

Business Process Support System as a Tool for Communication/Collaboration

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Abstract. In our predominantly “white-collar” society, office workers need to spend a lot of time communicating with each other. At least some part of such communication (e.g., reporting the state of a task to a lot of people) is considered as boring, and it is, usually, kept to the bare minimum. Not having “enough” internal communication may lead to undesirable consequences, like things “falling through the cracks”, or reinvention of solutions multiple times. The paper discusses one possible solution for making internal communication more effective without putting an extra burden on the office-workers. This is by incorporating effective channels for internal communication into a computerized system aimed at supporting business processes. The paper discusses a theoretical view on business processes appropriate for the task, architecture of the system built based on this view, and a pilot installation that serves as a test platform for the system.

1. Practical Motivation

All actions performed by an office worker in a modern company or organization, could be roughly divided into two categories:

- Doing some actual work (which might include communication with the external world, customers, supplies, etc.).
- Communicating with colleagues and management (internal communication).

Internal communication can be roughly divided into two types:

- essential communication, in which new information (value) is produced, e.g. problem solving discussions, brainstorming, strategic/operative planning, and
- routine communication which, among other things, includes:
 - reporting on the work that has been done to managers or colleagues who should know the results (e.g., accounting department)
 - getting new assignments from managers or colleagues and giving assignments to others (formally as well as informally, like please, let’s discuss the matter tomorrow)
 - searching/giving information on past experience

While, doing the actual job and participating in the essential internal communication is considered important, the workers tend to pay less attention to the routine communication and try to keep it to bare minimum, e.g., informing only managers. Insufficient internal communication may lead to the following undesirable effects:

- The information on the status of a task is known only to a person who completes the task, or may be his/her direct manager. Any questions on this status (e.g. from a customer) cannot be answered if the person (and his manager) is out of site.
- Information on a completed task or a new assignment does not reach the next in the chain in time (or does not reach him at all), i.e. the things fall “through the cracks”.
- It takes too much time to find information on past experience (e.g., the person who had it is out of reach when needed). A solution is reinvented repeatedly.

The obvious solution to make the routine communication more effective in the electronic epoch is to use electronic means instead of papers, stickers, phone conversations. Email can be considered as the most obvious solution for this end. However, business practice shows that simple switching from paper to electronic channels does not solve all problems of routine communication. For example, mailboxes can be easily clogged by messages with huge attachments being cc-ed to everybody (“just in case”). The question arises whether there are any other ways to make internal communication work without increasing time each person spends conducting it?

2. Introduction

The paper discusses one practical solution aimed at making routine communication more effective. The solution is based on the assumption that, normally, the routine communication is conducted in the frame of some business process, independently whether participants of this communication are aware of it or not. This process can belong to the organization’s main processes, like processing a customer order or an insurance claim, which are normally relatively well structured. Alternatively, it may belong to some internal, support process, like arranging an internal working meeting, for which most organizations do not have strict rules.

Currently, more and more organizations are trying to introduce some kind of a computerized system to support their business processes, be it some standard solution, like SAP, or a home-developed system. In these circumstances, it is only naturally to try to incorporate some channels for routine communication in a business process support system. We believe that for such channels to be more effective than the existing channels outside the system, the following conditions should be satisfied:

- The channels should support formal communication (e.g. reporting), as well as informal (ad-hoc) communication. This will require the system to deal with both main (well structured), and support (loosely structured) business processes.
- The channels are to be implemented in a “natural” for the business process support system manner, not as some additional and “foreign” mechanism that will require extra efforts from the end-users to learn it.

To satisfy these conditions we have chosen a state-oriented approach to business processes [5] as a basis for building a system that includes effective channels for internal routine communication. The state-oriented approach was specially designed to deal with the particularities of the loosely structured business processes. In addition, it is based on the idea of dynamic and distributed planning that feels like a promising way for providing means for routine communication.

Current version of the system has been built to support a number of loosely structure processes, but it also has a potential for introducing more strict rules required for more structured processes. The system has been satisfactory tested in our internal practice, and now it is installed at a pilot customer site. The latter will allow us to get a better understanding of the quality of the communication channels provided by the system.

The goal of the paper is to overview the results achieved so far, and summarize our research in progress. The paper is structured in following way. In Section 3, we overview the state oriented view on business processes that served as the basis for building the system. In Section 4, we overview the system architecture. In section 5, we shortly refer to related research. In Section 6, we describe the pilot installation. In Section 7, we summarize the result achieved and review research in progress.

