CONCEPTUAL-BASED REASONING IN MOBILE WEB 2.0 BY MEANS MULTIAGENT SYSTEMS

Knowledge Engineering Notes

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Abstract: Increasingly, users connect to the Internet by mobile devices and they are generating massive content through them. The lead-off projects in Mobile Web 2.0 offer the opportunity to add semantics in order to obtain structured knowledge. In this paper, we present specific challenges for tagging reasoning, into the *SinNet* project. SinNet is based on user generated content (UGC) by mobile devices, as well as how to solve them by means of combining multi-agent systems and formal concepts analysis.

1 INTRODUCTION

Mobile Web 2.0 (MW2.0) represents the new revolution in both social networks and digital convergence. Despite this convergence -it seems to be the "ultimate" one- more work on knowledge interoperability among heterogeneous devices and technologies (mobile phones, Web 2.0 mashups, Semantic Web or Intranets) will be needed, however several difficulties will arise. On the one hand, commercial, geopolitical and sociological interests have made the interoperability and knowledge organisation a challenge that mobile companies are not considering in their new projects. On the other hand, mobile phones have been designed for more activities than many of the traditional Web 2.0 (W2.0) ones, and are often more reflective.

Roughly speaking, Mobile Web provides to web experiences ubiquity and mobility. These features show significant differences between MW2.0 and Web 2.0, because users are able to generate content with explicit (geo)spatial, temporal, contextual and/or personal features. Some metadata associated with them could be automatically generated while others could be intentionally generated by users.

The marriage of social mobile networks and the Semantic Web (SMW2.0), which is unique because of its current features and mobile device limitations. In a mobile computing context, these special features and mobile device limitations can make the convergence of MW2.0 and SW technologies (aka. SMW2.0) difficult. These may lead to a new digital divide between mobile networks and SW (or Intranets).

Unfortunately, MW2.0 has been developed on special features networks which depict a completely different framework from the neutral WWW. Some of these features cause difficulties for MW2.0 and contribute to the rising of a new digital divide, between mobility and WWW computing, whereas other conditions make hard the semantic interoperability:

1. Mobile Web is supported by private telecommunication channels with different terms of use and technological features, as opposed to the global nature of conditions in Web 2.0.
2. Mobile Internet is not a neutral net. Network owners can set limitations, or access conditions to selected mobile services (e.g. VoIP services).
3. Mobile Telecomms companies can develop their own ontologies for selling or distributing mobile services, without the need to interoperate with competitor's ontologies.
4. Socio-economic aspects. In some countries, mobile internet is expensive or the infrastructure has not been deployed. Social networks based on primary channels (MMS) represent the main option.
5. Mobile user's behaviour differs from desktop

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users. MW2.0 encompasses classic W2.0 tasks with others related to diary needs that it may turn into new mobile services.

6. Usability, hardware architectures, costs...
7. Mobile Communications provide robust commercial infrastructures (subscriptions, rates, SMS/MMS channels) for designing feasible business models for MW2.0 (Martignoni and Stanoevska-Slabeva, 2007).

1.1 Social Network on SMS/MMS Channel

SinNet platform, was built as an evolution of Mowento (Aranda-Corral et al., 2009). Mowento was designed for publishing testimonial documents about events, witnessed by the user, at the time they are occurring, and it is possible to use with any mobile device, even it it only has basic features. These events are captured using mobile devices as photos and short videos. Digital documents are sent to the Mowento platform, via MMS, in order to be published onto the WWW. An alert about this new event is also broadcast -via SMS- to the Mowento user's neighbourhood, in different ways and depending on the user's account. Thus, the aim is to provide a social relationship among mobile users -usually without Mobile Internet access- by means of publication on Mowento's WWW site for photos and short videos, as well as the micro-dissemination of these in the user's social neighborhood on Mowento's mobile network (see fig. 1). The choice of the MMS/SMS channel (justified bellow) limits user management and participation and it leads UGC management to a Multiagent Platform (see fig. 1). SinNet extends Mowento with new features and with a new WWW portal with more classical Web 2.0 features.

