POLITeam
Bridging the Gap between Bonn and Berlin for and with the Users

K. Klöckner, P. Mambrey, M. Sohlenkamp, W. Prinz, L. Fuchs,
S. Kolvenbach, U. Pankoke-Babatz, A. Syri
GMD, FIT Institute, Schloß Birlinghoven, D-53757 Sankt Augustin
Email: politeam@gmd.de

Abstract: Supporting the cooperation of people in large organizations which are distributed geographically is one of the great challenges for the CSCW research. With POLIKOM, the German Federal Ministry of Education, Science, Research, and Technology launched a framework in which telecooperation applications will be developed to support the distributed government in Bonn and Berlin. POLITeam is one project embedded in that framework. Its aim is to support asynchronous cooperation in administrative or industrial settings by an integrative groupware system that applies the metaphors of electronic circulation folders and shared workspaces. The development process is based on the approach of using an existing groupware system that is evaluated and redesigned in close cooperation with selected pilot partners. This paper describes the initial design, our development approach and the first experiences of the POLITeam project.

Introduction

In 1991 the German parliament decided to move the government from Bonn to Berlin. As a consequence ministries and other public organizations will be distributed between Bonn and Berlin, as not all of them will move to Berlin in the next decade. Because of these changes the German Federal Ministry of Education,

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Science, Research, and Technology has launched the research framework POLIKOM (Hoschka et al., 1993). In this framework the required telecommunication and telecooperation technology will be developed to support the distributed government. One of the projects in this framework is the POLITeam project.

The project involves industrial partners (VW-Gedas), research institutes (GMD, University of Bonn) and application partners. Special attention will be paid to the application partners who will be closely involved in the design process from the beginning. The application partners are the Federal Ministry of Family Affairs, Senior Citizens, Women, and Youth as well as the Ministry of Justice of the state Mecklenburg-Western Pommerania. Both partners contribute experiences in ministerial, i.e. administrative and political office work. As industrial application partner the AUDI AG is involved. The focal point of that application partner is to enhance the support of concurrent engineering between project groups located at different cities.

The objective of the POLITeam project is the development and introduction of a system which effectively supports the cooperative work in large organizations distributed geographically. The processes at which POLITeam aims are workflows in business and public organizations. These are supported by a workflow component which follows the metaphor of electronic "circulation folders". This is augmented by the support of coordinated document and task processing. Here the guiding metaphor is that of a "shared desk". Both components will closely interact with an event and notification service which supports awareness of the cooperative environment.

In this paper we first describe the envisaged design of the POLITeam system. Then we describe the methodological and technological approach towards the implementation of this design. Finally, we describe the first experiences and impressions gathered from the use of the initial system and the cooperation with our pilot partners.

The Design of POLITeam

Overview

The POLITeam system implies several functional components which are illustrated in the following architecture diagram (Fig. 1). We will concentrate on the description of those components which are most visible to the user: the workflow support, the coordinated document and task processing, and the notification and information service. Further services are archive and registration, organization information and management (Prinz, 1993), and technical management. None of these components represents a completely new application

ın its own, however their combination and integration ınto a comprehensıve support system that can be tailored to different application areas is challenging (Navarro et al., 1993).
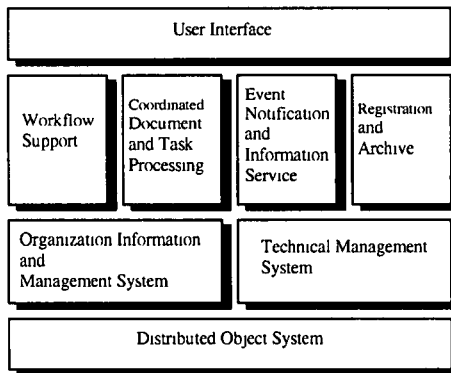