3. State oriented view on business processes

The state oriented view on business processes as described in [5] has its roots in the mathematical systems theory [4] that deals with physical processes. One of the main notions of the mathematical

system theory is the notion of state that, for continues processes, is defined by a number of state variables accepting real values. A process in such case is represented as a trajectory in the state space defined via a set of differential equations of the form:

$$F(x, \dot{x}, w) = 0,$$

where \dot{x} denotes the derivative of the vector of state variables x with respect to time, and w is a vector of environment variables that model interaction between the process and the environment in which it runs. Such equations are binding the direction and speed of movement of the system in the state space to the position of the system in the space and the state of the environment.

A *state* of the business process is defined by a “construct” that reflects the relevant part of the “business world” at some moment of time. The internal structure of the state construct depends on the business process in question. An example, of such structure for a business process related to a customer order is represented on Fig1 (left). The state structure includes: (a) attributes (variables), like *To pay*, *Paid*, *Ordered*, etc., and (b) references to various human and non-human participants of the process, like customer, product, etc. The state may have a variable structure, e.g., it may include repeating groups, see the list of ordered products in Fig. 1.

Each business process has an *objective* or *goal*. The goal can be defined as a set of conditions that have to be fulfilled before a process instance can be considered as finished (end of the trajectory). A state that satisfies these conditions is called a *final state* of the process. The set of final states for the process in Fig. 1 can be defined as follows: (a) for each ordered item *Ordered* = *Delivered*; (b) *To pay* = *Total* + *Freight* + *Tax*; (c) *Invoiced* = *To pay*; *Paid* = *Invoiced*. These conditions define a “surface” in the state space of this process.

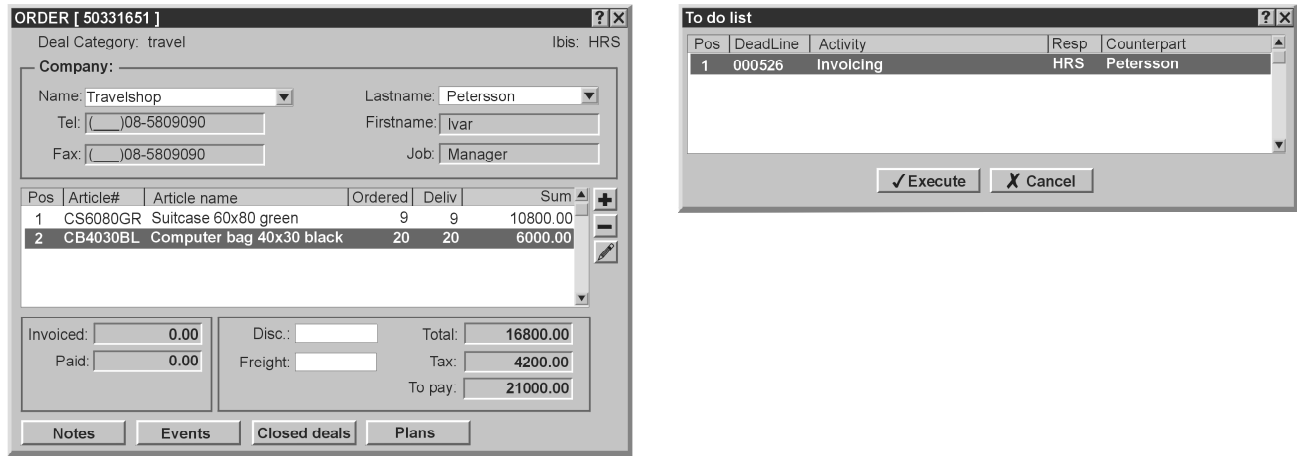


Figure 1. Left - state of a business process; Right - operative plan that complement it

Each instance of a business process is driven forward towards the goal through activities that are executed either automatically or with a human assistance. Activities can be planned first and executed later. All activities planned, but not executed for a given process at a particular point of time constitute the process’s *operative plan* (to do list). The plan lists activities the execution of which diminishes the *distance* between the current state of the process instance and the *nearest* final state. For example, “rules of planning” for the process in Fig.1 can be defined in the following manner:

- If for some item *Ordered* > *Delivered*, shipment should be performed, or
- If *To pay* > *Invoiced*, an invoice should be sent, etc.

