

A Team Collaboration Space Supporting Capture and Access of Virtual Meetings

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ABSTRACT

In this paper, we address the design issues of a collaborative workspace system, called TeamSpace, that supports geographically distributed teams by managing shared work processes and maintaining shared artifacts in a project. TeamSpace attempts to integrate both synchronous and asynchronous types of team interaction into a task-oriented environment. Since meetings are an integral part of teamwork, our current work focuses on supporting virtual meetings as part of a larger collaborative work process. We present an initial TeamSpace prototype that supports asynchronous meeting management seamlessly integrated with capture and access of synchronous distributed meetings. The captured synchronous data is integrated with other related information in TeamSpace, enabling users to efficiently gain knowledge of both current and past team activities.

Keywords

Team collaboration, virtual meetings, collaborative workspaces, capture and access, collaborative activities, teamwork.

1. INTRODUCTION

Teamwork is an integral part of today's work environment as much more can be achieved from the coordinated contributions of people with diverse backgrounds and resources than from those same people working independently. This is especially true for the development of complex systems that require a large work breakdown structure, such as aircraft and other aerospace systems. More and more, large development projects consist of people from different companies at different geographical locations, which makes the coordination of team activities difficult because of reduced team cohesion and limited awareness of team

members' activities. Computer support for distributed teams has focused on either improving communication in synchronous distributed meetings or on providing tools to facilitate distributed asynchronous collaboration, but not both. Today, teams are typically using a set of disjoint tools to accomplish their work, which entails redundancy and unnatural breaks in the workflow.

Boeing and IBM are jointly developing a framework and prototype, called TeamSpace, to support spatially distributed teamwork in a more holistic and integrated manner ([7], [14]). TeamSpace attempts to combine various collaboration technologies into a user-centric system that is integrated into the work process of team members. TeamSpace can be described as a task-oriented collaborative workspace system for managing shared work processes and maintaining shared artifacts in a project typically spanning months or years. It covers both synchronous and asynchronous cross-company team activities and provides a seamless transition between different work modes of team members

Meetings are a crucial communication and coordination activity of teams. While computer support for distributed conferences has been investigated, meetings involve much more than the synchronous act of discussion. Meetings relate to all of the various activities of a team, from reporting and scheduling tasks, to raising and debating issues, to reviewing documents. TeamSpace supports distributed meetings as part of a larger collaborative work process. We are doing this by providing capture, integration and access capabilities for distributed meetings. Captured synchronous information is integrated with other related information in TeamSpace, enabling users to efficiently gain knowledge of both current and past team activities.

This paper emphasizes the major design issues of TeamSpace and then focuses on the virtual meeting support in our initial TeamSpace prototype. We motivate the use of meeting capture along with some design features by sketching some usage scenarios. We then present the current TeamSpace prototype, where our focus is on time-based capture and access of virtual meetings. We have developed a general-purpose access interface to the captured material. The access interface allows browsing and searching the meeting records by using a multi-scale time slider

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that indicates points of interests, or significant events, in the meeting. Finally, we report on first experiences in using this system for our own distributed project meetings.

2. DESIGN CONSIDERATIONS

Existing team support environments either focus on supporting asynchronous team activities and project management or on synchronous communication support (distributed conferencing). TeamSpace attempts to apply an approach that is more integrated with the way people work.

As part of a long-term program in computer-supported cooperative work, Boeing has conducted observational studies and interviews over several years of teams developing large complex systems ([12], [13]). Our design considerations for TeamSpace are based upon these studies.

The teams observed spent the majority of their work time performing articulation work [19] to coordinate their work with the contributions of other members of their own team and with other teams. Interestingly, team members rarely viewed articulation work as their primary work activity but as a necessary but uninteresting facet of large system development, and one that they did not learn in their university engineering classes. These observations indicate that a teamwork technology must fully support team articulation work while being integrated with the remainder of the work environment [18].

2.1 Managing Articulation Information

Articulation work has formal and informal components. Every team produces and maintains a formal information collection that describes their work and its progress. This collection includes, for instance, a statement of work, a work breakdown structure, schedules, status reports, specifications, designs, analyses, action items, agendas, test plans, and other documents. An environment for teams should support creation, maintenance, sharing, and access to articulation information (articulation objects).