1.2 Aim and Contribution of the Paper

The aim of this paper is to describe our original work about how to increase the tagging task as a semantic annotation method in a more hostile scenario than above described, namely for non-sophisticated mobile devices. We show the solutions we have designed, as well as These techniques have been implemented in a SMW2.0 experimental platform called *SinNet*.The above restrictions have been considered both, scientific and economic features for SinNet project. E.g., The choice to use of MMS/SMS channel only, is based on it is neutrality and universal accessibility (solving restrictions (1),(2),(4) above), and provides a pay channel, a basis for a business model (feature (7)). Moreover, ontologies are based on user's tagging instead of company-owned ontologies (bridging the gap considered in (3)) and, finally, SinNet mobile application is designed for mobile devices which satisfy minimal requirements and concrete user needs (dissemination of testimonials on events) solving potential difficulties described in (5) and (6).

Why the MMS Channel? There exist strong reasons for developing a platform by using the MMS/SMS channel, as SinNet is.Neutrality of the SMS/MMS channel is a key feature, because they are revealed as universally accessible channels for mobile phone users. In MW2.0, socio-economic aspects of networks must be particularly considered. Although MW2.0 cannot be fully tested in developing countries, there exist opportunities for using the MMS channel instead of Mobile Internet when economic, social or geographic characteristics make the use of Mobile Internet difficult. Another important barrier is purely economic and local. If we wish to ensure that your social network will get a wider spread the relative high cost of Mobile Internet services, e.g. in Spain, discourage them as a primary channel. Recently, interesting initiatives have exploited this channel to bridge the mobile internet divide, such as Microsoft's Oneapp (http://www.microsoft.com/oneapp), a software application that enables basic mobile phones access to the W2.0 universe. In emergent countries such as South Africa (where initially Oneapp was adopted) or India, the impact of mobile based relationships on socio-economic activities is stronger because these relationships are new and often are not augmenting pre-existing social networking. The choice of this channel also provides the project a robust business model based on premium SMS/MMS.

The most important limitations of this choice are the limited size of the document generated by the user and the existence of so many mobile device hardware/software architectures. However it more important non-advanced mobile phones can also run the SinNet mobile application. This allows us to work with a great scope for the SinNet application, but the design and usability of the Mobile application will be a key issue. In fact, the SinNet mobile application is available to every mobile phone with basic minimum requirements (see Sect. 3).

Another requirement -observed from experiments- is the need for a quick publication when the user acts as a journalist for an ongoing concrete event. Thus, the mobile application must simplify the process to few clicks. The design of SinNet's Multiagent System (MAS), with specific agent's behaviours, is strongly limited by this re-

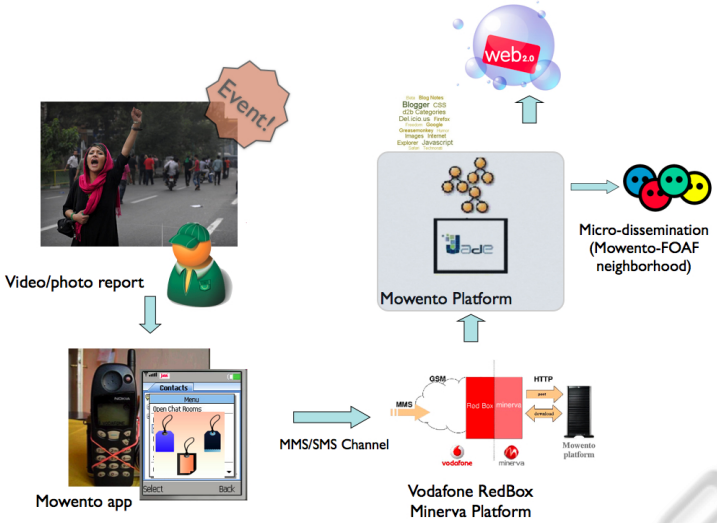

Figure 1: Mowento (precedent of SinNet) in action.

quirement. It is clear that, based on this scenario, documents with deficient tagging, will often be generated. SinNet's efforts are particularly addressed to fixing four main barriers: automatic enrichment of poor tagging, tagging app for mobile phones that allow basic tagging, by means of *clicks*, enhancement for older tagging with new frequent tags and knowledge conciliation among content generated by different users.

