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A Survey of Synchronous Collaboration Tools

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Abstract: This study investigates the features of synchronous collaboration tools, the meanings of the features and identifies common and key characteristics of synchronous collaboration tools. We organize features by the six stages of meeting process: starting meeting, communication, presentation, interaction, administration and ending meeting. We test nine collaboration tools that are today's market leaders. Data collected in this study come from our experiments and online documents. This study will help professionals gain knowledge of what current online meeting market has to offer and aid them make right decisions in selecting tools based on their meeting needs.

Key words: Computer-supported collaborative work, usage experience, collaboration tools, synchronous collaboration, real-time collaboration, online meeting

INTRODUCTION

Collaboration refers to all processes where people work together to achieve results. With the advent of computers and the Internet, many collaboration tools have emerged. Examples of early collaboration tools include e-mail, bulletin board, internet relay chat, whiteboard and desktop sharing. In a collaborative environment a team may be spread out in different locations and work at different times. The tools need to facilitate collaboration by making communication among distributed participants as easy and efficient as possible. Synchronous collaboration tools require a team to work at the same time. Examples include instant messaging, application sharing and whiteboard. Asynchronous tools allow team to work at different times. Examples of early tools include E-mail, bulletin board and web logs. Differences between synchronous and asynchronous collaboration tools and how to integrate them are investigated by Li and Hopper (1998) and Li *et al.* (2000). Case studies of collaboration tool applications are explored by Peden *et al.* (2000), Xenos *et al.* (2004) and Lefebvre *et al.* (2003).

In this study, we investigate features of synchronous collaboration tools. Synchronous collaboration is also called as real-time collaboration, online meeting or web conferencing. There is an increasing need for powerful synchronous collaboration tools by businesses to get their job done more efficiently and cost effectively. Several studies have shown that synchronous collaboration tool market has been growing rapidly and expected to grow continuously for years to come. The expanding applications of synchronous collaboration tools are explored by many researches. Examples of them are articles written by (Coleman and Ward, 1999; Cherry, 2002; Kramer and Wegner, 1999).

Many collaboration tools were developed in recent years. Mayrhofer's survey listed almost 100 synchronous collaboration tools (Mayrhofer *et al.*, 2004). These tools provide different set of features, yet they have common features. Often, the same features are marketed with different terms by the vendors. Questions arise as more and more of these tools emerge. What are the available features? What are the meanings of the features? What are the common features of these tools? What are the key features for synchronous collaboration tools? The goal of this study is to identify common and key features in synchronous collaboration tools. The results of study will help professionals gain knowledge of what current online meeting market has to offer and aid them make right decisions in choosing tools based on their meeting needs.

To gain the first-hand experience, The nine synchronous collaboration tools: WebEx Meeting Center, WebEx MeetMeNow, Microsoft Office LiveMeeting, 2005; IBM Sametime, iLink MeetingLinc, Adobe Acrobat Connect, Adobe Acrobat Connect Professional, Citrix GotoMeeting and Microsoft Meeting Space for Windows Vista was tested. Most of these tools are leaders in online meeting market. Microsoft Meeting Space is choosed for test because it is the only peer-to-peer collaboration tool that does not need server or even the Internet connection.

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Most of these tools are tested as 14 day free trial with exception of IBM Sametime and Microsoft Meeting Space. IBM Sametime server is hosted on a workstation running Windows 2003 server. Microsoft Meeting Space comes free with Microsoft Windows Vista.

SYSTEM OVERVIEW

Some of the tools we tested run on java-enabled web browsers. Some tools run as a stand-alone application on supported operating systems. Tools that run on web browsers run on more platforms because all popular operating systems have browsers. IBM Sametime installs stand-alone Instant Messaging software but meeting takes place in a web browser. Microsoft Meeting Space comes with Microsoft Windows Vista and it requires wireless connection. Most of the tools have client-server application architecture. Participants are required to logon to the server to start the meeting. Internet connection is required to use these tools. The only exception is Microsoft Meeting Space, which is peer-to-peer (P2P) application. Researches on P2P synchronous collaboration tools are explored by (Kawashima and Ma, 2004; Ma *et al*., 2003). In Microsoft Meeting Space, a face-to-face meeting tool, a small number of computers nearby use wireless network in ad-hoc or wireless LAN modes to collaborate synchronously. No internet connection or server is needed. Most of the vendors host the meeting server for their customers who pay fees for using their service. IBM Sametime, however, does not host the meeting server and users have to host their own server. The maximum number of concurrent meeting participants allowed by these tools varies significantly from 10 to 2,500. While small numbers represent actual limit of allowed concurrent meeting participants, large numbers are not significant in showing the capability of the tools because they are usually estimations that depend on hardware and bandwidth (Table 1).

