identify experts and relevant sources;
- the lack of assistance in analyzing, visualizing, combining and integrating a synthesis of the watch results;
- no easy way to publish and make available a synthesis or watch report back to the knowledge base of the organization.

Compared to other scenarios in knowledge management, scenarios in technology and scientific watch and intelligence process involve users who are often aware of the importance and usefulness of sharing knowledge. Nevertheless we will pay great attention to the risks of knowledge retention, to any brakes in our solution that could prevent knowledge from flowing and we will pursue the systematic inclusion of incentives and gratifications for sharing knowledge.

Business Intelligence relies on a collection of applications, technologies and methodologies that support access to and analysis of information in order to manage the competitiveness of firms. ISICIL aims at determining which successful social web practices will be equally successful inside an organization, and at leveraging these key tools in the context of technological and scientific watch and collective intelligence inside the firm. Thus the objective of ISICIL is at the crossroads of corporate business intelligence applications and web 2.0 concepts, also called “Enterprise 2.0” (E2.0), that Andrew McAfee defined as “the use of emergent social software platforms within

companies, or between companies and their partners or customers" [1]. Functionalities identified as needed in both use cases include:

- customizable and precise means of notification;
- interfaces assisting users in building and refining queries (collaborative filtering based on social networks, related tags, broader/narrower terms, etc.);
- systematic capture of contextual metadata in every action and production;
- analytic (statistical) views of metadata integrating semantics and customized visualization interfaces;
- assisting the creation of synthesis reports integrating search results and extracts of the visualization of the statistical processing;
- collaborative edition of composite synthesis reports and semi-automated tagging of their content;
- navigation and search based on internal web of possibly external documents overlaid by the social network of the members of the involved communities;
- enforcement of confidentiality and privacy preferences for profiles and documents;
- traceability of sources of information.

To implement these functionalities, the envisioned technical solutions include:

- web 2.0 tools as a foundation of the platform (wikis, blogs, social bookmarking servers, mailing systems, RSS and forums);
- web 2.0 interfaces to allow complex manipulations and mashup techniques for composite document generation;
- tagging and folksonomy techniques in interactions in conjunction with microformats and RDFa embedding in web pages;
- RDF/S and OWL representations of metadata [2];
- graph-based representations and reasoning in the manipulation of metadata.

We also envision new applications for example social scrapbooking, the equivalent of social bookmarking but for sharing extract of pages in a collective scrapbook. New application integrations also become possible, e.g., detecting that a bookmarked page is a search result from Google and processing it as a captured query and result.

3 Bridging web 2.0 and semantic web approaches

By nature, a Web application requires taking into account its semiotic dimension (as a meaningful system mobilizing signs of all types to build representations for humans), its pragmatic dimension (as a semiotic system with multiple usages which influence its interpretation) and its social dimension (as a virtual space of interaction). We see the semantic Web initiative as a knowledge representation framework allowing us to take

these dimensions into account, the official semantic web activity page [2] explains that the Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries. Therefore, the core motivating scenario of the semantic web initiative is the assistance to collaboration. This is why we believe it is counterproductive to oppose semantic web approaches and web 2.0 approaches.

Over the past nine years, semantic web researchers have proposed pivot languages to represent and exchange data, but they prescribed or restricted neither the use of these languages nor the methods to generate the data they convey. Opposing ontology and folksonomy is like opposing a "cake" and a "baked cake" - they are just not at the same level of abstraction. Folksonomies are defined by the way they are obtained (social tagging). Ontologies are defined by their content (a representation of a conceptualization). Furthermore, nothing in the objectives or formalisms of the semantic web is opposed to taking into account the social dimension of the web. One of the scientific objectives of ISICIL is to show that not only can web 2.0 approaches be supported by semantic web frameworks but they can actually be improved through additional inferences and intelligent behavior in interactions with users.

Another important point that is often missed is the notion of domain of formalization. In a semantic web application, the domain to be formalized in RDF/S or OWL is not always the application domain since formalization is primarily specified by the task to be assisted. For instance if the goal is to assist the alignment of several technical terminologies, the formalization will perhaps focus on linguistic primitives, e.g., the notion of terms, synonyms, hyponyms, acronyms, etc. allowing the representation and comparison of the various terminologies. In other words, we do not inevitably find the notions of our domain of application in our RDFS schema. Building semantic web applications in the telecom industry doesn't necessarily mean we will find the concept of "telephone", "line" or "provider" in our ontology. Mixed with Web 2.0 applications this means that the use of semantic web frameworks does not imply that the domain of application will have to be formalized. As an example, if we want to allow social tagging for the domain of “energy management” we won't necessarily have to formalize categories of energies and energy producing devices in RDFS; we can choose to formalize the domain of social tagging and declare the notions of "tag", "tag cloud", etc. that will then be used to capture these topics. One of the scientific objectives of ISICIL is to integrate light representations like tags and formal representations like ontologies to get the best of both worlds.

Another dangerous misconception is to consider that ontology-based solutions necessarily lead to frozen schemas. Multiple schemas, namespaces and equivalence relations are examples of core mechanisms of semantic web formalisms that clearly show that the semantic web vision is that of a distributed, decentralized, integration system. Moreover, to represent and publish an ontology in RDFS or OWL does not imply that it is now set in stone. The semantic web perfectly acknowledges the existence of a life-cycle of ontologies, e.g. relations of equivalences between two ontologies in OWL, best practices to choose URIs to manage the evolution of a concept, relations to previous versions, etc. One of the scientific objectives of ISICIL is to synchronize the life cycles of light representations and formal representations to enable mutual improvements.

A specific research topic we are interested in is the study of how annotating the diverse resources of the Web can help users better interact and exchange knowledge. The use of metadata has grown among web applications, be it in a free manner with tags, or

grounded on ontologies. Moreover, the formal status of the Web switched from a global library to a virtual platform of interaction and exchange of different kind of services and resources. Major sources of information have emerged from the possibilities offered by Web 2.0 applications (e.g. Wikipedia). In this context, it is possible to acquire valuable information from the usages, and to represent them through semantically enriched metadata. These metadata can in turn be integrated and exploited by semantically enabled applications to enhance the sharing of knowledge.

