Processbook: Towards Social Network-Based Personal Process Management

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Abstract. In modern society, we are frequently required to perform administrative processes to achieve our personal goals. While the last decade has seen many of these individual processes codified via Web sites, there remain significant problems in discovering and integrating the sets of tasks needed to accomplish these personal goals. This paper introduces *Processbook*, a social-network-based framework for managing personal processes. *Processbook* allows users to extract personal process models from online sources, to customise and maintain these models and to share them with other users. It also supports the execution of personal processes, allowing the underlying process model to be adjusted as circumstances change. The paper discusses the rationale for *Processbook*, describes its overall architecture, and defines the structure of process models.

Keywords: Personal Process Management, Social Networks, Process Modelling Support, Process Model Recommendation.

1 Introduction

In modern society, we are frequently required to perform administrative or business processes in order to achieve our goals. While the last decade has seen many of these individual processes codified via Web sites, there remain significant problems in discovering and integrating the sets of tasks that are typically required in order to achieve many useful outcomes. One important aspect of the problem is that tasks frequently span organisational boundaries and there are few mechanisms to carry information and outcomes from the processes in one organisation to those in the next organisation. Another major factor is that it is sometimes difficult even to identify precisely which organisations and which processes within those organisations are required to accomplish a stated goal.

Discovering which business processes are relevant is frequently achieved either by searching on the Web or by being given information from friends who have previously accomplished these tasks. One aim of social software is for people to share information among their social circle. It seems natural that one could consider the use of social software as a way of sharing information about business processes, but doing this as effectively as possible is a more challenging task.

This paper introduces an approach to using a specialised social software framework named *Processbook* as a basis for managing a repository of business process

descriptions, assisting in the discovery of these descriptions, and using these descriptions to assist users in carrying out the corresponding processes. Under this framework, users can construct descriptions of processes that span multiple organisations and which describe processes from a goal-oriented perspective. Since these processes are focussed on the aims of an individual, and since their details are typically discovered by an individual attempting to accomplish some personal goal, we call them *personal processes.*

The specific goals of *Processbook* are:

- to allow users to describe, refine and share personal process models
- to allow users with similar goals to make use of each other's experience
- to allow users to feed back information (e.g. problems, better approaches, etc.)
- to keep users informed of changes in processes which may affect them

The ultimate goal is that *Processbook* users should be able to find processes to achieve their current goals, be assisted in performing the required tasks, and be able to achieve their goals with significantly less effort than is currently required. However this paper mainly discusses the rational for *Processbook* and gives a conceptual overview of the system's architecture without going deep into implementation details.

In section 2, we describe the problem area with examples. Section 3 describes related work in the space of social software and personal processes. Section 4 presents an overview of the system. Sections 5 and 6 explain the personal process model and specifications that underpin *Processbook*. We conclude the paper in section 7 with future work.

2   The Problem

In this section, we elaborate on the problem of carrying out personal processes by considering a not uncommon example of such a process: a student from a non English-speaking country who wishes to study for a PhD in an English-speaking country. This student would typically have two primary goals: find a university that would accept them; maximise the amount of funding to assist their study. These goals could be augmented by additional constraints such as: must be a good University (e.g. ranked in top 100); must be in a country where there is the opportunity to work after graduation, etc. etc.

The above task would generally be accomplished by first identifying potential universities that satisfy the constraints. This would often be done by asking friends or by searching on the Web. Once universities are identified, information about the entry requirements and scholarship availability for each university would be collected and collated. The requirements might identify further subgoals and the process might identify documents that need to be provided, timelines for applications, etc.

In carrying out the above, questions would arise at each stage. For example, the web site at some university might specify that a student needs to provide an undergraduate transcript and English proficiency test results, but might not

mention the kind of visa that the student requires or how to obtain such a visa. In the best case, the University web site would link to a government visa web-site, but that leads to a whole new process and potentially a new set of questions.

If we consider the above approach at a more abstract level, we can map many common tasks into this approach, regardless of the specific domain of the goal. Typical questions that might arise during this process are: what step should I take next, what do I do at each step, which organisation should I deal with, etc. Several strategies that are used to deal with such questions and with the encompassing process: ask friends or consultants, visit organisation websites, ask questions in online forums, or search for the answers in online "how-to" lists.