MEETING STAGES AND COMMON FEATURES

To organize features, we divide the meeting into 6 stages: starting meeting, communication, presentation, interaction, administration and ending meeting. Each stage has key features as shown in Table 2. Except for starting meeting and ending meeting, the rest of stages do not have order and can happen at the same time. Our goal is to extract common and key features in these tools. Some tools may have more features that are not described below. The same feature implemented by different tools may have different qualities in speed, reliability and ease of use.

Starting meeting: Starting meeting is the stage which is related to how a meeting is created and joined. In a scheduled meeting, the host decides the starting time and duration of the meeting and the participants join meeting on the scheduled time. Typically, the host will setup the meeting on a web server and email invitations as a URL link to the participants. Participants join later by following the meeting URL. All tools we tested except for Microsoft Meeting Space provide scheduled meeting. In an instant meeting, the meeting host is aware of the availability of participants and creates a meeting by sending instant meeting invitations. There are multiple ways for creating an instant meeting. A typical example of instant meeting is Microsoft Meeting Space. Meeting is created by a host

Table 1: System overview of synchronous collaboration tools

Synchronous collaboration tools	System requirements	Concurrent user limit	Architecture	Server
WebEx Meeting Center	Web Browser	>1,000	Client-Server	Hosted
WebEx MeetMeNow	Windows	10	Client-Server	Hosted
MS Live Meeting	Web Browser	Up to 2,500	Client-Server	Hosted
IBM Sametime	Windows/Linux/Mac Web Browser	>500	Client-Server	Self-hosted
iLinc MeetingLinc	Windows	>500	Client-Server	Hosted
Adobe Acrobat Connect	Web Browser Windows/Mac for Presenter	15	Client-Server	Hosted
Adobe Acrobat Connect Pro	Web Browser Windows/Mac for Presenter	Up to 2,500	Client-Server	Hosted
Citrix GotoMeeting	Windows/Mac	10	Client-Server	Hosted
Microsoft Meeting Space	Windows Vista Wireless Connection (WLAN or ad hoc)	10	Peer-to-Peer	No server needed

Table 2: The common features in six stages of online meeting

Stages	Features
Starting meeting	Instant meeting and schedule meeting
Commnnication	Text, teleconferencing and VoIP/Video
Presentation	Document presentation, application/desktop sharing and annotation
Interaction	Participant status and polling
Administration	Changing roles
Ending meeting	Saving annotated documents and recording meeting

and the participating computers nearby can find and join the meeting instantly. Another way of starting instant meeting is by sending IMs to participants that are online. IBM Sametime begins with an Instant Messaging interface and online buddies can be notified to join an instant meeting. The meeting starts in a web browser that connects to server running IBM Sametime server. Windows Meeting Space starts instant meeting by finding and joining a nearby meeting as shown in Fig. 1. Invitation file provides an alternative way of joining a meeting bypassing the searching step. Invitation file is created by the meeting host and distributed to the participants.

Communication: Communication is a feature that allows participants to communicate with one another by text, audio or video. Some of these tools that provide phone numbers for teleconferencing. Among the tools that provide webcam video and VoIP features, the detail can vary in number of webcams displayed at the same time. Since Microsoft Meeting Space is deployed in a physically local face-to-face environment where people can see and hear each other, it has none of these features.

In Fig. 2 WebEx MeetMeNow shows the instructions on how to join a teleconference. It is common that vendors that provide hosting service also provide phone numbers for users to start teleconferencing.

Presentation: Presentation is the key feature for synchronous collaboration tools. We include document presentation, application sharing, desktop sharing and annotation as presentation features. In document presentation, documents are uploaded by the presenter to the server and distributed to the participants. Microsoft Power Point slide is the most common document type supported in document presentation. Some tools support documents of all printable file types. These printable documents are usually converted into a non-editable format. That is the reason document presentation is called share document to view by Microsoft Office Live Meeting. Adobe Acrobat Connect Professional also allows presentation of video and audio files. Five out of nine tools we tested support document presentation. WebEx and Adobe leave this feature out of their lower-end products: WebEx MeetMeNow and Adobe Acrobat Connect. Different collaboration tools name the document presentation feature differently. WebEx Meeting Center, Microsoft Office Live Meeting, IBM Sametime, iLinc MeetingLinc and Adobe Acrobat Connect Professional name this feature as Document Sharing, Share Document to View, Slide Sharing, Uploading Meeting Agenda and Document Sharing, respectively. Annotation is always associated with document presentation. Annotation usually is a simple white-board like drawing tool that allows participants to annotate on the documents. Typical annotation features include highlighter, drawing pen, eraser, pointer, etc. Annotations on documents can be saved for later reviews.