To achieve this objective, we need to investigate the possibilities to obtain semantically rich metadata in an unobtrusive way, and then to find how they can be efficiently exchanged or retrieved by users or other web applications. Web 2.0 services have shown that it is possible to get massive annotations through social tagging resulting in folksonomies. This approach has the great benefit of requiring very little efforts, and of rapidly and enthusiastically injecting human's intelligence within the overwhelming flow of data constantly aired on the web [3]. However these annotations freely provided by the mass of users are sometimes ambiguous, and in particular the spelling of tags may vary, thus limiting, for instance, the efficiency of information retrieval techniques. Moreover, very little of the context of use of the tags is preserved by to-date standard applications based on social tagging.

Thus, one of the problems we want to address is the annotation in the context of knowledge shared via online interactions. More precisely, we will focus on:

- Leveraging the interoperability between the technologies used to publish and annotate (blog, wikis, social bookmarking, etc) and the information processing that support knowledge sharing (folksonomies).
- Exploring the available formalisms for knowledge representation (folksonomies, ontologies), and adapting them to fit the usages to integrate the diversity and the variability of the vocabularies used.
- Identifying the tasks that directly or indirectly correspond to knowledge sharing (for instance posting a bookmark to a social-bookmarking service) and defining the functionalities of the applications that may help users better interact and exchange information.

Ontology-based representations and to a smaller extent folksonomies are whole fields of research in themselves. In ISICIL, we will focus on the intersection of both fields and we will target cross-fertilization, building on some past experiences [4]. While there are not fully dissociated, three trends can be identified in combining ontologies and folksonomies:

The first trend tries to mine folksonomies to structure them and in particular to build thesauri or ontologies from them. [5] proposes a tripartite model for folksonomies and a method to build hierarchies of tags based on the inclusion partial order of the communities using these tags. [6] builds hierarchies using the centrality calculation in the bipartite graph Tag-Resource. [7] relies on the conditional probability of co-occurrences of tags to build hierarchies. [8] and [9] explored different metrics to compare the tags. [10] and [11] studied clustering methods on the folksonomie. These contributions are variations on the two sides of the problem of structuring folksonomies: the choice of metrics and the spaces.

The second trend combines folksonomies and ontologies in the same application right from the start. [3] and [12] propose to tag the tags and thus support the manual structuring of the folksonomies. [10][8][13][14][15] automate the use of external linguistic resources to structure the folksonomy. [16] assist manual disambiguation through references to a vocabulary and, likewise and [17] assist manual disambiguation through references to a thesaurus. [18] augment the tag notation to allow the user to structure the tags for instance to declare that two tags he placed on a resource (e.g. "Paris", "France") are linked by a relation (e.g. "narrower")

The third trend proposes to use ontologies to model and capture the tags, the acts of tagging and the resulting folksonomies. [3] and [19] were among the firsts to propose ontologies of tagging and folksonomies. SIOC [20] is an ontology of the resources exchanged within and between web 2.0 sites. SCOT [21] is an ontology to represent tags et clouds of tags. MOAT [22] is ontology to represent the result of a disambiguation of tags *i.e.* to associate an intended meaning to a tag.

In ISICIL, we are currently designing an approach and some tools to tackle the limitations of folksonomies by building "lightweight ontologies" integrating the users of a folksonomy-based system into the process of ontology maturing. These semantically richer structures can then be exploited to suggest semantically related terms, or to include spelling variants when retrieving resources associated with a tag. To achieve this goal, we propose associating the power of automatic handling of folksonomies and the expertise of users by integrating simple semantic functionalities within the interface of the system. Users will then be able to validate or correct the automatic inferences. This system is based on our model of semantic enrichment of folksonomies. According to this model, all the assertions that can be made on tags are first captured, even if contradictory. Then, the exploitation and application of these assertions is postponed pending further processing steps, for instance while sorting the results of a request.

The goal of our model is to describe the semantic relations that may exist between the tags of a folksonomy, and, at the same time, to support confrontational views between the users. For example, if a user says that "CO2" is narrower than "pollution", and another user says that "CO2" is narrower than "green-house gas", the model will record both assertions, even if they may contradict each other leaving it up to the designer of the systems to decide how to treat this conflict between several options (with a voting system for instance, or by showing explicitly the different points of view). Our model is an extension of the RDF model of the reification of assertions in the case of tags, and also includes already existing ontologies such as SIOC and SCOT.

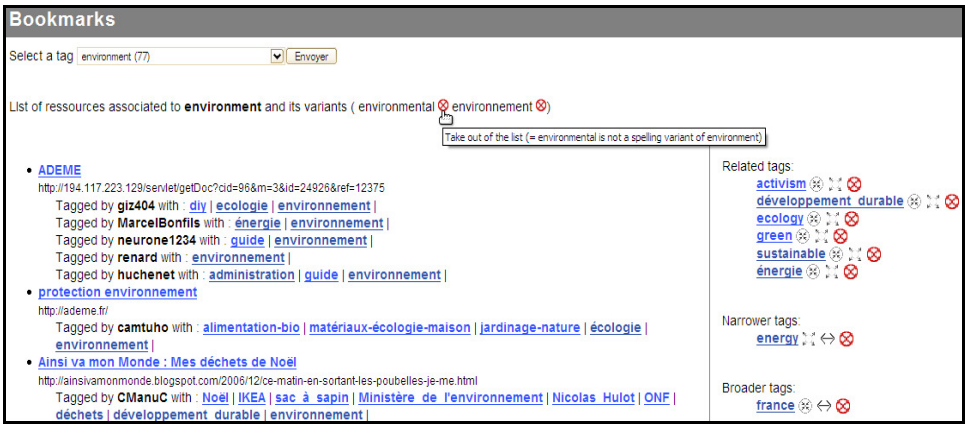
We are convinced that tasks such as searching, filtering, navigating or notifying can be improved in web 2.0 systems by turning their data structures into semantic representations and adding semantics in opportunistic ways: context capture, shallow parsing, profiling, mining, etc. A classical web 2.0 functionality such as navigation based on co-occurring tags or tag-clouds can benefit from ontology based techniques to organize terms and concepts and exploit these relations in the grouping and tagging techniques. It is also important to notice the scale factor of any improvement in the underlying semantic structures: if one user directly or indirectly adds to the semantics of the shared representation (e.g. stating or implying that the concept behind a tag subsumes the concept behind another tag) the whole community instantly benefits from this addition. One of the scientific objectives of ISICIL is to merge the ease of use of light representations and the automation capabilities offered by formal representations to improve the functionalities offered in the latest web applications and interfaces.