Fıg.1 The POLITeam archıtecture

Workflow support by electronic circulation folders

Workflows are supported by means of *electronic circulation folders* ın correspondence to the internal mail folders used ın the real office world. Similar approaches can be found ın (Shephard et al., 1990, Karbe, 1993). Circulation folders contaın documents of arbitrary content; their contents can be changed during the workflow. Addressees can be individual users of the system, or role descriptions, represented in an organization management system, whıch are then resolved at runtime. Informal annotations can be attached by any user to the circulation folder and can be deleted later. A circulation slip prescribes in an arbitrarily and dynamically configurable way the route of a circulatıon folder. Sınce these are easıly modıfiable at runtime according to the actual cooperatıve situation, the folder can provıde flexıble mechanisms for the coordınatıon of workflows. This satisfies the requirements drawn from experiences gained by office procedure systems (Kreifelts et al., 1991).

The envelope and contents of a circulation folder can be protected wıth access rights. In the case of the envelope, this concerns the adding and removıng of documents and the inclusion and deletion of addressees on the circulation slip as well as of annotations. Access rights on documents specify who may read, modify, or delete them.

It will not be possible to supply all relevant employees of an organization wıth the POLITeam system in the initial phase. Nevertheless, all users must be able to participate in workflows. Furthermore, interviews with our application partners have shown that documents are often processed which are not available or are

unwieldy in an electronic form due to their size (e.g. construction plans) or their large number of pages (e.g. catalogues). These documents must still be circulated in paper form. Therefore, the system must provide mechanisms to integrate both external users and paper documents. In the case of users, obvious limitations apply to this integration, such as the restriction that external users can only be end recipients of the circulation folder or recipients of concurrent copies of the circulation folder. For external documents, the system will provide means for the combination of the paper and the electronic information that is exchanged in the context of the process. This allows users to recall all electronic information, e.g. related messages, to a process they have received in paper form.

Coordinated document and task processing by shared workspaces

As a supplement to the workflow system and to support less structured cooperative work, a component for the coordinated document and task processing is developed in the form of a *shared workspace*. A shared workspace (which also can be seen as a shared "desk") offers an environment for the coordinated document and task processing in a group; it integrates, but does not implement the tools for document processing.

In contrast to the circulation folder of the workflow system, the members of a shared workspace (Fuchs et al., 1995) have a non-sequential, time-unlimited, access to its contents. It supports the handling of tasks for which group members require continuous access to common background and work documents. The access to the contents of the workspace can be freely specified which enables a broad spectrum from private up to public workspaces.

An essential difference between a shared workspace and a file or archiving system is the continuous processing possibility of its contents by different, often remote, members of the workspace. That raises special requirements for consistency, as well as for the representation of the events within the workspace, following the last access or visit of a user. An overview of past actions in the workspace, and the most recent state, is therefore offered to the user by special visualization techniques. The members of a workspace can further access the history of individual objects for more detailed information.

As a special service, the combination of task descriptions with shared workspaces is provided. This is achieved using task lists which assign tasks, related resources, and deadlines to individual workspace members. Thus cooperative task management can be supported the same way as proposed by Kreifelts (Kreifelts et al., 1993). This is useful, for example, if the shared workspace was set up for the production of different documents. Members can be assigned to different tasks of the document production and the responsibilities can be recorded visually. During the task execution, the current processing status is recorded within the task list, which enables a rapid overview of the status of the task, or of future tasks to be accomplished.

The history of processing contents is recorded and it can be inspected by the users, controlled through access rights. Archived documents or external message sources (e.g. internal distribution lists, press releases, news) can be integrated via filters into a workspace if these sources are available electronically. In this way, background information, which is useful for task handling, can be automatically supplied to the group.

Awareness by the event notification and information service

One of the main design goals of the POLITeam system is to provide users with information about the activities of others, as far as it affects their cooperation. In this way, the dynamics of the working environment is presented at the user interface - providing awareness. Awareness is a key mechanism to coordinate and fine-tune cooperative work, as well as a base mechanism to establish communication by showing the availability of other users (Dourish, Bellotti, 1992). POLITeam supports both an active approach (notification service), where the system automatically notifies users of relevant events, and a passive approach (information service) where users can query the system for specific facts. Since this component is used by all other parts of the overall system, for example the shared desks and the electronic circulation folders, there are several key issues for its design that must be considered.

