

1 Team proposal: Wimmics

Name: Wimmics

Meaning: Web-Instrumented Man-Machine Interactions, Communities, and Semantics.

Challenge: bridging formal semantics and social semantics on the web

Status: joint research team between INRIA Sophia Antipolis - Méditerranée and I3S (CNRS and Université Nice Sophia Antipolis).

Main research area: graph-oriented knowledge representation, reasoning and operationalization to model and support actors, actions and interactions in web-based epistemic communities.

Main application area: supporting and fostering interactions in online communities and management of their resources

INRIA Field: Perception, Cognition, Interaction

INRIA Theme: Knowledge and Data Representation and Management

I3S division: GLC Software and Knowledge Engineering

CNRS institute: INS2I

2 Research proposal

2.1 Context: semantic frictions on the web

The Web is no longer perceived as a documentary system. Among its many evolutions, it became a virtual place where persons and software interact in mixed communities. These large scale interactions create many problems in particular the one of reconciling formal semantics of computer science (e.g. logics, ontologies, typing systems, etc.) on which the Web architecture is built, with soft semantics of people (e.g. posts, tags, status, etc.) on which the Web content is built.

Let us take a concrete and very common example. Many Web sites include forums, blogs, status feeds, wikis, etc. In other words, many Web sites include content management systems and rapidly build huge collections of information resources. As these collections grow, several tasks become harder to automate: search, notification, restructuring, navigation assistance, recommendation, trend analysis, etc. One of the main problems is the gap between the fairly informal way content is generated (e.g. plain text, short messages, free keywords) and the need for structured data and formal semantics to automate these functionalities (e.g. efficient indexes, domain thesauri). Mixt structures are starting to appear (e.g. structured folksonomies, hash tags, machine tags, etc.) but automating support in such collaboration spaces requires efficient and complete methods to fully bridge that gap.

And as the Web becomes a ubiquitous infrastructure bathing all the objects of our world, this is just one example of the many frictions it will create between formal semantics and social semantics.

This is why the Wimmics team proposes to study models and methods to bridge formal semantics and social semantics on the Web.

2.2 Research topic: bridging formal semantics and social semantics

From a formal modeling point of view one of the consequences of the evolutions of the Web is that the initial graph of linked pages has been joined by a growing number of other graphs. This initial graph is now mixed with sociograms capturing the social network structure, workflows

specifying the decision paths to be followed, browsing logs capturing the trails of our navigation, service compositions specifying distributed processing, open data linking distant datasets, etc.

Moreover, these graphs are not available in a single central repository but distributed over many different sources. Some sub-graphs are small and local (e.g. a users' profile on a device), some are huge and hosted on clusters (e.g. Wikipedia), some are largely stable (e.g. thesaurus of Latin), some change several times per second (e.g. social network statuses), etc.

And each type of network of the Web is not an isolated island. Networks interact with each other: the networks of communities influence the message flows, their subjects and types, the semantic links between terms interact with the links between sites and vice-versa, etc.

Not only do we need means to represent and analyze each kind of graphs, we also need the means to combine them and to perform multi-criteria analysis on their combination. Wimmics proposes to address this problem focusing on the characterization of (a) typed graphs formalisms to model and capture these different pieces of knowledge and (b) hybrid operators to process them jointly. We will especially consider the problems that occur in such structures when we blend formal stable semantic models and socially emergent and evolving semantics. We believe Wimmics can contribute to this understanding by combining two research domains:

- (1) by proposing a multidisciplinary approach to analyze and model the many aspects of these intertwined information systems, their communities of users and their interactions;
- (2) by formalizing and reasoning on these models to propose new analysis tools and indicators, and support new functionalities and better management.

2.3 First problem: analyzing and modeling users, communities and their interactions in a Social Semantic Web context

Challenges: *How do we improve our interactions with an information system that keeps getting more and more complex? How do we reconcile and integrate the formalized stable semantics of computer science and the negotiable social interactions? How to facilitate communication between systems and system developers using formal representations and users and usage analysts using corresponding less formal or non-formal representations? How do we reconcile local contexts of users and global characteristics of the world-wide system?*

Approach: We will rely on cognitive studies to build models of the system, the user and the interactions between users through the system, in order to support and improve these interactions.

In the short term, following the user modeling technique known as Personas [44] we are interested in these user models that are represented as specific, individual humans. Personas are derived from significant behavior patterns (i.e., sets of behavioral variables) elicited from interviews with and observations of users (and sometimes customers) of the future product. Our user models will specialize "Personas" approaches to include aspects appropriate to Web applications. The formalization of these models will rely on ontology-based modeling of users and communities starting with generalist schemas (e.g. FOAF).

In the longer term we will consider additional extensions of these schemas to capture additional aspects (e.g. emotional states). We will extend current descriptions of relational and emotional aspects in existing variants of the personas technique. In particular we will exploit Olsen's characterization of a user's relationship to a product [46] since this characterization was made by analogy to human relationships. The elaboration of the characteristics to be included in a "relational-user" model will rely on work dealing with "relational agency" ("as a capacity to recognize others as resources, to elicit their interpretations and to negotiate aligned actions" [45]), and on "relational agents" (as "computational artifacts designed to build long-term social-emotional relationships with users" [43]). The elaboration of relational characteristics will be informed by empirical studies of relationship characterization, and of personality definition by users on the Web. These directions are a natural extension of our work on the use of affective ontologies in semantic web applications [16] and algebraic modeling of emotional states [35].

Beyond the individual user models we propose to rely on social studies to build models of the communities, their vocabularies, activities and protocols in order to identify where and when formal semantics is useful.

In the short term we will further develop our method for elaborating collective personas [17] and compare it to the related “collaboration personas” method [54][55] and to the group modeling methods [56] which are extensions to groups of the classical user modeling techniques dedicated to individuals. We also propose to rely on and adapt participatory sketching and prototyping to support the design of interfaces for visualizing and manipulating representations of collectives.

In the longer term we want to focus on studying and modeling mixed representations containing social semantic representations (e.g. folksonomies) and formal semantic representations (e.g. ontologies) and propose operations that allow us to couple them and exchange knowledge between them.

Since we have a background in requirement models, we want to consider in the short term their formalization too in order to support mutual understanding and interoperability between requirements expressed with these heterogeneous models. In a longer term, we believe that argumentation theory can be combined to requirement engineering to improve participant awareness and support decision-making. On the methodological side, we propose to adapt to the design of such systems the incremental formalization approach originally introduced in the context of CSCW and HCI communities [57][58]. In incremental formalization users first express information informally and then the system helps them formalize it. The goal of such an approach or of similar approaches is to get users to interact at least partially with formal representations, to make them contribute to a formalization closer to their needs [41].

Finally, in the short term, for all the models we identified here we will rely on and evaluate knowledge representation methodologies and theories, in particular ontology-based modeling. In the longer term, additional models of the contexts, devices, processes and mediums will also be formalized and used to support adaptation, proof and explanation and foster acceptance and trust from the users. We specifically target a unified formalization of these contextual aspects [40] to be able to integrate them at any stage of the processing.

2.4 Second problem: formalizing and reasoning on heterogeneous semantic graphs

Challenges: *What kind of formalism is the best suited for the models of the previous section? How do we analyze these typed graph structures and their interactions? How do we support different graph life-cycles, calculations and characteristics in a coherent and understandable way?*

Approach: Formalize as typed graphs the models identified in the previous section in order for software to exploit them in their processing.