A first system we built to test this approach is a bookmarks navigator which is able to automatically include spelling variants within the results of a query, and to suggest related tags according to a SKOS thesaurus. Our system is composed of: (1) automatic agents applying semantic processing on folksonomies, and (2) a user interface to browse the bookmarks database, and at the same time, to validate or correct the automatically suggested tags and semantic relationships. Figure 2 shows this interface displaying bookmarks tagged with "environment".

One of the new functionalities we are experimenting consists in allowing the user to reject suggested spelling variants by clicking on a red cross. The second type of functionality proposes the users to reject (with the same symbol) or choose other types of semantic relationships between the original tag and the suggested related tags, such as "is narrower" (symbolized by arrows pointing inward a circle) or "is broader" (symbolized by arrows pointing outward a circle). The actual use of these functionalities remains completely optional and is non intrusive to the regular standard of the system. A second stage will be to design a usable interface for this prototype.

In our model every assertion is recorded and added to the database, even when it is contradictory with other assertions (for example the assertion "pollution is related to car" can be approved by John, and rejected by Paul). The administrators of the system may then decide: (1) to make visible the contradictions by organizing them through different points of view, explicitly shown in the user interface (e.g. the point of view of the "car's opponents", and the point of view of the "car's defenders"); or (2) to show the results of an assertion according to the community to which the current user belongs (e.g. John and Paul belong to different communities, so we won't take Paul's assertion into account when displaying results to John); or (3) to rely on statistics on the approval or rejection of the users to keep the assertions which collect the higher number of implicit votes; or any other technique to manage confrontational conceptualizations.

Figure 2 Screenshot of an early interface to navigate social bookmarks and their tags and provide feedback on their organization.



This first prototype is tested on a set of tags extracted from Del.ico.us. One of the points it illustrates is that designing an application using semantic Web frameworks does not imply building a solution only with the tools of the semantic web. On the contrary, even a proprietary application which manages an electronic calendar is an application of

the semantic web if it simply makes it possible to export and to import its data in one of the languages of the semantic web. It doesn't need to have a rule engine, a Prolog virtual machine, some tableau algorithms or a projection operator implementing SPARQL. The only effort which is required from it is to do the only thing towards the interoperability which cannot be done by something else, *i.e.*, to make explicit its data structures and the conceptualization on which it is based. It is the old challenge of ontologies but with results at the scale of the Web. One of the technical objectives of ISICIL is to show that small but viral solutions relying on open standards for representations and APIs are enough to bootstrap semantic web applications. We are convinced that in the scenarios of business intelligence, like in many other scenarios, a little semantics can already go a long way.

To summarize, the contribution in this section is twofold. First, we proposed exploiting both the power of semantic automatic processing and the expertise of users to validate and regulate this processing. The two main functionalities we are testing are the detection of spelling variants of tags and the suggestion of related tags. These functionalities are suggested by the interface to induce users to validate, reject or correct the automatic suggestions. Second, we have also proposed a model which formalizes (1) the semantic relations between tags and (2) the semantic assertions made after automatic processing or made by the users themselves when they interact with the system. This model allows capturing and keeping track of all the semantic assertions, even when they are contradictory, and makes provision for exploiting them in several ways according to the choice of the administrators of the system, who can, for instance, set up a voting system, or organize the contradictions as points of view explicitly shown to the users.

Our future work includes a testing campaign among our community of users from the "Ademe" agency, and the integration of semantic processing to detect other kinds of semantic relations (such as broader or narrower) and their corresponding functionalities within the user interface. The detection of sub-communities of interest and the semantic social network analysis [23] are also promising fields of research to us since we are looking for different ways of personalizing the exploitation of the results of the semantic assertions. In the future, we wish to extend our research to the closer analysis of the everyday activities and working processes of our users' communities in order to identify other kinds of tasks which could be turned into opportunities for the semantic enrichment of shared knowledge. More details on our work can be found in [24-28].

4 Bringing ontology modeling to social networks representations and social network analysis

Social network analysis provides models and tools to analyze structures, roles and positions of resources linked by a network. In most sciences, like sociology, the studied resources are persons linked by one or more human relationship. These relationships can have the same type (e.g. 'knows'), but in general relations are of different types. Typically, in an acquaintance network we have family links, friendship, business contact, etc. Resources can also be of different types like woman, teacher, and even organization or course, etc. Social network analysis can be applied to understand social interactions with physical or conceptual entities.

Web 2.0 is a good example where persons are explicitly linked through social networking sites but also implicitly with collaborative platform like wikis, blogs and

social bookmarking sites. They share interests, opinions and experiences trhough a network of resources and acquaintances. This network is composed of different kinds of documents (web pages, post files, multimedia, etc) manipulated by persons. There are links like 'knows' (and all its possible inheritance) between two persons, but also links like 'author' between a document and a person, 'has tag' between a bookmark and a tag, etc. like in the tripartite model of [5]. Thus the web is a huge graph including huge social networks, with different type of resources linked with different types of properties.

Social Network Analysis (SNA) tries to understand and exploit the key features of social networks in order to manage their life cycle and predict their evolution. Classical methods from social network analysis (SNA) have been applied to online networks. On the one hand, most of the current work in social network analysis represents and exploits only one type of relation between the members of the network. On the other hand, most networks are really made of very different types of relations. Likewise the types of nodes in the network can be used to capture aspects such as roles, profiles, etc. Thus ontology-based graph modeling, such as the ones we find in RDF/S models or conceptual graphs models [29], can be used to propose expressive graph-based representation and their logical interpretation. In addition, the operators available in these ontology-based representations can provide inference means to extend classical network analysis algorithms. One of the scientific objectives of ISICIL is to extend social network analysis to ontology-based social graphs inferences to detect and stimulate communities of interest, main actors or experts, etc.

