



## **Usability Overview of the MECCANO Conferencing Tools**

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video conferencing,  
distance education,  
multicasting,  
human-computer  
interaction

IP Multicasting promises increased performance and usability for video conferencing, and tele-education systems. The following report gives a general overview and usability assessment of the key tools currently in use over the Multicast enabled part of the internet called the Mbone.

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## **1.0 Usability overview of The Meccano Conferencing tools**

### **1.1 Introduction**

Because of the inherent advantages of multicast based conferencing the bulk of this study will focus on the tools currently being developed within the MECCANO project. The following section gives a general overview of these tools and discusses key features of the tools, which enhance or limit their usability. The section also lists the key features of the various tools. While each tool has a whole range of features such as the various codecs' it supports, this section for reasons of brevity lists only the primary features, which are central to the tools usability. The basic approach to the usability analysis has been to examine the tools for their usability at the end user end. While issues such as the development of control protocols, and codecs' play a crucial role in the usability of the tools this section does not address these issues directly. This is largely because these issues are well understood and discussed in other areas of the MECCANO project and within the general Mbone community. The following report has also tended to concentrate on the core set of the tools to a larger extent than other tools within the MECCANO project. Further some tools require specific scenarios, and platforms in order to be implemented and tested and at the current juncture these have not been available within the test environment available at Hewlett Packard.

### **1.2 SDR 2.7**

#### **Overview:**

SDR, the Session Directory developed at UCL, is a directory service interface to the Mbone. SDRs' primary purpose is to allow participants to access sessions without the need to explicitly know the address of the initiating member. It is used for browsing and the announcement of public multicast sessions as well as the establishment of private sessions. SDR employs a simple interface, which allows users to browse advertised sessions, join sessions, and create their own sessions.

#### **Key Features:**

- Allows the initiator of a session to invite specific individuals to join the session.
- Allows encrypted announcements, which can provide both authentication and privacy for specific sessions.
- Allows for the categorisation of sessions by type.
- Provides a user-friendly interface for creating and announcing sessions.
- Provides facility for access to the session announcers' web site.
- Extensive online help facility

#### **Platforms:**

SunOS, Solaris, SGI, DEC OSF, HP-UX, FreeBSD, NetBSD, Linux, NeXT, RS6000/AIX, Windows 95/NT.

#### **Usability:**

To date SDR implements a sufficiently full set of features for organising and handling session announcements. The interface for browsing sessions is reasonably clean, and employs a number of features, which enable the categorisation of the session displayed. For example

users can choose to show only public sessions, or seminar broadcasts or only the current days sessions. SDR also allows for intuitive step-by-step procedure for initiating a session. The procedure is explained in a manner, which would make it possible for a non-experienced user to announce and start a session. This is a key usability feature of SDR as it allows sessions to be announced and created with a minimal amount of difficulty.

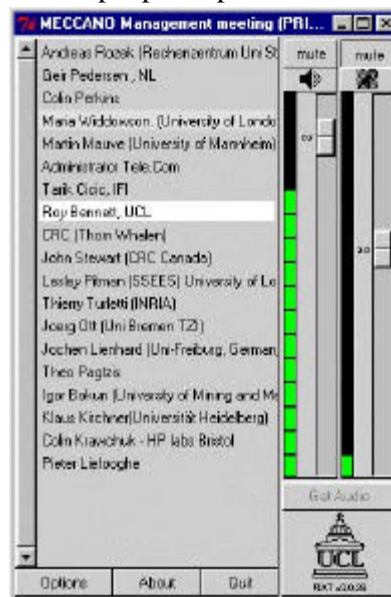
The additional feature of integration with web sites, such as the ability to provide links to a session owners web site is a particularly useful feature, as it allows for the provision of additional information about session originators to be delivered to users. As will be discussed later the ability to integrate conferencing tools within a web environment has advantages for the delivery of conferencing solutions.

The only current limitation in SDR is in the handling of large numbers of sessions. Currently browsing sessions on the Mbone through SDR is trivial in terms of cognitive load. However as the amount of multicast sessions grows revisions will need to be made to the design of SDR in order to more efficiently categorise, filter and display very large number of sessions. This is likely to require changes to the underlying session control protocols in terms of the information, which is available to SDR to extract.

### 1.3 RAT (Robust Audio Tool) 3.0

#### Overview:

RAT is an audio tool, which allows users to participate in audio conferences over the Internet. RAT can be used for either point-to-point conferences between two participants or for Multicast conferencing between multiple participants. RAT was developed at UCL and was



originally designed to provide increased resistance to network loss in order to insure more reliable transmission of audio in conferencing scenarios. The ability to deliver loss less audio is perhaps the key usability requirement of audio tools used for conferencing purposes, as audio is the primary channel of communication. RAT's ability to accomplish near loss less audio transmission through the use of redundancy encoding greatly increases its usability for conferencing scenarios. This improves the natural flow of communication between members of a session. RAT is also able to handle and deliver high quality encoding, and stereo transmission. Currently work is now proceeding on providing sound localisation. This feature

will be of particular importance for creating effective conferencing scenarios, (especially in virtual environments), as it will facilitate the recognition of speaker location, which is a key factor in aiding group communication.

**Key Features:**

- Full Duplex Audio Transmission, which allows users to listen to audio and talk at the same time.
- Encryption for confidential conferencing.
- Speaker identification.
- Synchronisation with VIC.
- Silence Suppression.
- Mute control over audio transmission.

**Platforms:**

SunOS, Solaris, SGI, DEC OSF, HPUX, FreeBSD, NetBSD, Linux, NeXT, RS6000/AIX, Windows 95/NT.

**Usability:**

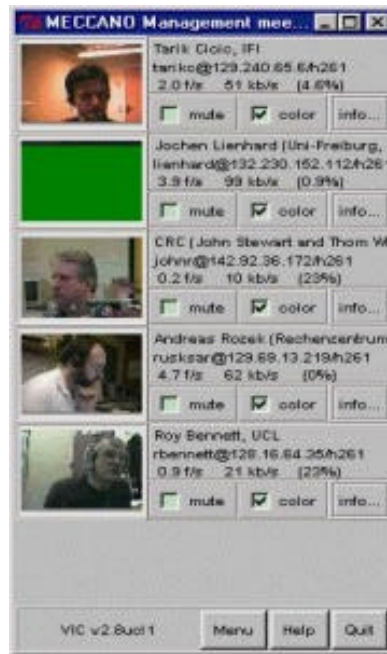
RAT is currently in very stable and provides a sufficient set of functions for delivering real-time audio communications over the Internet. Using RAT is a fairly straightforward process and appears to present no initial difficulties for the non-expert user. Initial option configurations are obvious and require little effort to understand or use. Minor difficulties with the interface are largely confined to the size of the application. With screen space at a premium the RAT interface could be made smaller by reducing the size of the scroll bars and, and overall window size. A particularly useful feature in RAT is the identification in the participant list of which member of a group is currently talking. This is accomplished by highlighting their name in the participant list. This is especially useful when the participating member is not using a video channel as it aids in identifying which members of a conference are talking. RAT delivers audio quality at a sufficient quality level to allow for near natural audio communication between participants. The primary limitation in RAT's usability arises from the difficulty of establishing communication between multiple participants in remote locations.

For a more detailed discussion of various features of RAT see the RAT user guide which is available at [Http://www-mice.cs.ucl.ac.uk/multimedia/projects/Meccano/](http://www-mice.cs.ucl.ac.uk/multimedia/projects/Meccano/)

**1.4 VIC 2.8ucl**

Vic is the video capturing tool originally developed at the Network Research Group at the Lawrence Berkeley National Laboratory in collaboration with the University of California, Berkeley. The UCL version discussed here has made a number of changes to the initial design. Like RAT, VIC has a simple interface which is easily grasped by novice users with little or no training. The essential features for transmitting and receiving video options are easy to access and understand. It also allows users to modify more complex features like transmission RATE control, encoding formats, and the display options. These features however often require a more experienced understanding of networking and video conferencing. Vic supports a number of encoding formats, including H.261 and Mjpeg and allows users to make changes to the various features of Vic in order to cope with problems which may occur as a result of network congestion. Vic also has the ability to adjust the bandwidth RATE at which

the user is transmitting, which will allow them to configure VIC for low bandwidth or high bandwidth scenarios.