The challenge then is two-sided:

1. To propose models and formalisms to capture and merge representations of both kinds of semantics (e.g. formal ontologies and social folksonomies). The important point is to allow us to capture those structures precisely and flexibly and yet create as many links as possible between these different objects.
2. To propose algorithms (in particular graph-based reasoning) and approaches (e.g. human-computing methods) to process these mixed representations. In particular we are interested in allowing cross-enrichment between them and in exploiting the life cycle and specificities of each one to foster the life-cycles of the others.

While some of these problems are known, for instance in the field of knowledge representation and acquisition (e.g. disambiguation, fuzzy representations, argumentation theory), the Web reopens them with exacerbated difficulties of scale, speed, heterogeneity, and an open-world assumption.

Many approaches emphasize the logical aspect of the problem especially because logics are close to computer languages. We defend that the graph nature of linked data on the Web and the large variety of types of links that compose them call for typed graphs models. We believe the relational dimension is of paramount importance in these representations and we propose to consider all these representations as fragments of a typed graph formalism directly built above the semantic Web formalisms. Our choice of a graph based programming approach for the semantic and social web and of a focus on one graph based formalism is also an efficient way to support interoperability, genericity, uniformity and reuse.

In the short term we target a first abstract graph model close to the GRIWES model [1] and we will evaluate it in merging social graphs (e.g. sociograms, folksonomies) and semantic Web graphs (e.g. RDF, schemas, linked data) in a unified typed graph formalism. In the longer term we intend to build on our experience with such formalisms to identify, propose and characterize fragments of typed graph formalisms best suited for each type of model identified before. We will restrain ourselves to specify the required characteristics of a limited number of formalisms (ideally one) and systematically evaluate their effectiveness in implementing these abstract graph models in real applications. This work on abstracting the knowledge representation models will follow our experience with conceptual graphs and semantic networks approaches. An example of such abstract structure is the ERGraph [1] defined relatively to a set of labels L as a 4-tuple $G=(E_G, R_G, n_G, l_G)$ where:

- E_G and R_G are two disjoint finite sets respectively, of nodes called entities and of hyperarcs called relations.
- $n_G : R_G \rightarrow E_G^*$ associates to each relation a finite tuple of entities called the arguments of the relation.
- $l_G : E_G \cup R_G \rightarrow L$ is a labelling function of entities and relations.

New knowledge structures are regularly identified (e.g. folksonomies, named graphs) and old ones re-launched (e.g. thesauri and SKOS). This kind of abstract construct can be used and reused across graph representations such as RDF, Topic Maps, Social network, etc.

These mixed representations call for hybrid reasoning methods merging semantic Web inferences, social graph analysis and content mining in cross-dimensional indicators and operators. The key problem is to have integrated operators on these formalisms, able to perform at the same time exact reasoning and more approximate one to combine all aspects of the problem. For instance a centrality [51] can be computed on a social network taking into account only some relation types [18] or some topics of interest using an extension of regular expressions to graph paths [10]. This same centrality can be computed by using a complete walk algorithm or approximated by using random walks but in both cases the ability to consider and reason on types of links and nodes will be a core problem. We believe that type-based inference algorithms (e.g. conceptual graph projection, inference rules) and type-parameterized operators (e.g. parameterized betweenness centrality) provide declarative formalisms to flexibly define operations to monitor, filter, query, mine, validate, protect, etc. these imbricated graph structures taking into account constraints spanning several types of network at once.

In the longer term, the goal is to have both an abstract language dissociated from the concrete languages and an extensible abstract machine. In particular this would allow us to define parameterizable graph operators for instance to revisit classical structural metrics and adapt their definition to go beyond the pure structural calculation and take into account the types in the graphs. In the short term, graph operators (joint, homomorphism, propagation, distances, etc.) allow us to perform a broad range of queries and reasoning operations. In the longer term, not only can we perform search (e.g. homomorphism) and logical derivation (e.g. homomorphism and merge) but also approximation (e.g. distances), clustering (e.g. propagation), analysis (e.g. centrality), etc. We target the design of an abstract graph machine generalizing operations needed by and sometime shared across different languages (e.g. SPARQL, RIF, POWDER, RDF/S and OWL inferences) and operations. An example of abstract

graph operation is an ERMMapping [1]. Let G and H be two ERGraphs, an ERMMapping_{<x>} from H to G for a binary relation X over $L \times L$ is a partial function M from E_H to E_G such that:

- $\forall e \in M^{-1}(E_G), (l_G(M(e)), l_H(e)) \in X$
- $\forall r' \in R_{H'} \exists r \in R_G$ such that
 - $card(n_{H'}(r')) = card(n_G(r))$
 - $\forall 1 \leq i \leq card(n_G(r)), M(n_{H'}(r')) = n_G^i(r)$
- $\forall r' \in R_{H'} \exists r \in M(r')$ such that $(l_G(r), l_H(r')) \in X$

where H' is the sub-ERGraph of H induced by $M^{-1}(E_G)$.

This mapping operator can then be used and reused for many operations (searching, deriving, grouping, etc.) across many graph formalisms. In particular when X is a preorder over L , it captures a hierarchy such as the taxonomical skeleton of an ontology, a thesaurus, a partonomy, etc.

There exists now an extensive body of work in Graph-based Knowledge Representation [53] that we align with the ones needed for semantic web data structures (e.g. [1] [10] [15]) and in the short term we intend to continue specifying the required characteristics of such a language and systematically evaluate their effectiveness in implementing these abstract graph models in real applications [6][7]. In the longer term, we also believe it is interesting to study alternatives to OWL stack and the associated DL-reasoning. For instance a rule-based semantic web with an alternative stack (RDF/S + SPARQL + RIF) provides certain advantages: rules are often more natural for humans, they support event-based programming and web service integration, they are usable both for domain independent and domain dependent inferences, etc.

We will extend our abstract graph model to cover as many features as possible of the upcoming SPARQL 1.1 language and the RIF rule format. A challenge is also to integrate other operators with classical graph manipulation in particular approximation, clustering, analysis operations, spreading algorithm, temporal reasoning and extend them to work on typed graphs. For instance one can consider the near linear time algorithm to detect community structures in large scale network RAK/LP [52] based on label propagation and change the propagation algorithm to take semantics into account as we did in SemTagP [19]. In the longer term we intend to evaluate other approaches (e.g. Random walk on graphs approaches) that do not naturally use labels but could be indirectly parameterized (e.g. making a correspondence between probabilistic distributions and the types of links) but also consider temporal reasoning approaches to include temporal context and change patterns to identify trends, mine temporal propagation to build oriented networks, track behavioral patterns to qualify actors and communities (e.g. detect a dying community) extending models from [59] for instance.

In the longer term, we believe that moving to graphs languages with open-world logics, temporal aspects, distributed and loosely coupled algorithms and model-driven programming relying on higher abstractions (e.g. formal ontologies) provides an adequate theoretical framework to allow at the same time the specification and operationalization of the models and algorithms and the opening of these black boxes to be able to explain, document, prove and trace results for the users. The same graph-based formalisms we propose to use in representing our models can be used to declaratively capture workflows of operations [22], interpret them and execute them. This is the approach we would like to explore to support different operations on heterogeneous and distributed data [2] and automated explanation, trace and documentation of the processes.

2.5 Impact and outputs

Wimmics will provide models and algorithms to bridge formal semantics and social semantics by formalizing and reasoning heterogeneous semantic graphs.

The models we intend to design include: users, their profiles, their requirements, their activities and their contexts; social links, social structures, social exchanges and processes; conceptual models including ontologies, thesauri, and folksonomies. Whenever possible these models will be formalized and published according to standardized web formalisms and may motivate

research and suggestions on extending these standards. The schemas and datasets produced will be published as linked data following the web architecture principles.