The first step of this work is to represent social networks with semantic web standards. Such social network is developed by people using web applications, almost as a side effect. It captures persons' profiles, their different online accounts and their multiple usages on the web. We will have to adapt existing standards (FOAF, SIOC, SCOT, hCard, etc.), extend them if necessary and manage their intersection in order to enable their integration. We will pay special attention to providing seamless and non intrusive means to capture these annotations and make them understandable and usable by applications. Capture methods as well exchange and aggregation formalisms will be proposed.

By their nature, semantic web annotations, expressed in RDF with ontologies support, form an oriented types (labeled) graph. Nodes and vertices of this kind of graph can be of different types. Ontologies and inferring languages enable us to deduce new annotations from existing ones which in turn add others nodes and vertices to the graph.

The main methods to analyze social network come from graph theory and structural graph analysis. Lots of algorithms are available to detect social structures, roles and positions. One of our goals is to apply these algorithms to social networks that are described with semantic web technologies. But a second objective is to extend existing algorithms or create new ones in order to detect interest communities and manage their life cycle taking into account not only the graph structure but also the semantics of the ontological primitives used to label it.

Furthermore, by adding semantics to representations of social networks (users, activities, resources) and tracing the activity over time (who is doing what, where), richer analysis will be possible for understanding and studying the global activity of a community: quantify it, but also qualify it, e.g., by identifying acquaintance networks, by measuring the amount of “new knowledge” that is being input in the shared resources, by spotting the key members of the community, etc. One of the scientific objectives of

ISICIL is to exploit ontology-based representations of social networks for finding out new algorithms for discovering and monitoring a community's activity.

Finally, the crucial and difficult problem of confidentiality will have to be taken into account. Private and public annotations need to be distinguished and it will be necessary to provide profile access control, using semantic exploitation of these annotations.

Semantic web also provide a querying language, SPARQL, designed to query semantic web annotations. We will semantically investigate the way to abstract graph analysis algorithms with high level queries.

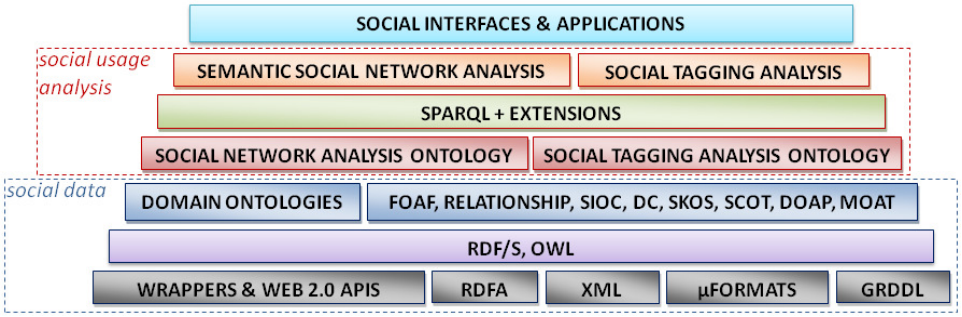
User interactions representations and social networks are among the cornerstones of "Web 2.0". Well-known applications that have helped spread Web 2.0 are blogs, wikis, social bookmarking services (e.g. del.icio.us) and image/video sharing sites; they have dramatically increased sharing and participation among web users. The analysis and understanding of such social network generates a lot of interest in the research communities. Researchers from the semantic web community try to set up semantic representations of persons and usages e.g. the FOAF ontology [30] describes "people, the links between them and the things they create and do", the SIOC [20] ontology describes "the information contained both explicitly and implicitly in internet discussion methods", Gruber proposed an ontology of folksonomies [35], the SCOT ontology [21] is a way to "represent the structure and semantics for social tagging data and provide methods for sharing and reusing them", while the SKOS and MOAT [22] ontology are often used for modeling the meaning of the tags. Another approach consists in using social network analysis methods in order to extract information e.g. build acquaintance networks or communities of interest. Most common analysis methods rely on the graph theory or on algebraic approaches. For example, Mika [5] showed that folksomies can be exploited, using graph theory in order to identify user groups and interest emergence. An approach by [31] uses annotations based on FOAF in order to identify communities of interest from the network of LiveJournal. [32] studied trust propagation in social networks using semantic web frameworks. [33] verified the power law of the degrees and community structures in FOAF profiles.

[34] worked on merging FOAF profiles and identities used on different sites. Other researchers like [35-40] have extended tools (e.g. the SPARQL query language), in order to find paths between semantically linked resources in RDF-based graphs and these works will be a basis for us to work on graph-based an ontology-based social network representation and analysis.

As shown in Figure 3, we use the RDF graphs to represent social data, using existing ontologies together with specific domain ontologies if needed. Some social data are already readily available in semantic formats (RDF, RDFa, hCard µformat, etc.) and can be exploited straightforwardly. However, today, most of the data are still only accessible through APIs (e.g. flickr, Facebook, etc.) or by crawling web pages and need to be converted.