Figure 3 shows presentation features of Adobe Acrobat Connect Professional. It has document presentation and application/desktop sharing. Annotation is done by whiteboard drawing tools.

Document presentation does not allow direct edit to the original document. However, it can be made by

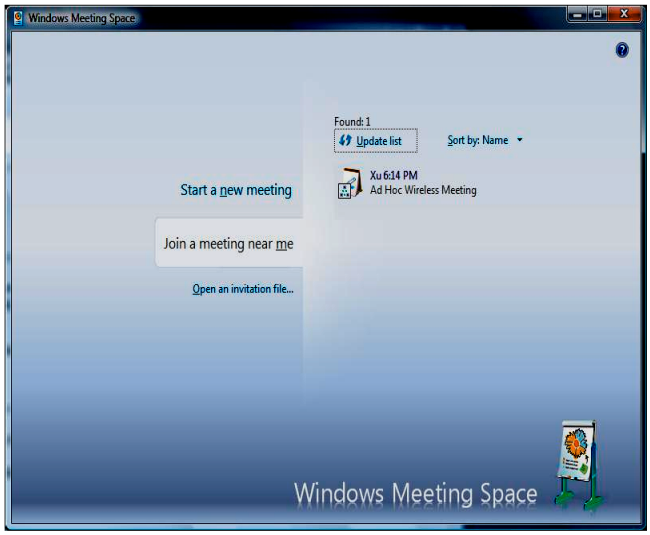

Fig. 1: Windows meeting space instant meeting by finding and joining a nearby meeting

Fig. 2: WebEx MeetMeNow's instructions on joining a teleconference

Fig. 3: Presentation features of Adobe Acrobat connect professional

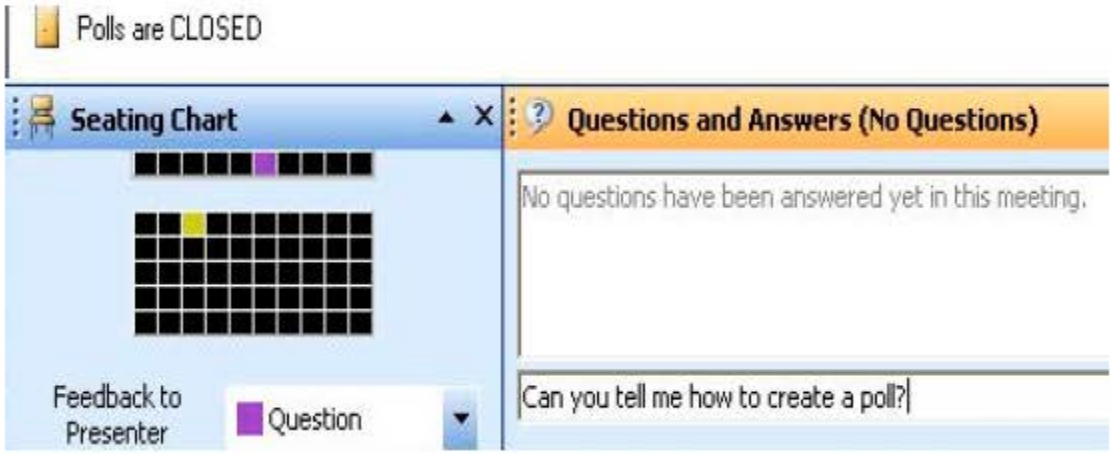

Fig. 4: Interaction features of microsoft office live meeting

application sharing or desktop sharing. Microsoft Office Living Meeting's Share Document to Edit is implemented by application sharing. Application or desktop sharing is a very common feature as all the tools we tested have it. The presenter shares its applications to the participants. Participants can be given the control of mouse and keyboard during application sharing and desktop sharing. Some tools allow annotations on application sharing or desktop sharing. However, these annotations are only temporary as they will be deleted from screen as it changes back to application sharing mode. Application and desktop sharing may cause problems because errors in operations by participants may cause loss of data. Because application and desktop sharing require more network bandwidth, the performance is not good as document presentation.