2.2 Support of Different Work Modes

The informal components of articulation work are a result of ongoing interactions within the team, and they occur as team members shift between three work modes [12]. In the *individual mode*, team members work alone at a computer using specialized tools of their engineering discipline or using general office products to capture information on their work. They usually describe the individual mode as the “real work”. At regularly scheduled times, all team members gather in a meeting room for work performed in a *meeting mode*. The primary activity in these meetings is to review their progress with respect to their schedule, identify any problems in meeting the schedule, and devise solutions to these problems. They also may hear presentations from other teams performing related work. Both the individual and meeting modes are often interrupted for work performed in a *social mode* in which two or more people talk informally. We believe that it is mandatory for a teamwork environment to support these three work modes and to provide a seamless transition from one work mode to the other. This often implies switching between asynchronous and synchronous types of collaboration. Most existing team support tools or systems do not support this workflow. Note that shifting between these modes is frequent and relatively easy for a physically collocated group while it is a challenge for distributed teams.

2.3 Task-oriented Environment

The activities people perform depend on their current work mode: When working alone at their desks, they perform different tasks than when they are attending a meeting. The tools and information they use also depend on the current work mode. When working in social mode, for example, synchronous interactions such as voice conversations gain in importance. Based on the Boeing team studies ([6], [12], [13]), we organized some common articulation tasks performed by teams and the dependence of these tasks on work modes, summarized in Figure 1.

We categorized the tasks as *work-related*, *meeting-related*, or

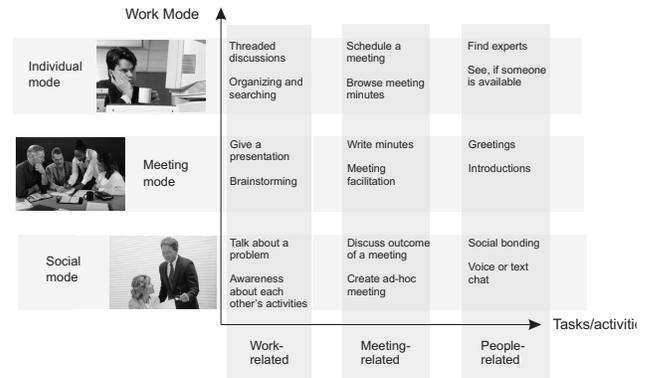


Figure 1. Tasks and work modes

people-related. Although these three task categories appear to have a one-to-one relationship with the three modes, Figure 1 shows that people perform some work from each category in other modes. Consider meeting-related tasks, for example. People work in individual mode to plan meetings, prepare an agenda, or revisit minutes from a past meeting. During a meeting, the tasks might include meeting facilitation, engaging in a discussion, or note-taking. An environment for distributed teams should be task-oriented, i.e. the shared workspace should adapt the supported tasks to the current work mode of the team member.

2.4 Awareness and Communication

Informal articulation work benefits from being physically collocated since team members working in the same physical space are continuously aware of the work activities in progress, and they frequently consult with one another about details of the work. At Boeing, one team leader noted the value in being able to see his team members from his desk. If he wanted to speak to someone, he could see at a glance whether they were absent or occupied. Moreover, in earlier days, everyone would have readily seen the team’s progress as designs evolved on drafting tables and physical models were constructed. Today, the designs and models are all digital and greater effort is required to maintain awareness of progress. Awareness cues embedded within the formal articulation work could extend awareness of this progress. An environment for geographically distributed teams should provide awareness of the activities of other team members, facilitate communication with available team members, and provide awareness about the status of formal articulation information.

2.5 Ubiquitous Access

Articulation work does not just take place in the office at the desktop or in a computer-equipped meeting room. Thus, a

technology to support distributed teams in their articulation work has to be ubiquitous. We strongly believe that using mobile handheld devices in a distributed team environment can leverage efficiency of team members. The key to highly efficient teamwork is continuous awareness of each other's activities and timely communication, which is relatively easy to achieve for physically collocated teams. While computer-support for virtually collocated teams can provide awareness functions to remote team members, these functions are mostly limited to the desktop, which makes them inefficient in many situations. Hence, being connected everywhere and anytime using pervasive devices will tremendously increase awareness of team activities, team communication, and thus, team cohesion (see previous Section).

Using the mobile device as a Smartcard will also facilitate switching between different work modes. When entering a meeting room, team members will be automatically logged into the ongoing meeting session. When entering their office, people are automatically logged onto the TeamSpace workspace on their desktop computer. During an ongoing meeting, handheld devices can be used to increase interactivity through messaging, voting, feedback tools, or simply for note-taking or book marking points of interest in the meeting.

Mobile devices can also be used as a means of opportunistic communication, i.e. documents or topics that team members would like to discuss with other members are carried on the handheld and an alarm is triggered when the related people are coming close to the device. For a more detailed description of our efforts in integrating mobile devices into TeamSpace see [4].