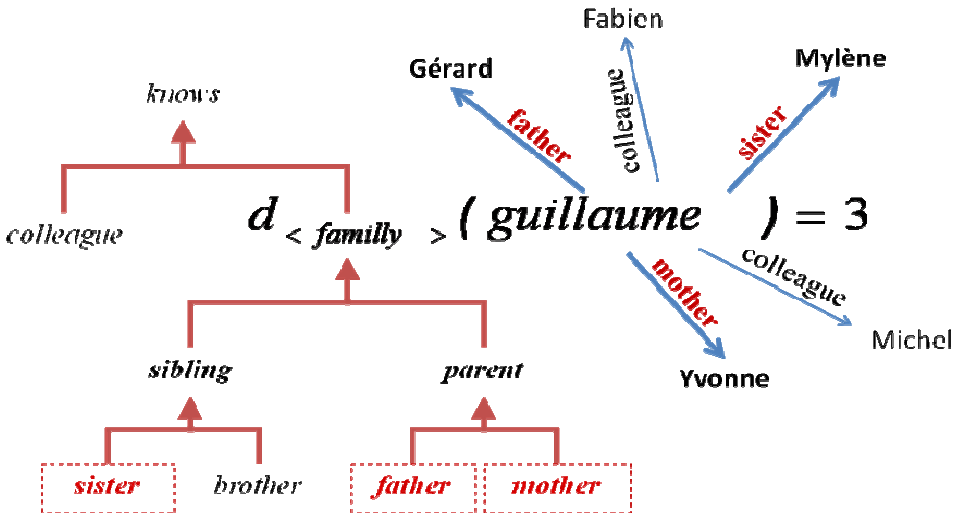
We designed SemSNA, an ontology that describes the SNA features (e.g. centrality). With this ontology, we can (1) abstract social network constructs from domain ontologies to apply our tools on existing schemas by having them extend our primitives; and we can (2) enrich the social data with new annotations such as the SNA indices that will be computed (e.g. centrality). These annotations enable us to manage more efficiently the life cycle of an analysis, by calculating only once the SNA indices and updating them incrementally when the network changes over time.

Figure 3 Abstraction stack for semantic social network analysis



Based on this model, we propose SPARQL definitions to compute semantically parameterized SNA indices (e.g. Figure 4) and annotate the graph nodes with their results. The current test uses the semantic search engine CORESE [36] that supports powerful SPARQL extensions particularly well suited for the computation of the SNA features that require path computations [41]. More details on that ongoing work can be found in [23, 42-44].

Figure 4 The simple example of a semantically parameterized degree



$$d_{<family>}(guillaume) = 3$$

$$d_{<R>}(p) = \left\| \{x ; \exists(p, R, x)\} \cup \{x ; \exists(x, R, p)\} \right\|$$

Social networks and social activities, e.g. social tagging, are not only interesting in themselves, but they also provide criteria for tasks such as searching, filtering or notifying. These representations traditionally support functionalities such as expert matching. These functionalities are often limited by the lack of semantics in their structures (both in term of representation of the social network and of the tags usually reduced to terms). We intend to leverage ontology-based representations of both social networks folksonomies to provide inferences improving these functionalities. We also intend to exploit feedback from social use to maintain the formal representations, for instance deriving subsumption links from the inclusion of the community of users of a tag

in the community of users of another tag [5]. One of the scientific objectives of ISICIL is to enrich exchange fostering functionalities using ontology-based representation and to exploit feedback from this usage to drive the evolution of these representations.

Communities are living objects and highly dynamic structures. Annotations about and produced by the community will evolve too. Capturing and representing these evolutions can enable us to monitor the emergence and disappearance of topics of interest, to find the most active topics and users at a given time, to detect active or declining communities, etc. From these clues, we could provide functionalities fostering the life-cycle and animation of the social networks. One of the scientific objectives of ISICIL is to reify and exploit the evolution of representations and to use them in semi-automated functionalities to assist the life-cycles of communities.

5 Reconcile usability, web 2.0 applications and corporate organizational reality

Many web2.0 applications have rich clients with “nice, flashy and trendy” interfaces. However when it comes to rapidly performing a task or finding a piece of information, these interfaces may require many complex manipulations, provide clumsy views or exclude users with disabilities or not acquainted with the latest web trends.

In addition to ergonomic concerns, basic interoperability and usability aspects are often broken, for instance many web 2.0 clients do not provide precise URLs to bookmark in order to share web 2.0 pages. We want to address these problems of usability and adoption, because these two criteria in designing 2.0 social applications go largely beyond a good interface and efficient navigation. The question is to focus on how users experience each other via some mediated technology, rather than to observe how users interact with the technology itself. The goal is to diminish the classical individual and organizational hindrances when implementing new collaborative work and knowledge management systems, *i.e.*, top-down approach, low participation, lack of personal incentives and reduced adoption because of other competing software applications (such as word processing, mail clients or web browser). The success of such a project on our ability to take into account from the outset the global incentive mechanisms that will allow the involved end-users to share their know-how and to create actionable knowledge for the organization. One of the scientific objectives of ISICIL is to ensure that advanced web interfaces are not only nice but also usable and effective in the tasks they were designed for with a special focus on intrinsic incentives (social recognition and emotional entertainment) to foster adoption of the solution.

In order to tackle the interactions between users mediated by social semantic tools (or "social interactions"), ISICIL has set the goal to adapt to the design of social interactions the *interaction design* approach popularized by Cooper [45], an approach focused on the interaction between (one) user and (one) system. The envisioned adaptations concern two basic artifacts of interaction design: personas and scenarios. We intend to join the task of constructing *collective personas and scenarios* to the task of constructing *individual* personas and scenarios.

To help designers of social semantic tools to clearly identify the type of the collective entities (e.g., a community, a network, a group, etc.) for whom they are designing the tools, another goal of ISICIL is to construct a *matrix* gathering the distinctive characteristics *of collective entities* (esp. communities), and to use this matrix as a

generator of questionnaires and of interview grids for collective entity identification. Another goal of ISICIL being to provide users with tools representing people networks graphically, we will use existing graphical tools (e.g., ManyEyes) as simulation tools to help users express their representation needs.

The recent evolutions of the web 2.0 focus on the social dimension of knowledge. But actual theories lack mechanisms to explain structural links between what "social" really means for knowledge activities. Post-cognitivists theories [46], like Activity Theory, Situated Action Theory, Distributed Cognition Theory and Situated Cognition Theory, all failed to specify this point. Only Actor Network Theory (ANT) (Bruno Latour) addresses this specifically. ANT does not assume existing social ties between entities (humans and non-humans), but observes their creation through various associations. Associations between heterogeneous entities (like personal or shared documents, discussions taking place in a dedicated environment, articles extracted from a knowledge base, votes, tags, colleague's profiles) will be explained to understand social ties. DemonD is an example of a tool which implements a Social Search Engine built upon the Actor Network Theory. We could enlarge the scope of this topic to take into account and explore the ways human (and non human) knowledge can be increased via social transactions. One of the scientific objectives of ISICIL is to contribute to a robust social theory of knowledge by identifying all factors (not just the ones that influence information retrieval activity) that affect relations between knowledge and social transactions.