### Key Features:

- Synchronization with RAT
- voice switched viewing windows
- multiple dithering algorithms
- interactive title generation
- routing of decoded video to external video ports
- Support for a variety of video codecs'

### Platforms:

Linux, Windows, Sun (Solaris and SunOS), HPUX, Dec (Alpha and Ultrix), RS/6000 AIX and SGI IRIX.

### Usability

In general Vic is well developed and provides the basic functionality required of a video tool. The iNTERface is straightforward and provides easy access to the primary functions which users may need to set up or change during a conference. While there are minor changes which may be required at the iNTERface level Vic along with RAT and NTE (Network Text Editor) are the most usable and stable set of conferencing tools examined. It is quite feasible to accomplish most basic conferencing tasks through the use of these tools. However as is discussed later there are current limitations to VIC, which arise as a result of limitations in the current bandwidth capacity of the underlying network layer for delivering video RATHER than in any inherent limitations in VIC basic functionality.

One of the key usability features of the current Mbone tools is lip synchronization between Vic and RAT. This ability is a key requirement for delivering useful iNTEractions in a conferencing scenario. Other useful features are the ability to geneRATE notes which users can associate with their video image, and in particular voiced switched windows. This feature allows the user to configure VIC so that a single larger window will alternate the video window to show the video of the speaker who is currently talking.

One of the primary difficulties with desktop video conferencing is lack of proper eye contact mechanisms and localization. This in turn makes it difficult to recognize cues about who is talking or who is likely to talk. The bandwidth restrictions currently impose a frame rate of 6.5 frames a second on conferencing which is not sufficient to allow for natural interactions between participants in the session. One of the difficulties with group conferencing arises from this limitation, which is the overlapping attempts at discourse or conversely long silences, in which the participants are waiting for someone to take the floor. This can be alleviated by having a highly formal conference in which one participant acts as chair, designating who will speak at each turn. However this is less than ideal and hinders the spontaneous exchange of information which is often crucial to successful meetings. While improvements in compression schemes and network bandwidth will help to address this matter there will still be some difficulties arising from the simple logistics of co-ordinating multiple users and multiple tasks within a single interface and computer screen.

The implementation of voice switch windows and synchronization of sound with RAT attempts to alleviate this problem and adds to the usability of both VIC and RAT. In particular the voice switched windows offers the ability to improve participant interaction and floor control. The planned implementation of sound localization within RAT will also be of potential benefit to video interactions in VIC if there is some form of co-ordination between video and audio localization.

## 1.5 NTE 1.5a23

### Overview:

NTE (Network Text Editor) was developed at UCL and allows users to simultaneously access and edit text documents. NTE allows users to open standard text files, which the participating members of the conference can subsequently edit and comment upon.



### Key Features:



- NTE displays individual users' contributions in different colours, which makes it easy for users to rapidly identify the source of comments and changes.
- Employs similar menu structure as standard text editing programs
- Allows loading and saving of plain text files, as well as importing of text as editable blocks
- Allows for explicit assignment of colours to specific text blocks. Colours are intended primarily to distinguish between different people editing the same document. One cannot set parts of a block to different colours - only the whole block. The colours have been chosen to be fairly dark, to make text readable.
- The font styles for the current editable block can also be set.
- Provides a document Map that aids navigation through the document.
- Users can identify parts of the application interface to be hidden to save screen space.
- NTE provides a locking feature that enables users to control whether or not other members may update or delete other specific text blocks.
- Participant list

**Platforms:**

SunOS, Solaris, SGI, HPUX, Linux, Windows 95/NT.

**Usability:**

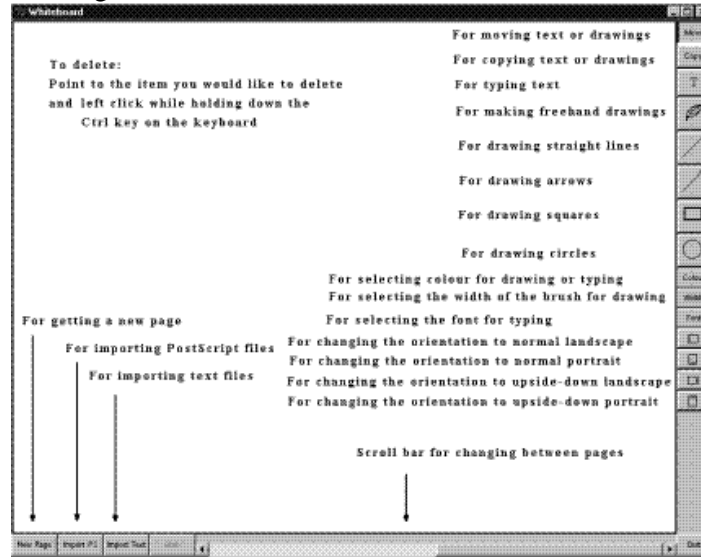
NTE has proven quite usable for networked conferences even by users with little experience of networked applications. A particularly useful feature is the color and text coding facility as this greatly facilitates interactions between group members. It is particularly useful for collaborative work where multiple authors are working on a single document. This feature has also proved useful in creating and maintaining meeting agendas as it allows members of the meeting to make amendments to the agenda as required and for those changes to be easily identified. It was also useful in the delivery of language lesson over the web as it allowed for the identification of text which the pupil was meant to learn and speak.

Ostensibly a useful feature for the shared text editor would be an extensive range of conversion filters. This would allow for the importation of a wider range of documents. However it is not clear whether this is in practice desirable or advantageous. The number of differing file formats which currently exist are large, and it would seem intuitive that employing a standardized file format such as the current text file would be a greater advantage. In this context if any file format were to be integrated within NTE or WB it would probably be more useful to provide support for HTML and XML structured documents. These are increasingly becoming the standard for document display and would seem to be a natural extension of NTE's functionality. An additional limitation in NTE is in document control and management. Although NTE is currently sufficient for small documents and basic network interactions it lacks the facility for sophisticated large document control and navigation. The introduction of such features such as bookmarking of section pages or text blocks, would be particularly useful for educational based sessions, or seminars. The incorporation of these features particularly XML may help address the requirements for editing and finding sections within large documents.

**1.6 Wbd 1.00s3**

**Overview**

WBD - is a shared Whiteboard and functions much as would be expected of a collaborative Whiteboard. It allows participants to share a graphical space which they can draw upon, or enter text which can be view and edited by other participants. WBD however is not a text editor like NTE and once text is entered it cannot be reedited. Its primary usefulness is for sharing graphics, or slide type material, which members of a group can comment upon, or as a Whiteboard for discussing ideas, etc.



### Key Features:

- Allows users to import Postscript Files.
- Supports secure sessions.
- Allows joint editing of files.

