JPS - MEETING: A SCHEDULING WORKBENCH

Johannes Gärtner
Peter Purgathofer

Institut für Gestaltungs- und Wirkungsforschung
Technical University of Vienna
Argentinierstr. 8, 1040 Wien, Austria
Tel. - (1) 58801-4419
email: jgaertne@email.tuwien.ac.at
purg@iguwnext.tuwien.ac.at

ABSTRACT
Scheduling of meetings is an important task within organizational work.
Most approaches focus on technical aspects. We focus on how competent users actually go about their scheduling meeting within an organizational environment and how these *work practices* can be supported by computers. This approach developed during our work on computer aided shift work modeling.
Our main issue is that the following requirements are more important than pure scheduling techniques:

- Firstly, a broad range of ways of communication and coordination has to be supported;
- Secondly, a workbench of flexible scheduling techniques is necessary;
- Thirdly, the system has to fit into specific organizations and enhance established user practices.

We claim that scheduling systems will not be successful if they do not fulfill these requirements.
Based on these requirements, a prototype (JPS - **J**ohn's & **P**eter's **S**cheduling) for a meeting-scheduling system has been implemented. It's use is discussed in a specific example (´The Secretaries' Nightmare`) where we show the system's efficiency and effectiveness.
The fundamental advantages are:

- It works in a real organizational environment.
- Not everybody has to use electronic calendars and meeting systems;
- Effectiveness is maintained while keeping scheduling work to a minimum;
- Goal conflicts and hidden agendas can be handled.

KEYWORDS
Computer Aided Time Scheduling, Meeting Scheduling, Electronic Workbench, Information Management in "Fuzzy" Environment, Organizational Computing.

1) INTRODUCTION

From a technical point of view, scheduling of meetings is a task where resources (human beings, rooms etc.) have to be assigned to more or less discrete time frames. A number of different approaches to represent temporal relationships (e.g., Allen 1984, 1991) and to scheduling do exist (e.g., Fröschl 1991; Graves 1981).
In spite of the powerful technical methods of scheduling the success of meeting scheduling systems is not very impressing.

We chose a different approach, namely an organizational one: focusing on how people do their (scheduling) work. This approach was developed in the area of shift work modeling, and found work practice, organizations and politics to be crucial to the successful implementation of a supporting system (see Gärtner 1992).
Seeing users as competent practitioners in an organizational environment, we emphasize according to Greenbaum (1991) :
"... take work seriously ..." "...work tasks must be seen within their context and are therefore situated actions...; ... work is fundamentally social, involving extensive cooperation and communication."
Therefore, our first focus in designing a meeting scheduling system was to analyze the organizational environment and how meetings are scheduled by competent practitioners.

This approach is strongly supported by several analyses of scheduling systems in organizations of different domains.
E.g., Grudin (1989) describes different reasons for the failure of CSCW systems: especially on automatic meeting scheduling systems. He emphasizes the main reason for the failure: the fact that those persons who benefit from such a system are different from those who have to do additional work to maintain it. This causes poor maintenance of calendars by most users and the failure of scheduling systems.
Egger et al. (1992) analyzed the task of timing in a surgery clinic. She states that in this case:
"Given the high degree of temporal ambiguity and the existing of competing priorities, time management cannot be conceptualized as a pure scheduling problem."

In Gärtner (1992) the possible role of computer support in the development of shift rosters is analyzed. He discovered strong social and political limitations for a highly

automated system and proposes a concept of a workbench. This would enable the users to use their explicit, implicit and hidden knowledge. This is a concept also to be found in the area of production scheduling (e.g. Hsu 1993). McKay (1989) also stresses the important role of the human scheduler.

In this paper we will thoroughly analyze the organizational requirements and work practices of scheduling with respect to competent users. In doing this, our approach of focusing first on organizational and work practice requirements in the design of a scheduling system is exemplified[1]. This analysis leads to requirements for

- a broad range of ways to communicate;
- a workbench of flexible scheduling techniques;
- a system which fits into specific organizations and enhances established user practices.