Algorithms we intend to design include: typed graphs indexing, reasoning and searching; hybrid processing merging logical inferences, rules and metrical inferences; approximation and propagation algorithms; distributed and scalable alternatives to classical reasoning. These algorithms will be implemented and distributed as part of a generic open source platform and library.

The targeted communities for the scientific publication of these models and algorithms include ISWC, WI, WWW, ESWC, KR, JWS, JODS, COLD, EKAW, IC, EGC, and others.

We also have the culture of producing prototypes of applications and extensions of existing applications relying on web languages as demonstrators and proofs of concept. At the core of our prototypes will be the abstract graph library we develop, maintain and publish as open-source software. In particular our platform Corese/KGRAM currently implements W3C standards (in particular RDF/S and SPARQL 1.1) and is both a research result and a library on top of which we test new ideas and algorithms. Currently KGRAM (Knowledge GRaph Abstract Machine) is the new SPARQL 1.1 interpreter at the core of the Corese 3.0 Semantic Web Factory maintained by the team and extensively used in several applications such as: Isicil, Neurolog and VIP ANR projects. It is also used at CSTB, Liganz, Alcatel Lucent Bell (Cifre PhD Thesis), etc.¹ We intend to continue in that direction and maintain the Corese/KGRAM platform as we extend the graph formalism and operators we study.

Finally we will continue to participate to the extension, specifications, implementation, tests, deployment and teaching of W3C Web standards.

2.6 Risks and mitigation actions

The first risk is to work on rapidly changing domains. Another one is to bet on the wrong formalism or language. To mitigate these two risks our involvement in W3C gives us the opportunity not only to contribute and influence standardization but also to monitor and follow new trends. In addition the choice of relying on an abstract graph model and an abstract graph machine allow us to port our models and algorithms to different languages with a reduced overhead.

It should also be stressed that while the web is known for its constant changes it is also true to say that there is an inertia to its architecture: the core principles of the web (URI, HTTP, LINKS) cannot be changed without breaking the web. They induce a certain stability and continuity on which our modeling and computing choices are based.

Likewise the risk of having big players entering the scene is constant on the web. But not only is this true for the whole computer science domain, it is also often the case that the same problem dealing with the open web or an intranet, a small dynamic graph or a large distributed graph will be solved with very different solutions. Big players are often threaten on the web by a new usages or new approaches, and some of them have been working with us (Alactel-Bell-Lucent, SAP, Orange, etc.) to integrate our results to their systems. Many types of graphs are used on the web and even big players are not mastering them all.

Finally, we do not have specialist in Graph theory, Probabilities, Databases, Grids, Network Protocols, etc. in our team although all of these computer science areas would be relevant to some aspects of our work (graph analysis, random walks, storage, distribution, etc.). However for each one of these aspects we collaborate or collaborated with other teams in the past and we intend to keep it so. Our goal is to remain specialists of one topic at the cross road of several of such domains: graph-based knowledge systems on the web.

¹ See <http://wimmics.inria.fr/corese> for a complete list of applications.

3 Team description

3.1 Members

Permanent researchers:

- Michel Buffa, MdC (UNS)
- Olivier Corby, CR1 (INRIA)
- Catherine Faron-Zucker, MdC (UNS), Vice Team Leader
- Fabien Gandon, CR1, HDR (INRIA), Team Leader
- Alain Giboin, CR1 (INRIA)
- Nhan Le Thanh, Pr. (UNS)
- Isabelle Mirbel, MdC, HDR (UNS)
- Peter Sander, Pr. (UNS)
- Andrea G. B. Tettamanzi, Pr. (UNS)
- Serena Villata, RP (INRIA)

Assistants:

- Christine Foggia (INRIA)
- Sarah Choulet (I3S)

PhD Students:

- Pavel Arapov, 1st year (EDSTIC-I3S)
- Adrien Basse, 3rd year (UGB-INRIA)
- Franck Berthelon, 3rd year (UNS-EDSTIC)
- Ahlem Bouchahda, 3rd year (UNS-SupCom Tunis)
- Khalil Riad Bouzidi, 3rd year (UNS-CSTB)
- Luca Costabello, 2nd year (INRIA-CORDI)
- Papa Fary Diallo, 1st year (AUF-UGB-INRIA)
- Corentin Follenfant, 2nd year (SAP)
- Maxime Lefrançois, 2nd year (EDSTIC-INRIA)
- Nguyen Thi Hoa Hue, 1st year (Vietnam-CROUS)
- Nicolas Marie, 2nd year (Bell-ALU, INRIA)
- Rakebul Hasan, 1st year (INRIA ANR-Kolflow)
- Oumy Seye, 2nd year, (INRIA Rose Dieng allocation)
- Imen Tayari, 3rd year (UNS-Sfax Tunisie)

Post-doc: Elena Cabrio (CORDIS)

Research engineers:

- Julien Cojan (INRIA, Ministry of Culture)
- Erwan Demairy (ADT)

External collaborators:

- Nicolas Delaforge (INRIA, ANR ISICIL)
- Claude Frasson (University of Montreal)
- Alexandre Monnin (La Sorbonne, IRI Georges Pompidou)

3.2 Short CVs and positioning of permanent members

Michel Buffa: teaches web technologies at the University of Nice, France, since 1994. He is co-author of the semantic wiki SweetWiki and co-supervised recently two PhDs on semantic social network analysis and on semantic enrichment of folksonomies.

Goal in Wimmics: 1) Social network analysis, develop models and tools for representing and exploiting social network graphs, i.e. help classifying and exploring resources produced by social

network members based on the social network activity/analysis. 2) Tools for better exploiting the web of data.

Olivier Corby: PhD from University of Nice Sophia Antipolis, he is researcher (CR) at INRIA. His research topics are Knowledge Engineering and Semantic Web. He is a specialist of Knowledge Representation software environment and is the designer of the Corese Semantic Web Factory.

Goal in Wimmics: design abstract model for labeled graph and abstractions of graph operations to provide a graph abstract machine that can operate on heterogeneous graph models

Catherine Faron-Zucker: Assistant Professor at University Nice Sophia Antipolis (UNS) since 2002 She got a PhD in Artificial Intelligence from the University Paris 6 (UPMC) in 1998. Her main research focuses are Knowledge Engineering and Modeling, Graph based Knowledge Representation and Reasoning, Ontologies, Semantic Web and Social Web. Her main application domains are Web-based Collective Memories and Intelligent Tutoring Systems (ITS).

Goal in Wimmics: querying and reasoning with graph operators and in composing and integrating sources and operators, while relying on Semantic Web standards ; context and social representation and analysis in ITS and more generally in communities.

Fabien Gandon: senior research scientist and HDR in Informatics and Computer Science at Inria and Advisory Committee representative of Inria at the World-Wide Web Consortium where he also participates in several standardization groups. His professional interests include: web, semantic web, social web, ontologies, knowledge engineering and modeling, mobility, privacy, context-awareness, semantic social network, semantic analysis of social network, intraweb. He previously worked for the Mobile Commerce Laboratory of Carnegie Mellon University.

Goal in Wimmics: models and algorithms to bridge and analyze resource-centric social semantic networks on the web.

Alain Giboin: PhD in Experimental Psychology, Alain Giboin specialized in Ergonomics of HCI and of CSCW, and later on in Knowledge Engineering. He organized and entered the program committee of several conferences and workshops on these domains, and animated several working research groups. He also teaches ergonomics in the "Parcours IHM" of EPU Nice and in the Master "Sociologie et Ergonomie des Technologies numériques" of UNS. In this context, he initiated a training in HCI involving both students in computer science and students in ergonomics working around a common project of HCI design.