The paper can be divided in two parts. The first part is devoted to describe the environment where the project is realized and to justifying design decisions. The second part details the Knowledge Engineering behind the system, especially the MAS that supports Knowledge representation and reasoning. The next section is focused on describing the main characteristics of tagging from mobile devices that we have considered. In section 3, Formal Concept Analysis is introduced as a key mathematical tool for managing ontologies based on concepts, and how it is applied by SinNet. Section 4 is dedicated to describe SinNet project, its main components and the role of the Multiagent System embedded into SinNet as a semantic assistant for users. The four main semantic problems about Knowledge Organization Methods based on FCA are described in Sect. 5, and how these have been solved in SinNet in Sect. 6. The paper ends with some considerations and future work.

2 TAGGING IN MOBILITY

In order to design tagging methods for SinNet users, several considerations have been discussed. Tagging is a universal method for annotating files, documents and urls. Historically, it was the primary semantic activity in the WWW, because it represented a social method for categorizing and classifying documents and allows users to navigate through document databases. Web 2.0 Tagging is a task that different Web sites consider in many different ways. In MW2.0 the main motivation is to collect and to share digital objects. Therefore, User Generated Content (UGC) from mobile devices has to be smartly organized. Sociological and psychological context of UGC in mobility differs dramatically from Web 2.0 experience through desktops. In fact, tagging from mobile devices may be dangerously considered by users as a tedious task (particularly when user has a non-advanced phone).

An interesting solution could be to design and to implement an ontology for representing specific features of the content that is generated, or transformed by the social network. However, such ontology -that allows users to tag digital objects generated from a mobile application- should be a consensus ontology, for both users and recommender systems. This must be so because there is a real danger that ontologies designed by engineers are not well understood by (non specialist) mobile users. Thus, it seems more natural to provide a consensus ontology extracted from users' folksonomies, cognitively sound for the social network. In these kind of ontologies, it does not consider features associated with the user's mobility which can be automatically provided by the system/-platform. Lastly, in SinNet project the tagging process must be easy, cheap and quick, therefore usability decisions are key aspects to consider.

In order to conciliate tagging with ontologies, several methods to integrate this kind of knowledge organization and SW realm have been considered. It can be classified according to formal semantics associated to tag sets (or folksonomies). A first class are th methods based on ontological definition of tagging (see (Kim et al., 2008)). A second one are the methods based on transformation from folksonomies to ontologies (Damme et al., 2007), included ontologies designed to deal with folksonomies as for example (Gruber, 2007). Finally, methods based on concept mining from folksonomies (Jäschke et al., 2008). The latter is very useful for tag-based services

In order to use mobile phones for sharing content in SMW2.0, it is necessary to accept that semantic annotations of digital documents from mobile applications suffer several limitations. On the one hand, as already commented, mobile phones are often tedious tools for writing (some how) large content, specifically in basic phone models. Therefore mobile applications should simplify the tagging task, producing an automated set of tags, such as geo-location and temporal metadata. On the other hand, a user appreciates both the immediate generation of digital documents on an event that he/she aims to report, and their fast publication in their social network. Therefore, a careful balance between sound annotation and usability is necessary. All these considerations have influenced tag management in the SinNet Platform.

Several difficulties for tagging through mobile devices have been detected in SinNet:

Incomplete Tagging According to Concept Lattice. User tags are not enough to locate the document into a lattice concept. This tagging behaviour does not mean a mistake, the user could not be sure of all of the tags that can be applied to the document. Solution is described in Sect. 5

Outdated Tagging Menu in Mobile Application. The application should offer to users a menu broad enough to obtain high quality tagging. Thus the application has to avoid the user not completing all tagging for the document. This could happen if the current menu pages are not up-to-date (synchronized) with the current lattice. The concept lattice is automatically by agents updated when new documents or labels came into the platform. In the same way, agents send to the mobile devices new tagging menu pages. This process will be described in Sect. 5.

Re-tagging with New Tags. Mobile application allow to users add new tags. They can induce user to complete old tagged documents with the new one. This routine is not appropriate for SMS/MMS channels. Therefore, an agent in the SinNet platform should extend old tagging to new ones in an automatic/autonomous way. A behaviour have been implemented for SinNet's agents to extend the tagging set in a proper way.

Knowledge Conciliation. The use of personal concept lattices could be an obstacle: Linking labels from different users to navigate through SinNet global content can be hard. Although the initial lattice is common, introduction of new tagged documents and the addition of new tags can cause semantic heterogeneity. Hence, concept lattices must be reconciled to reach an agreement and to accept labels from other users. SinNet implemented solution was presented in (Aranda-Corral and Borrego-Díaz, 2010). It is useful in any tagging-based service (see Sect. 5).