We claim that scheduling systems will not have success if they do not meet these requirements.
Additionally we will present a prototype (JPS - **J**ohn's & **P**eter's **S**cheduling) for such a meeting scheduling system based on these requirements. This prototype and its advantages in a real world environment are discussed on the slightly modified example of ´The Secretaries' Nightmare`.
This prototype does not depend on the assumption that everyone uses electronic calendars and meeting systems. Work is kept to a minimum and goal conflicts as well as hidden agendas can be accommodated effectively and efficiently.

2) SCHEDULING OF MEETINGS: A LOOK AT THE ENVIRONMENT

In this chapter we will look at the environment where actors do their scheduling. We will then look further at the actors: their positions within the organization and their group memberships

The environment

Scheduling tasks may arise in different environments for example within organizations, between organizations and in private life (e.g., visiting relatives at Christmas time). Our focus is on organizations: We look at actors tackling scheduling tasks as members of said organizations.

Organizations as environments

Organization theory offers different kinds of useful approaches to analyze the scheduling tasks in this environment.
Perrow (1984, 1986) described a rather interesting to the scheduling task. In his risk analysis regarding organizations, he distinguished two independent dimensions: whether interactions are linear or complex, and whether coupling is loose or tight. E.g. in Table 1 rail transports are an example of organizations with (mostly) linear interactions but tight coupling. Universities on the other hand have rather complex interactions which are loosely coupled.

Coupling	Interact.: Linear	Interact.: complex
tight	rail & marine transp.	Chemical plants
loose	most-manufact. companies	R&D firms universities

TABLE 1: Examples of organizations with different interaction (linear, complex) and coupling (loose, tight).

The style of interaction and the degree of coupling has consequences on the centralization/decentralization of a company and by this to the scheduling focuses as exemplified in Table 2.

Coupl.	Interact.	
tight	linear	Centralized scheduling for tight coupling compatible with linear interaction.
tight	complex	Centralized scheduling for tight coupling. Decentralized scheduling to cope with unplanned interactions.
loose	linear	Centralized or decentralized scheduling possible.
loose	complex	Decentralized scheduling for complex interaction compatible with loose coupling.

TABLE 2: Different kinds of scheduling with respect to the style of interaction and the degree of coupling.

Whether one has to support centralized or decentralized scheduling makes a big difference to a scheduling system. Centralized scheduling makes it necessary to collect as much information as possible at the center, decisions have to be publicized. Decentralized scheduling makes it difficult or impossible to share all relevant information and makes a lot of coordination and communication necessary. Different scheduling systems or at least adaptation of a scheduling system to the specific organizational environment is necessary.

These different scheduling requirements for organizations describe the overall requirements. The needs of specific departments may differ (e.g., the R&D department of an chemical plant). Specific problems may arise when decentralized and centralized scheduling requirements have to be harmonized (e.g., SN: to schedule work and meetings between a task group for EINSTEIN™ [2]

[1] Examples marked as SN refer to the scheduling problem of ´The Secretaries' Nightmare`.

[2] Follow up to NEWTON™.

scheduled for the end of 1994 and researchers in the field of PSI-communication).

We concentrate on decentralized scheduling in organizations with loose coupling to exemplify the further analyses of requirements for meeting scheduling system(e.g., SN: all participants work in the software industry).