The plan on Fig. 1 (Right) corresponds to the “rules of planning” for the process state on the left.

Conceptually, the notion of operative plan substitutes the idea of derivatives in continuous processes, each activity on the plan list showing the “direction” of movement along some “axes” in the state space, and the speed of the movement (e.g., through a deadline). “Rules of planning” plays a role of the differential equations. Using these rules, the process instance is driven forward in the following manner. First, an activity from the operative plan is executed and the state of the process is changed. Then, an operative plan is adjusted with new activities, manually, automatically, or in a mixed manner.

4. System architecture

The heart of the system we built based on the state oriented view on business processes consists of:

- Historical database that automatically stores information on all events and all past states of all processes, documents, and other business objects.
- Navigational system that allows the end user to freely navigate through the space of interconnected processes in the present and past.

The system, among other things, provides:

- A virtual calendar that allows the users to plan tasks to each other, and gives immediate access to all information required for completing individual tasks. The latter includes information on the current situation and all relevant events and documents in the past and future.
- Automatic support of history recording that allows not only to see what happened in the past, but also how things looked like at that time.
- Document management that facilitates getting access to any internal or external document without knowing its name or storage placement. The documents are found through association to their usage (e.g., purpose of creation). In addition, via support of history, all internal documents are automatically versioned.

Current version of the system called *ProBis* is built as a client/server solution, where clients run under Microsoft Windows, and a server runs an SQL DBMS, Oracle, or MS SQL Server. Historical database is implemented as a set of stored procedures and triggers in an SQL database. User interface is built with the help of *Prolifics* application development tool from Prolifics, Inc.

Internal routine communication is conducted by planning activities to each other in particular process instances, e.g., “Review a document”, “Fix a problem”, “Suggest a solution”, etc. A new planned activity automatically appears in a virtual calendar of the worker to whom it is planned. When executing this activity, the worker automatically gets access not only to the parameters of this particular activity, but also to the full information on the current state of the process, its history and future, i.e. other activities planned for the process, see Fig.2. No extended communication with the colleagues previously engaged in the process is required. When the completion of an activity is finished, an event is automatically registered in the frame of the process, which greatly reduces the needs of reporting (anybody interested can see it him/herself).

In addition, the full history of previously completed processes is easily available which greatly reduced the needs of internal communication just to find out past experience (similar cases).