Above deficiencies should be fixed by agents at platform, due to the cost of SMS communications.

3 ARCHITECTURE OF SINNET

SinNet has three main components: the mobile application, SinNet Web and the MAS which bridges both.

The **SinNet mobile application** lets users to publish audiovisual documents (photos and videos) forthwith, so the user should find it attractive, fast and easy enough, to create and to send documents to the platform. The selection file picking, that it could be a short video or a photograph, with a current 300KB limitation due to MMS technology. Any other kind of files have not been considered for this project. A basic document tagging system and some fields, such as title, small description, date, etc. Finally, the sending of full audiovisual documents by MMS.

The current Mobile Application version uses a system of menu pages which is built automatically by means an algorithm which extracts the menu from the concept lattice. The user navigates among them by clicks, where each click represents a new tag (fig. 3 (left)), or a set of them can be selected in the last menu page (fig. 3 (right)).

The mobile application allows users to capture images, or videos, by means of the installed camera on the device. Documents (images or videos) are processed (size, codification, etc) and saved temporarily. Also it allows the addition of some basic information, such as title, short description, private,...). But the main task is the tagging of the document. Finally, the documents and all the information/metadata about it is packed and sent in a MMS format. This application is portable, based on Java J2ME, and it accomplishes usability and speed.

The **SinNet Web portal** has been built on Elgg (http://elgg.org/), an open source social networking

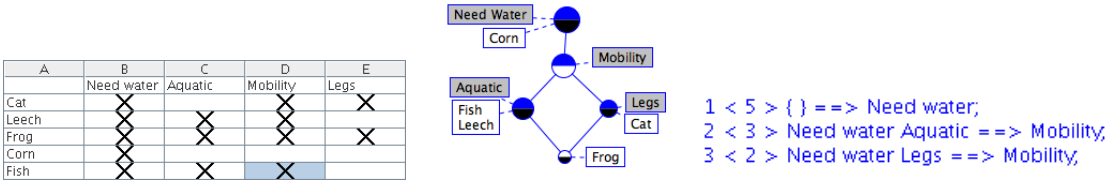

Figure 2: Formal context, associated concept lattice and Stem Basis.

platform which provides basic Web 2.0 features for users.

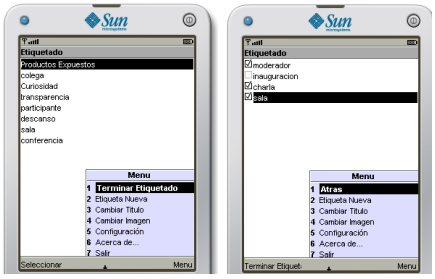

Figure 3: Mobile Application, nonterminal (left) and terminal (right) screens.

The **SinNet Multi-Agent System** offers mobile services. Roughly speaking, MW2.0 services can be created in two different ways: By Mobile extension of an existing Web 2.0 service or by a pure MW2.0 service specifically dedicated to mobile networks and based on user-generated content. New tools for this kind of generated knowledge engineering and management have to be designed. In our case, the second way is considered, by the choice of a MAS to execute several semantic tasks. Each document - which is received in SinNet (via Vodaphone's Red Box platform)- leads to the creation of an agent associated with this document which performs some of the classical Web 2.0 user tasks as well as other specific (reasoning) tasks.

SinNet is a SMW2.0 which is supported by a multiagent system platform installed in a public Internet system. Agents, which are living in this platform, behave as facilitators, moving the hard task from the mobile device to the platform, and therefore, making the users life easier. Although the possibility of agents embedded into mobile devices exists, it was discarded based on the decision that the SinNet mobile application only will require minimal features from user's mobile phones. The customisation of every task for each user and document, which is sent to the Platform, is supported by the autonomy(of computing) that a MAS can provide. Future scalability will also be solved by means of controlling agent population. The agent platform can be composed by a group of servers and the agents can move over them without difficulties. Another advantage is to be able to extend the functionality system without a big effort. Developers only have to add a new behaviour to agents, as indeed has been done already.

SinNet's platform is built on JADE (http://jade.tilab.com), a FIPA compliant MAS platform and tools for fast development. JADE could offer us, in the future, the opportunity to open SinNet to others platforms and interact with other social networks.