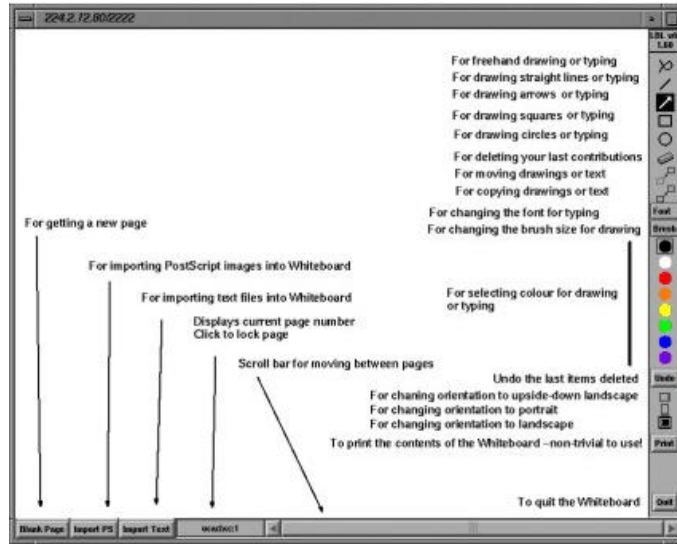
SunOS, Solaris, SGI, DEC (Ulrix/OSF), HPUX, FreeBSD, NetBSD, Linux., Windows

### Usability:

In this capacity it is reasonably useful, and provides the basic functionality which would be required of this type of tool. Its primary limitation however is the limited range of options for importing existing slide material into the program. While it can import Postscript slides and text files it is unable to import Powerpoint slides or other such formats. However as discussed with NTE it is uncertain whether this is a desirable feature to build into WBD or whether it would be better to simply allow for the support of HTML and XML or some other standardized graphics file format. As commercial products generally provide a range of import and export filters. It is perhaps a more useful endeavor to define, or add support for standardized, formats for implementing interactive document exchange and manipulation, rather than trying to keep up with the constantly changing file formats of commercial products.

### 1.7 WB 1.60

WB is a shared whiteboard application for Unix based systems.



**Figure 1: WB**

WB consists of two parts, the Main WB Window which is used for sharing whiteboard style graphics, and a control panel which lists and manages members of the conference.



**Figure 2: WB – control panel**

The Control Panel allows users to mute other members in a session, and to get information about the members of a session, as well as information on the activity which has occurred in a session. WB automatically switches to pages based on where a user is drawing. It can import postscript files and text files and pages in WB can be saved or printed.

#### Platforms

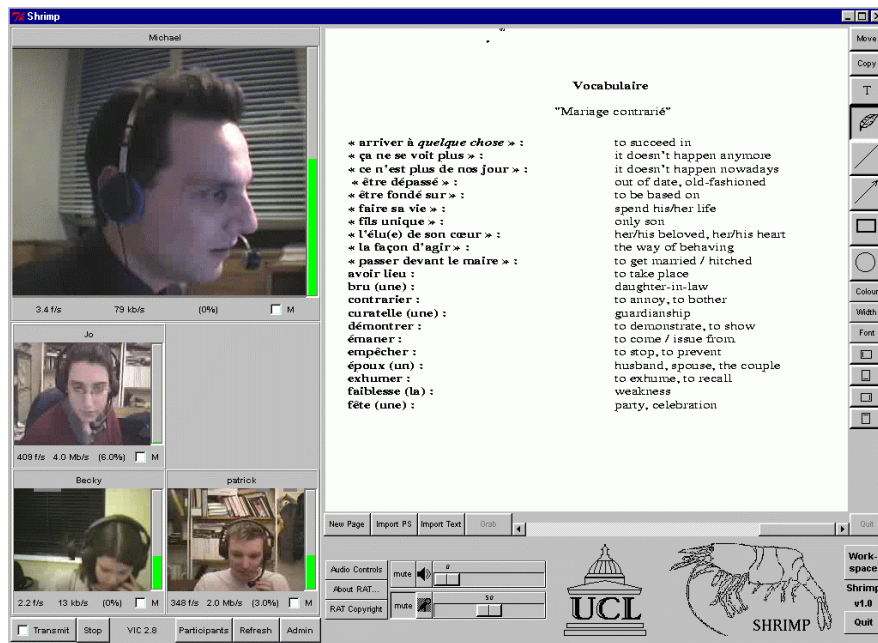
SunOS, Solaris, SGI, DEC (Ultrix/OSF), HPUX, FreeBSD, NetBSD, Linux.

#### Usability

As a whiteboard WB functions well and is very stable. It provides a sufficient range of features to aid in network collaboration. While it lacks the features of tools like DLB it suits its purpose well.

## 1.8 The SHRIMP and ReLate integrated interface.

Shrimp and Relate provide an integrated interface for the separate MECCANO tools discussed in the previous sections. They are especially effective for applications needing limited numbers of video windows. Using these interfaces provides the user with a single window in which are embedded video (Vic), audio (RAT) and shared workspace tools (NTE and Wbd) between which the user may switch easily. Shrimp and Relate are largely similar in their functionality. Relate was developed at Exeter University, and Shrimp was developed At UCL and is based on the Relate Interface.



### Key Features:

- Can be started directly from SDR.
- Workspace switching between NTE and WBD.

### Platforms

Sun Solaris, IRIX, Windows

### Usability:

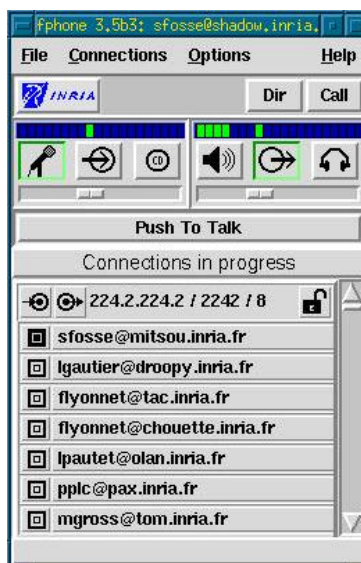
While this feature does not quantifiably improve the actual usability of the tools, it is a desirable addition to the tools in that it allows individual users to choose between interface styles. Some individuals strongly prefer a decoupled set of windows for each tool in the conference. Other users, especially novice users may prefer to use a single integrated interface, which allows them to access and configure the various tools from a single set of menus. This works particularly well with NTE and WBD in shrimp as users can easily switch between the two applications. By incorporating a single user interface into the tools the MECCANO tools add an additional layer of functionality to the tools, which improves the overall usability across a broad range of users. In conferencing scenarios this would be a distinct advantage as it is likely that a disparate range of users will wish to use the tools. This feature highlights one of

the advantages of a replicated architecture in that it allows individual users to tailor the applications interface to best suit their methods of working, without affecting the other members of a conference.

### 1.9 FreePhone 3.5

Overview:

FreePhone is an audio tool developed by MECCANO partner INRIA. It is similar to RAT in its basic features. Like RAT it has provisions for redundant encoding techniques and implements a variety of codecs for use in differing network conditions [Bennet, 5]. One of the primary advantages of FreePhone is its ability to be used over unicast networks allowing point-to-point calls to be made.



#### Key Features:

- Provides support for multiple concurrent unicast and multicast conversations.
- Provides a FreePhone "white pages" on the Web.
- Allows CD/DAT stereo quality audio capture.
- Is able to adapt to various network conditions to improve the quality of the audio
- Allows the user to establish direct calls to remote participants using a simple call button.
- Employs a simple clean interface

#### Platforms:

SunOS, Solaris, Linux, FreeBSD, SGI (IRIX 5.3), and PC's

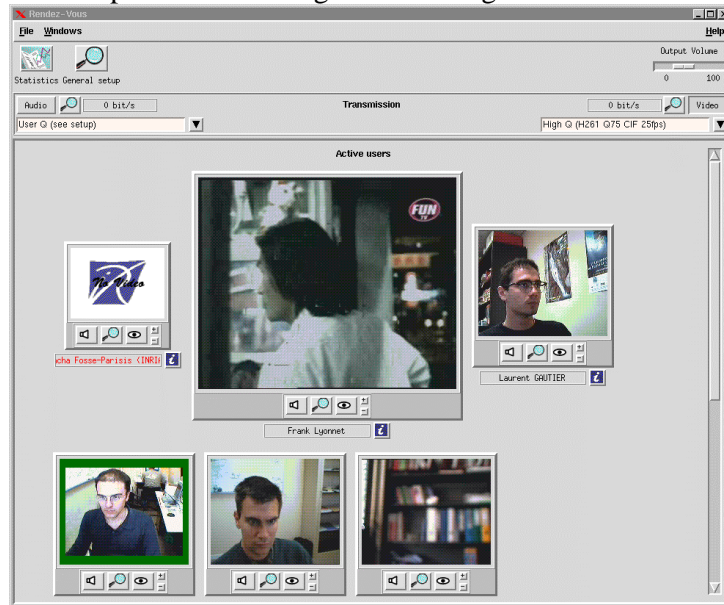
#### Usability:

FreePhone is highly usable in its basic implementation. It is relatively easy to install, although it requires TCL 8.0 to be installed but this is a relatively trivial undertaking. The interface is simply to understand and use. The mechanisms for placing and receiving calls is straightforward and presents little difficulty. The primary limitation of the tool is only in the lack of direct support for windows NT. However this is a minor limitation.