Goal in Wimmics: Designing methods and tools to articulate, formal and formalization operations (mainly applied by software developers, knowledge engineers, and computer systems) to "informal" representations and "informalization" operations (mainly applied by domain experts, "usage analysts" and end-users).

Nhan Le Thanh: engineering degree in Computer Sciences at ENSEEIHT, ENPT in 1983, and "Docteur d'Etat" in Mathematics and Computer Science at the University of Nice-Sophia Antipolis in 1986, where he was named "Maître de Conférences" in 1988 and "Professeur des universités" in 1992. He currently teaches in the Computer Sciences Department of the IUT Nice-Côte d'Azur. His current research activities are centralized on the combining of semantic web formalisms such as description logics, RDF, OWL and other formalisms such as graph theory, colored Petri nets, to model information systems.

Goal in Wimmics: modeling distributed information systems and usage in the domain of social networks and digital personal patrimonies.

Isabelle Mirbel: associate professor and HDR at University Nice Sophia Antipolis. In 1996, she got a PhD entitled object-oriented design scheme integration from University Nice Sophia Antipolis and she defended her HDR about modeling, reuse and flexibility of information systems in 2008. She is currently in charge of courses about database management systems and requirement engineering. She is also vice-head of MIAGE and vice-dean of Science Department.

Her research interests include information system engineering, method engineering and requirement engineering.

Goal in Wimmics: designing methods and tools relying on web based interactions to help stakeholders and designers to articulate their representations and processes; proposing models and methods to take advantage of social semantic networks for collaborative requirement engineering.

Peter Sander: professor at the Polytechnic School of the University of Nice - Sophia Antipolis. His research interests include the use of the internet and social networks for healthcare applications. He is studying affective computing, involving human emotions, as a key element in future healthcare, particularly for enabling seniors to continue living securely at home, as well as for other applications including serious games.

Goal in Wimmics: affective computing is increasingly recognized as an important contributing factor to informal social semantics. Modeling individual behavior through complex systems will lead to a better understanding of individual input to social cooperative knowledge systems.

Andrea Tettamanzi: PhD in Computational Mathematics and Operations Research in 1995 from the University of Milan with a thesis on evolutionary algorithms; he became assistant professor at the University of Milan in 1998 and associate professor at the same university in 2002. His research interests focused on combining different methods of computational intelligence, namely evolutionary algorithms, fuzzy logic, and neural networks, to solve real-world problems in presence of imprecision, noisy data, and ill-defined optimization criteria, leading him to investigate the management of vagueness and uncertainty in knowledge representation.

Goal in Wimmics: extend graph-based knowledge representation formalisms to take uncertainty, imprecision, and the temporal dimension into account; adapt data mining methods to socio-semantic networks; bring possibility theory, belief revision, and results from cognitive agency to integrate data coming from heterogeneous sources by taking trust and reliability into account.

Serena Villata: starting research position at INRIA. She received a PhD in Computer Science in 2010 from the University of Turin with a thesis on argumentation theory. She is member of the W3C Linked Data Platform working group. Her research interests focused on using argumentation theory for explanations and justification in non-monotonic reasoning frameworks, coupling argumentation theory with natural language processing for decision making in social semantic networks, reasoning on trust, access control models and data licensing in the web of data, normative reasoning.

Goal in Wimmics: apply semantic-based reasoning techniques to control, explain and argument about interactions, trustworthiness and data in the web; unify semantic web standards and argumentation theory to support normative specifications, dynamics and reasoning in the web.

3.3 Rationale

Wimmics results from the merging of two research teams collaborating for several years: Edelweiss and Kewi.

The research team Edelweiss (INRIA), previously known as Acacia, aimed at offering models, methods and techniques for supporting knowledge management and collaboration in virtual communities interacting with information resources through the Web and using graph-based and ontology-based formalisms and algorithms. Latest research topics included: multilingual interaction with knowledge bases, mobile access to the Web of data, rule-based semantic Web formalisms, online presence and resource centric sociality, semantic Web in business intelligence, automatic indexing of triple-stores. The reason for closing down the Edelweiss INRIA team was the decease of its leader Rose Dieng-Kuntz.

The research team Kewi (I3S), was interested in knowledge engineering techniques and web-based applications to capture, extract analyze, organize, store and share knowledge. Latest research topics included: semantic Web and graph-based knowledge modeling; semantic

security and access control; affective computing and emotion detection; requirement engineering and collaborative work.

The two teams have been collaborating for now more than eight years. As shown by their short descriptions, they exhibit both common interests (web, semantic web, graph-based formalisms, ontologies, access control, etc.) and complementarities (interaction design, affective computing, triple-stores, rules, etc.). Merging the two teams really is a natural acknowledgement of an ongoing collaboration and of numerous co-publications. Moreover this merge will create a group including full-time researchers, assistant professors and professors that could naturally cover all the activities of a research team.

Compared to other research teams it must be noted that Wimmics operates in a highly technological field. This has implications in terms of member activities and member profiles for the team. We need a strong complementarity and a good balance, between theoretical and applied profiles. We need members who can work on human and social aspects, members who can work on conceptual and formal aspects but also members who can follow and stay up to speed with rapidly changing technological aspects and software engineering framework, in particular for the web. For all these aspects we need members able to contribute and teach.

Finally there are philosophical concerns and even ethical concerns in working with web data and web users. This is the main reason for having full members, collaborators and projects partners with a strong background in humanities and we intend to keep these partnerships very strong in the future.

4 Diffusion and Collaborations

4.1 Current projects

- Ocktopus (to start end of 2012): Ocktopus is a research project funded by the French national research agency (ANR). Its goal is to increase the potential social and economic benefit of the large and quickly growing amounts of user-generated content. We believe that it is possible to considerably improve upon existing generic Information Retrieval techniques by exploiting the specific structure of this content and of the online communities which produce it. We focus on a multi-disciplinary approach in order to address the problem of finding relevant answers to questions within forums and question-answer sites and to propose metrics and predictors of content quality and use them to improve the search experience of a user.
- CrEDIBLE (started in June 2012): CrEDIBLE is a research project funded by the Interdisciplinary mission of CNRS in the MASTODONS program. Due to the increasing online availability of various biomedical data sources, the ability to federate heterogeneous and distributed data sources becomes critical to support multi-centric studies and translational research in medicine. The aim of this project is to gather scientists from all disciplines involved in the setup of distributed and heterogeneous medical image data sharing systems, to provide an overview of this broad and complex area, to assess the state-of-the-art methods and technologies addressing it, and to discuss the open scientific questions it raises
- DBpedia.fr (started in November 2011): DBpedia.fr is a project funded by the French Ministry of Culture. It proposes the creation of a French version of the DBpedia base used in many applications in English, in particular for the publication of cultural collections. Unfortunately, DBpedia is focused on the English version of Wikipedia and ignores some of the French topics and their data. DBpedia.fr aims at extracting a

maximum of RDF data from the french version of Wikipedia and providing a stable and scalable end-point for them.