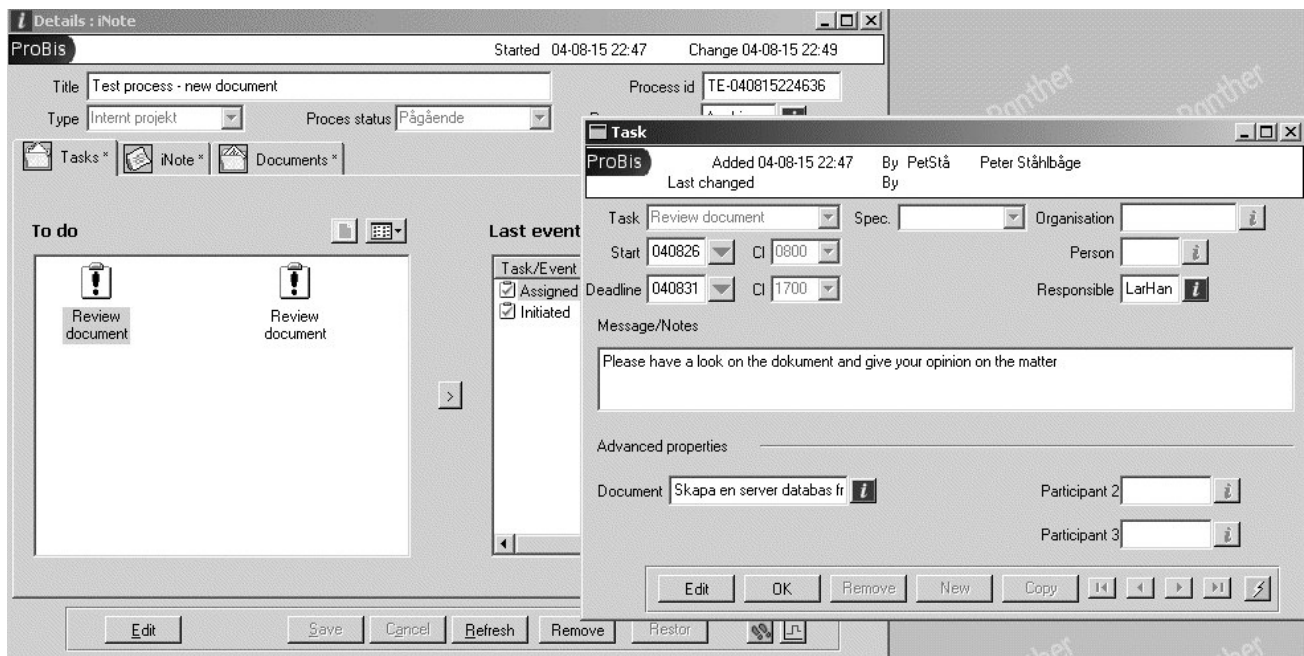


Fig. 2. Screen dump from ProBis

5. Related research

The *ProBis* system has many traits that are similar to the systems designed or suggested based on other ideas, like emerging workflows (see, for example [3]), and CSCW (see, for example [1]), to name a few. Conceptually, it also resembles a communication system with multiple backboards from AI. The main difference between our work and the works of others is not these traits themselves, but a way of deriving them from a theoretical view on business processes. We believe that having a high-level theoretical view provides a better foundation for building and further developing a computer system than just user-requirements, common sense, and intuition. The state-oriented view, which we have chosen, has quite high-level of abstraction. In addition, it itself is based on a more abstract model [2], the one that uses more “high-level” notions than activity and plan. This more abstract model is used when choosing architectural solutions that are not directly covered by the business-process model.

6. Pilot installation

The current version of *ProBis* was developed for “Association of Tenants, Region West Sweden” (in Swedish: Hyresgästföreningen, Region Västra Sverige), abbreviated to HGF. HGF is a non-profit interest organization that unites more than 60 000 tenants and has as its primary goal guarding the interests of its members. The regional office, which is used as the main pilot site, has about 50 employers whose task is to provide service to the members and to the “field-level” organizations. The service is provided in a number of areas, such as: giving legal and practical advice to the HGF’s members, conducting rent negotiation with the properties owners on behalf of the members, lobbying, i.e. influencing decisions made by authorities on the local, national, or international levels.

Most of business processes in the pilot organization are of administrative nature, such as negotiation, conflict management, lobbying, etc. Some of these processes are quite specific, e.g. lobbying, others are of very general nature (see Fig. 2). The latter gave us a possibility to use the system in our own organization in parallel with installing it at the customer site.

Our own experience of using the system as a communication tool was quite positive. The first experience on the customer site was worth than expected. Based on the previous experience of introducing a support system into one department of this organization, some delays were expected in the introduction process. However, the difficulties of introducing a system aimed at functioning through the whole organization showed to be much greater than in the case of system introduction in a single department. One of the major problems was the system's user-interface poorly adapted to the "occasional" end-users. Based on results of the first try, the user-interface has been totally redesigned to satisfy the less skilled users (Fig. 2 is from the redesigned system).

The redesigned system was already demonstrated to the staff of the pilot organization, who expressed their full satisfaction with the new "face" of the system. Now, they are eager to start afresh with the *ProBis* introduction after the Swedish holiday season is over.

7. Conclusion and research in progress

We started with the hypothesis that effective channels for conducting internal routine communication can be provided by a specially constructed business process support system. So far the following has been achieved to test this hypothesis: (a) we have chosen a theoretical view on business processes that is suitable for the task; (b) we have built a system based on this view; (c) we have tested it in own operative environment; (d) we have installed and tested the system at a pilot organization; (e) we have adjusted the system for the kind of users, the pilot organization have.

The project has encountered some difficulties, which was to be expected. However, none of the difficulties so far has been unsolvable and we do not expect to run into any really critical problems for the future work. Our future work concern: (a) evaluating the results of the introduction of the system at the pilot organization, (b) introducing automatic planning, and (c) improving communication channels. For the sake of the last task, we started to analyze the architecture of our system from the view-point of the speech act theory framework [6]. Some results of this analysis are already under consideration to be included into the system. For example, in speech act theory there is the notion of a promise. One actor promises another actor to do something within the frame of a process. An analysis through a speech act perspective revealed that promises are not expressible in the system in a natural way, which needs to be solved in the next version of the system.

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