We believe that Information Watch Process is necessarily a social process, creating ties between individuals and expanding their social capital [47]. The problem is to define a relevant vision of "social", constructed through a review of theories that explicitly stressed the social dimension of watching tasks. In recent years the concepts of practice and activity have attracted the attention of academics and practitioners working on learning and knowledge in organizational and work setting. They all begun to explore implications for research and intervention of notion that knowledge and learning are mainly social and cultural phenomena. The result is increasing interest in the thesis that organizational knowledge and learning cannot be conceived as mental processes residing in member's heads; rather, they must be viewed as forms of social expertise, that is, as knowledge in action situated in the historical, social, and cultural contexts in which it arises and embodied in a variety of forms and media. In spite of the distinct intellectual traditions, a practice-based view of "knowing in organization" now starts to be acknowledged [48-51].

The Activity Theory is helpful to look at the social dimension of Information Watch Process. Engeström's contributions to the Activity theory expanded Vygotsky's mediating triangle with a social component [52] providing the activity theoretical community with a powerful tool for social systems analysis. The situated action theory is another helpful framework to analyze information retrieval as a social process. Lucie Suchman's research demonstrated the inefficiency of action plans and suggested that activity was constantly constructed and reconstructed from dynamic interactions with the material and social worlds "situated" [53]. Relying on ethnographical methods, Edwin Hutchins analyzed sophisticated activities such as flying airplanes or sailing [54]. His research identified an exhaustive cognitive system formed / (distributed among) by human and the artifacts they use to achieve their activity. The theory of socially shared cognition recognizes the importance of a network or a community in the study of human cognition [55]. In communities of interest [56], members share information on a specific subject whereas epistemic communities [57] are conducting a cognitive activity relying

on globally distributed individuals. Communities of practice offer a new paradigm for social knowledge and information activity [58-60]. We identify also a new form of information network, relying on information retrieval activity as a social process in order to build an organizational network of expertise [61]. Finally, Bruno Latour in his actor-network theory suggests a dynamic vision of social ties constructed when entities interacts with each other [62-63]. But cognition as a social and cultural phenomenon requires, in a computer mediated environment, artifacts able to transmit individual awareness and create a context for the completion of collaborative activities [64]. Among others, practice-based theories appeared as a pertinent theoretical framework to represent social search practices. Beyond this state of the art, one aim of ISICIL is to elaborate a specific implementation of these theories in social search services online and in organizations.

One of the contributions of the ISICIL project since it started concerns the association of two kinds of analysis: the usages analysis (which has been presented earlier in this section) and the processes analysis. The usages analysis objectives are the understanding of users' characteristics, the understanding of the different usages/scenarios concerning the tasks they accomplish (or they will have to accomplish) and the capture of their requirements. However, this approach presents some limitations due to the interest in individuals/actors that can be described as a psycho-cognitive approach. First, the vision of the proposed tool is related to the representation that an actor is able to formalize (as use cases) based on the potential use of this tool. But complex and innovative tool often exceeds the ability of the actor to represent and describe it exhaustively. Secondly, this approach offers a technologic and human view of the activity. Therefore, it does not take into account the economic aspect. Yet, this economic aspect can often overcome some constraints (e.g. when a company can outsource a part of the activity that could not be achieved in-house for various reasons). Thus, we provide a framework for the formalization of the activities as processes. Their analysis allows us to complete the usages approach thanks to the provision of insights into the economic facet of the activity (without neglecting the technical aspects). Our objective concerns the development of an analysis approach aiming at the creation of a repository of Enterprises Architectures (EA) mapping the ISICIL end-users (Orange and Ademe). The modeling of their processes and organization helps us determine the way they have to operate and to be transformed in order to apply their strategy. The detection of these scenarios, and the current lacks and opportunities, aims at proposing a new and adapted model. These scenarios support and enrich the ISICIL innovation process.

However, the processes analysis is not really concerned with the human-related aspects. Although we distinguish mechanical processes and human-driven processes, the current processes management tools only support mechanical processes. The humans' involvement is limited to the injection of data in entry and to the decision points while numerous activities (e.g. strategy, conception, sales, etc.) depend on their collaboration and behaviors. Moreover people usually seek to impose a logical sequence of activities in a planned action view. "*Consequently, the resulting process definitions have […] the disadvantage of being prescriptive and rigid*" [65]. The human interactions are often crucial and they include opportunistic behaviors that affect the expected order. It is therefore necessary to propose a new model in which the human activities could be formalized and the activities activation could be opportunist (situated). Few authors have brought formal elements for human interactions and even rarer are those that have studied the link between human interactions and processes. Some extensions of business

processes have been proposed (e.g. BPEL4People) but they are criticized by the HIM (human interactions management [66]) community (in particular in the case of innovative, collaborative and progressive activities). Indeed, what is named "human interactions" often corresponds to Humans to Systems (H2S) interactions and not Human to Human (H2H) interactions. The integration of processes and human interactions contributes to our objective of integrating the method of the social interaction conception and a real business modeling. We rely on the concept of HIM which has been proposed by Keith Harrison-Broninski [67-68]. He uses the RAD notation (Role Activity Diagram) [69] which is a kind of flowchart covering six standard objects: roles, participants, resources, activities, interactions and states of the processes. Harrison-Broninski proposes a set of additional elements to model human-driven processes: a better characterization of roles and participants, an improved technique for the modeling of relations, a better processes management and control (start, stop, definition of objects, transfer of information, etc.), an opportunistic activation of the activities (with not prescriptive processes and the use of logical conditions), and the consideration of not synchronous interactions (via multiple channels). In the ISICIL project, we also pursue the objective of linking a HIMS (Human Interactions Management System) with a BPMS (Business Processes Management System) (see the example of HumanEdj).