In solving the above, getting advice from someone experienced with the specific process would be extremely useful, but finding such an expert might be difficult. Experts bring domain and process knowledge, but also need to have your personal circumstances communicated to them. A more effective approach might be to have the process information available online, and have a system that understands both the process information and your personal situation (in terms of progress through the process), and can offer sufficient information that you can determine how to proceed.

In practice, a number of difficult issues need to be dealt with before such a system can be realised:

Invalid data. We may be faced with untrusted sources of information, or conflicting items of information, or may be given out-of-date information. For example, a university may change its entry requirements
and may require additional information which had not previously been thought necessary.

Incomplete data. Sometimes, we simply do not know certain parts of the process. In other cases, there may be hidden (or ignored) pieces of information. For example, Middle Eastern students may face a wait of up to six months in applying for a US student visa.

Inability to predict task effects. Sometimes it is difficult to know what kind of effect accomplishing a specific task will have on the process as a whole. For example, while either of the IELTS and TOEFL English competency tests are accepted world wide, it is better to have IELTS scores if applying for Australian universities because they are better regarded.

Difficulty in monitoring task flow. Personal processes typically span multiple organisations and need to combine several workflows into a single process. Organisations may impose constraints, change their processes or policies. Keeping track of all of these, and maintaining a useful notion of each user's state within their overall process is challenging.

Difficulty in detecting data flow. Similar to task flow, tracking flows of data across multiple organisations, each with their own internal workflow, is difficult. Additional complications may arise from data dependencies between documents and forms in different organisations.

In section 3 we will examine previous works in the area of social software and business process modelling which may provide input into our design.

3   Related Work

The need to remain competitive in today's fast-changing business environment has made enterprises introduce flexibility into their process models. [1] investigates four distinct approaches to gain flexibility within a Process-Aware Information System (PAIS): flexibility by design, by deviation, by underspecification and by change. All of these approaches trade off user support for flexibility. Moreover PAIS suffers from lacking a systematic approach for reusing and sharing knowledge. [2] also expresses the need of a new management system for personal processes - business processes as experienced and described by a single person.

The most notable defect of classical BPM is the model-reality divide, the distance between abstract process models and the processes executed in practice. [3] even states that agile BPM not only requires changes to the BPM life cycle, but also a paradigmatic change. [4] argues that more realistic models can be designed by applying social software features such as self identification, transparency, signing, logging, discussion and banning to the mechanism of process modelling. [5] contrasts the work management style in social software and business process modelling system(BPMS) and then proposes a set of guidelines suggesting how to use both in organisations. portrays an ideal modelling framework which eliminates the conventional hierarchic views of the world, includes more people in designing models and removes *a priori* decisions on process modelling.

Others attempted to combine social software and process modelling tools. [6] targets the problem of "one person modelling tools" which has brought a general dissatisfaction among business users. As a solution, it proposes a social-based recommendation system for business process modelling tools in which formalisation dialogue of creating process models has been improved. [7] embeds social software features, such as collaboration and wiki-like features, in the modelling and execution tools of business processes with the aim of encouraging people participate in the bottom-up design and execution of business processes. On the other hand [8] concerns of participation of end users in modelling processes, thus presenting an ad-hoc workflow system that focuses on non-intrusive capturing of human interactions.

[9] takes another perspective focusing on the execution of business processes in the context of Web 2.0 and social software in a self-managed and decentralised environment. It examines the use of status feeds for supporting the execution of non-predictable business processes. [10] presents a process design methodology for addressing the extension of business processes with social features. In particular they extend BPMN 2.0 with social roles, present a gallery of design patterns and finally propose WebRatio BPM as a technical framework for generating Social BPM applications from specifications encoded in Social BPMN.

While most of the existing works in the area focus on adding social features to an existing BPM framework, our proposal intends to create a flexible BPM environment within a social network structure. We inspire from how we manage our personal processes, e.g., the way we consult friends, looking for ready-to-use information on the web and sharing information with others. In our proposed system we adjust the typical features of a social network like collaboration,

knowledge sharing, item recommendation and notification messages to help individuals manage their personal processes.