Position in an organization

The position of a person is relevant for the design of a scheduling system with respect to two features:

a) position in work and information flow;
b) power and control.

ad a) The person's position in work and information flow will differ with respect to his position within an organization. Different positions in work and information flow have to be considered in designing a scheduling system. This will be shown in chapter 3.

ad b) The person's position within an organization is, besides other aspects (e.g. expert power, referent power), an important source of power (compare Robey 1991). Powerful people can schedule their meetings in other ways than powerless people. As Schmied (1985) points out, power allows the owner to push through his requirements on time (e.g., SN: if Carl is an executive director of an important company and the others are technicians in smaller companies it is a difference).
Scheduling systems may be more or less suitable to push through one's own interests on scheduling (e.g. withholding information to the chief, getting information on the schedule of one's secretary).
A meeting scheduling system has to meet requirements of all its users when it is not possible to push through a concept by force. The latter is not as possible in most cases. (As Grudin (1989) pointed out, a redesign of jobs or hiring of other people will work only partially in cases of additional tools like meeting scheduling systems.)

Positions in organizations differ in power and in the way people are controlled. As Giddens (1984) pointed out, withholding information prevents people from loss of power and from sanctions as result of control. Therefore we have to be aware that in control situations people have an interest in keeping their individual scheduling data secret. This holds true also for competitive situations (inside and between organizations).

The withholding of information has important consequences for the design of a meeting scheduling system. In most cases we have to design systems, that give as little information as possible on one's own calendar to others. Only in cooperative structures, free of control and competition, can we give more information. In other cases - where information is made explicit by force - we have to expect counter strategies (e.g., filling the whole calendar, not using the calendar etc., extensive reservation strategies).

Working in groups

McGrath (1990) discusses temporal features of groups and how they are affected by technological tools. He points out that:

Individuals are partially nested within the groups of which they are members .... Groups are partially nested and loosely coupled systems.

Nesting refers to the fact that every person is a member of different groups with complex relationships. Different groups may be overlapping (e.g., SN: Carl is a member of task force "Gödel" and task force "Einstein"; every Friday he has lunch with Steve and Eve) and may include each other (e.g., SN: Carl is a member of department communication within the company "Relativity Products"). Coupling of a group refers to the interrelationship between the members of a group which may differ from one group to another (e.g., SN: Carl is facilitator of group "Gödel", member of group "Einstein").

In order to make meeting scheduling systems efficient and effective, they have to be designed for the requirements with respect to very different groups.

These groups may further be different in their scheduling methods. We have to be aware that stable groups, with well established working and scheduling methods may differ from one another and from groups that have just started their work. (E.g., some groups fix their next meeting date at the end of a meeting. In other groups meetings are scheduled by a specific person.)

3) SCHEDULING OF MEETINGS - HOW TO DO IT EFFECTIVELY

In this chapter we look at the task of meeting scheduling and how it is done in practice. This includes the aim of avoiding scheduling work as much as possible, different ways of using calendars, work relating to a meeting and the communication infrastructure.

Minimax

Many meetings are fixed by entrained social practices e.g. jour fix. In some cases it is sufficient to propose one or a few dates (because of the priority of a meeting or because of luck with the proposed schedule). In other cases a more or less complex discussion over date and time is necessary. If things get complicated, a discussion on the way the group fixes a meeting date has to be started, which makes personal communication necessary.
Different levels of communication and coordination have to be supported. An automation of such meta-communication is in most cases rather complex and not

efficient (it would be necessary to define and maintain a huge bulk of rules and priorities).
This leads to the design requirement that when a solution can't be found easily the meeting support system should also support the establishing of other, more direct ways of communication. (E.g., when it is not possible to find a fitting meeting date, try to find a time where a telephone conference could take place.)

Individual electronic calendars & communication tools

Not every person uses electronic calendars. Some do it partially, some do it religiously. The same holds true for electronic communication tools. As discussed previously, people have to fix meetings in many nested groups. The system has to take different ways of possible coordination into account.

Furthermore even users of electronic calendars will not always make their calendar accessible to others (e.g., in general we won't give any access to others). But there are exceptions: In some cases it is already a practice to make them accessible (e.g., the calendar of a manager to his/her secretary). In other cases a meeting has such a high priority that it overrules nearly everything (e.g., my executive director wants to meet me to discuss my impressive results in designing scheduling systems).
The system should allow differentiations and rules of accessibility but it won't be efficient and effective to define rules for every date and all possible accessors.