- Kolflow² (started in February 2011): Kolflow is a research project funded by the French national research agency. Its goal is to reduce the overhead of communities in the process of continuously building knowledge by extending collective intelligence with smart agents relying on automated reasoning. It intends to do so by building a social semantic space based on distributed semantic wikis where humans collaborate with smart agents in order to produce knowledge understandable by humans and machines.
- Datalift³ (started in September 2010): Datalift is a research project funded by the French national research agency. Its goal is to develop a platform to publish and interlink datasets on the Web of data. Datalift will both publish datasets coming from a network of partners and data providers and propose a set of tools for easing the datasets publication process.
- SegViz⁴ (started in October 2010): SegViz is an ADT INRIA Grant for the development of a Semantic Web Gephi Plugin coupling Corese and the Gephi Open Graph Visualization Platform to provide a framework to query and visualize RDF data taking into account their schemas. The current version of this SemanticWebImport plugin supports the import of semantic data into Gephi by processing a SPARQL CONSTRUCT request on any standard web data source or file.
- ISICIL⁵ (until autumn 2012): ISICIL is a research project funded by the French national research agency. It studies and experiments 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.

4.2 Selected past projects

- PUSLearn (started in 2010) is a 3-year scientific cooperation project with the University of Annaba in Algeria funded by CNRS and DPGRF (Algeria). It aims to study the personalization and socialization of ubiquitous e-learning systems based on semantic web models and techniques.
- RBP and ImmunoSearch (until 2011): The objective of ImmunoSearch is to design biomarkers for controlling the harmlessness of the molecules used in perfumes, aromatics and cosmetics. The purpose of this research is to conduct comparative studies of in vivo and in vitro test models on the skin (irritation, allergy) and to propose alternative methods defining the new norms applicable in this field. In this context, we aim at proposing methodological and software support for capitalization and valorization of knowledge resulting from experiments and techniques to preserve and reuse data. We rely on the semantic web technologies (semantic annotations, ontologies, RDF, SPARQL, etc.).
- DESIR⁶ (ended 2009): This COLOR project aimed at supporting the activities of a community of agronomists and geneticists through a semantic collective memory. It

² <http://kolflow.univ-nantes.fr/>

³ <http://datalift.org/en/>

⁴ <http://wiki.gephi.org/index.php/SemanticWebImport>

⁵ <http://isicil.inria.fr/>

⁶ <http://www-sop.inria.fr/edelweiss/projects/desir/wakka.php?wiki=ColorDesirHomePage>

highlighted the need for the capitalization, reuse and sharing of queries and more generally search processes.

- E-Wok Hub⁷ (ended 2009): E-Wok is a research project funded by the French national research agency. It designed a set of communicating data and service portals offering both: (a) web applications accessible to end-users through online interfaces, and (b) web services accessible to applications through programmatic interfaces. As applicative objectives, the project aimed at enabling management of the memory of several projects on CO2 capture and storage, integrating results of technological watch on the domain.
- SeaLife⁸ (ended 2009): a European project that designed a semantic grid browser for the Life Sciences Applied to the Study of Infectious Diseases Project Reference. The browser has access to comprehensive background knowledge of life science topics consisting of domain specific ontologies and dictionaries of proteins. It comprises an advanced text-mining module, which is able to automatically extract ontology terms from free text to form Semantic Hyperlinks and a service module, which enables users to access through semantically identified terms, web and grid services to facilitate actions on the data identified.
- SevenPro⁹ (ended 2008): a European project that developed tools supporting deep mining of product engineering knowledge from multimedia repositories and enabling semantically enhanced 3D interaction with product knowledge in integrated engineering environments
- Palette¹⁰ (ended 2008): this European project aimed at facilitating and augmenting individual and organizational learning in Communities of Practice (CoPs). Towards this aim, an interoperable and extensible set of innovative services as well as a set of specific scenarios of use were designed, implemented and thoroughly validated in CoPs of diverse contexts: information services, knowledge management services (based on an ontology dedicated to communities of practice) and mediation services for CoPs. Eleven pilot CoPs were involved in the participatory design of Palette services.
- GRIWES (ended 2008) this COLOR (Inria funding) project aimed to specify a generic platform for graph-based knowledge representation and reasoning. We considered multiple languages of representation, such as conceptual graphs, RDF/S, and various extensions of these languages.

4.3 Partnerships

- Alcatel Bell-Lucent: with the Ph.D. (CIFRE) of Nicolas Marie we collaborate on the capture and modeling of online user presence and object-centric sociality on the web. We intend to develop new graph models to represent presence, detect opportunities of interactions and foster their emergence.
- SAP: with the Ph.D. (CIFRE) of Corentin Follenfant we collaborate on the integration of semantic web inside Business Intelligence reporting processes in particular to facilitate the reuse of knowledge from previous reports.
- Collaborations with Orange (CIFRE, ANR), PhD thesis of Guillaume Erétéo on “Semantic Social Network Analysis” defended the 11th of April 2011

⁷ <http://www-sop.inria.fr/edelweiss/projects/ewok/>

⁸ <http://www.biotec.tu-dresden.de/sealife>

⁹ <http://www.sevenpro.org/>

¹⁰ <http://palette.ercim.org/>

- Collaborations with Ipernity (CRE)
- Collaboration with the neuropsychologists of the Laboratoire de Psychologie Cognitive et Sociale, Université de Nice – Sophia Antopolis (experiments on emotional interactions).
- ICR (University of Luxembourg): The ICR group is an interdisciplinary research team at the University of Luxembourg. The group is driven by the insight that intelligent systems (like humans) are characterized not only by their individual reasoning capacity, but also by their social interaction potential. Its overarching goal is to develop and investigate comprehensive formal models and computational realizations of individual and collective reasoning and rationality. ICR and Wimmics cooperate on the formalization of normative reasoning in the Web using semantic technologies, and the definition of models and techniques to allow the actors of semantic social networks to interact based on argumentation theory.
- IM Group (University of Torino, Italy): The IM group carries out research on natural language processing, cognitive social agents, and normative ontologies. IM and Wimmics cooperate on the research topic of normative ontologies, with a particular attention to all the problems dealing with the licenses on the Web, and the assessment of the trustworthiness of the sources on the Web.
- Philips Semiconductors France (now called NXP) in the framework of the KmP-Philips (or KM2) project funded by this industrial company. This two-year project aimed at designing and validating a prototype supporting the strategic management of individual and collective competencies within this firm. During this first year, the prototype was implemented using SeWeSe and Corese, and tested. The second year will be devoted to getting and analyzing usage feedback of the prototype within the enterprise.
- IFP, BRGM and EADS, in the framework of the ANR RNTL project e-WOK_Hub. This 3-year project aims at building a set of communicating portals (the e-WOK Hubs), offering both web applications accessible to end-users through online interfaces, and web services accessible to applications through programmatic interfaces. From applicative viewpoint for IFP and BRGM, e-WOK_Hub aims at enabling management of the memory of several projects on CO2 capture and storage, with use of results of technological watch on the domain. It will enable the diffusion of Corese and SeWeSe to these application partners IFP and BRGM, the application of our semi-automatic annotation techniques from texts and our web-service architecture on a real-world application, with a collaboration with EADS on these techniques.
- Semantic Systems (Spain), LivingSolids (Germany), Estanda (Spain) and ItalDesign (Italy), in the framework of the 3-year STREPS project Sevenpro. Semantic Systems and LivingSolids are two IT small and medium enterprises specialised in Semantic and Virtual Reality for engineering technologies. Estanda, a SME manufacturer of metal castings and ItalDesign, a big engineering company play the roles of end-users in Sevenpro. We collaborate with Semantic Systems on the use of RDF(S) and on annotation of CAD files. We apply our semi-automatic annotation techniques to the corpora provided by Estanda and ItalDesign. Moreover, we play the role of support to these end-users on ontology development and on RDF(S) use.
- GDF/Suez: a consulting mission was done in 2010 to evaluate the opportunities of semantic web applications in their IT infrastructure.
- Ongoing discussions with IRIT and UTT (Tech-CICO) for strong associations between the research teams.
- Discussions with In Situ and in particular with Emmanuel Pietriga about the use and extension of Fresnel in our projects.
- Yearly exchange with UGB (University of Gaston Berger, Senegal) for lectures, internships and co-supervised Ph.D. students (Adrien Basse, Oumy Seye)