### 1.10 Rendez-Vous 1.0.4

## Overview

Also developed by MECCANO partner INRIA, Rendez-vous' is an Audio and video tool for participating in multicast or unicast conferences. Rendez-vous' functionality is similar to VICs' and RATs, but has the advantage of integrating the audio (FreePhone) and the video into a unified interface [Bennet, 4]. It also implements new approaches to video encoding and process management to optimise the coding and decoding of video.



## Key Features:

- Allows for easy configuration of conferencing options and functions.
- Provides an integrated user interface.
- Incorporates coding and transmission mechanisms which maximize the suggestive quality of the audio and video.

## Platforms

Sun Sparc Solaris, Linux , FreeBSD machines, Windows 95

## Usability:

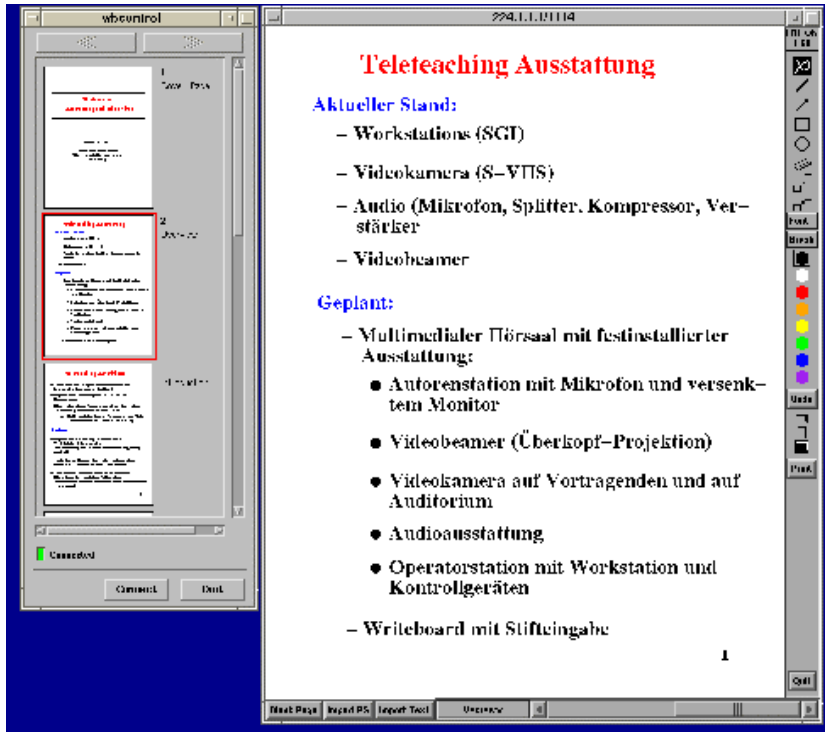
Like FreePhone, Rendezvous is very user friendly and allows novice users to easily join and participate in multicast or unicast conferences. The interface design is especially useful for novice users in that configuring options is reasonably easy, and accessible.

### 1.11 AOFwb1.1b/AOFrec 1.1b

AOFwb is a shared whiteboard tool developed by The University of Freiburg. While it is basically similar to WBD it has an additional component, AOFrec that allows the recording of sessions on the fly. This facility makes it especially useful for educational applications.

## Platforms:

Linux, Sun Solaris, and IRIX systems.



**Usability:**

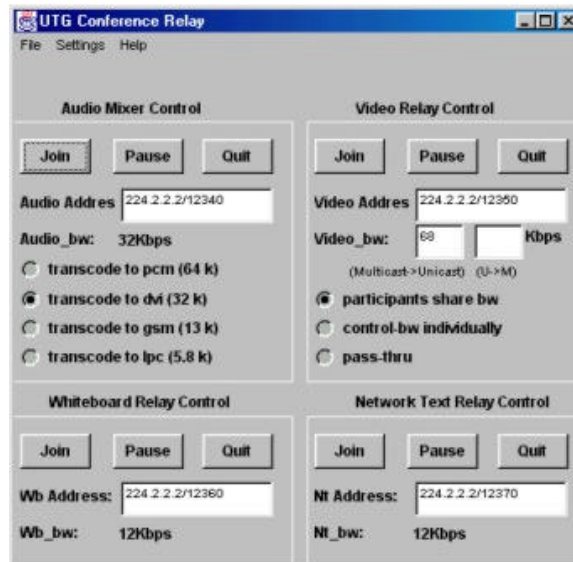
Currently AOFwb and AOFrec are only available for Linux, Sun Solaris, and IRIX systems. This places a limitation on the environments they can be operated within. Within some corporate environments for instance the range of platforms may be limited to one or two supported platforms, (as is the case at Hewlett Packard). However as a basic tool the functionality of Avow and AOFrec, seems reasonably promising, and contains a number of improvements over Wad in terms of the interface, which is generally more intuitive. In particular the conceptual approach to allowing the recording of presentations by the receiver is a particularly useful feature for seminars, presentations and educational situations.

## 2.0 Support tools

The following section discusses tools, which are being developed to enhance or support the core conferencing tool set discussed above. These tools range from Gateway tools to conference recording and playback tools. The following section outlines briefly the main features these tools are attempting to address and gives an overview of the potential benefits of the tools to the overall usability of the MECCANO tools set. The majority of these tools are in early stages of development and require further testing in order to adequately assess their usability. However general indications are that the various approaches are sound and primarily require broader distribution and use in order to be effective.

### 2.1 UTG 1.2

UTG (UCL Transcoding Gateway), consists of a Server running on a Sun workstation connected to the Mbone and a client running on a Windows 95/NT machine at the end of a unicast link [Kirstein, et al, 33]. UTG allows users to access multicast sessions over N-isdn or other low bandwidth link lines. The client can connect to the server and receive Session information via SDR; when a session is selected, the server will send the relevant traffic to the client at the rates defined by the client. In this way a user is able to allocate the bandwidth between the available media for the session. The primary limitation of this model is that it introduces a client server situation into the multicasting scenario. This introduces a layer of complexity that negates one of the primary advantages of the multicast model. In order to implement UTG a user at the client end must have access to a provider, or the institute in which the client is operating must have a machine, which is running the Server part of UTG. To date this is not a widespread situation, although there appears to be little hindrance to its adaptation other than.



UTG promises a very usable service in that it will open access to Mbone sessions to a much broader base of users. This will be especially useful for private users, as a large obstacle to multicast conferencing is the limited scope of the current multicast network. The MECCANO project is developing a number of different gateway tools like UTG for overcoming these



limitations. These tools would allow users to access the Mbone without being directly connected to it.

## **2.2 Audio Gate**

Audio Gate (Audio Mbone-Telephony Gateway) is designed to provide participants on telephone networks to access the audio channel of an Mbone Conference. Audio Gate would allow users to call a phone number, which would transfer the participant to a pre-selected Mbone session.