This means that a meeting scheduling system has to take into account that everything between open and closed, different priority rules, partial access, group related rights etc., should be possible.

Scheduling meetings: related work

In many cases only the date of a meeting has to be fixed, as all necessary resources are already in place (e.g., a meeting in my room). In other cases, resources (over-head, projection etc.) have to be checked as well. The meeting scheduling system should support such work as far as it is convenient.
If resources make up the most important part in the scheduling, one has to use alternative, more specific approaches (e.g., scheduling of experiments with scarce resources like a super-computer for visual demonstration).

Integration into the existing work and communication environment

It is crucial to a meeting scheduling system that it is integrated in the existing work flow and communication environment to avoid extra-work. The meeting scheduling system has to be integrated into e.g.,

- one's (personal and organizational) address and project system;
- the electronic communication system;
- the telephone system;
- the room reservation system.

4) RÉSUMÉ OF REQUIREMENTS FOR OUR PROTOTYPE: JPS

Assumptions on the environment for our prototype:

- Scheduling meetings for work in organizations;
- Organization with loose coupling and decentralized scheduling;
- Power does not play a very important role.

Design requirements

- Position, power and individual preferences lead to different requirements: an acceptable balance has to be found;
- Withhold as much information on individual calendar data as possible;
- Requirements have to meet very different groups. These groups differ in their scheduling methods;
- Support different practices of meeting scheduling;
- Support different ways of communication (eventually parallel);
- Support work around the meeting as far as it is convenient under the specific organizational environment;
- Start with easy proposals for meetings and allow a shift to metacommunication;
- Integration of the scheduling system into address, project and communication system.

Design Meta-requirements

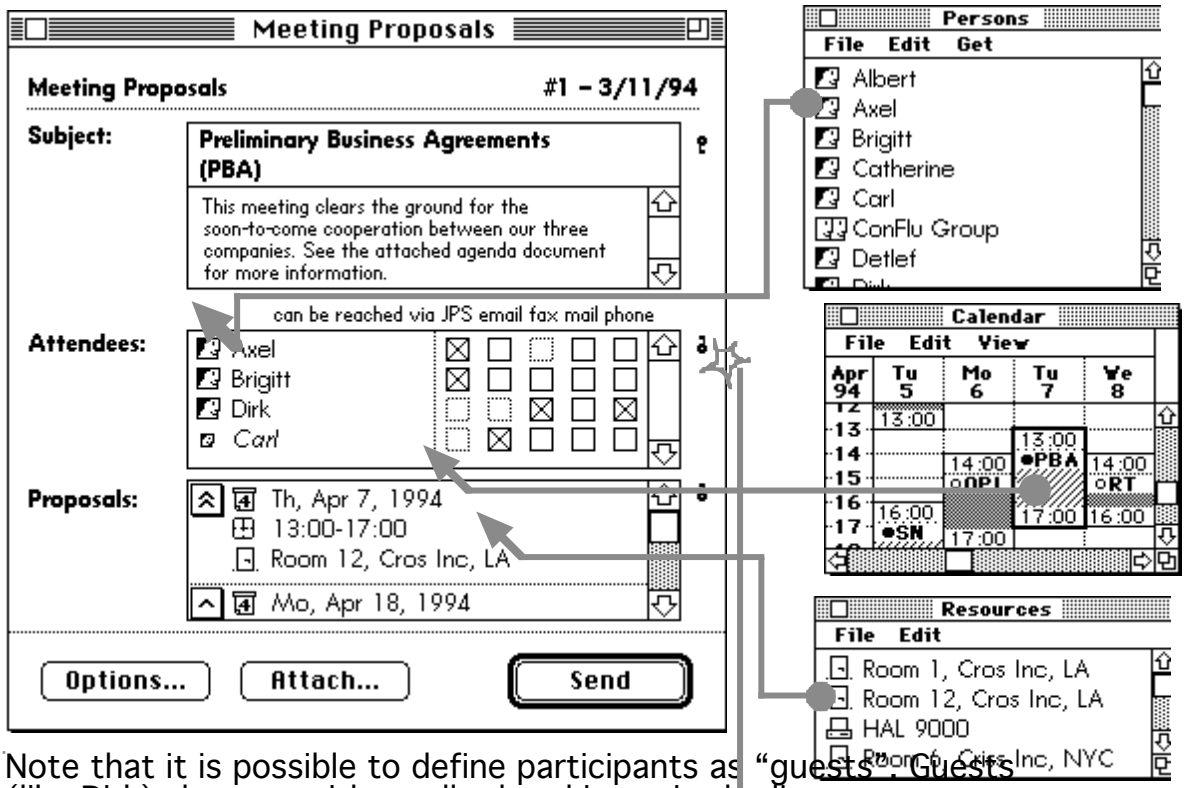
- Allow adaptation of the system to specific requirements and their changes;
- Support communication in as many different ways as possible