- Discussions with LSIS UMR CNRS (Bernard Espinasse) on the use of Corese for using ontologies and inference rules.
- Exchanges with EURECOM (Raphael Troncy) in particular in the context of the KIC.
- Contacts with several SME: Life2Times, Slice Factory, AmiSW, ImmunoSearch, Addax, Intellinium.
- We take part in W3C working groups and interest groups: In particular we participated to the note release of the Semantic Web Best Practice working groups and we are editors and co-authors of two drafts of the GRDDL (Gleaning Resource Descriptions from Dialects of Languages) working group (a mechanism to extract RDF from XML dialects) as well as SPARQL, RDFa, RIF, and RDF 1.1
- Centre Scientifique et Technique du Bâtiment (CSTB): we are involved in a long-term collaboration on the management of technical and regulatory knowledge based on semantic web models and techniques. CSTB has already funded two Ph.D. on this domain.
- One of the leaders of the project NiceCampus with the University of Danang (Vietnam) to create a campus and a research Lab.
- RoboSoft: experimenter of SweetWiki, a semantic wiki developed during the Palette European Project, also partners for a ANR proposal to come about using an emotion system in assistance robots for elder people
- Discussions with Jolita Ralyté (University of Geneva), Rebecca Deneckere and Manuele Kirsh-Pineiro (University of Paris I) on information system engineering.
- Contacts with several SME: StoneTrip; Ipernity, Robosoft.

4.4 Education and diffusion

- Course on Semantic Web at UNS (Polytech Nice Sophia and Master 2 IFI) 45H plus several student projects.
- Course on Knowledge Engineering, at UNS (Polytech Nice Sophia and Master 2 IFI) (32H).
- Course on Agile Web at UNS (Polytech Nice Sophia and Master 2 IFI) (32H)
- Course on XML languages at UNS (Polytech Nice Sophia and Master 2 IMAFA) (24H).
- Course on Knowledge Engineering, at University of Danang (In English, Master 2 IFI) (36H).
- Course on Semantic Web, License Pro., IUT, UNS (24H).
- Introduction to the semantic web course at University of Nice (master MBDS , master Miage, Master "info").
- Course on Semantic Web at University Gaston Berger, Saint Louis du Sénégal (18H).
- Invited lecture (3H) at Ecole Centrale de Paris "Web Sémantique ou comment les ontologies pourront favoriser l'échange des connaissances sur le web du futur"
- Course on Human-Computer Interaction at UNS (Polytech Nice Sophia and Master 2 IFI) 48 h + several students projects
- Course on Ergonomics of digital technologies at UNS (Master 2 Socio-Ergonomics of digital technologies), (6H)
- Course on ICT Ergonomics at IUP Sophia Antipolis (Master 2 "Economie des TIC et Conseils en e-business")(15H)
- Course on Software Ergonomics (Licence Pro "Software Engineering")(2H)
- Distant Course on Human-Computer Interaction (In English, University of Danang) (36H)

- Distant Course on Semantic Web, at University of Danang (In English, Master 2 IFI) (36H)
- Distant Course on Agile Web, Master (In English, University of Danang) (36H)

Edelweiss and Kewi are currently involved in the KIS course of study of master IFI at the University of Nice and in MIAGE. We intend to reinforce and focus this action on developing an ecosystem to train and support professionals of the web and semantic web. We envision an evolution toward a double curriculum:

- An evolution of the course of study KIS toward a “Web Science” course of study possibly as a European KIC master 2.
- A reinforcement of the Web courses in MIAGE toward a “Web Information System” course of study master 2.

This may also require reinforcing web courses and internships for master 1.

4.5 Current Ph.D. Thesis

- Pavel Arapov: Semantic application wikis, UNS
- Adrien Basse: Graph Index for distributed queries, Univ. Gaston Berger, Senegal
- Franck Berthelon: Detecting emotional states in Serious Games, UNS
- Ahlem Bouchahda: A semantic approach to secure data base accesses, with SupCom Tunis
- Khalil Riad Bouzidi: Management of technical and regulatory knowledge, with CSTB
- Luca Costabello: Mobile access to the Web of Data, INRIA
- Papa Fary Dialo : community building of ontologies and bases of micro-cultural knowledge bases in limited technological environments
- Corentin Follenfant: Semantic Web and Business Intelligence, with SAP
- Maxime Lefrançois: Collaborative Management of Interlingual Knowledge, UNS
- Nguyen Thi Hoa Hue: Schema checking and orchestration of SPARQL queries, Vietnam-CROUS
- Nicolas Marie: Modeling online presence on the Web of People, with Alcatel-Bell-Lucent
- Hasan Rakebul: explaining distributed query on the semantic web (ANR-Kolflow).
- Oumy Seye: Rules for the Web of Data, Lirima, Univ. Gaston Berger, Senegal
- Imen Tayari : Representing, annotating and detecting emotions in multimodal signals , with Sfax Tunisie

5 Positioning and collaborations

The other actors in the domain of Wimmics have been described and positioned in this section starting from the closest teams from a thematic point of view.

5.1 Semantic web and knowledge representation

5.1.1 Graph based approaches

The closest teams to Wimmics combine semantic web formalisms with graph-based knowledge representation and reasoning to address epistemic problems i.e. propose information systems relying on graph-based formalizations and algorithms to assist their users in knowledge intensive tasks.

- At LIRMM, Montpellier, the team GraphIK was created in 2010 to work on Knowledge Representation and Reasoning (KRR) following a logic-oriented approach of the field with a graph-based vision of KRR. GraphIK focuses on some of the main challenges in KRR, such as querying large knowledge bases, dealing with hybrid knowledge bases (i.e., composed of

several modules having their own reasoning mechanisms), or reasoning with imperfect knowledge (i.e., vague, uncertain, partially inconsistent, ...). GraphIK and Wimmics collaborated in the Griwes project that led both teams to align their graph models and share their results. Although GraphIK is the closest INRIA team from Wimmics, it does not focus on semantic web nor on social web.

- At LINA, Nantes, the team COD studies ontology engineering using semantic web formalisms, data mining using graph approaches and preference integration with visual support to decision making. COD works on social network analysis but does not focus on that subject nor does it focus on bridging graph approaches and semantic web formalisms.
- At IRIT, Toulouse, the team IC³ works on knowledge models engineering for cooperative systems and cooperative systems engineering. They use semantic web formalisms for ontology engineering and textual corpus analysis methods and lately they developed graph approaches to suggest query patterns and ease the access to triple stores. However the team does not focus on graph operationalization of semantic web formalisms nor on semantic web approaches to social network analysis.
- At LIC, Laboratory of Computational Intelligence of Laval University, Canada, the team studies Conceptual Graphs formalism for Knowledge Discovery, Data Mining and in conjunction with multi agent systems applied to the semantic web. Again, here the difference is that the collective aspects come from the multi agent point of view not really social networks and the focus of the LIC team remains on conceptual graphs formalism not semantic web formalisms.