Audio Gate would allow users who wish to participate in a conference, yet are unable to access a desktop computer to dial into the conference from a phone line. This feature would greatly increase the usability of the overall system, particularly if it is usable in conjunction with mobile phones. The primary limitation of Audio gate is a lack of broad Platform support. Currently it requires Linux and a special isdn card.

## **2.3 Stargate**

Stargate is intended to provide connectivity to conferences between endpoints who are connected through different types of networks, such as ISDN, and the Mbone. This naturally would increase the accessibility and range of the MECCANO tools and increase their overall usability.

## **2.4 Multicast Unicast reflector:**

The Multicast-Unicast Reflector is designed to allow users to participate in Mbone sessions without direct access to the Mbone, The Multicast-Unicast reflector, consists of a multicast-to-unicast packet reflector which joins a chosen multicast group and replicates the data traffic to a given set of unicast addresses. A modified RTSP server controls this unit which, makes integration with the WWW simple. A user reads the information about the current Multicast sessions using a web browser. Clicking a link for a Multicast session returns an RTSP-file containing the URL for the session description such as *rtsp://rtsp.ifi.uio.no/seminar.sdp*.

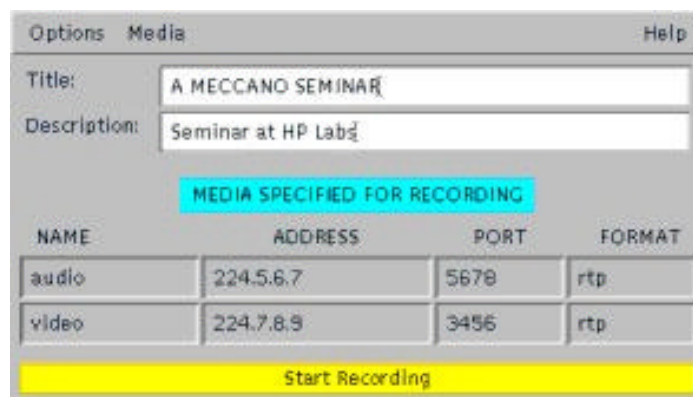
The reflector is controlled using Real-Time Streaming Protocol [rtsp]. RTSP simplifies Web-integration and includes the necessary streaming control functionality for both Unicast and Multicast transport. Design criteria for usability were:

- using the reflector to stream media must be as simple as browsing the Web
- the only assumptions about users' capabilities is that they be able to use a Web-browser and run an installer application.

The Multicast Unicast Reflector has two parts a client and a server. The Client is available for Windows platforms and for Unix based platforms. The Client element is easy to install and demands little on the side of the user to set up. Its primary advantage is that it is incorporated into the web browser so can be integrated into a users normal Internet browsing activity. Implementing the server module of multicast Unicast reflector engine is more difficult although not beyond what would be expected of a network administrator.

## **2.4 MMCR - Multimedia Conference Recorder**

MMCR from UCL is designed to enable the recording of multicast conferences. MMCR allows for full browsing, storage and retrieval of multimedia sessions. MMCR consists of a client-server architecture. The Server runs on a remote machine from the client and upon request stores the media streams received from the multicast network. The stored streams can then be edited and reviewed by individual members ore or replayed into other conferences. MMCR also allows the storage and retrieval of encrypted sessions.



### Usability

MMCR has obvious benefits for seminar type sessions and for educational applications, by allowing a facility for recording sessions, institutes can potentially create archives of educational material that it can provide to clients, and can record educational sessions, for later review or for the purpose of assessment. In terms of usability for basic conferencing scenarios the use of MMCR is not essential. However it is potentially one of the most useful of the Mbone tools for seminar sessions, and educational scenarios. MMCR would be particularly useful in an educational setting as it would enable the storage and re transmission of teaching sessions, evaluations exercises etc.

The client part of MMCR employs a graphical front end, which allows users to easily set up the recording of a multicast session. The client end is easy to install, and logical in its layout and access to features. This provides local control to users for browsing recorded sessions and for recording current sessions. In addition the client does not have to be an active participant in the session, in order to record it. MMCR also allows users to be able to browse and playback specific streams in a session.

The server part needs to be installed on a suitable Unix machine. While this is reasonable in the current stage of videoconferencing development, easier to install and configure implementations would be desirable. In particular support for a wider range of platforms should be considered. This would broaden the potential user base for MMCR as it would make it accessible to small groups, and institutions with limited IT resources.

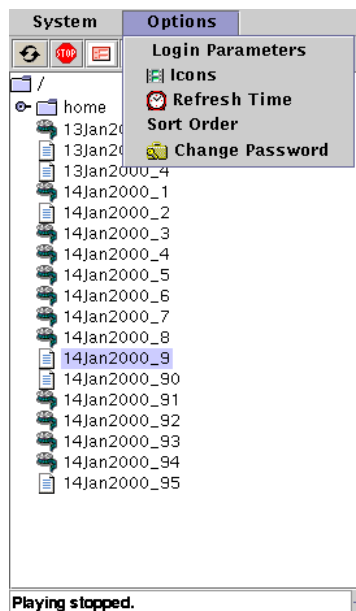
### 2.5 SVDA Media Server

The SVDA media server is under development at ACC and is designed to provide for large video storage and retrieval. It is able to process large numbers of simultaneous request and retrieve multimedia data. SVDA is based on a client server architecture in which the client connects to the server to request the data. The primary usability for SVDA would be for the control of large archives of Video and other multimedia material. Video on Demand services, educational institution, and archival resources such as the British Film Institute would be likely candidates for SVDA and other such multimedia archival systems.

The Scalable Video Distributed Architecture (SVDA) is an environment that introduces enormously large storage capacity devices into multimedia environments. In modern multimedia environment there is a tendency of moving the responsibility of storing and delivering video data onto video servers. Such a solution has a lot of well-known advantages: clients don't need to be equipped with large discs, a video stored on a video server can be delivered at the same moment to many clients and thus the need of keeping the same data at many places is refused, etc. The solution presented in SVDA follows that idea. Furthermore, it enhances the functionality of video servers by adding third-party devices that can save video files on its low access time, but large storage capacity devices.

The SVDA system has been built upon the following assumptions:

- A user has a transparent view of the whole file system that is made accessible by the SVDA system. It has no idea where the files are actually stored: on which video or archive server. All that the user knows is whether it is possible to stream a movie promptly, or the movie must be requested to be streamed.
- At least one video and archive server must be used. The video server must give the network access to its resources, so all the file transfer operations might be performed through the network. The archive server must provide a large storage capacity and, as a video server, give the network access to its resources.
- The whole environment must be modular, scalable and hardware-independent. The CORBA middleware was used to meet this requirement.
- The system must be designed in the way that accepts all the new solutions that might appear on the IT-market in the future. It must be possible to access the system 'from anywhere, anytime, by anyone on anything'. It implies the use of the Java technology for a client layer of the system. The system cannot be limited only to the Java platform, thus all the others solutions for the client layer must be acceptable, too.



## 2.6 Mpoll 1.5

MPoll [patrick] was developed by the Communications Research Centre in Canada. It is a specialized multicasting tool designed to collect quality ratings and opinions from session participants. MPoll was developed with the following uses in mind:

- collecting quality ratings during multicast sessions
- collecting opinions and votes during multicast collaborative work sessions
- collecting opinions on general topics or current events

While Mpoll does not have a direct impact on the usability of the conferencing tools themselves, it is a useful tool for collecting and organising session ratings. This can enable creators of session to assess the success of a session. This is a particularly useful tool for educational based sessions as it can allow session organizers and network administrators, to retrieve and analysis ratings on sessions. Difficulties and therefore be pin pointed and addressed.

## 2.7 MultiMON

MultiMON is a multicast Mbone monitoring tool developed by MECCANO partner CRC, the Canadian Communications Research Centre.