5) THE JPS PROTOTYPE

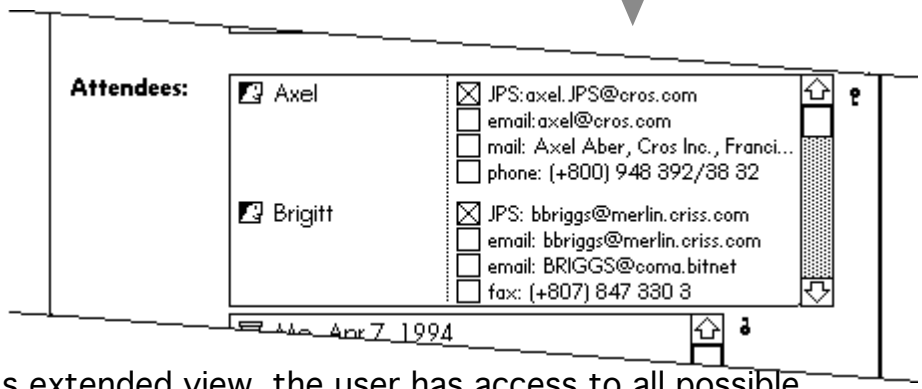
Based on the requirements laid out in chapter 2 and chapter 3 we developed a prototype (JPS) for a meeting scheduling system. It's use and it's basic features are shown in Figure 1 and Figure 2, that are based on the scheduling example ´The Secretaries' Nightmare`.

To assemble a proposal, the user fills a form. The subject and a short abstract a
proposals are dragged from various palettes:

- a person palette that allows connections to various sources (e.g. databases)
- a calender, that Axel can set up to show his appointments in different ways (
- a resources palette that could be connected to a resource management syste