2.6 Time-based Information Capture and Access

Teams usually document their work and status by means of formal articulation components (articulation objects) such as work breakdown structures, agendas, action items, or specifications. If stored digitally, these data are usually structured hierarchically by categories. This collection of formal articulation objects is used, for instance, to communicate information between work groups and to orient new project members. However, most of the informal articulation work occurring in the meeting mode or in the social mode is not captured. We believe that a teamwork environment should support collecting all the collaborative activities occurring during the lifetime of a project. This includes the capture of virtual meetings, which are a crucial portion of teamwork. The captured material combined with the formal articulation information can then be accessed and visualized so that users are provided a more efficient way of gaining knowledge of current and past team activities.

All the gathered information and the captured material have in common the dimension of time. Therefore, in addition to accessing the material hierarchically by categories, a team environment should also provide a time-based structure of the workspace. The notion of time as an access criterion can be very powerful for browsing and finding information. This approach is motivated by cognitive psychology research in episodic memory, our memory of life experiences. In contrast to the information in semantic memory (which might be compared with a dictionary), episodic memory allows us to reconstruct sequences of events that have occurred in the past [22]. When asked to describe a project's work during a given time frame, team members structure their

responses in terms of well-known scripts or templates, such as a formal development process consisting of different phases. If asked for more detail about the work within a phase, people decompose the phase into finer-grained episodes. Teams also adopt idiosyncratic temporal markers, such as before and after Jim joined the project or after a critical design review.

In order to gain a better understanding of how the captured material, especially virtual meetings, is going to be used and accessed, we have identified five different user groups that benefit from the captured information. These groups differ in the tasks they do and in the amount of contextual knowledge they have.

- *Participated.* Participants of collaborative activities, such as virtual meetings, have much knowledge about who, what, and when things occurred. However, their knowledge may not be perfect and they do not remember all of the details. The main task of this group is to review something they or others said, for instance, to aid in writing a report or completing an action item. This group is likely to review more recent activities.
- *Not participated.* People who did not attend the meeting, but are active project members, also have much knowledge about the project activities. Their main task is to review or catch up on something others did or said. Even though they were not present, they usually have a good idea of what they are looking for and where to find it. They are also likely to review recent activities.
- *Long-term.* Long-term reviewers have significant knowledge about the project, but little about particular activities and when they occurred because they happened a while ago or over a period of time. Their main goal is to find detailed information, such as why a decision was made, how something was implemented, and who the experts or responsible persons are.
- *New Person.* New project members have little knowledge about the project. They are looking for high-level information and summaries in order to understand the structure of the project and its people. They are also looking for experts and may wish to delve into details as they learn more about the project. Thus, their main goal is to catch up with the current standing of the project.
- *Historical.* Historical reviewers have little knowledge about the project. Their goal is to examine process-related progress and decisions. Thus, their tasks will focus less on project-related details and more on patterns of behavior, decisions and rationale.

These five user groups differ in contextual knowledge and in the time horizon they are looking at. In general, the more contextual knowledge users have and the more short-term their reviewing horizon is, the more they will need flexible, yet detailed browsing and search mechanisms. The less their contextual knowledge is and the more long-term their reviewing horizon is, the more they will need structural and summarization information.

While the act of capturing virtual meetings and other related team information is not of a collaborative nature per se, capturing and accessing material as part of the workflow can aid collaboration. Team members can participate more fully in discussions when they can rely on the capture system to remember the details should they forget. Additionally, members who did not participate in

activities can review the captured material, reducing the amount of articulation that is required from the rest of the team.

3. VIRTUAL MEETING SUPPORT IN TEAMSPACE

Since meetings are a crucial part of teamwork, we decided to focus our initial work in the TeamSpace project on developing a prototype that supports virtual meetings. The TeamSpace prototype basically provides capture and access functionality of virtual meetings but also partly supports some of the other design issues presented in the previous section, such as providing a basic set of articulation objects and shifting between different work modes. We also took great care in developing a mostly web-based system since this is crucial for enabling cross-company collaboration, i.e. overcoming the cross-firewall connectivity barrier. Our current research efforts emphasize capture and access in such an environment and we are investigating the usefulness of captured material, e.g. how the user groups previously described can best be supported and what the appropriate visualizations and browsing paradigms are for the captured material.

The following scenarios try to motivate our research, highlighting how captured meeting information can be used, along with the features that we would like the TeamSpace meeting environment to support:

Bill, the team lead, prepares for a weekly status meeting planned the next day. He checks the meeting information in TeamSpace to make sure the rooms are scheduled and adds a few guest participants. Opening last week's meeting, he checks to see if any agenda items were not discussed and copies them to this week's meeting. He also checks which action items generated discussion last week, and adds those as well. Finally, he adds a small presentation he has prepared for the meeting.