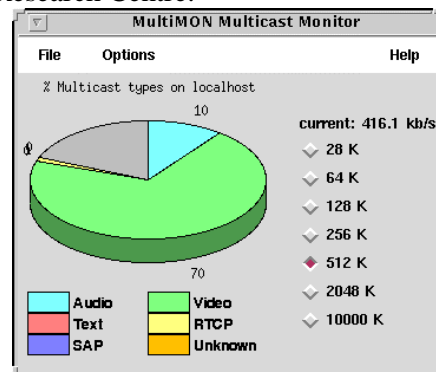
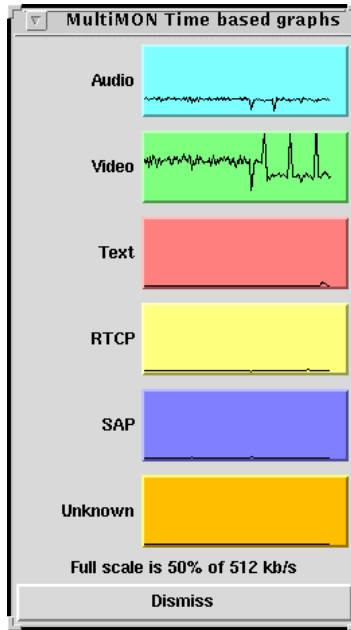


Figure 3: MultiMON



**Figure 4: MultiMON - time-based graphs**

This tool monitors a network segment, reports on multicast traffic seen and optionally allows one to view and record RTCP statistics. It is built on a client/server basis, which allows the data collectors (Servers) to be distant from the GUI front end displays (Clients). MultiMON is capable of providing both real-time display of traffic patterns as well as the ability to log the traffic patterns. It supports the display of the traffic breakdown by application type, and a time by bitrate bar chart. Sub-windows for each identified session can be spawned from the Client. These sub-windows show the session name, type, current and max bitrate, and allow one to join the session (locally), or to run an rtcp monitor on it. It also allows the collection of long term information on traffic patterns.

**Usability:**

MultiMON, is a particularly useful tool for session organizers and network administrators. It allows the users to monitor the amount of network capacity, which is currently being used by multicast traffic, and to measure and monitor the quality of service across the Mbone network. Network administrators on a LAN can therefore pin point network problems and diagnose the performance of the network. MultiMON is of particular advantage to corporate LANs as it can help network administrators increase the overall efficiency of the network. MultiMON provides a sophisticated range of methods for extracting information on network conditions for multicast applications. Although it requires an understanding of network principles to interpret the data meaningfully it is easy to use and to generate reports on network traffic. It is therefore appropriate in its functionality for the user base it is aimed at.

### **3.0 Alternative conferencing tools**

In addition to the MECCANO toolset a number of other conferencing tools have been evaluated and are mentioned throughout this paper. The two primary tools aside from the MECCANO toolset which were investigated are Microsoft Netmeeting and the Placeware conferencing system.

#### **3.1 Placeware**

Placeware is a product available from Placeware Inc and is based on a hosting type conferencing service. This service consists of a hosting system on a central server, which is typically maintained by Placeware. This approach is conceptually different from the Meccano approach and is based on a centralized architecture. Placewares primary advantage is that it offers a clearly defined structure for implementing and delivering conferencing situations. Placeware has developed a structure which offers meeting rooms and auditorium metaphors. This feature allow users to easily identify and implement the conferencing scenario which is most appropriate for their particular needs. However this is also in some ways its primary limitation in that it incorporates an interface and conferencing approach which all participants are required to use.

#### **Key Features:**

- Allows users to give presentations through a Web browser. The presenter uploads a slide presentation to the Placeware server. The slides are then made available to the other participants in the conference, for viewing and annotating.
- Incorporates limited application viewing and collaborative Web browsing. Placeware allows presenters to annotate slides during presentations, and allows participants to work in a collaborative mode using a shared whiteboard.
- Includes an interactive chat capability. Users can choose to initiate chats between themselves or with the group.
- Is able to operate freely over Firewalls.
- Offers Video streaming. While it does not enable video conferencing as such. It can provide video streaming for seminars, or pre recorded presentations.
- Offers mutli level security. The placeware room metaphor allows specific control over participants access to conferences.

While Placeware is perhaps the most consistently accessible of the various conferencing solution. (all it requires is a web browser and a connection to the internet) and in some ways the most mature, it is limited by the inability to provide true multiparty video conferencing. It is also constrained by the need to purchase or establish a server based service to control conferences. Further it is potentially prone to the network bottlenecks that can occur under heavy traffic loads. This sort of difficulty is typical of server based solutions. As the amount of traffic requesting data from the server grows the performance can decrease.

#### **3.3 NetMeeting**

The Netmeeting tools were examined because

- They are also a stable, commercially available product. Although Microsoft provides Netmeeting free of charge it is for all intents and purposes a commercial product.
- It delivers a replicated conferencing system over standard unicast networks. This makes Netmeeting usable from standard home connections to the internet.

However Netmeeting is still restricted by corporate firewalls. Hewlett Packard for instance does not allow the transmission of netmeeting data packets across its firewall, although it can be used within the internal network.

### **Key Features:**

While Netmeeting is quite different in interface design and approach from the MECCANO tools, in functionality it is very similar. It offers the transmission of video and audio, a shared whiteboard, and a shared text editor. It offers the basic tools and features that a conferencing system should contain, including the ability to share applications. However it is severely limited by the inability to support true multi-participant interactions, and the lack of multi platform support.

- A tighter more unified interface. Netmeeting version 3.0 integrates the controls within a single initial interface which starts up with a video and audio channel open. If a member in a conference requests the sharing of a document, then Netmeeting will launch the appropriate application at both the originating members site and all participating sites.
- It provides a text chat feature. While this provides the facility for members without audio to participate in a conference in actuality it is typically an ineffective method of communicating within a multi media conference. As members with audio must also type their discussions which quite realistically will not occur. The chat feature therefore can only be used effectively if all participants are using the chat as the primary method of communication.
- It also provides the ability to share applications, like Powerpoint, Word, etc. While this is ostensibly an extremely useful feature in reality the cost in network load is so great that using this feature on any thing other than a highspeed Lan is unfeasible. From a typical modem connection or even over ISDN the network lag in transmitting the data makes editing shared applications painfully slow. In addition shared applications potentially introduce security risks.
- Operates over unicast networks. Because of the greater reliability and availability of unicast networks, it is generally easier to initiate and access Netmeeting conferences. However because of the less efficient performance of these network compared to a multicast network, Netmeeting tends to suffer from performance restrictions, and is only well suited for point to point conferences.

## **4.0 Summary**

The aim of this section has been to provide an overview and usability assessment of the MECCANO conferencing tools.

### **4.1 Application usability**

The primary conclusion of the survey has been that the range of tools being developed address the primary requirements for delivering conferencing and educational iNTERactions. In

general the only primary feature lacking from the MECCANO tools which are resolvable within the context of the MECCANO project is the management of shared documents, and Multimedia data and the provision of session recording and archival features. These issues are currently being addressed within the MECCANO project by tools such as MMCR, AOFrec/AOFwb, and SVDA., as well as gateway such as UTG which would increase the accessibility of the tools.

#### **4.2 Network usability:**

The primary conclusion of the survey has been that in general the range of tools being developed address the primary requirements for delivering conferencing and educational iNTEractions. The report has largely found that there are two separate but dependent issues which affect the overall usability of the tools. This is application level issues and network layer issues. One of the primary limitations which affected testign of the core tools was caused by issues outside of the scope of the MECCANO project. This typically has been poor connectivity problems within and to the Mbone. At Hewlett Packard for instance, the establishment of a proper connection to the Mbone took three months from the time of the initial request to by completed., and then was plagued by some restrictions initially raised by security issues, and connectivity difficulties. The problem within HP pointed out a secondary difficulty which was the lack of dedicated Multicast support technicians. As Multicast is not typically used within HP support for setting up and using multicast tools is not available on an official basis. For many corporations and institutions this is still the case, making the installation and usage of multicast conferencing tools difficult, and often prohibitive. There are a number of tools and feature within the MECCANO toolset which promise a fully usable conferencing infrastructure but as yet are unable to be fully exploited and used within HP.