The social organization model chosen for SinNet agents' is hierarchical. Now it is 2-levels deep, but this could be increased. Also, we can separate the agents into two types: generic and specialized. Both of them live in the platform and they can move through the containers (servers). Generic agents, also called Planners, are responsible for all high-level tasks and the platforms performance. They are the core of all semantic information management. When a document arrives, they review it and organize all the tasks to be performed. Within a platform there can be several planner agents to avoid bottlenecks in this task, because this could block the entire system. This Planner agent has a timer behaviour (TickerBehaviour) where it checks if a new document has arrived to the platform and, if so, pre-analyses this content. Depending on the nature/format of this content, a set of tasks should be applied on it. Some of these tasks will be semantic ones, but not all of them(e.g. format converting). For this, the planner agent will create some specialized agents and assign a task to each one. In this stage, the planner agent also must avoid the bottlenecks distributing them on all containers (servers) as a load balancer.

The main specialized agents, performing semantic tasks, can be technically divided in two classes: One Shot Behaviour agents and Dialogue agents. The First ones runs its tasks in an autonomous way and does not need any collaboration from any other agent. Some of these are the tag suggestions agents, the micro-dissemination agents, etc. Dialogue agents need other agents to collaborate/compete and its behaviours are mostly cyclical. When a specialized agent finishes, it informs to its Planner and its running is finished.

4 FORMAL CONCEPT ANALISYS

The convergence between Mobile Web 2.0 and Semantic Web depends on the specific management of ontologies. Ontologies and tags/folksonomies must be conciliated in such kind of projects. A useful bridge between these two kinds of representations could be *Formal Concept Analysis* (Ganter and Wille, 1999). According to R. Wille, FCA mathematizes the philosophical understanding of a concept as a unit of thoughts composed of two parts: the extent and the intent. The extent covers all objects belonging to this concept, while the intent comprises of all common attributes valid for all the objects under consideration. It also allows the computation of concept hierarchies from data tables. We succinctly present basic FCA elements.

A formal context $M = (O,A,I)$ consists of two sets, O (objects) and A (attributes) and a relation $I \subseteq O \times A$. See Fig. 2 for an example of formal context about live beings. The FCA main goal is the computation of the concept lattice associated to the context. Given $X \subseteq O$ and $Y \subseteq A$ it defines

$$X' := \{a \in A \mid oIa \text{ for all } o \in X\}$$
$$Y' := \{o \in O \mid oIa \text{ for all } a \in Y\}$$

A (formal) concept is a pair (X,Y) such that $X' = Y$ and $Y' = X$. For example, concepts from living beings formal context (Fig. 2, left) is depicted (right).

Using this Fig. 2, each node is a concept, and its intension (or extension) can be formed by the set of attributes (or objects) included along the path to the top (or bottom). E.g. The node tagged with the attribute Legs represents to the concept $(\{Legs, Mobility, NeedWater\}, \{Cat, Frog\})$.

Logical expressions in FCA are *implications between attributes*, a pair of sets of attributes, written as $Y_1 \rightarrow Y_2$, which is true with respect to M. It says that $Y_1 \rightarrow Y_2$ holds in M ($M \models Y_1 \rightarrow Y_2$) if for all $o \in O$, the set $\{o\}'$ respects $Y_1 \rightarrow Y_2$, and it is said that $Y_1 \rightarrow Y_2$ is *an implication* of M. A set $\mathcal{L}$ of implications is a (implication) basis for M if $\mathcal{L}$ is complete and non-redundant. It can obtain a basis called *Stem Basis* (SB) in a standard way (Ganter and Wille, 1999). A SB for the formal context on live beings is provided in Fig. 2 (right). It is important to remark that SB is only an example of a implication basis. In the paper any specific property of the SB can be used, so it can be replaced by any basis.

Armstrong rules (Armstrong, 1974) provides implicational reasoning. By defining $\vdash_A$ as the proof relation by these rules, it holds that the bases are $\vdash_A$-complete: Let $\mathcal{L}$ be an implication basis for M, and L an implication. Then $M \models L$ if and only if $\mathcal{L} \vdash_A L$

In order to work with formal contexts, stem basis and association rules, the Conexp (http://sourceforge.net/projects/conexp/) software has been selected. It is used as a library to build the module which provides the implications (and association rules) to the reasoning module of our system.