The following day, team members in Seattle gather in their conference room. Mary, the meeting facilitator arrives a few minutes early to log into TeamSpace and start the meeting. Meanwhile, team members in other locations enter the virtual meeting from their desktop browsers. After team members greet one another and chat for a few minutes, Mary opens the meeting agenda to start. She adds any new items proposed by the team. Pushing the agenda aside, she opens the action item log to get an update on each of the unfinished tasks. As each team member lists their progress, Mary updates the item list, marking off items, changing items, and adding new action items. She also opens the master schedule to determine if any of the unfinished items will delay upcoming milestones.

The next item on the agenda is a presentation by Bill about an interface problem just discovered between their component and another component. Bill opens the presentation and explains the problem. Working at her desktop in St. Louis, Sally circles a region on one of the components and notes some of the manufacturing constraints that influenced its design. Also from his desktop, Jim draws a sketch to explain the reason for these constraints. All of these annotations are automatically saved and attached to the presentation.

The presentation spawns a brainstorming session for solutions. The team sketches their ideas on an electronic whiteboard, with distributed team members drawing at their desktops. The team is split between two different solutions and needs more data to

resolve uncertainties. Mary assigns two subteams the responsibility for investigating these in more depth.

Pat and Jim meet later that day as a subteam investigating one of the proposed solutions. During their meeting, which they also capture, they try and recall a contact Sally mentioned during the earlier meeting. They open up the meeting and browse through it by using a timeline that indicates the spots where Sally was talking. They easily find and replay the portion where Sally was sketching on the components and hear her mention her co-worker Dave. The group looks up Dave's contact information and gives him a call. They explain their problem and ask Dave if he has a few minutes to answer their questions. Dave joins their meeting from his desktop computer and adds his own sketches about the component interface they are discussing. Later, Pat emails Chris, a member of the other subteam, to let him know that their conversation with Dave could be useful for him.

Chris had to leave the weekly status meeting early. Before he meets with the rest of his subteam, he returns to the meeting records to listen to the portions he missed. He skims the meeting with a time slider by jumping from one agenda item to the next. Then he dives into Bill's presentation, using a thumbnail navigation, to replay the portion of the presentation where the group talked about the manufacturing constraints. Later on, during the meeting with his subteam, Chris replays the comments Dave made to Pat and Jim.

One year later, Bill is leading a team that runs into a similar component interface problem. He asks Harry, one of his team members, to look at the problem the old project had, and why they chose their solution. Harry reads the documentation, accesses the meeting records and replays pieces of the various discussions by the subgroups, and prepares a presentation using some of the older material to present his findings.

These scenarios demonstrate how a user might shift between the various tasks and work modes of Figure 1. Users should have support for each of the different modes of meeting-related activities, as well as be able to perform work-, meeting-, and people-related activities while in a meeting. While our current prototype does not provide all of the features highlighted in the scenarios, we do provide most of the meeting preparation, meeting participation, and short-term reviewing capabilities mentioned above.

4. TEAMSPACE PROTOTYPE SYSTEM

The TeamSpace prototype we have developed consists of a TeamSpace server that is accessed with a standard Web browser, a conferencing client for conducting and capturing virtual meetings and an access component for the captured material called MeetingViewer. A more detailed description of the system architecture can be found in [7] and [16].

4.1 Web Interface

The Web interface is the standard entry point into the system. It is used to perform user authentication and to create, edit, share, and delete persistent articulation objects. TeamSpace currently supports the following basic set of objects: Meetings, Action Items, Agendas, Presentations, and Users. The Web interface also provides access to ongoing synchronous meetings and to the meeting records of completed and captured meetings. A graphical room map indicating other team members' activities facilitates easy switching from individual, asynchronous types of work to

synchronous meetings or social interactions and enhances team awareness. Figure 2 shows the TeamSpace Web interface.

The main control area is tab-organized, allowing users to manage their project activities in work-centered environments (1). Currently we have identified meetings, document management, task management, people and project management. The meeting environment provides access to all meeting-related information: Meetings can be created, edited, scheduled, reviewed, and joined. The document environment allows users to author, share, and manage semi-structured documents, such as text documents. The task environment provides access to the user's action items, and allows tracking and assigning of action items. The people tab contains all the tasks related to user administration. Since our focus is on virtual meetings, we will confine our subsequent discussion to the meeting environment.

Below the main control tabs is a resizable general display area that is divided between a list view (2) and a document view (3). The list view is used to search and retrieve lists of objects. The document view provides a display and input area for documents or arbitrary content. Meta information for the selected objects is displayed in (4).