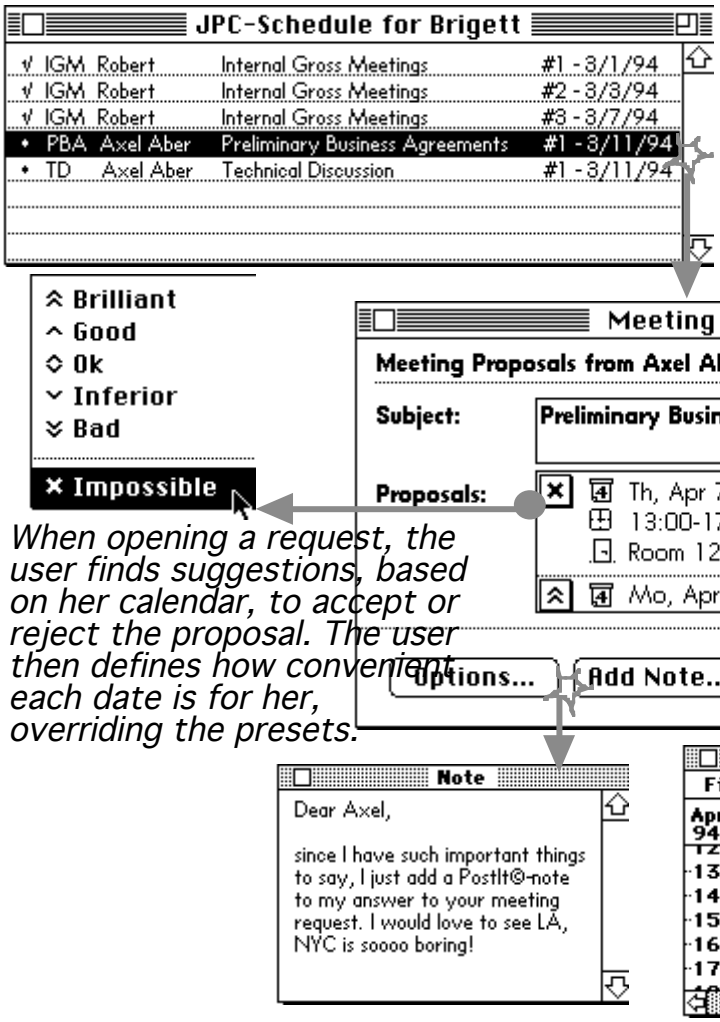


Note that it is possible to define participants as "guests". Guests (like Dirk) show up with smaller head icons in the list.



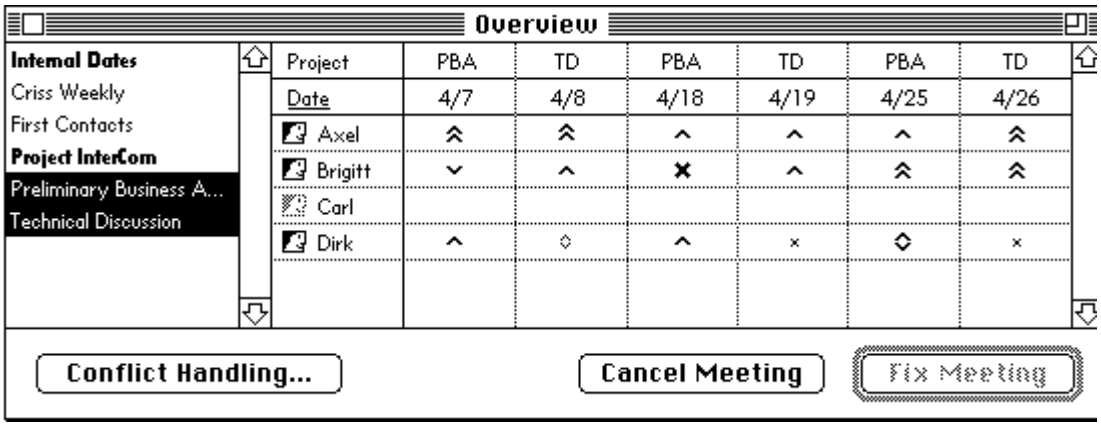
In this extended view, the user has access to all possible channels through which the attendees can be reached. This is especially useful when a person has different addresses of one kind (e.g. email addresses) in different locations or at different times.

Fig. 1: Basic workbench elemen



This window shows an overvie incoming proposals from other users. By opening one of them easily match the proposals wit personal appointments, judge and find the degree of conven to accept the date. If conflicts user can either move her date proposal.

When opening a request, the user finds suggestions, based on her calendar, to accept or reject the proposal. The user then defines how convenient each date is for her, overriding the presets.