4   *Processbook* Overview

Processbook aims to provide a goal-oriented social network whose users actively participate in the managing and sharing of personal processes. More specifically, (i) it supports users to, collaboratively, create and carry out personal processes, (ii) it allows users to utilise various data sources from the web to create *process fragments* as constituents of a personal process, (iii) it encourages users to share the intermediate results with others and receive feedback from them, and (iv) it creates links between people with similar goals so that each other's experiences are shared.
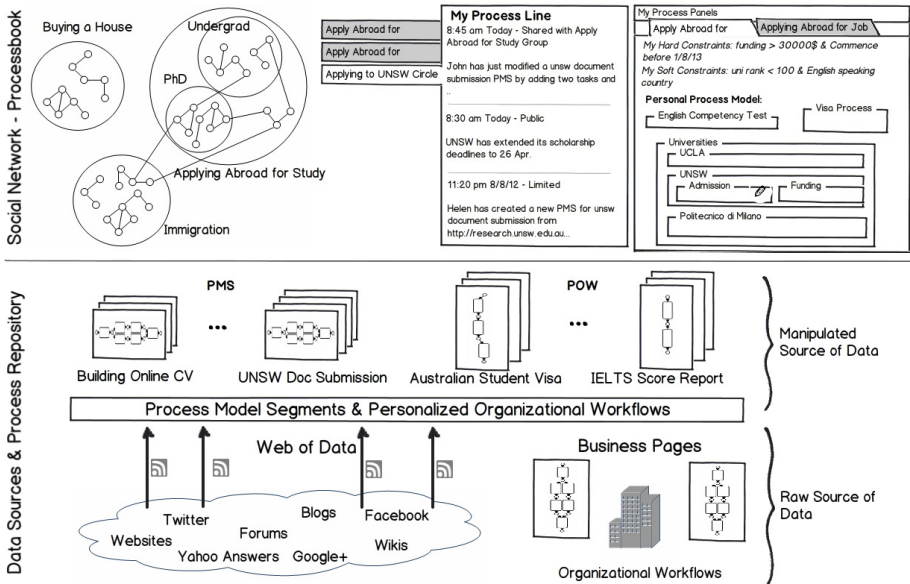

Fig. 1. *Processbook* Conceptual Overview

Figure 1 gives a conceptual overview of the *Processbook* system. It shows the different sections of the system and suggests how the social network module (top left) is integrated with the process modelling and process execution modules. Upon registration in *Processbook*, users will be given a personal workspace called a *process panel* where they have the facilities to create processes and execute them. Once the user defines the goal/purpose of the process she wants to engage in, and any constraints (e.g., "the amount of funding needed to study PhD

abroad"), she will be offered the option to join groups of people working on similar goals. She can now "follow" or "be followed by" other people, forming links and groups.

After that, the *Processbook* process modelling task (i.e., defining a personal process) continues with the user receiving a recommendation package consisting of business pages, web feeds and personal processes of her group mates. The recommendations are based on the goal and constraints specified, and the three components in the package are the main data sources from which the user may derive her own *Processbook* process.

The bottom half of Figure 1 shows the data sources. *Processbook* users may use a combination of them to create their own personal process:

- **Business pages**: Organisations, institutions and business owners upload their business process and workflow models in special pages called business pages. These models can be downloaded and brought to the user's process panel to form part of her own personal process.
- **Web feeds**: Data spread over the web in blogs, forums, news pages, web sites provide a useful source of information for the descriptions of personal processes (e.g., a discussion forum on PhD applications, a university's scholarship application page). *Processbook* makes the data accessible for users in the form of *web feeds*. Users can search the feeds, subscribe to them and, importantly, can extract process fragments out of them and share them with others.
- **Other users' processes**: Instead of searching in raw data in feeds and business pages, users can rely on their followers or the groups they belong to, and follow the work of others. If they discover a useful process model developed by another user, they can extract the whole model or some parts of it and customise it to fit their own constraints. They can also integrate process models from two or more users.

Through the process panel (shown top right in Figure 1) a user can search through recommended items to find any process fragments that might be useful to complete her model. She is also able to browse her *process line*[1] to figure out what actions other users have taken to manage their processes. The social network section in the figure illustrates circles of people in *Processbook* grouped based on their goal. Lines between users indicate that they are also following each other's work. By following a user, recommended items from that user will be prioritised and their actions could also be tracked in the process line.