The lower left side (5) contains a graphical representation of user activities displayed on a two-dimensional room map. The room map shows the current status of users (active, busy, inactive, connected, disconnected) and gives an indication of which mode users are working in. Thus, it provides a very basic awareness function. In addition, the rooms automatically establish a chat communication channel and are integrated with the TeamSpace communicator (6). Whenever a user enters a room, she can see live images of other users who are in the same room in the TeamSpace Communicator. The images are captured at a very low frame rate (approximately one frame per minute) to restrict the demands on bandwidth. But they are sufficient to convey more vivid and spontaneous awareness about other's activities and go well beyond the purely technology-centered status indications that are prevailing in standard instant-messaging tools (e.g. Sametime Connect [9] or ICQ [8]). With the TeamSpace Communicator, users can create IP-based audio- and video channels to the team members in the same room. Overall, the tight integration of these synchronous awareness and communication features with the asynchronous parts of the TeamSpace user interface provides an attempt to facilitate shifting between the different work modes (individual, social and meeting).

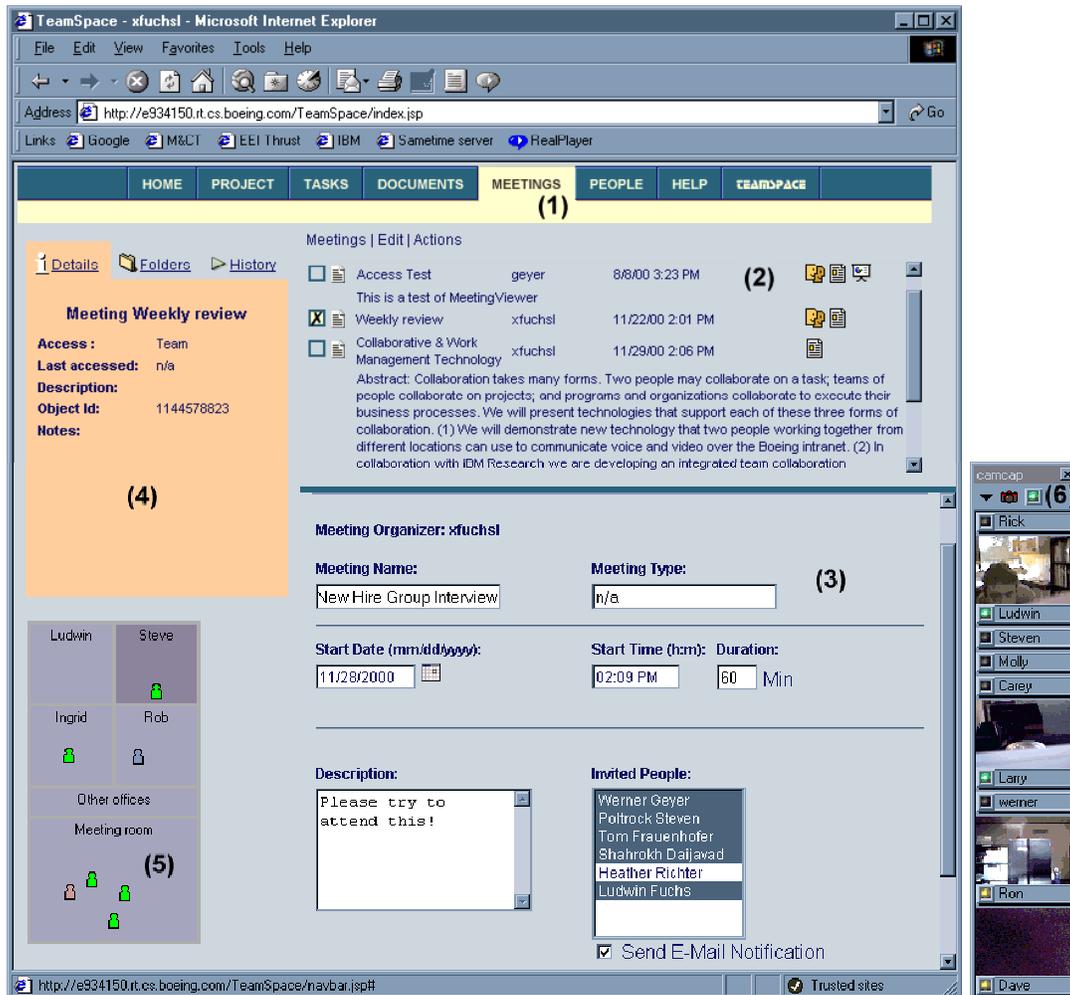


Figure 2. Screen shot of TeamSpace's Web interface

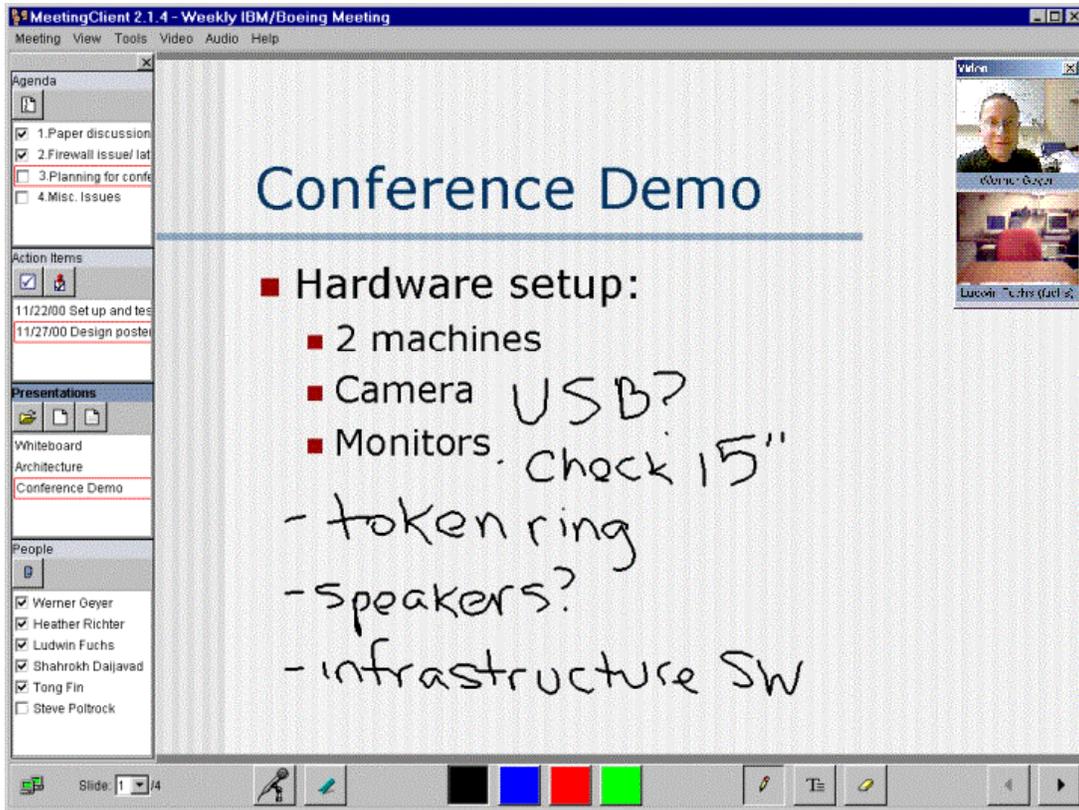


Figure 3. Screenshot of MeetingClient

4.2 MeetingClient

From the TeamSpace web interface, a user can join an ongoing meeting. Upon joining, the MeetingClient application (see Figure 3) is automatically launched and connected to a conferencing server that is part of the TeamSpace server. MeetingClient provides the following synchronous conferencing functionality that is tightly integrated with the articulation objects on the TeamSpace server.

- Sharing and annotating PowerPoint presentations