Many problems related to the notification and information service are concerned with the design of the user interface. For the active component, the information must be visualized in the working context in an as unobtrusive and non-disruptive manner as possible. Adequate visualization and animation techniques must be used to take maximum advantage of the screen area and to allow peripheral viewing of the displayed events (Sohlenkamp, Chwelos, 1994). Furthermore we must ensure that important events are always noticed by users. Another problem is the compression of event history: users should be able to get a summarized version of past events to learn about previous actions and to catch up to the current state of the working process.

For any system providing information about users to others, adaptability is a crucial issue. A user must be able to control outgoing, as well as incoming information, the former to provide privacy where needed, the latter to prevent disruption and information overload. POLITeam addresses these problems by providing user-definable filters, allowing the specification of interesting events together with definable access rights for specific classes of events. The challenge is to design a system that is flexible enough to support the usual forms of cooperative work and the evolution of social protocols analogous to those used in real-world collaborations.

Finally, POLITeam is designed to be expandible - additional services and hardware should be easy to integrate into the system when necessary. Since these additional components should use the same basic mechanisms to signal events to

users, it is especially important that the notification system provides a well-defined, open interface to other parts of the system.

The POLITeam Design Approach

The methodological approach

The objective of the POLITeam project is the introduction, evaluation and further development of a system to effectively support coordination of asynchronous group work and office procedures. The leading metaphors are the "shared desk" and the "electronic circulation folder" in a virtual office as introduced before. Although academic laboratory research will be done, the main focus lies upon the users who will use the system in a real world setting, i.e. their workplaces. The users work for the three pilot-partners of the project: a German federal ministry, a German- state ministry, representing the public administration, and a car manufacturer, where concurrent engineering will be supported. The three organizations have outlets located in different cities, which will be connected closely to their headquarters, bridging the gaps which derive from the differences in time and space. In the following we concentrate on the experiences gained from the ministerial application partners.

The basis for the workflow support and the coordinated teamwork is a product available in the project consortium (see next section), which offers a sufficient basic functionality for the workflow control in order to be able to begin the project in a real life setting. Several steps were planned in advance:

- to analyse work and organizations at a first glance;
- to begin with a short adoption phase in the laboratory to shape the existing CSCW-system (named POLITeam I) to the obvious users' and organizations' needs;
- to introduce the system into the organizations by teaching and guiding the users, which will lead to the usage of the system as an instrument of daily work;
- to evaluate the experiences of the users made with the system in work practice and to redesign the existing system directly, or alternatively to take the experiences as future system requirements for the enhanced system (POLITeam II).

The next milestone will be the introduction, usage and evaluation of this new system POLITeam II, which again will lead to a reshaping of the system, to new requirements and to evolutionary steps of design.

This approach enables stepwise modification and development of the system and guarantees that both, users and developers, maintain control over the process. They can decide about system alternatives and consequences, during a long term

learning period, and not just at one, irreversible decision point. This enhances participation in the design process. Furthermore, studies show that user participation also has a direct relationship to user satisfaction (McKeen, Guimaraes, Wetherbe, 1994). The approach, planned as an open process, takes into account the dynamics of the organization such as the organizational goals, organization of group work, careers, fluctuation of personnel, cognitive access to the system, qualification process, the state of the art of technology, etc. (Mambrey, Oppermann, Tepper, 1986).