Interaction: A very common interaction feature is participant status where a participant can express its condition to the presenter and other participants. The typical conditions include: raise hand, slow down, away, question, etc. Microsoft Office Live Meeting has seating chart feature that can see status of participants more clearly. Polling is a powerful way of interacting among the participants. The presenter creates polls using provided editor and distributes them to the participants. The results of the poll can be made public or private by the presenter. There are five tools we tested that have polling feature and they are exactly the same set of tools that provide document presentation. Some tools allow participants to initiate questions to the presenter by Q and A feature.

Figure 4 shows nice interaction features of Microsoft Office Live Meeting. It has seating chart, participant status, polling and Q and A.

Administration: Administration features manage and coordinate the meeting. Most of the collaboration tools have three participant roles: host, presenter and normal participants. The host, also called organizer or leader, is the administrator and coordinator of the meeting. It can remove participants, assign presenter and set participant privileges. The presenter, also called floor holder, shares its document, application or desktop. It also annotates and creates polls. The roles of participants in six stages of collaboration is shown in Table 4.

The roles can be switched by the host or the presenter. Host can delegate presenter or transfer role of host to another participant. The presenter can transfer presenting role to another participant. Some tools do not distinct between presenter and host. This makes meeting less formal because of the frequent changes of the meeting coordinator. In application sharing and desktop sharing, the control of mouse and keyboard can be switched among the participants. Instead of automatic transferring controls, coordinated request/grant transfer makes meeting more formal and reduces the confusion.

Ending meeting: After the meeting is finished, there may be need to save the meeting for later reviews. There are two common ways of saving the meeting. The first one is saving the annotated documents, result of polls and the transcript of meeting. All the tools that allow document presentation and polling features have this feature. For example, Microsoft Office Living Meeting saves the annotated documents and polls into PDF files. The other saving method is recording the meeting. Recording usually capture the sharing screen area of the tool and encode it into a video format. Some tools provide meeting statistics after the meeting is finished.

Table 3: The roles of participants in six stages of collaboration

Participant	Start meeting	Communicate	Present	Interact	Administrate	End meeting
Host	X	X		X	X	X
Presenter		X	X	X	X	
Other		X		X		

Table 4: Synchronous collaboration tool feature summary

	Starting meeting		Communication		Presentation			Interaction	Admin..	Ending meeting	
Synchronous collaboration tools	Instant	Scheduled	Teleconf.	VoIP Video	Doc. presentation	App/Desktop sharing	Annotation	Polling	Host and presenter	Saving	Record
WebEx meeting center	1	X	X	X	X	X	X	X	X	X	X
WebEx MeetMeNow		X	X			2	X		X		
MS live meeting 2005		X	X		X	X	X	X	X	X	X
IBM Sametime	X	X	3	X	X	X	X	X		X	X
iLinc MeetingLinc		X	X	X	X	X	X	X	X	X	X
Adobe Acrobat Connect		X	X	X		X	X		X		
Adobe Acrobat Connect Pro.		X	X	X	X	X	X	X	X	X	X
Citrix GotoMeeting		X	X			X	X		X		X
Microsoft Meeting Space	X					X					

WebEx AIM Pro instant messaging is integrated. Desktop sharing only. Users have to provide its own phone number for teleconferencing

Other features: There are some other less common but interesting features. Microsoft Meeting Space has a handout feature that distributes files to the participants and changes are synchronized automatically to all participants. With iLinc MeetingLinc, users are able to create a breakout sessions for smaller group discussion. IBM Sametime has IM features besides its meeting capability. Some tools include IBM Sametime and WebEx have support for mobile devices.

Table 4 is a summary of common features of the tools we tested. Among them, the following five tools have most comprehensive features: WebEx Meeting Center, Microsoft Office Live Meeting, IBM Sametime, Adobe Acrobat Connect Professional and iLinc MeeingLinc. They have document presentation, polling and saving features that do not exist in the rest of the tools. WebEx MeetMeNow and Adobe Acrobat Connect are lighter versions of WebEx Meeting Center and Adobe Acrobat Connect Professional. Microsoft Meeting Space is best used as a file and application sharing tool that supplements a local physical meeting. However, it is the only tool that we tested that works without a server.

CONCLUSION

We identified common features based on our experiments and online documentations. We organized the common features of synchronous collaboration tools by six stages of collaboration: starting meeting, communication, presentation, interaction, administration and ending meeting. Most of the tools have client-server architecture. We would like to see more powerful peer-to-peer synchronous collaboration tools emerge. Current recording feature is still very primitive as it only encodes the sharing area on the screen into a video file. If recording is able to highlight important events and interact when replaying will make it a more attractive feature. Although quality of collaboration tools was not our research focus and all the tools tested performed reasonably well, improving the quality of features in terms of ease of use, stability and performance is as important as inventing new features.

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