One of the major trends which explain the interest for human interactions is the growth of services activities. But, we notice that the concept of service remains fuzzy. Today, the engineering definition is the most dominant: services are reusable features (i.e. Web services). However, two levels of services are often confused: the technical level and the logical level. These levels correspond to views of systems conception. Indeed, the concept of service also appears as the logical level of the tools' structuring. It is the lower level component of a system's logical architecture and the answer that this system gives to a need of information, action or transformation. It is completely independent from business and technical levels and it is translated into software components according to the technical choices. Thus this notion of service is neither connected to the requirements nor to the business. A new concept of service has recently emerged at the business level [70-73]. The SSME discipline (Science management services and Engineering) has been introduced by IBM and several Universities. It gathers all the synergies (social sciences, administration and management, global economy and market, science and engineering) concerning this kind of concept [72-73]. In order to express its complexity, some SSME researchers propose the term "Service System" [70-73]. They define it as "a value-coproduction configuration of people, technology, other internal and external service systems, and shared information". This service can only be experienced, created or participated in. It is intangible, perishable and heterogeneous and it is coproduced and consumed simultaneously [74]. But the modeling of this kind of service is not the object of numerous works [70,71,74]. The ISCIL project is interested in corporate intelligence and expertise activities. So, it seems to be interesting to better position this concept of service as a functional level which can be useful to investigate the key and interactive activities. Upstream of this functional level, we could find the companies' value chain, their main business domains, their objectives and key performance indicators (through business map) and downstream we could find the processes and their activities which are associated with information treatments, and then the logical structure which is linked to the organization and the information system.

The on-line publication of the processes models and their simulation as animations allow raising the BPM barriers. In the ISICIL project, we suggest to combine the power

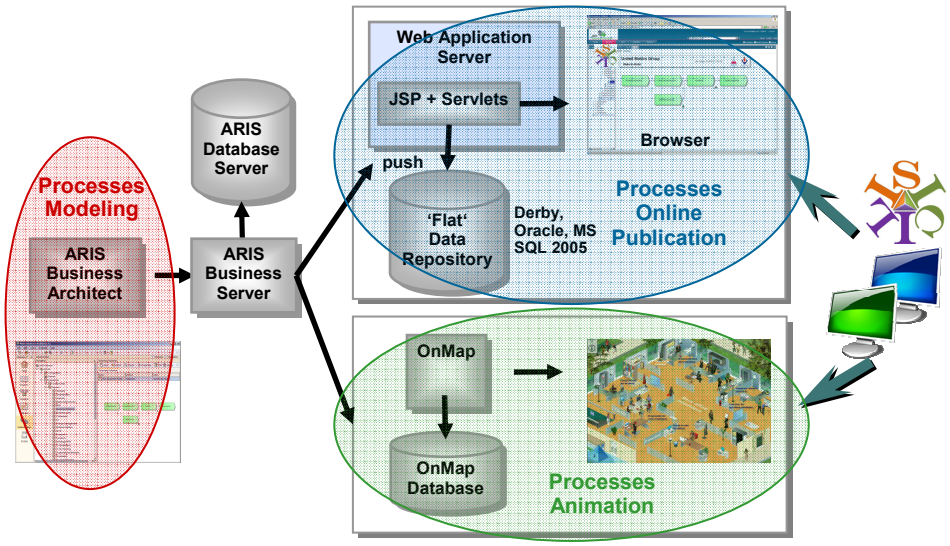
of the modeling tool ARIS Business Architect from IDS Scheer to the flexibility and the interactivity of ARIS Business Publisher from IDS Scheer (for the publication of a Web portal of processes) and OnMap from Nomia (for the animation of these processes). Figure 5 presents the architecture of the proposed solution.

The objectives of the online publication thanks to ARIS Business Publisher are:

- the presentation of the models to the whole ISICIL community,
- the contribution of the ISICIL members by the sharing and communication based on these models,
- the validation of the models and underlying analyses.

Regarding the simulation of these models, some tools allow the creation of an ergonomic expression of the processes and their associated micro-world. The OnMap Suite from the editor Nomia is one of these solutions. It facilitates the teams' communication and cooperation. The relevance of the processes representation as scenes instead of their representation as diagrams has been established. These animations facilitate the memorization and the understanding. They illustrate the usages of the studied ecosystem and they help us validate the processes functioning. Therefore they are a useful tool for the ISICIL appropriation and validation of the models.

Figure 5 Architecture: from processes modeling to processes publication and simulation / animation



Finally, it is often necessary in data management applications to control the ways in which data is accessed, modified and transformed. When data is under centralized control, arbitrarily complex restriction scenarios can be actively enforced inside the boundaries of the owner. All this becomes much harder when data cannot be actively controlled and monitored, for instance when it is shared in a distributed and open context such as large social networks for information and knowledge sharing. The management of trust and privacy is becoming crucial in many applications, like collaborative publishing of information (Wikipedia, open software communities, e-bay) or social

networks applications. Many novel issues are raised in such contexts and one of our objectives is to study appropriate models and tools for trust and privacy management. More precisely, the project must innovate on the following points: (1) Better understanding of the use of trust models and their limits in open communities (for example, trust transitivity issues). (2) Developing suitable models for privacy based on trust measures in open communities for information sharing and publishing. In particular, these models should allow data owners to preserve their anonymity and to control how private information is disseminated, accessed or modified. One of the scientific objectives of ISICIL is to propose appropriate models and tools for trust and privacy management in the context of open communities for information and knowledge sharing within organizations.

Trust is now being studied in many research projects. These include the work of the database group at Stanford University on the Eigentrust algorithm [75-76], the work at EPFL [77], or at Queensland University of Technology [78-79]. Generally, trust is designed to help determine whether an interaction can occur with a user, as in e-commerce, for instance. In the case of privacy, we can mention [80] in the field of architecture at a high level of confidentiality. Their main idea is to handle the most sensitive data on highly secure hardware (a smart card, for instance). They propose models of mixed evaluation for the queries, where a part of a query runs on servers and the other part on the smart card so that the most sensitive data can never be visible outside the smart card. Work closest to what we want to achieve in ISICIL is that conducted in the area of access control in autonomous networks [81-82], which we will compare with confidentiality models for data management [83-85].