Therefore the approach of relying on graph formalisms unified in an abstract graph model and operators unified in an abstract graph machine to formalize and process semantic web data, web resources, services metadata and social web data is a characteristic very specific to Wimmics.

5.1.2 Approaches with other formalisms

The closest teams w.r.t. Wimmics are the teams working on knowledge management, knowledge engineering and semantic Web. Through the GRACQ network (Groupe de Recherche sur l'Acquisition des Connaissances) and conferences like IC and EGC, we have regular contacts with most of the French teams working on knowledge engineering. Through networks of excellence, consortiums and communities (e.g. ISWC) we have contacts with the most active international teams.

Generally speaking, we identified the following close teams:

- EXMO: This team produces theoretical and software tools for enabling interoperability in formalized knowledge exchange. EXMO focuses on three topics: semantic properties in knowledge representation language translation, semantic adaptation of multimedia documents and ontology matching for interoperability. In Wimmics ontology alignment is not a main topics as for EXMO but it may be useful in case of interactions involving multiple ontologies. In this case, results of existing alignment algorithms could be exploited such as those offered by EXMO among others. EXMO and Wimmics have cooperated in the past and currently cooperate in the ANR project Datalift where: EXMO focuses on resource alignment while Wimmics focuses on access control and privacy.
- Orpailleur: The main objective of this team is to extract knowledge units from different sources and to design structures for representing the extracted knowledge units. The research of Orpailleur is at the intersection of knowledge extraction, knowledge representation, and semantic Web. Wimmics and Orpailleur rely on different knowledge representation formalisms (cf. Description logics and Galois Lattices for Orpailleur, Knowledge Graphs for Wimmics), but Wimmics future work on knowledge graphs may take into account the Galois lattice representation studied in Orpailleur. Orpailleur and Wimmics

cooperate in the ANR project Kolflow where Orpailleur studies knowledge incoherencies and Wimmics studies proof and explanations in queries and reasoning.

- GEMO/LEO: The main theme of this team is the integration of information and its approach combines Artificial Intelligence techniques and Database techniques: integration of heterogeneous data; mediation between sources of information; data warehouses on the web; active XML approach to integrate web services; data model theory. This team historically focuses on XML, Description Logics and databases. Clearly the database-oriented aspect of LEO is a difference with Wimmics and they do not work on the social web either.
- Karlsruhe University: this university produces KAON an environment for ontology development, ontology learning, semi-automatic annotation from texts, semantic web services, ontology mapping, ontology evolution and versioning, and evaluation of ontology-based tools. KAON v1 and v2 are based on frame systems and OWL. The formalisms used in this team and the fact they don't study social structures and representations are clear differences.
- Vrije University Amsterdam: this university is a co-proposer of OWL and produces the SESAME system. They also have a background in description logics, ontology alignment, ontology modularity and ontology versioning. Again, the models used in this team and the fact they do not study social aspects are clear differences.
- Departamento de Inteligencia Artificial, Politecnica Madrid: this research department produced the MethOntology method, the WebODE environment for ontology development, and studies interoperability, peer-to-peer architecture, and semantic grid. This team is extremely active on ontology engineering and ontology based knowledge representations using semantic web formalisms. They do not study graphs structures nor social representations
- The Musen Lab, Stanford: this lab studies methods for building intelligent computer systems that support the work of clinicians and basic scientists. The overall goal is to support e-science and clinical decision making using systems that store encoded knowledge. The laboratory investigates the use of components for building knowledge-based systems, controlled terminologies and ontologies, and technology for the Semantic Web. They produced the well-known PROTEGE ontology editor, Anchor-Prompt platform for ontology alignment and have numerous and huge applications in medical domain. Their application domain and the formalisms they use are again differentiators with Wimmics.
- Manchester University: this university is a co-author of OWL, they study OWL extensions for instance with rules, semantic web services, ontologies in biomedical domain and applications in bioinformatics. We collaborated with them in the framework of the SeaLife project on biomedical ontologies. The group focuses on OWL and description logics and not on graph-based knowledge representations.
- DERI, Galway: this institute is a leading international web science research center. They work on many aspects of the semantic web e.g. semantic web services, rule languages for semantic web. The institute has three overall complementary research strands: Social Semantic Information Spaces, Semantic Reality, Application Oriented Research Domain. The first one is the closest from us but does not focus on graph models.
- Trento University: this university has a group studying epistemological foundations of ontologies (e.g. DOLCE top-level ontology) ontology engineering and alignment. Their work is very interesting for the theoretical part of our models (e.g. methodologies for formal ontologies) but not directly comparable to the agenda of Wimmics.

- The Knowledge and Media Technologies department of Salzburg: this department studies social media, content management and semantic technologies. We follow their work on KiWi (Knowledge in a Wiki) combining the wiki philosophy with methods of the Semantic Web and IKS (Interactive Knowledge Stack) providing an open source technology platform for semantically enhanced content management systems. In Wimmics wikis are only one of the web 2.0 platforms we consider and we really are interested in a graph based formalism bridging the different social web data structures and semantic web formalisms.
- ICS-Forth: this group is developing the ICS Forth Suite for RDF which is directly based on relational database approaches which is not the case of Wimmics where our graphs could be stored in very different stores
- HP Jena: this team has been developing Jena for RDF above relational databases. We use parts of the Jena platform in CORESE and KGRAM and interact with them through our W3C activities. Wimmics designs and experiments with many extensions of standards and considers other aspects not covered by standards such as approximate matching.

Again the approach of relying on graph models and operators and the importance given to social dimensions are clearly differentiators of Wimmics with regard to the other teams reviewed here.

5.2 Data and knowledge based systems

A number of other teams are interacting with us or partially relevant to one of our subjects:

- MODALIS: this I3S team aims at modeling and exploiting large scale distributed computing infrastructures such as grids. Its research works include the design of flexible service architectures taking into account user needs. Several members of both teams regularly have discussions on knowledge modeling and we jointly participate to the CrEDIBLE project.
- KEIA: this I3S team focuses on knowledge extraction and knowledge mining algorithms. As such we have many exchanges with this team and even common publications. Note that MODALIS, KEIA and Wimmics belong to the "Pôle GLC", a research structure gathering I3S and Inria teams working in the domain of software and knowledge engineering.
- LARIA, Amiens: this team now studies organizational semantic webs with a strong emphasis on ontology engineering.
- UTC (COSTECH) Compiègne: that group studies epistemological foundations of ontologies, multi-agents approach for KM, learning memory combining semantic web and eLearning,
- UTT (Tech-CICO), Troyes: this multidisciplinary team studies cooperative approaches for knowledge management, action communities, socio-semantic web, project memory and memory for professional training.
- LIRIS, Lyon: this group is working on knowledge-based systems, case-based reasoning and trace modeling. They use semantic web formalisms to represent their models.
- LIPN, Paris: this group works on terminology and NLP tools, and has developed TERMINAE, a tool supporting construction of ontologies from texts.
- Sheffield University: this university produces NLP tools such as GATE or Amilcare, used by their partners of the AKT project in UK. We relied on their NLP platform GATE in our previous work on semi-automatic generation of annotations from text.

5.3 Interaction design and knowledge systems

- IN-SITU: This interdisciplinary project develops new interaction techniques, new tools and new methods for designing interactive systems. The goal is to develop situated interfaces, i.e. interfaces that are adapted (or adaptable) to their contexts of use, taking advantage of the complementary aspects of humans and computers. Two IN-SITU research themes are close to

Wimmics' themes: 1) Participatory design; 2) Engineering of interactive systems - A new research action could be particularly worth considering by Wimmics, namely: End User Interaction with Semantic Web Data. Precisely, IN-SITU is exploring the problem of displaying RDF data in a user-friendly manner through the development of visualization applications based on state-of-the-art interaction techniques, as well as through the specification of new languages for describing Semantic Web data presentation knowledge.

