

# Semantically assisted Workflow Patterns for the Social Web

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**Abstract.** The abundance of discussions in the Social Web has altered the way that people consume products and services. This PhD topic aims to materialise a novel approach to assist online communication in the Social Web by combining workflow patterns and behaviour modelling. Semantic Web technologies are considered beneficial in various aspects of this approach, like in the behaviour modelling, personalisation and context-aware workflows.

**Keywords:** Social Web, Semantic Web, Behaviour modelling, Ontologies, Workflow Patterns

## 1 Motivation

The character of online communication has radically changed upon the introduction of Social Web in the daily life of people. This vast expose of users to information and opinions from colleagues, friends or acquaintances in their online social circle has definitely affected enterprises that rely on the traditional word-of-mouth regarding the quality of the offered services to the end-user by introducing both challenges and new opportunities in the Social Web [1]. The speed of message distribution and the number of people that a message reaches comprise the major aspects of word-of-mouth. Both dimensions have been drastically changed in the last few years; sharing an opinion requires only some internet connection (on a mobile or desktop device) and a few seconds to compile a message and share it; and the number of people that a message can reach has exponentially been increased as we can push a message simultaneously to the various ever-expanding social network graphs. Enterprises, in order to address the above-mentioned challenges and turn them into opportunities, should be able to understand the dynamics of communication and the behaviour of users in the Social Web. In this respect, behaviour modelling and workflow patterns could assist enterprises handling the online communication with end-users by applying them in a context-aware manner. The initial idea is to map behaviour patterns with actions in a workflow to assist the offering of services; these workflow patterns are referred as *communication patterns* in the proposed approach.

Therefore, the aim of this PhD research is the *specification of the infrastructure and the communication patterns that could assist the offering of services*

*based on the user behaviour in the Social Web.* In the scope of my thesis, I consider various dimensions that should be combined for the realisation of the aforementioned conceptual idea as the following section presents.

## 2 State of the Art

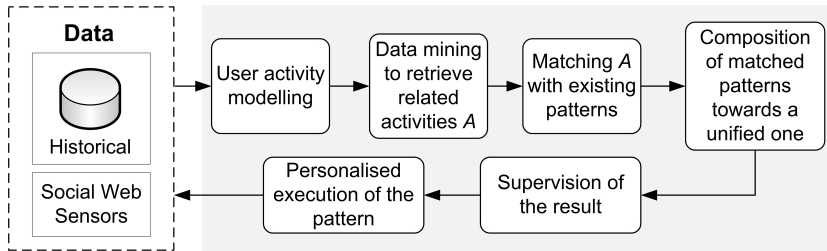
Inspired by the work of Mika [2] regarding the tripartite model of ontologies for social networks (i.e. Actor-Concept-Instance), this thesis aims to define workflow patterns that are usable and adaptable to the needs of the Social Web. Moreover, there has already been considerable interest in the social network interactions, like the work in [3] which coined the ‘social property’ as a network of activity theory concepts with a given meaning. Social properties are considered as patterns that “*represent knowledge grounded in the social sciences about motivation, behavior, organization, interaction...*” [3]. The results of this research direction combined with the generic workflow patterns described in [4] are highly relevant with the objectives of the proposed approach and the materialisation of the communication patterns. Furthermore, the design of the patterns is related to the collaboration among the various agents as described in [5], in the scope of the social workflows. Besides the social properties, the work described in [6] introduces the usage of ontologies in the modelling of the user’s activities in conjunction with content and sentiment. In the context of our approach, modelling behaviours will enable us to identify patterns in communication problems and understand the dynamics in discussions in order to discover ways of engaging more efficiently with the public in the Social Web. Extending the state of the art work in the existing behaviour modelling methods, the contribution will be the specialisation of the ontology towards specific domains, in respect to the datasets of the use cases.

Several researchers have proposed the realisation of context-aware workflows [7] and social collaboration processes [8], which are related to our initial idea of modelling the related actors and artifacts in order to enable adaptiveness and personalization in the communication patterns infrastructure. Moreover, research in the area of semantics regarding the retrieval of workflows [9] as well as the semantic annotation paradigms like described in [10],[11] is considered relevant to our planned contribution. The contribution could be considered as three-fold: application of user and behaviour modelling methods on certain domains, design and implementation of workflow patterns specific for the communication in the Social Web, and context-aware adaptation and evolution of the patterns.