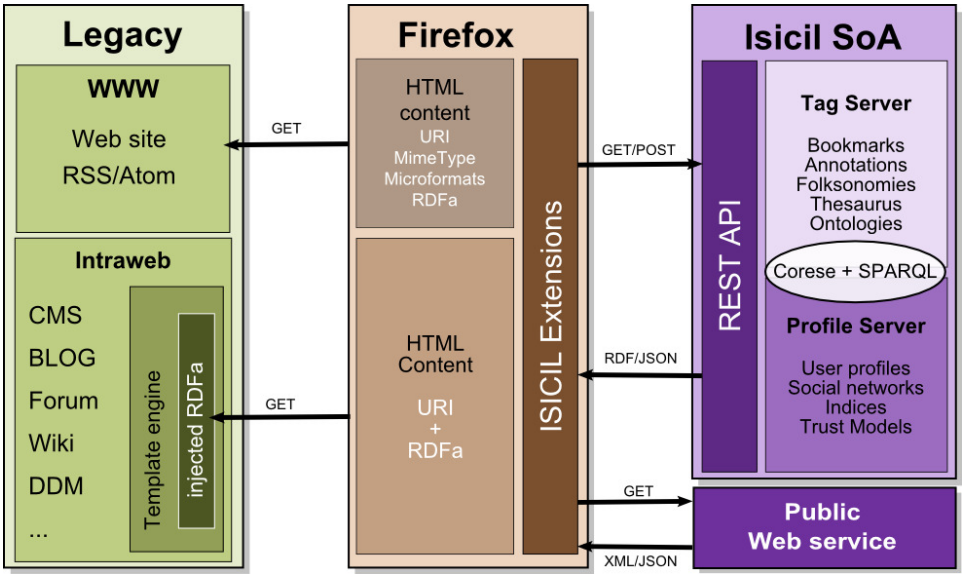
6 Summary and conclusion

ISICIL proposes studying and experimenting with the usage of new tools for assisting corporate intelligence tasks and relying on web 2.0 advanced interfaces (blog, wiki, social bookmarking) for interactions, and semantic web technologies for interoperability and information processing.

ISICIL started six months ago and one of the first outputs is the choice of a software architecture to design and deploy or prototypes. Studies show that many companies are now beginning to adopt Services Oriented Architectures (SOA). With the architecture shown in Figure 6, we intend to integrate existing corporate content and applications at three levels:

- enriching the templates of intranet applications with RDFa annotations to directly integrate existing tools and their data in a novel way *i.e.* through the front-end.
- inside the browser using Firefox extensions in XUL, assisting the task of intelligence by connecting to the ISICIL servers and collecting according to the browsing context the most relevant metadata.
- at server end, by providing an application server which services are published in REST and are provide functionalities for processing semantic annotations and semantic queries, managing users and their access rights, groups and networks, providing visualizations, analysis and notifications.

Figure 6 Software architecture and approach in ISICIL



This architecture is designed to be sufficiently flexible and rich to meet the needs of the project and integrate the existing IT landscape of an intranet. We want to show that small but viral solutions relying on open standards for representations and APIs are enough to bootstrap semantic webs and that tools can merge the ease of use of light representations and the automation capabilities offered by formal representations to improve the functionalities offered in the latest web applications and interfaces.

From a knowledge representation perspective, ISICIL aims at bridging web 2.0 and semantic web approaches to show that not only can web 2.0 approaches be supported by semantic web frameworks but they can actually be improved and propose additional inferences and intelligent behavior in interactions with users. We intend to show that we can reconcile on the one hand folksonomy-based representations and processing and on the other hand ontology-based representations and processing. For reasoning we will rely on graph-based reasoning on ontology-based models as an alternative to classical logic-based approaches. ISICIL intends to integrate light representations like tags, and formal representations like ontologies to get the best of both worlds. A challenge will be to synchronize the life cycles of light representations and formal representations to enable mutual improvements.

The advent of tagging and folksonomies for organizing shared resources on the social Web brought promising opportunities to help communities of users capture their knowledge. However, the lack of semantics, or the spelling variations between tags lowers the potentials for browsing and exploring these data. To overcome these limitations, we proposed exploiting the interactions between the users and the systems to validate or correct semantic analysis automatically applied to the tags. This process is based upon our model of the assistance of folksonomies enrichment which supports confrontational points of view. Several strategies can then be applied to propose novel browsing facilities to users.

ISICIL also aims at extending social network analysis to ontology-based representations of users, communities, links and relationships. We propose to bring ontology modeling to social network representation and analysis by extending social network analysis to ontology-based social graph inferences to detect and stimulate communities of interest. ISICIL will exploit ontology-based representation of social networks to support new algorithms for discovering and monitoring a community's activity. The ultimate goal is to support exchange fostering functionalities using ontology-based representations, and to exploit feedback from usage to drive the evolution of these representations. Since social networks and indexes are living objects, ISICIL will also consider means to reify and exploit the evolution of representations and use them in semi-automated functionalities to assist the life-cycles of communities.

The introduction of web 2.0 applications in organizations is not as obvious as one might think. ISICIL acknowledges the problems in reconciling open web practices with corporate processes. We intend to ensure that advanced web interfaces are not only nice, but also usable and effective in the tasks they were designed for with a special focus on intrinsic incentives to foster the adoption of the solution. We will design interaction GUIs using methods based on human-to-human computer mediated relationships. We also intend to contribute to a robust social theory of knowledge identifying all factors that affect relations between knowledge and social transactions.

Finally a distinction between traditional web 2.0 applications and traditional corporate applications is in the concern for privacy, security, access control and confidentiality. ISICIL will propose appropriate models and tools for trust and privacy management in the context of open communities for information and knowledge sharing within organizations.

One of the originalities of ISICIL is to contribute to the development of a flexible web services framework for supporting the stakeholders engaged in the Information Watch Cycle, as close as possible to their usage practices

As a closing note, we want to stress that the challenge and novelty of ISICIL is not only scientific (new algorithms and representations to assist the watchers), not only technological (merging state of the art technologies to get the best of them), not only ergonomic (reconciling the latest web interfaces with usability), it is also sociological (integrating user centric approaches with corporate workflows and rules).

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