This window shows a chart of all received answers to two proposals. The user the left side and selects one or more to view them. The proposals then show selectable row title (here "Date"). In this case, Axel, Brigitt and Dirk have alre response is still to come.
Participants that are guests to a certain proposal can be identified by the size

Fig. 2: Some interaction element

6) SOLVING „SECRETARIES' NIGHTMARE" WITH JPS

Starting the scheduling...

Meeting scheduling in JPS requires that one person, probably one of the participants, takes over the role of organizer/coordinator of the scheduling process. In our example Alex (or maybe his secretary) initiates the meeting by sending out proposals for possible meeting dates to Brigitt, Carl and Dirk. While in some cases the coordinator suggests dates according to her possibilities, she might in other cases gather these dates from the participants or by checking the availability of resources.

After dragging the persons, dates and locations for the request from several palettes into the proposal form and typing in a title and a short abstract (Fig. 1, top), Alex also attaches a document containing the agenda of the meeting. He also prioritizes each date to show his degree of convenience with the separate proposals.

Sending the messages...

The system supports him by automatically suggesting the most effective way to reach the participants. These settings can be overridden by Alex (Fig. 1, bottom), for example he knows that the fax to Dirk might get lost because of an inefficient deliverance structure of messages in Dirk's company. JPS then sends out all requests to other JPS users directly. JPS also sends out email and fax messages, and prints out letters (and envelopes, if possible). For participants that can only be reached via phone the initiator gets reminded to make the calls via a user selectable channel (printed notes, email, JPS-alarms, etc).

The participants answer...

Each of the invited individuals receives the message via his/her preferred channel. If he/she can use JPS, then the interaction could take place in the way shown in Fig. 2 (top). In this case, the first proposal conflicts with a date Brigitt already has fixed, but she can move the conflicting date without a problem so that she is available.

Furthermore, all collaborators add their personal rating to each of the proposals, showing how convenient each date would be for them to participate. They all send back answers (through various channels) that are collected by Alex's JPS-System (either automatically or entered manually by Alex or his secretary) and presented to Alex (Fig 2, bottom). Alex can instruct the system to notify him at certain times that answers are still missing and/or to send out reminders automatically. He can at any time see the status of the planning, how many participants have answered his request(s), and how their decisions are. Additionally, he can see an overview over the status of different meetings, sorted by various aspects (e.g. time, projects, missing answers, participants)

The next steps...

Based on the information on this table, Alex decides what action to take. If a perfect date is obvious, Alex can fix it: the system then sends out all necessary messages comparable to the original request. Otherwise, Alex can choose between several possible conflict handling strategies. He can:

- contact individual collaborators
- send out additional date proposals, messages or other additions (like supplements to the agenda)
- invoke an email conference (in that case the JPS system could take over the part of the mailing list server) or a telephone conference
- ask the participants of other meetings for a general rescheduling of their date
- cancel the meeting (in the worst case)

Summary

In this way, a scheduling process is invoked that very much takes individual structures and personal problems into account. The participants probably never get the feeling that a computer system takes over their date scheduling and they don't have to accomplish the equally difficult and exhausting task of prioritizing their calendars. Furthermore, this system supports the back-formation of tayloristic division of labor into a more holistic workplace.

7) ANSWERING THE QUESTIONS

1. What part of the problem does your approach help with and how?

The most obvious thing about our approach is that it's problem solving power comes from the support of established human problem solving structures. Thus most of the problems will be solved by the participants themselves, but with minimized time/energy needed and relieving the participants from routine work. The workbench-approach increases the users efficiency and effectiveness drastically.

2. Which functions are distributed and which are centralized?

At first only the function of the coordinator is centralized. Even this function can be taken over by any of the participants, and can be assigned in a democratic process. It is not determined by the system. There is no limitation on the participants to start individual communication threads (even using JPS) or to invite additional guests and send out more date proposals. The degree of centralization will vary from case to case if for example an email

conference is invoked. In these cases, the JPS program of the coordinator takes over more and more central coordination functions.