The development of the POLITeam project will be done in close cooperation with users. The definition of the requirements for the system components is done such that an already existing system is installed at the users workplace, and that the requirements are determined by means of the practical experiences gained by using this system. The strategy of the project follows the helical model of cooperative evolutionary system design represented in figure 2.
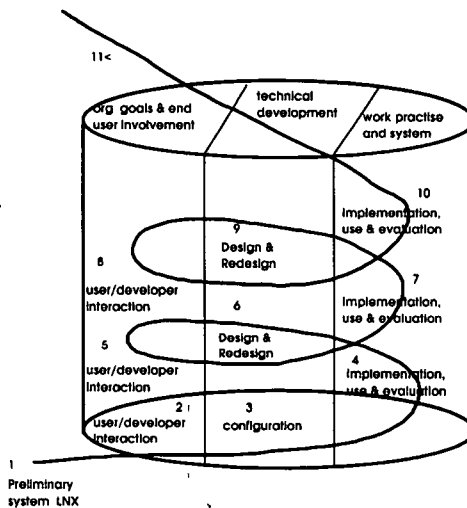

Fig. 2: The helical model of cooperative evolutionary system design

This development strategy of POLITeam is based on previous work done by Eason (Eason, 1982) and Floyd (Floyd, Keil, 1983). To achieve these ambitious goals some basic methodological development ideas structure the development process of the system. We call this a cooperative and constructive design philosophy. This includes a set of activities, methods and tools characterized as follows:

- We start with an existing system which gives us the opportunity to evaluate it under working conditions and not only in the laboratory (Bowers, 1994). We are interested in how work practices match, or mismatch, the system.

- Evaluation criteria of the system are: the usage in existing organizations, how they assist users in their tasks, and how they help to meet the requirements they have towards organizational goals and working life.
- We apply an evolutionary system design cycle, which is more open to changes than a fully, structured top down design approach.
- We reshape existing functionality, and shape new ones, by intensive end-user involvement. The users are the experts of the group work. We apply interactive methods like workshops, meetings, group discussions etc. during the whole development process, instead of a theoretical requirement analysis at the beginning of the process.
- Methods and tools we use take into account that the users are partners and not research objects. I.e. methods and tools must be transparent for the users, approved by them, and must take ethical considerations into concern, e.g. data protection laws, right of informational self-determination, rules and etiquette of the working place, etc.
- We design the cooperative development process as a mutual learning process for users and developers to exchange experiences of design and work practice, and to enhance people's cognitive access to the changes.

Based on this approach, how did we proceed practically in the federal ministry? We started with discussions about CSCW for the government with external experts in this field to get a rich picture of the work practice and further aims in general. Based on this knowledge we developed semistructured guidelines to analyse the structures and workflows of the organization and the work practice of the users. Special points of interests were the individual organization of work and the use of office media, obvious office procedures, non-obvious office procedures, interaction partners, privacy aspects, requirements, expectations, hints, wishes, obstacles. Because in this case the number of participants was limited, we decided to talk with every user (19 persons, approximately two hours per interview, at their workplace) about their work before the introduction of the system. Although we wrote minutes to document the basic requirements, needs, or statements for the team of developers we did not apply a known office analysis methodology (e.g. Sirbu et al., 1984). We were interested in the narrative descriptions of the users about their workplace and work.

The risks of decontextualization of information, overemphasizing of the formal workflows, overestimating the users knowledge about the benefits or problems of a CSCW system theoretically without practical knowledge led us to the following approach: Each designer had to take part in the interaction process with the users and got a personal impression of the workplaces, the employees, and the employees' description of their work practice. Via these personal impressions developers could interpret written information more adequately and design based on the insights of the work practice. After this first interaction phases we did not try to represent all office procedures by formal models but designed some rich

scenarios of semistructured workflows like an incoming letter to a unit leader, a speech for the minister, or a registration process. We discussed these scenarios with the users in workshops and asked for the adequacy of the procedures, tested the appropriateness, and discussed the aspects the users required for reshaping work with the assistance of computers. The workshops are another important platform for the cooperative user/developer interaction in this project.

The technological platform

The platform required for our evaluation had to fulfil the basic functionality requirements identified in the design section. Furthermore, it was important that the platform provided a tailorable, programming interface which allowed modifications and extensions to its functionality and its usage as the platform for the realization of future POLITeam versions.

Our industrial project partner, VW-Gedas, contributed LinkWorks[1] which turned out to be a suitable basis for evaluation, as well as for realization of additional functionality, for the following reasons.