- Viewing, creating, editing, annotating, and checking off agenda items
- Viewing, creating, editing, annotating, and checking off action items
- Creating public or private bookmarks
- Viewing and transmitting low-bandwidth video, providing real-time awareness of session members
- Viewing and editing session participants

All of the meeting data and events remain synchronized between clients, and are automatically time-stamped and stored on the server.

A dedicated audio capture client, which is also connected to the conferencing server, automatically digitizes the audio taken from

the conference call and stores it on the TeamSpace server at the appropriate location¹.

The MeetingClient can also be used with an electronic whiteboard or pen tablet so that ink or drawing annotations can be captured. Thus, MeetingClient is appropriate to use either in a meeting room or at a desktop machine.

For a more detailed description of the MeetingClient user interface, see [16].

4.3 MeetingViewer

After a meeting is completed, the meeting records are automatically available on the server for retrieval. In this prototype we have focused on retrieving meeting details to support time-based access for both participant and non-participant users. Users can select completed meetings in TeamSpace and launch a MeetingViewer to view and playback these meetings. We are using this general-purpose access interface to investigate visualizations and browsing mechanisms for captured meetings.

The MeetingViewer, shown in Figure 4, integrates all of the meeting information based on time. The viewer uses a two-scale timeline for navigating a set of selected meetings, providing random access playback. The timeline is painted with interesting events as both a visual summary of the meeting, and as an aid for navigation. Interesting events may be people joining and leaving, agenda items being discussed, action items created, slides visited,

¹ Note that we are currently not transmitting audio over the network because of the poor quality of IP-based audio.