Every implication has also associated some properties, e.g. support. Support is defined as the number of objects that contain all attributes from Y_1 and holds the implication. Based on this property, a variant of implicational basis is defined, called Stem Kernel basis, which it will be used in 5 . A Kernel Stem basis is the subset of implications with support greater than zero of a Stem basis.

In case of SinNet, FCA is used as an ontological representation of tags. Rougly speaking, ontology class X, in SinNet's ontology, is intended as *the class of digital objects with tags X*. In fact, the ontology is extracted from several experiments with our mobile application and an arbitrary set of tags. Attribute exploration method (Ganter and Wille, 1999) is used to refine this ontology, as well as, to obtain a system for supplying deficiencies in tagging, as seen below.

FCA is the Knowledge Engineering technology that SinNet uses for knowledge mining and reasoning. FCA is a useful tool for computing and reasoning on folksonomies (Jäschke et al., 2008) that allows one to find and to work with conceptual ontologies behind tagging. Associated SinNet tasks to FCA are classified in two ways. On the one hand, it intensively uses the computing of concept lattices and stem basis. On the other hand, new FCA methods have been designed for solving SinNet specific features. These methods have been proved to be useful for facilitating intelligent tagging reasoning and to allow the system to delegate several tasks for the MAS allocated into SinNet. In this way, SinNet removes several user imperatives and minimizes their interaction with the system, improving their knowledge organization.

Currently, SinNet runs only for reporting events such as conferences, workshops or meetings. The concept's lattice that SinNet uses as its initial ontology was obtained from an experiment with a set of 200 tagged photos. In Fig 4 part of concept lattice is depicted. The concept which contains these attributes is the most specific one.

5 SOLVING DEFICIENCIES

The problems described above were related to deficient tagging from mobile phones and for synthesizing sound metadata in platform, and they have been

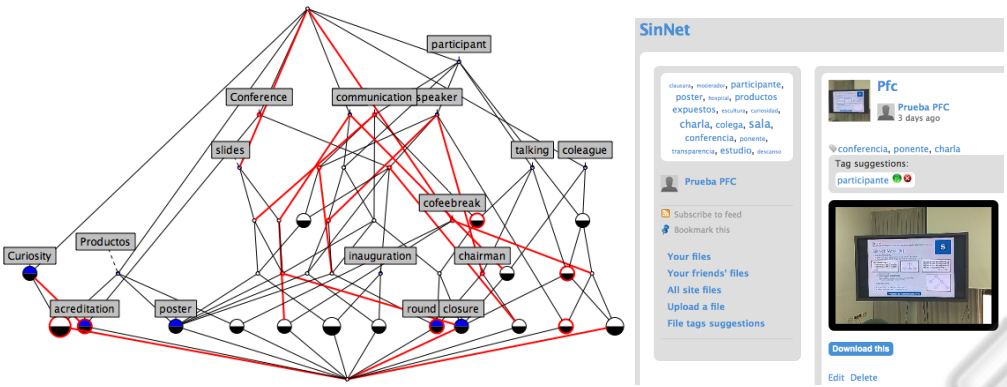

Figure 4: Example of concept lattice within SinNet (left) and thumbnail with tags and suggested tags.

solved in SinNet by means of the agents.

The **solution for the incomplete tagging problem** was shown in (Aranda-Corral et al., 2009). Recommender agents are responsible for completing the document's tagging using a specific behaviour that it was implemented to reason with a SB associated to its concept lattice (computed with ConExp) To obtain the SB, Conexp tool is used. The basis is transformed into a production system executable by the agent. Roughly speaking, it changes the question "Every object that has the attribute $X_1,\ldots,X_n$ has also the attribute Y?" by "Every document with tags $X_1,\ldots,X_n$ should have the tag Y?".

Actually we are interested in the "suggesting tags" task, which is carried out by an agent with a deliberative (rule-based) behaviour. The agent loads the rules from the production system (from SB) created above and initializes the rule's engine with the facts (tags) written by the user and read from database. It is executed to obtain a new set of facts (tags), which will be suggested to the users, through the SinNet web interface.The soundness of the reasonig process is based on the following result: Iet $\mathcal{S}$ be the SB for the context M, $A_1,\ldots,A_n$ and A attributes. The following conditions are equivalent:

1. $\mathcal{S} \cup \{A_1,\ldots A_n\} \vdash_p A$ (where $\vdash_p$ is the deduction associated to the production system).
2. $S \vdash_A A_1,\ldots A_n \rightarrow A$
3. $M \models \{A_1,\ldots A_n\} \rightarrow A$.