3. What other tools and methodologies do you presume?

The availability of appropriate hardware like a fax modem or a printer with different trays (for printing letters and envelopes) will help the users to interact in a more continuos way. Internet access would be of great help, if the planning exceeds a local network.

Other than these trivial requirements, no additional tools or methodologies are needed. Due to the simple basic structure of JPS, interfaces to other systems can be implemented easily.

4. Do you allow heterogeneous agents, such as different calendar systems, to participate? What changes are required to the systems?

It is possible to implement JPS in a way so that interface modules to other electronic calendar systems can be added. This would enable users to stick with their conventional scheduling methods and would not impose any changes to existing systems.

In this way, JPS is open to communication with other systems, but causes problems for highly automated systems, because all decisions concerning meetings are made by the user (with possible exceptions).

5. What messages, or kinds of messages, are exchanged between your agents?

All messages are transparent. There are no additional messages other that those initiated by the coordinator or a participant.

6. Why is your approach better than email between people? Between systems?

Email requires a lot of temporal coordination to take place. Like with any asynchronous communication, conflict handling can use up an overwhelming amount of time or energy. JPS takes a lot of this overhead from the participants and lets them concentrate on the main task: finding a perfect date for a meeting.

Furthermore, not all people can be reached via email.

8) MODIFICATION'S AND QUESTIONS TO ´THE SECRETARIES' NIGHTMARE`

Several aspects of the scenario and of it's possible "real world" solutions are not touched by the definition. They show in a dramatic way the difficulties with approaches that take control from the individuals. In the following we enlisted some of these points for discussion in the workshop.

• "Secretaries' Nightmare"

Practice shows that in a case like this only the first few interactions would be delegated to the secretaries. After encountering major problems, especially under time pressure, participants often take over the scheduling, yielding in a metacommunicative process that most effectively solves all problems in a relatively short time. Scheduling tasks can be a nightmare for secretaries, but this problem presumably would not.

• "...must be scheduled on weekdays..."

With respect to the importance of the meeting and the problems to fix it, it is plausible to assume that the participants could agree to meet on or overlapping a weekend. This furthermore would open the possibility to connect private interests with the travel.

• "...travel should be minimized..."

The special conditions and the significance of the meeting suggest that this aspect is minor. Furthermore, neither the other travel activity of any member (maybe Dirk is in New York during the second week of April?) nor private interests (Brigitt's mother lives in Austin) are taken into account.

• Who is in charge for coordination?

The scenario is rather unusual regarding the coordination of the meeting. In most real-world settings, one person would be delegated to arrange everything for the meeting, including the scheduling of the meeting date.

9) CONCLUSION

In contrast to straight technical approaches to meeting scheduling we focused on organizational issues and work practices at the beginning of our analyses. We exemplified this approach by an analysis of loosely coupled organizations and found significantly different modes of communication and problem solving to be involved in the process. We also found that individual strategies for resolving complications differ depending on the situation, the style of interaction and personal preferences.

Based on these results we formulated the following requirements:

- Firstly, a broad range of ways of communication and coordination has to be supported;
- Secondly, a workbench of flexible scheduling techniques is necessary;
- Thirdly, the system has to fit into specific organizations and enhance established user practices.

We implemented a prototype (JPS - **J**ohn's & **P**eter's **S**cheduling) for a meeting scheduling system according to

these requirements and discussed it's use in a specific example (´The Secretaries' Nightmare`). The fundamental advantages of JPS are:

- It works in a real organizational environment.
- Not everybody has to use electronic calendars and meeting systems;
- Effectiveness is maintained while keeping scheduling work to a minimum;
- Goal conflicts and hidden agendas can be handled.

This knowledge is a valuable base for any system that tries to support scheduling activities. It opens further research in two areas:

- Firstly, research on time planning practices and requirements;
- Secondly, research on building systems that support human problem solving strategies based on a human centered perspective of social computer use.

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