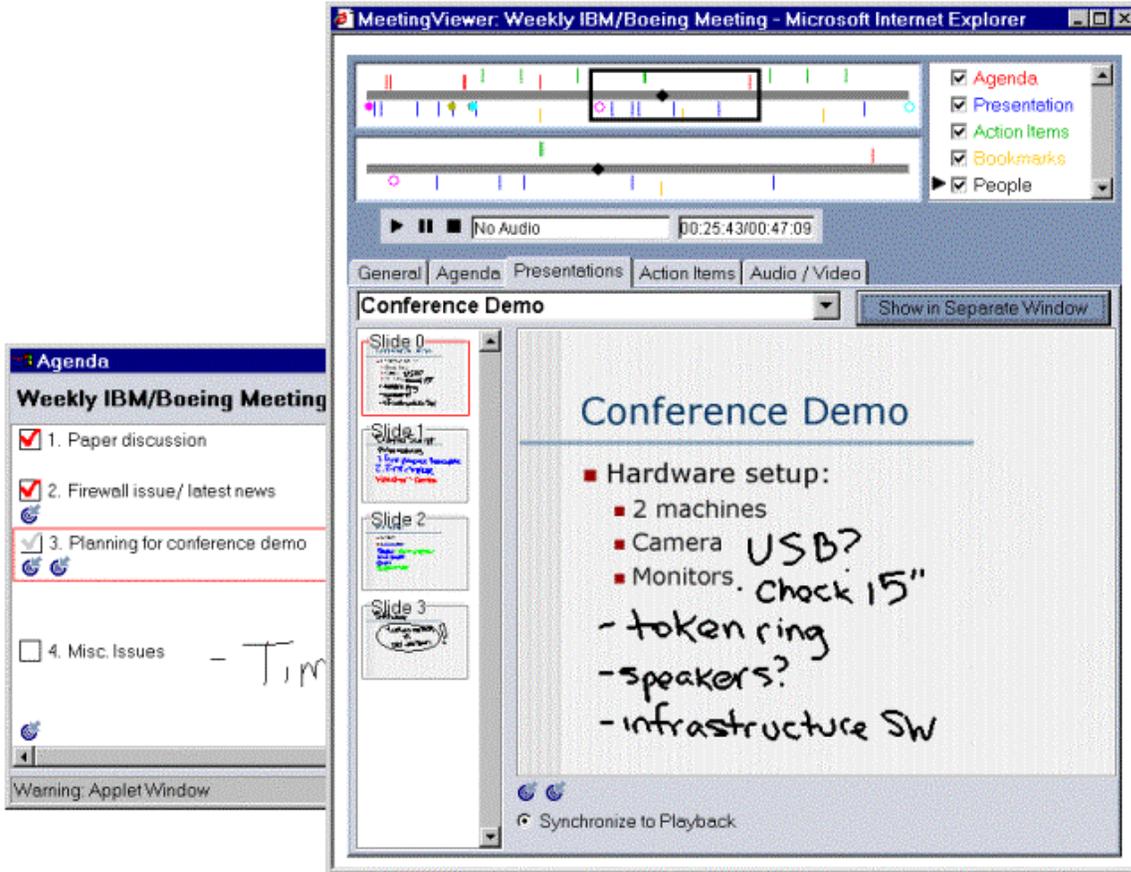


Figure 4. Screen shot of MeetingViewer

or bookmarks created. Users can control which of these events they view and can use the events to find relevant portions within a meeting to playback. This timeline visualization is based on the Multi-scale Timeline Slider [15]. Playback of a meeting not only involves playing the audio and video, but also involves playback of all of the recorded events of a meeting such as slide visits or agenda item discussion.

The remainder of the meeting information is displayed on a series of tabbed panes for each of the articulation objects related to the meeting, including descriptions and summaries of the meeting, agenda, presentations, action items, and video images. Users can view each articulation object and can also navigate to the parts of the meeting where these items were the focus of attention. These panes are a very general approach for displaying a large amount of related information. However, to enable customized views, each pane can be opened in a separate window, moved and resized. In this way, users can view any subset of the information they wish at once. Additionally, as we add more articulation objects to TeamSpace, we can easily add more meeting-related objects to this interface, such as documents that were reviewed or referenced during the meeting. We anticipate that as we learn more about the types of information users need for various tasks, we can design

task-oriented views that are simpler and more integrated. Additionally, we are now investigating visualizations to navigate through very large sets of meetings to support long term and new reviewers.