LinkWorks provides an open framework for the integration of various office applications. This aspect together with its availability on different hardware platforms, allows the integration into the already existing, and often heterogeneous, office environments that we have found at our application partners (Unix servers; Windows, OS/2 and Macintosh clients). Furthermore, its functionality can be tailored, to a certain extent, to the specific needs of a user group. This is possible without programming due to a graphical administration interface. Further functionality extensions can be realized using the APO (Applications plus Objects) interface which provides programmers access to the internals of the system.

Having described some underlying technical properties let us turn our view to the features which affect the user.

LinkWorks uses the "desk" metaphor. After a user has logged in, the system presents his personal desk, which is the same for every client machine to which a user logs in. The configuration, appearance and the default contents of the desk can be configured, either by the users themselves or by a system administrator, according to the requirements of the users. For the organization of the structure and content of the desktop the user is offered different filing facilities, e.g. cabinets, drawers, registers and folders. These are based on a configurable object model, making it easy to introduce new filing objects which apply metaphors from the pilot partners' office environment.

Communication and cooperation between users is supported by the provision of email, workflow, and shared container components.

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[1] LinkWorks™ is a groupware product by Digital

The workflow component allows the attachment of circulation slips to arbitrary LinkWorks objects, e.g. files or folders. The circulation slip describes the path for the attached object. Each user who receives the object can easily modify the circulation slip, which provides a flexible mechanism to react on new circumstances. In addition to the path description, users may add annotations, remarks and dates to the slip. If the circulation slip is attached to a container object, e.g. a folder, users can also add new objects, e.g. documents or spreadsheets, to the container. Thus, the transported content of a workflow can easily be modified. We adopted this functionality to create an electronic circulation folder object which models the behaviour of circulation folders, as known to our pilot partners. This allows us to evaluate the applicability of that concept within the pilot system.
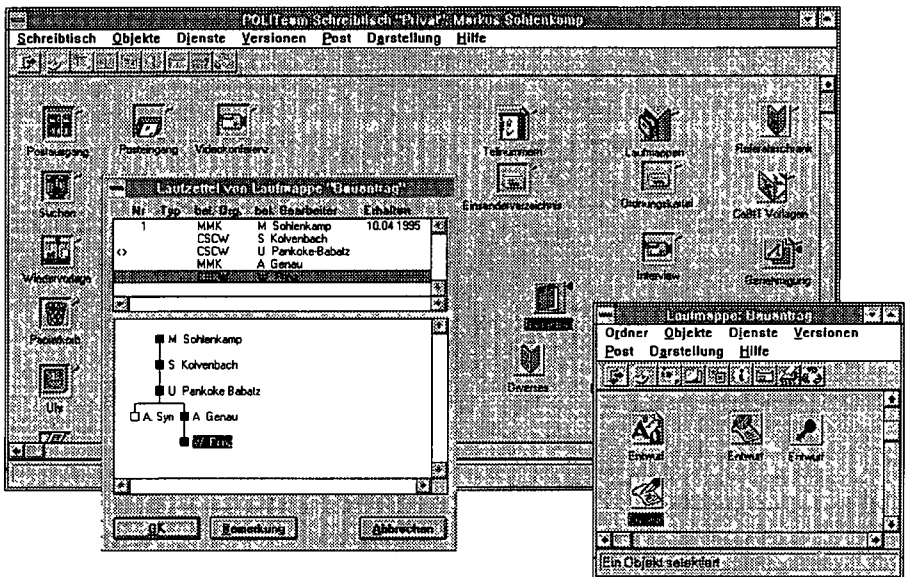

Fig. 3: The initial POLITeam desk, showing the contents of a circulation folder and the attached workflow

The shared container component enables the sharing of filing facilities among users. This provides an easy way of document exchange and group editing: every object put into a shared folder, for example, is visible to every person that has access to the folder. The system prevents concurrent document write access, but allows concurrent read accesses. To receive information about the actual work process, users are offered the opportunity to register interest in particular objects (filing facilities as well as documents) that they are interested in. The registered users get informed about changes that affect these objects. By these means

LinkWorks already provides a rudimentary form of awareness service, which however is inadequate to realize the goals described before.