The initial assessment of the tools therefore is that for further development and testing to be undertaken the supporting multicast network, and the acceptance within the internet community of IP Multicasting needs to be broadened.



## **5.0 An Implementation Analysis of conferencing tools**

### **5.0. Introduction**

For the purposes of assessing the usability of the meccano tools in real world usage this report has investigated their usage in three basic scenarios:

- Collaborative work.
- Multicast seminars.
- Tele-educational applications

These scenarios broadly encompass the range of use which is typical of collaborative applications, and encompass the types of usage they have been employed for within Hewlett Packard Laboratories in Bristol. The MECCANO tools were tested and evaluated for their general usability in these scenarios, and to assess the requirements of establishing a networked collaborative system within a corporate setting.

The above categorization is not intended to be a definitive categorization of multi-participant scenarios. But simply functions to indicate broad areas which encompass unique problems that affect the usability and implementation of collaboRATive applications. While there are crossovers amongst these scenarios, and specific applications which fall between these categories, there are general characteristics within these scenarios which have proven useful for assessing the usability of the various tools. Collaborative work environments for instance require the ability to share in an interactive manner documents or even programs and have strong demands for multiparty real time communication and flexible floor control policies. Tele education applications on the other hand may require tighter floor control policies, or the ability to maintain a centralized document management system which can deliver identical copies of material to participants as well meet the need to record and rebroadcast specific sessions or parts of a session. A more detailed breakdown of the uses and applications for realtime multimedia is discussed in the MECCANO paper Real-time Multi-media Applications which is available on the Meccano website at <http://www-mice.cs.ucl.ac.uk/multimedia/projects/meccano/deliverables/>

### **5.1 Multicast seminars.**

A potentially large scale use of Multicast enabled tools is the broadcast of live seminars which can allow iNTEractive participation by remote participants, such as questions, commenting on slides etc. . Meccano partner Hewlett Packard for instance is currently investigating the use of the Mbone for the transmission of a series of seminars and workshops which it holds through Brims (Basic Research Institute in Mathematical Sciences) and the IRI ( the internet Research Institute). Hewlett Packard Laboratories relies on seminars, workshops, and presentation for a large part of its communication of research programs and issues being undertaken within the Laboratory. Such seminars, and presentation of project work and research findings are a regular occurrence and make up a large part of HP research archives These presentations are typically recorded to tape and archived. Recently however HP has been investigating methods of making these seminars available online. Both as recorded material and for live delivery.

Two primary methods have been investigated for this purpose. The use of Real Video for delivering recorded material, and the Mbone for the delivery of live seminars.

Currently the delivery of live seminars is carried out through a transmission connection between the central seminar room and a multicast enabled machine connected to the Mbone. The seminars occur within a single room within HP which contains sufficient broadcast quality equipment and a connecting feed to a Desktop PC with a class C connection to the internet. This machine is required for broadcasting to the Mbone as it maintains a direct connection to the external internet, bypassing the need to filter traffic through the corporate firewall.

#### **5.1.1 Network Security issues.**

The initial issue raised by the establishment of this facility was the limitations and requirements of setting up a secure connection which would meet the requirements of the security procedures of Hewlett Packard. While security issues with regards to the transferring of multicast signals across corporate firewalls may be more perceived than actual. The establishment of the above service has pointed out a number of issues required to deliver quality presentations.

One of the constraints of the seminar situation at HP is that the multicasting machine must be disconnected from the rest of the HP network in order to maintain security. This necessity hampers the usability of the machine for collaborative work as it disables the machine from accessing network resources. This improves security but hinders productivity. The machine therefore is suitable for multi-casting seminars and for partaking in meetings, but would be unsuitable for use in collaborative work, educational applications, or any scenario in which a user may need to access their resources on the internal network. While this is less of a problem for Seminar broadcasts, as typically a connection to the internal network is unnecessary, it does become a problem for conferencing scenarios. Firewalls therefore are perhaps the primary limitation to the usage of Mbone tools within corporations such as Hewlett Packard and increasingly within University institutes.

#### **5.1.2 Deliver of secured conferences:**

An additional security issue is the ability to deliver secure seminar multicasts. Within Hewlett Packard a number of the seminars, and presentation which occur are of a sensitive nature, and the ability to insure that only authorized personal are allowed to access the material is essential. For seminars there fore which are to multicast over the Mbone the facility within the MECCANO tools for establishing encrypted sessions addresses this problem adequately. However although secure sessions are achievable, lack of awareness and distrust of the multicasting seminars over the Mbone has resulted in a reluctance to fully trust Multicasting of seminars.

#### **5.1.3 Infrastructure for capturing broadcast content.**

While in many ways the followign issues discussed in are orthogonal to the usability of the tools themselves they do raise a number of issues which it is felt are worth discussing. While the requirements for building a machine capable of delivering basic multicast seminars is relatively low, the underlying infrastructure required to capture the seminars and transmit them to the broadcasting machine is still relatively high. Good quality cameras, sound equipment and the networking infrastructure to transfer materials is still prohibitively expensive.

As it is always desirable to capture the original source material at as good a quality as possible, it is necessary to have sufficiently good equipment, and technicians to support and operate the equipment. The trials at Hewlett Packard are in some ways therefore atypical as a fairly sophisticated and comprehensive video recording facility was in place. The primary work which needed to be established therefore was the connection for delivering the video and audio signals between the video broadcast room, where the seminars session was being taped to the multicast transmission machine.

#### **5.1.4 Transmission of supporting material.**

Typically seminars involved more than just the transmission of speakers but often include the use of slides, or occasionally the demonstration of application etc. In this situation the use of a video channel to capture and transmit such material is typically inadequate. This is due to the low resolution of video which is usually unable to capture small textual details on the slides with sufficient detail. The solution to this is to broadcast the slides and the material on a different channel from the video. The use of a whiteboard for this purpose seems obvious however placing slides in a presentation into a whiteboard application is not easily achievable in a typical live seminar broadcast. Currently solutions to this problem are being undertaken.

Slide transmission through the use of a video channel is typically difficult to achieve due to the low resolution rate of the video channel. Typically slides are produced by users on a desktop PC with a resolution of 800 by 600 and contains text and other detailed information which are beyond the capabilities of video to capture. This situation is worsened when the video is played back in a typical window display of (180x240). For this reason the inclusion of a facility for transmitting slides in conjunction with a video and audio channel would be desirable. The general methods for achieving this might consist of three basic approaches. Shared application, slide or document import, or shared HTML.

##### ***5.1.4.1 Importation of slides***

The method would consist of the integration into the whiteboard tools the facility to launch and display a variety of slide formats such as Powerpoint, Pdf, etc. This would allow the individual presenting the seminar to display their slides to the viewing participants of the lecture. While this may be a feasible solution to the problem, as discussed in section 2.3.5, in the context of the MECCANO tools it may not be the preferable solution.

##### ***5.1.4.2 Shared HTML***

A more desirable solution may be to integrate the ability to display HTML pages into NTE or WBD, or provide some facility to display and control web Pages. As with the Web it is likely to be a better solution to develop a set of standards and protocols which define a basic method for delivering content over the Mbone. The ability to deliver application specific material is a facility which is perhaps best developed by third parties users and developers of the tools.

##### ***5.1.4.3 Shared application:***

while this feature may be useful and perhaps desirable for conferencing, or educational scenarios it is less useful for Seminar style broadcasts where typically users will be delivering a set of slides which does not require any form of collaboration.