5. EXPERIENCES

Our research team has been using TeamSpace to conduct our distributed meetings for several months. The meeting environment has been useful for brainstorming and for discussing presentations together. We have revisited several meetings to view the annotations we made. Additionally, we were able to use the system to give a distributed presentation of the project for a yearly project review. Our experiences have highlighted multiple issues for team collaboration and meeting capture.

First, enabling inter-company collaboration is more difficult than expected. Security is a major issue in any system, and is only compounded by cross-firewall communication. Security infrastructures are in place to inhibit the flow of information outside of the company, yet collaboration requires circumventing security mechanisms without violating their principles. While our current prototype can communicate through Boeing and IBM firewalls, the information is not secure enough for real use. We

are exploring alternative architectures to address security concerns [5].

Our usage also highlighted deficiencies in our meeting capture interface. Navigation, particularly navigating between different pieces of information, such as an agenda item and a slide, was awkward. This navigation needs to be extremely simple, particularly for those using a pen on an electronic whiteboard. Meeting capture will not be as powerful if information such as agendas or action items is not recorded because it is too difficult to use during a meeting. We evolved the capture system to more tightly integrate meeting information and provide a better overview and navigation.

Finally, we are experiencing an interesting phenomenon of any distributed collaborative system – knowing what the other party is seeing. We frequently ask if others can see an annotation or that one of us has just joined the meeting. While this was often necessary when the prototype was not stable, we continue to ask these questions even now. We need to investigate how the system can give users these cues so that they do not have to interrupt the meeting to ensure that the system is still working.

While our experiences have helped highlight several technical and usage issues with TeamSpace, we need much more extensive usage to understand the impact of such a collaborative system. We are going to deploy our current prototype to several teams for more extensive studies of meeting capture and team collaboration. We are also continuing to evolve TeamSpace, both by adding capabilities to the meeting environment, and by focusing on other activities and artifacts.

6. RELATED WORK

As a team collaboration environment, TeamSpace has many predecessors. TeamSpace builds on prior research integrating synchronous and asynchronous collaboration capabilities, as in TeamRooms [17] and CVW [20]. Like TeamSpace, both TeamRooms and CVW used room metaphors to provide persistent places where people could communicate and interact with one another. TeamRooms included multi-user synchronous applications developed in Tcl/Tk, and CVW was based on the lambda MOO environment. The concept of places or locales for workgroup collaboration was integrated with the web in wOrlds [3] and its descendent Orbit [10]. Unlike TeamSpace, wOrlds has not focused on synchronous meetings or their capture and playback.

In this phase of development of TeamSpace we focused on capture and access of team meetings. Capture and access systems have been a concentration of the multimedia community and the ubiquitous computing community for the past decade. Research has explored automated capture in both education and meeting domains. One example, eClass (formerly Classroom 2000) [1], focused on providing students automated access to lecturer's notes and audio and video recordings and has been used to record over 1000 lectures at several universities. The system's success is due to addressing the real needs of students: to be able to easily review slides and notes, augmented with audio and video. In contrast to TeamSpace, eClass only captures the local classroom experience and does not support remote collaboration. Many meeting capture systems, such as [2] or [11], have also focused on augmenting presentations and hand-written notes with audio and video streams. Unlike TeamSpace, these systems do not integrate

capture and access into the larger context of a collaborative work process, i.e. they focus on the capture of the synchronous experience only.

The emphasis in the multimedia domain has been on innovative ways to access, segment, and review media streams. Both CueVideo [21] and Informedia [23] provide search and retrieval within a single media stream or across a library of streams. Similarly, TeamSpace must search a library of meetings, then the contents of a single meeting. This is particularly important for supporting the long-term and large-scale reviewing.

7. CONCLUSION

TeamSpace is targeted at enabling geographically distributed, cross-company teams to match the high performances achieved by collocated teams. Members of a high performance team are continuously aware of team activities, and they move fluidly and easily between individual, social, and meeting work modes. Providing all the collaboration capabilities needed by such teams is an ambitious long-term goal. In TeamSpace we have defined an architecture and conceptual framework for these capabilities, and then focused on one aspect of work, team meetings.

Our initial prototype of TeamSpace supports meetings as events in the team's work context. It supports the primary artifacts used in meetings, including agendas, action items, and presentations. TeamSpace supports planning and scheduling future meetings, conducting and capturing a meeting in progress, and finally searching and reviewing prior meetings. The design of the system architecture enables cross-company collaboration.

Because meetings are key events for many teams, they define temporal markers in a team's work history. We are investigating navigation through large sets of meetings organized both chronologically and topically. We are also continuing to evolve TeamSpace and we are beginning studies of the use of TeamSpace by project teams at Boeing and IBM.

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