- GRAVITE: this team aims at designing interactive visualization methods and tools to analyze and mine large datasets. Their emphasis is on the visualization of graph structures to help users gain insights from large datasets and large-scale simulations, to understand the data and/or the underlying model, and ultimately, to identify intrinsic properties or emergent phenomenon. With the ADT of Erwan Demairy we are currently evaluating how graph visualization tools like the ones designed by GRAVITE could be adapted to take advantage of typed graphs like the one processed in Wimmics.
- KMI, Open University: this group is known for platforms like the Watson semantic web search engine. They also study semantic web services for e-Learning, WSMX for semantic web services, MnM for annotation edition and MAGPIE for Web browsing. We collaborated with them in the framework of the Knowledge Web network. Their closest activity is on interaction design for the semantic web and could be a potential subject of collaboration in the future.
- AVIZ is a multidisciplinary project-team that seeks to improve analysis and visualization of large, complex datasets by tightly integrating analysis methods with interactive visualization. If we share with AVIZ some research goals (e.g., studying collaborative visualization, developing user-oriented methods for evaluating visualization tools) or a research approach (multidisciplinarity), a clear difference is that AVIZ focuses on visual analytics, which is not the case for Wimmics. Wimmics could however make some suggestions to include semantics in visual analytics.
- AXIS: This team performs research on: (1) Web Usage Mining and Reuse, (2) Semantics and Web sites, (3) Design management of Web sites. Axis focuses on knowledge mining while Wimmics focuses on knowledge representation and the processing it supports.
- RAINBOW: the research area of this team covers software engineering for ambient computing, from middleware to Human Computer Interaction. Both teams are complementary and collaborate on model and HCI composition and transformation.
- WAM aims at making it easier to develop and use rich multimedia contents and applications on the web. They focus on multimedia documents and applications that tightly integrate different types of media objects, be they discrete (text, images, equations) or continuous (video, audio, animations). We collaborated with this team in the context of PALETTE and we share with them the use and study of web formalisms. A main difference is our focus on knowledge representation while they are experts on multimedia documents and flows.

5.4 Social Network analysis and knowledge systems

The domain of social network analysis is a whole research domain in itself. Important teams in this domain include: the team of Mark Newman (Michigan University), the team of Ulrik Brandes (Konstanz University), the team of Santo Fortunato (Complex Network Lagrange Lab, Institute for Scientific Interchange, Turin), the team of Albert Barabasi (Boston, Northern University), etc. However we do not intend to contribute on the core theory of social networks like these teams do but rather focus of what can be done with typed graphs in this domain.

5.5 Semantic Requirement Engineering and knowledge systems

Finally, different attempts have been made to “semantify” requirement engineering, especially to improve requirement elicitation. The group of John Mylopoulos (University of Toronto), in collaboration with Ivan Jureta (Louvain School of Management) are currently working on foundations of Requirements Engineering and provide a core ontology about requirement engineering. Duisburg-Essen University and Leipzig University collaborated in the framework of the Softwiki project and proposed the SWORE ontology as a mean to support functional requirements elicitation. Nonfunctional requirements have also been addressed, for instance by the group of Pericles Loucopoulos (Manchester university), which proposed the OWL ontology ElicitO. Seok Won Lee (University of Nebraska Lincoln, USA) currently works on the Onto-ActRE and GenOM framework relying on ontologies to link together different requirement elicitation paradigms.

6 Some selected peer-reviewed publications

From books and book chapters:

- Fabien Gandon, Catherine Faron Zucker, Olivier Corby, *Le web sémantique - Comment lier les données et les schémas sur le web ?*, DUNOD, 2012
- Rose Dieng, Olivier Corby, Fabien Gandon, Alain Giboin, Joanna Golebiowska, Nada Matta, Myriam Ribière, *Knowledge management: Méthodes et outils pour la gestion des connaissances*, 3ème édition, DUNOD, 2005
- Alain Giboin. Correspondances : cadre dialogique pour analyser et assister la coordination entre production et compréhension de documents, in: *Production, compréhension et usages des écrits techniques au travail*, Toulouse, France, D. Alamargot, P. Terrier, J. Cellier (editors), Octarès, 2005, p. 225-243.
- Fabien Gandon, *Ontologies in Computer Science*, Book Chapter in *Ontology Theory, Management and Design: Advanced Tools and Models*, Ed. Faiez Gargouri, Wassim Jaziri, Pages 1-26, ISBN10: 1615208593.
- Alain Giboin (2004). Construction de référentiels communs dans le travail coopératif. In J. Hoc & F. Darses (Eds.), *Psychologie ergonomique : tendances actuelles* (pp. 119-140). Paris: Presses Universitaires de France.

From Journals:

- Olivier Corby, Rose Dieng-Kuntz, Catherine Faron-Zucker, Fabien Gandon. Searching the Semantic Web: Approximate Query Processing based on Ontologies, *IEEE Intelligent Systems Journal*, January/February 2006 (Vol. 21, No. 1).
- Michel Buffa, Fabien Gandon, Guillaume Ereteu, Peter Sander and Catherine Faron, SweetWiki: A semantic wiki, *Special Issue of the Journal of Web Semantics on Semantic Web and Web 2.0*, Volume 6, Issue 1, February 2008 , Edited by Mark Greaves and Peter Mika, Elsevier, Pages 84-97
- Isabelle Mirbel, Ralyte, J. Situational method engineering: combining assembly-based and roadmap-driven approaches. *Requirement Engineering Journal*, 11(1), 2006, pp. 58--78.
- A. Yurchyshyna, C. Faron-Zucker, N. Le Thanh, and A. Zarli. Knowledge Capitalisation and Organisation for Conformance Checking Model in Construction. *International Journal of Knowledge Engineering and Soft Data Paradigms (IJKESDP)*, 2(1):15–32, 2010.
- Isabelle Mirbel, Pierre Crescenzo, Improving collaboration in the neuroscientist community. *International Journal of Web Portals*. To appear 2011.

- Khalil Riad Bouzidi, Bruno Fiés, Catherine Faron-Zucker, Alain Zarli, Nhan Le Thanh: Semantic Web Approach to Ease Regulation Compliance Checking in Construction Industry. *Future Internet* 4(3): 830-851, 2012
- Villata S., Costabello L., Delaforge N., Gandon F., A Social Semantic Web Access Control Model, *Journal on Data Semantics*. Springer. 2012.
- Villata S., Boella G., Gabbay D.M., van der Torre L, A Socio-Cognitive Model of Trust using Argumentation Theory, *International Journal of Approximate Reasoning*. Elsevier. 2012.
- Amel Yessad, Catherine Faron-Zucker, Rose Dieng-Kuntz, M. Tayeb (2011), Ontology-based Semantic Relatedness for Detecting the Relevance of Learning Resources, In *Interactive Learning Environments Journal* 19(1), Special issue "Semantic Technologies for Multimedia-enhanced Learning Environments", pp. 63--80.

From international conferences:

- Cabrio E., Villata S., Natural Language Arguments: A Combined Approach, In *Proceedings of the 20th European Conference on Artificial Intelligence (ECAI 2012)*, 2012,
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- Luca Costabello, Serena Villata, Fabien Gandon, Context-Aware Access Control for RDF Graph Stores. *20th European Conference on Artificial Intelligence ECAI 2012*
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