5 Personal Process Model

Now we define the structure of a *personal process model* which underpins *Processbook*. The proposed social network in Section 4 allows users to build personal processes in terms of this structure and then execute *personal process instances*

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[1] The idea of process line is similar to Facebook Timeline or Google+ Stream.

based on these models. In the remainder of this paper, we generally refer to personal process instances simply as *processes*. Note that the term *process fragment* used in Section 4 refers to process models that have been stored in *Processbook* with the intention of being used to drive process instances and re-used in building larger-scale process models.

A **personal process model** *ppm* is defined as a six-tuple (G, C, D, T, M, A), where:

- G is the goal of the process,
- C is a set of constraints,
- D is a set of inputs and outputs (data),
- T is a set of tasks,
- M is a mapping that describes how tasks are connected,
- A is a set of annotations associated with the tasks.

Each task in T is either a simple activity or is a nested personal process model, thus models may be re-used in the construction of other larger models.

The goal G describes the intended outcome of the process and is used by *Processbook* to classify models. The goal in the example illustrated in Section 2 is "Going abroad to study for PhD in computer science". The set of constraints C specifies requirements to be satisfied in achieving the goal. C contains two kinds of elements: soft constraints (SC) and hard constraints (HC). Soft constraints are user preferences; satisfying them adds value to the process, but violating them does not prevent the process from reaching the goal. For example, being admitted to a university not far from ones hometown may be defined as a preference, but is not a pre-requisite, Hard constraints, are critical requirements; violating them may lead to the failure of the whole process. In our example, securing at least $30,000 of annual funding may be essential.

Individuals decide whether a constraint is soft or hard in the domain of each process model. The set of constraints may be updated several times during the life of the process. Such updates are inevitable, due to the complexity and longevity of personal processes, which makes it difficult to foresee every aspect. For instance, receiving a low score in a language test may introduce a new hard constraint which limits the user's choices to those universities which accept students with equal or lower scores. Users may also add constraints later to take account of particular conditions which were unknown or not considered when the process commenced. For example, "applying for universities in countries which their student visa allows working beside studying" could become a constraint for users who were not thinking of such a visa condition initially.

The set D describes the inputs and outputs to the process; it identifies what data is required in order to commence the process and what data will be produced when the process completes. Data flow between the tasks in the process model is given by the mapping function M. A is a set of annotations, where each annotation is added to a task to help possible automation of the task (e.g for sending documents by email, adding the email address helps automate this task).

As noted above, tasks in T are of two types: simple activities and nested process models. Simple activities are the basic unit of activity in process models.

Each simple activity has inputs and outputs (the source and destination of these is defined in M). Any process model can be treated as a task and included in some other process model. This allows us, for example, to integrate known organisational processes as a component of our own personal processes.

In practice, tasks are drawn from several different sources in *Processbook*. Based on this, we can partition tasks into three sets: $T = POW \cup PMS \cup GFT$.

POW contains *personalised organisational workflows*. Each task in POW is derived from a standard business process model from one organisation in the *Business Pages*. Personal processes may involve multiple workflows from several organisations thus have to be gathered to shape the whole personal process model. As organisations usually include all variations of paths and conditions in their workflows, it is desirable for individuals to have their own personalised views of those workflows e.g. by pruning extra paths and omitting unnecessary tasks. In our example scenario, the "visa application" workflow could be personalised to "postgraduate student visa application subclass 574".

PMS contains *process model segments*. Each task in PMS is derived from a source outside any organisational workflow, typically from a description of a process on a web site. Such tasks are typically found by users searching the *Web Feeds*. In our scenario, tasks such as submitting documents to a university scholarship office, or registering for an English language test would typically be process model segments.

GFT, gap-filler tasks, are any other tasks that are necessary to guarantee the completeness of the process model, but are not included in POW or PMS. Such tasks are generally not present in organisational workflows or model segments for the following reasons:

- The task exists outside any organisation or institution and is also out of the scope of texts discussing related issues.
- The task is assumed too trivial to be modelled in business workflows or be mentioned in texts.
- The task may be handled in so many different ways that it makes the modelling too complicated or the texts too lengthy.