## 3 Approach

The proposed approach is closely related with the objectives and contributions as described in section 2. Figure 1 demonstrates the approach that will be followed to materialise the concept of the communication patterns. The design and implementation of the workflow patterns will be based on the open communication issues of the use cases that have been extracted from the datasets. According

to Figure 1, the first steps include the modelling of the user behaviour in order to understand it and retrieve her/his activities  $A$  that are related to a specific context. The next step is to match  $A$  with existing patterns (we assume that some basic patterns will have already been defined) by exploiting the benefits of inference as some semantic meta-data will be stored in conjunction with every pattern definition. These patterns while being predefined and seemingly static, will also be able to adapt in the context of specific cases by employing context-aware paradigms like those represented by the papers mentioned in the state of the art, in section 2.



**Fig. 1.** General flow in the communication patterns' infrastructure

The research will be based on datasets from various domains, e.g. tourism including hotel reviews and points-of-interest reviews. Employing the Behaviour Ontology described in [6], an extended model (specific to the domains) will be applied on the datasets in order to understand the dynamics in the discussions of the users. Thus, helping to address possible issues and preventing the churning [12] of the users from the provided services. For example, a typical user activity could be the post of a bad review for a service (e.g. accommodation), which the affected enterprise should be able to handle in an appropriate way. The reaction from the side of the enterprise could be assisted by a communication pattern specific for this context.

Various technologies are available for modelling workflows like YAWL and BPEL. The YAWL ecosystem [13] (i.e. language, workflow engine, etc.) has been designed in an Open Source manner [14], which perfectly fits the proposed approach as it enables the extension of the workflow engine due to its high modularity. However, the contributions of the proposed approach will remain independent of platform in order to be easily adoptable on other research initiatives in the future.

The effectiveness of the designed patterns can be measured by employing and extending the findings of the work presented in [15] regarding metrics of the user engagement in terms of popularity, activity and loyalty. Moreover, research in the area of Quality of Service (QoS), e.g. [16], is considered to be important for our approach in the scope of evaluating the impact of the communication pattern infrastructure.

## 4 Methodology

The planned methodology of the proposed approach includes various steps that are interconnected, albeit they could run in parallel in order to enhance the overall research process.

1. *Idea Initialization*

In the first phase of the research work, the usage scenarios will be defined as well as the pilots that will be used from various domains in order to evaluate the research results. Moreover, existing approaches regarding the various dimensions of the research plan will be evaluated in order to find gaps and specify our contribution.

2. *Specification of Communication Patterns Infrastructure*

The state of the art analysis and the requirements analysis will qualify in this phase to the specification of the infrastructure that will support the concept of communication patterns.

3. *Implementation*

The next step is to apply the design of step 2 and the theoretical background that has been acquired from the aforementioned steps in the development of the algorithms that will be used by the various components and the ontology for the behaviour modelling. The implementation phase will be assisted by experiments that will run in an iterative way in small-scale and per component in order to recognize problems and bottlenecks at an early-stage in the approach.

4. *Final Evaluation*

The final validation of the results will consist of various indicators and measurements that will be gathered from user studies related to the domains of the use cases (e.g. tourism, social networking, product quality management or brand management).

The aforementioned methodology layers are reflected in the research working plan which is presented in section 5.

## 5 Schedule

The schedule of my thesis is based on the realization of the steps mentioned in section 4. The first phase of studying the state of the art in the research fields of my contribution has already started. In addition, the study of the state of the art runs in parallel with the specification of the usage scenarios, the retrieval of the datasets and the requirements analysis in order to specify the needs and the expectations in this early-stage. The next step is the theoretical design of the communication patterns infrastructure, which will have finished until the end of the second quarter of 2013 and the first research results should have come out of this process. The next two quarters of 2013 will be exploited in refining the theoretical part, the algorithms and the ontology for the behaviour modelling. In case that all the above-mentioned goals are achieved till the end of

2013, the refiniment of the running prototype will take place in the following year (i.e. 2014) as well as the final validation in conjunction with the writing of the dissertation document. Throughout this research initiative several high-level conferences, workshops and journals have been considered for submissions.

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