This short description of LinkWorks gives only a little insight. What should have become clear is that LinkWorks provides the basic functionality for the goals of the future POLITeam system. Actually the complete functionality of LinkWorks had to be reduced for the first pilot phase to provide a comprehensible, easy to learn and easy to use system. This included the adaptation of the system to the terminology known by the users, the removal of unneeded functionality and the configuration of appropriate access rights. The first installation of the POLITeam system will include approximately 55 clients and 6 server components.

First Experiences and Impressions

Based on the results of our empirical work, we gained a deeper insight into the working procedures of our application partners and were able to make rich pictures about several aspects of the organizations, users, tasks, and their work practice.

A general problem we encountered were the elections for the new governments in Germany which took place between the start of the project and the installation of the system and resulted in the change of the relevant ministers and some of our pilot users. This had serious consequences for the organizations of our ministerial partners showing that extensive organizational changes may occur and that our system has to be flexible to be adapted to new situations.

In the following sections we concentrate on further experiences before and after the introduction of the system.

First impressions from the preparation of the system introduction

The interviews confirmed that German federal and state ministries are organized by rules and procedures that precisely describe how (paper)work has to be done, and who is responsible for each activity. On the other hand unwritten rules exist how those tasks have to be done, which do not fit into the general, prescribed scheme. Officially, we are dealing with strict hierarchies, assuming the Weberian, top-down model of bureaucracy. Informally we have to analyse the actual work practice· how things are really done. Consequently, systems have to match both requirements if they are supposed to be used in daily work.

Office procedures in the ministries involve a sophisticated use of paper, folders, colour pens, stamps, annotations, initials, and signatures. Furthermore, persons at higher hierarchical levels have to deal with large quantities of paper in a very short time every day. It will be difficult to develop computer applications which offer a similar functionality combined with the ease of use paper offers.

Accordingly, our current design approach proposes the use of pen-based computers, particularly for the support of managers.

When we discussed features of the system before its introduction, our ministerial pilot users considered shared workspaces to be not as important as circulation folders, since those are closer to the way of working they are used to. Interestingly, their opinion changed after the introduction of the system (see below).

The discussion of the event and notification service was always very lively and interesting. In reality, people walk from office to office in search for a folder, therefore almost everyone considered it very useful to be able to check the current location of a circulation folder. Interestingly, this was not a demand from the department leaders but from normal office clerks who are often asked for the current location and status of a folder. However, after it became clear that with the start version of POLITeam users can observe others without being noticed, their opinion about this functionality changed. In accordance with real life where the owners of requested folders are aware of their colleagues searching for the folders, our design approach for the next version of POLITeam is to notify the users about these searches. Other design approaches are based on the idea of negotiating the status and notification information that is visible and exchanged within a group (Wulf, 1995).

During the workshops one of the main factors for success or failure of our project turned out to be the solution of problems like secure procedures for routing, signing, annotating documents and the authorisation of documents. This was an aspect we had not considered to be of this importance at the beginning of the project.

Adapting the pilot system to the demands of the users required a deeper knowledge about the target organizations and the processes to be supported. It took more than six months to get acquainted to the organizations, to identify the final pilot users and to inform them about our project and to close the first phase of interviews.

Designing office procedure scenarios helped us to understand the application domain. Describing office procedures, and discussing them with the users involved in the procedures, gave furthermore a good opportunity to correct our view of the organization.

Our approach to involve all members of the POLITeam project in the interviews, giving them the chance to come personally into contact with our users, proved to be a valuable experience especially for the designers, allowing them a better understanding for the rationales behind a specific user requirement. The experiences reported in (Heinbokel, 1994) support this approach. In particular the knowledge gained from the interviews and workshops allows us to understand how the system should look in the following application domains:

- the organization of the electronic desk (e.g. organization of folders and tools, access to information services),
- organizational procedures (e.g. signing process, history mechanism informing about past actions),
- mail services,
- shared access to documents and folders (e.g. specific access rights),
- specific hardware/software demands (e.g. scanners, colour printers, extensions of the word processor).