### **5.1.5 Conclusion**

Despite the difficulties raised by current bandwidth and firewall limitations the general conclusions of using the current MECCANO tools for transmitting live seminars appears to be a fairly successful. The primary limitations to the establishment of the seminar multicast facility within HP has arisen from the physical requirements of establishing the system capable of capturing seminars in the first place, and the difficulties of negotiating the corporate firewall.

### **5.2.0 Videoconferencing**

The use of video conferencing systems at Hewlett Packard has traditionally involved the use of ISDN Video or teleconferencing conferencing rooms. Recently the use of Netmeeting , and the MECCANO tools has been investigated to determine the feasibility of establishing Desktop conferences, and collaborative work spaces.

#### **5.2.1 Netmeeting**

Net meeting is a freely available conferencing solution from Microsoft and offers a tightly unified range of features for video conferencing. However while it offers most of the basic features available within the MECCANO tools it will not operate over firewalls, and does not properly support multi-participant meetings. Its primary limitation is in the performance of the video and audio over unicast connections and the lack of effective multiparticipant conferencing support. Further some of its feature such as application sharing while ostensibly useful are not particularly practical for usage in a low bandwidth unicast conference.

Further Netmeeting is greatly hindered by its lack of multi platform support within organization like Hewlett Packard there are likely to be a number of differing platforms and therefore the inability to allow users of a HP-UX system, or a Linux system to join a conferences is a severe limitation. Netmeeting would therefore only feasibly be useful for point to point video conferencing or for application sharing within an Intranet between two users on windows machines.

#### **5.2.2 Placeware:**

The primary advantage of the Placeware system and other web conferencing solutions is that it provides the most geographically accessible solution. It enables any individual with a phone line and internet connection to access a conference from any location. Further it can be used over standard modem connections, and is scalable to very large groups of participants. PlaceWare incorporates a very structured approach to the organization and presentation of conferences and seminars. While this can be a disadvantage in that it limits the range of features which are available in the conference, it has the advantage of being easy to set up and requires little configuration or preparation once it is set up. Also for non IT experienced users, it offers an extremely easy to understand and use conferencing solution, with little or no need to configure options, video compression settings etc.

Placeware is most effective as a collaborative tele-conferencing application, and for use in presentations, and lecture type scenarios. It allows for a centralized document or slide presentation to be shared amongst participants, and provides a tight yet flexible floor control policy. Further Placeware offers a clearly defined conferencing approach which makes it easy

to understand what style of conferencing can be accomplished, and to guarantee the quality of that conference. Other tools like Netmeeting, which offer a large set of features and seemingly encompass any possible requirement for a video conferencing system, offers inconsistent and limited performance, and lacks the unified integration of features which Placeware offers. However Placeware has chosen to offer a limited range of features, in order to maximise the accessibility, and ease of use of its system. For this reason there is no realtime, collaborative video channel, the audio is delivered through the use of a second phone line.

### **5.2.3 The Meccano tools**

To date the Meccano tools offer the most robust and potentially powerful system available for desktop conferencing. The advantages of conferencing over Multicast networks is far superior to unicast solutions. Of the tools tested the MECCANO tools have proven to be the most robust and flexible. They are available on the widest range of platforms. A secondary advantage of the tools is the freely available source code which allows for customization of the tools.

However while these tools are perhaps the most powerful and least limiting tools available in their design they currently lack the supporting infrastructure to make full use of their potential. As well some of the more advanced features such as session recording, and unicast gateways are in an early stage of development and are not yet fully developed. The ideal scenario in which the Mbone tools could be used would be within a multicast enabled intranet containing a number of platforms. In such an environment the tools are capable of delivering a fully interactive, video conferencing and offers the most flexible solution, of the tools available.

### **5.2.4 Summary**

In general the usage of desktop conferencing within Hewlett Packard has not been widely taken up due to the lack of a supporting infrastructure. However it is also likely that a large part of the hesitancy is due to the lack of a communication culture which employs this form of integration. While initial responses to the concept of desktop conferencing and shared application situations is positive, The actual implementation of the tools has met with a lack of enthusiasm. Initial indications suggest that the current effectiveness of the conferencing infrastructure is insufficient to make using video conferencing tools more attractive than the alternatives.

### **5.3.0 Educational**

The need for employee training an increasing requirement in today's corporate environments. This is seen as such a large need that HP has established the HP education service as a business for the delivery of training to IT professionals. This is a Web based system and employs the Placeware conferencing tool in order to deliver unicast classroom conferences. While this system works well enough for the model which HP education has established, as discussed in section 2.4.1, there are some limitations in its overall functionality..

A particular area in which the Placeware tools are likely to be limited is in the delivery of language lessons. This is a costly demand for corporations like HP as a good deal of travel abroad needs to be carried out. The cost in terms of time and money of language lessons, can

be alleviated through the delivery of online lessons. However for this type of course, the ability to integrate effective multimodal communications is particularly important. A series of trials were undertaken at HP to test the feasibility of delivering language courses over the internet using the MECCANO tools as well as Netmeeting. Respondents tended to indicate a preference for the presence of a video channel during the lessons, and the tutor felt that the presence of a video channel improved the quality of the lesson.

In general both the MECCANO tools and NetMeeting have proved largely effective in this task. Because participants were few, typically two to three members, there was little difficulty with delivering the courses at a sufficient level of quality to effectively introduce students to the course material. The quality of sound in both applications proved high enough for the teacher and student to be able to identify the subtle pronunciation differences within the language. The ability to open text documents within NTE was also successful. In general the tools have quite adequately demonstrated the feasibility of delivering language courses in this manner.

### **5.3.1 Network limitation**

The primary limitation which arose in the initial trials, were two fold, The first was the inability of Netmeeting to effectively deliver multiparticipant sessions. While Netmeeting was sufficient for point to point conferences between two participants the addition of a third participant was limited to a text only interactions. They were unable to use a video or audio channel in their communication with the participants.

The secondary problem was arose as a result of the limited multicast network access for the participants. In order to use the MECCANO tools all participants were required to operate on a multicast enabled network. In practice this is unlikely to be the case and prevented the tutor from delivering the session from his home or a remote location.

### **5.3.2 Recording sessions**

As mentioned the ability to record sessions is of particular advantage to tele-educational applications. Currently the Meccano toolset employs a set of tools available under Linux for recording events. In order to improve the usability of the MECCANO toolset it would be useful to incorporate this feature into the tools in a more natural layer. However the problem is raised of how to record the various media streams being delivered.

## **5.4 Summary**

The above section has attempted to provide an overview of the current state and usability of desktop conferencing systems for particular session types. It has outlined the basic issues and requirements for these systems and has evaluated different approaches to delivering the three primary session types. The initial conclusions of this report are that current approaches to delivering conferencing systems require limiting the nature of the conference interactions to a specific style and choosing the appropriate tool to address this scenario. This is not an ideal solution and it would be more desirable for a conferencing system to be robust enough to enable a full range of interactions and features. In this context the MECCANO tool set promises the most wide ranging of features, although it is also currently the most demanding to set up and is not yet fully mature as a set of tools.

### 5.5 Basic Feature comparison

	Aud io supp ort	Vid eo sup port	Sha red Whi tebo ards	Sha red appl icati on	Rec ora dabl e sess ions	Sec ure con fere nci ng	Multi point suppo rt	Point to point suppo rt	Flex ible Flo or cont rol	Ope RAT es over fire wall s	Platform support
Meccano tools	yes	yes	yes	no	yes	yes	yes	yes	no	no	Windows, Irix, SunOs, freeBSD Linux
Netmeeting	yes	yes	yes	yes	no	yes	no	yes	no	no	Windows
PlaceWare	yes	no	yes	no	yes	yes	yes	yes	yes	yes	Requires Java enabled browser, and PlaceWare plugin.

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