That is, if o a document is tagged with $\{A_1,\ldots,A_n\}$ and the production system entails the tag A, then $\{A_1,\ldots A_n\} \cup A$ is a more specific attribute set for the document. In Fig. 4 (note that tags appear in Spanish) it shows that if a document is tagged with {conference, speaker, talk}, agent will suggest the tag *participant*".

Dynamic creation of pages behaviour is designed for enhancing tagging tasks from the SinNet mobile application. An agent's behaviour was developed that helps users to choose the most adequate tag set to describe the appropriate concept. This method of assistance consists of the creation of a sound menu pagination system with a controlled depth. SinNet empirical studies obtained that users usually click up to 3 times in a tagging task, with the current concept lattice. So, we need to create a good selection for the tag menu.

When users want to annotate content, the SinNet mobile application shows the tag-list pages to select a tag. Only one selection per page except for the final page. The last page is a multiple selection tag-list with, even, the option to add new tags. The paging system aim is that, by each click that users make, they move through the concept lattice and the concept related to the document is refined.

To build the menu paging, first a compatible spanning tree is built. This spanning tree holds the subconcept relation and the root node is related to the most general concept (Top). Next, for each spanning tree node a tag is selected, preserving the set composed by this tag and all super-node tags, pointing to the most general concept which contains tags and to which the document is related. To select the tags in each tree node, agent uses an algorithm based on the sound selection of a concept's own attribute (attribute not contained by any other of its super-concepts)

The concrete menu page system obtained will be sent to the user's mobile phone in XML format. The user can interrupt navigation and finalise the tag selection, but the last spanning tree node visited gives us the concept related to that document. If the last page is reached, a multiple selection page lets us classify the document into a concept. Even it can add new tags which causes the creation of new concepts and, therefore, the lattice evolution.

Also it may be necessary to **update old-tagged documents**. Experiments with SinNet shows a frequent situation: the user decides to introduce new

tags for new documents. These new tags are included in its own concept lattice, but it may be possible old documents should be re-tagged with the new tag. The re-tagging process would be carried out by means of the classical completion procedure and implemented as an agent behaviour. The formal result that supports this behaviour was presented in (Alonso-Jiménez et al., 2008) (definability in formal contexts) in FCA. The new tag will appear as a suggested tag in the user's older documents preserving old SB. Thus it completes older tagging by using the new tag and also preserving the original Stem basis.

Lastly, **Users's Knowledge Conciliation** aims to exploit an important benefit of the Web 2.0, the sharing of information and knowledge among users. A potential threat is that semantic techniques are adapted to each user. Over time, user's knowledge can vary a great deal, and this difference could create knowledge incompatibility issues. This is because ontologies evolve with the each user, and not in a joint manner. In order to navigate through the set of tags and documents from different users, SinNet has delegated to agents to make these different conceptualizations compatible. The agent-based conciliation algorithm was presented in (Aranda-Corral and Borrego-Díaz, 2010). This algorithm's foundations are on the basis that conceptual structure associated to tags gives more information on the user's tagging (as in (Jäschke et al., 2008)). Once finished the process, the agents will get a common context. So they can extract new concepts and suggestions from a common context, and therefore, ashared conceptualization.

6 CONCLUSIONS

SinNet is a MW2.0 platform that uses the MMS/SMS channel for social relationship (WWW platform is not the user main reference), in its pure mobile version, and thus it may avoid the use of Mobile Internet. Most important semantic/reasoning activities carry out from user's mobile devices to a MAS. Cognitive tasks performance by agents represented an effort of agent's behaviour design.

As MW2.0 project, SinNet seems similar to SeeMeTV (launched by the mobile network operator Hutchison 3G UK) using MMS channel for sharing content. SinNet also shares some features with the mobile extension of German video-sharing platform Clipfish (http://www.clipfish.com) called "Handy Clipfish", as a stand-alone mobile portal. However, SinNet's basic idea differs from both ones. Authors do not know of any MW2.0 platforms based on MMS/SMS channel and semantic features implemented. SinNet's tag reasoning is unique. To the best of our knowledge, no other MW2.0, intensively using FCA tools, exists.

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