All tasks, no matter how small, should be considered in the final model. Even an apparently trivial task such as *going to the post office to send documents to the destination university* in the "apply abroad for PhD" process consumes time and budget and may even introduce new constraints.

6   *Processbook* Specification

Linking users to the Web Feeds and Business Pages (i.e., organisational workflows) and providing them with a process modelling and execution tool will not guarantee the success of their personal process. The inconsistent and untrusted nature of web-based data, combined with the complexity and dynamism of personal processes pose the kinds of problems discussed previously in Section 2. To overcome these issues, We have customised some of the conventional concepts

used in social networking sites and applied them to the process management cycle in *Processbook*. In the following, the four main capabilities of our proposed social network are explained.

6.1   Collaborative Process Modelling

Once a user starts to create a process model, it is associated with their profile and can be shared with others. Sharing is controlled by the user and could be: public, a group they belong to, or friendship circles. Users who have been granted a permission to view other user's process model may:

- `like` the model
- `flag` the model as a faulty or incomplete
- `comment` on the model
- `copy` the model or its components to their process panel
- `modify` the model by adding, deleting, renaming, annotating tasks or changing the task or data flow

Modification of a process model will result in a new version of that model. A set of different versions of process models which describe a single sub-goal are kept in a pool and ranked based on the feedback given from users. Feedback is quantified using the factors such as number of likes and flags a model received, number of times copied, etc. Storing all versions of a model helps new users expedite their modelling process by reusing a model from the pool. Figure 2 illustrates such collaboration between Helen and John in extracting a PMS for "document submission to UNSW for research degree application". It shows the real excerpt from the website on the right and process panels on the left. The order of actions are shown on the figures; the dotted boxes indicates annotations for tasks. John refines an existing annotation, adds a branch to PMS and enriches it by adding more annotations. He then flags Helen's work to inform other possible visitors of her seemingly incorrect PMS.

Once a user is given permission on a model, they can see all of its components, including constraints, tasks and annotations. *Processbook* also provides users with a view on the execution of models belonging to friends and group members, or users they are following, via their *process line*. The process line is a place where users can observe other's activities sorted by time. It serves as an area from which users can obtain ideas on how to manage their own personal processes.

6.2   Knowledge Capturing and Sharing

Processbook aims to enhance the process management life-cycle by improving knowledge and information exchange, which in turns speeds up modelling and execution decisions. The key point in information exchange is to find a method that automatically and non-intrusively captures users' modelling and execution experiences and then shares the captured data appropriately. Since users' actions are all performed in a web based social network framework, a web monitoring component in conjunction with a log analyser could provide users with the
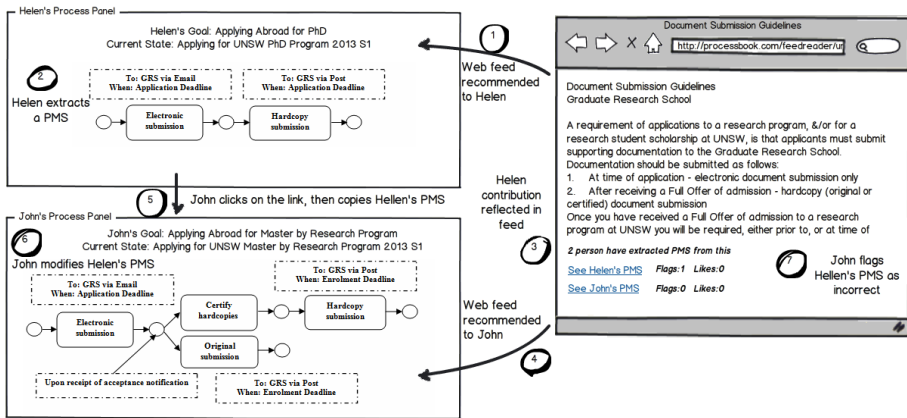
Fig. 2. *PMS* Extraction and Collaborative Process Modelling in *Processbook*

needed information. The extracted information could then be posted by a user and shared according to their preferences. A `post` consists of following elements:

- `topic`: the type of action
- `timestamp`: time of the action
- `group_access`: the group of people for whom the post is visible
- `auto_desc`: an automatically generated description of the user's action
- `action_param`: a set of action parameters
- `meta`: meta data part containing the user's goal, satisfied and broken constraints, and a progress plan in terms of completed and planned tasks

Table 1 summarizes the most important action types. The parameters of each action type are given in brackets.