This allowed us to configure a suitable start version for POLITeam I.

First impressions from practical use

The introduction of the system in one ministry began in February 1995 and was accompanied by a very intensive user service. Two members of our project team are permantly assigned to this service. This allows to have some continuity for the users. Their personal presence at the ministry - every day in the first week and once a week later on (the so-called " jour fixe") - turned out to be very useful. It allows us to gain an insight into the usage of the system and it allows our users to ask questions appearing during their daily work. Despite their qualified training, the users were not able to directly use the groupware functionality of the system for their daily work, since they had no experience in electronic group work. While our personal presence was very useful, an additional telephone hot-line was used only sparingly.

At the beginning we were asked to help arranging the users' work settings. They started on their own to establish several shared workspaces, where cooperation partners could deposit papers they work on jointly. Their first problems were "unpredictable" and "irreproducible" effects that happened to the objects in the shared folders. We could clarify that this was caused by the usage of the same object by another user and advised them to be very explicit and disciplined when using shared folders, as well as to negotiate the purpose and the handling of each shared folder among the cooperating partners. There are two important lessons we have learnt: First, a suitable event information service is crucial to efficiently work with shared folders. Second, although our users claimed to have no need for a shared workspace feature in the first interviews, it turned out that this functionality is heavily used for their daily work. This shows the difficulty of users to express their needs without having the possibility to actually experiment with the system.

Currently the groups of our pilot users are limited to small parts of the ministerial hierarchy. We expect further results when the user groups will grow and begin to span hierarchies.

Conclusions and Outlook

The initial design of the POLITeam system has been presented in this paper. This includes the electronic circulation folder and the shared workspace component which interact with an event and information service that aims to provide awareness about the ongoing affairs in the cooperative setting. In particular, the design of the last component requires more knowledge about the needed functionality, and about necessary constraints and limits. Our first experiences show that the integration of the coordination facilities into the personal working environment is more important than sophisticated coordination mechanisms themselves. We expect that this raises new requirements for the openness of interfaces to standard office applications, which go far beyond the usual cut and paste.

Future research will additionally focus on answering some basic questions: Does the new software influence work practices and organizations? To what extent do organizational changes in public organizations result from applying these techniques? And in more detail, reflecting the security and reliability focus of this project: How will coordinated document processing functionality be taken over by the users after learning about their advantages? How will authorizing procedures, based on electronic document processing facilities, be accepted in organizations?

We expect the following years to be very interesting but also involving great responsibility since we have to satisfy the current enthusiasm of our application partners.

Acknowledgements

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Authors list

Ludwin Fuchs
GMD - German National Research Center for Information Technology
FIT Institute
Schloß Birlinghoven
D-53757 Sankt Augustin
Phone: (+49) 2241 14 2721
Fax: (+49) 2241 14 2084
Email: ludwin.fuchs@gmd.de

Konrad Klöckner
GMD - German National Research Center for Information Technology
FIT Institute
Schloß Birlinghoven
D-53757 Sankt Augustin
Phone: (+49) 2241 14 2055
Fax: (+49) 2241 14 2084
Email: kloeckner@gmd.de

Sabine Kolvenbach
GMD - German National Research Center for Information Technology
FIT Institute
Schloß Birlinghoven
D-53757 Sankt Augustin
Phone· (+49) 2241 14 2721
Fax: (+49) 2241 14 2084
Email: kolvenbach@gmd.de

Peter Mambrey
GMD - German National Research Center for Information Technology
FIT Institute
Schloß Birlinghoven .
D-53757 Sankt Augustin
Phone: (+49) 2241 14 2710
Fax: (+49) 2241 14 2084
Email: mambrey@gmd.de