Table 1. Action types in *Processbook* posts

Type	Description
Extract a process model segment	I have just extracted a process model out of [`web feed W`] which I have earlier found by searching [`Terms a set of terms T`] or which was recommended to me. I created the process model to reach [`Sub-goal SG`] on the way to accomplishing [`Ultimate-goal UG`].
Personalise an organisational workflow	I have just personalised [`organisational workflow OW`] from [`business page BP`] to reach [`Sub-goal g`] on the way to accomplishing [`Ultimate-goal G`].
Modify a process model segment	I have just modified [`process model segment PMS`] by [`set of modelling activities MA`]
Create a task	I have just created a gap filler task to integrate [`PMS/POW/GFT`] with [`PMS/POW/GFT`] to reach [`Sub-goal SG`] on the way to accomplishing [`Ultimate-goal UG`].
Execute a task	I just did [`Action A`] to reach [`Sub-goal g`] on the way to accomplishing [`Ultimate-goal G`]. This action has satisfied [`Constraint C`$_1$] while breaking [`Constraint C`$_2$].
Undo a task	I just did undo [`Action A`]. This will also restore my broken [`Constraint C`].

6.3   Social Network-Based Recommendation

Processbook's built-in recommender system filters the process knowledge repository for each user based on the user's goal, preferences and status. An *intelligent query processor* module will implicitly and non-intrusively build a query from the user's goal, soft and hard constraints, past actions - recorded as described in section 6.2 - and the process execution state of the user's personal process model. When users choose to get PMS or POW suggestions, a query of their request is built and executed over the process knowledge repository where the users' posts and a link to related PMS, POW, web feeds, business pages and other action parameters are stored. Users would specify whether to search all the repository or limit the search to items shared by the group they belong to or by their friend circles. In addition to recommending process model elements, the *Processbook* recommender system may also suggest a user to follow other users' process panels or to subscribe to a web feed or a business page.

Here is a sample of an automatically generated query for a user of the "apply abroad for PhD" process, wanting more than \$30,000 funding per year. The query states that she has already taken an English competency exam and also prepared her undergrad transcripts, and returns the set of PMS and POW needed to complete the remaining tasks.

```
SELECT PMS, POW
FROM GROUP ''Apply abroad for PhD''
WHERE CONSTRAINT IN
(country="Australia" & annual-funding >= 30,000 & major="computer science")
HAVING COMPLETED TASKS
{getting transcripts from undergrad universities, taken English test}
ORDER BY POST DATE;
```

6.4   Notification-Based Management of the Dynamic Environment

Processbook makes use of a notification mechanism to reflect both regular changes in user-defined process models and policy changes in business environments. When an institution obsoletes a workflow, changes its policies or adds new criteria to one of its old workflows, *Processbook* will send notification alarms to those who either have created POW from that workflow themselves or copied an existing POW associated with that workflow. Similarly when a new PMS is extracted from a web feed or when an existing PMS is flagged as inappropriate, a notification message will be sent to those directly involved in creating that PMS and those who copied it to their process panels. Moreover when the top ranked PMS in a pool of PMSs - depicting the same goal - changes based on the users' feedback, it will be announced to users working on that pool to be aware of the new best practice PMS. It is also possible to get notification messages directly from one of the group or circle members stating new updates from her personal model.

7 Conclusion and Future Work

We have presented a conceptual framework for *Processbook*, a specialised social network for managing personal processes. While many focus on adding social features to an existing BPM framework, our proposal intends to create a BPM environment within a social network structure. Ultimately, the system aims to realise an environment where users can find relevant processes, be assisted to perform the required tasks by other users and the system, and to have their experiences recorded and shared. Our immediate future work includes more detailed work on the model and specifications, assisted process model extraction methods, process model/fragment recommendation methods (including an intelligent personal process query language), and approaches to resolving data conflict arising from integrating multiple data sources for a process model.

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