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over ATM Networks and Others (MECCANO)**

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Abstract:

The MECCANO project, building on the results of the MERCI project, is further improving the MERCI toolkit to provide a better environment for multimedia collaboration.

The tools used by the project, whether developed by MECCANO or from other sources, are proven within the project by the activities of WP8, Consolidation of Applications. Further validation and important user feedback is provided by those projects and users using the MECCANO tools in their work. Some we actively support as part of WP9, Support for Validation Sites. In this document we report on the work of supporting our users during the first year of the project.

The projects we have supported have used the tools under the *real* conditions for remote teaching, seminars and distributed virtual meetings. We describe the work of the supported projects and the progress that has been made by them and by us.

Keyword list:

Multimedia Conferencing, Distance Education, Mbone, User support, Validation.

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Introduction

The objectives of Work-package 9 are to ensure that the MECCANO software releases meet the needs of the different validation activities using the packages. This includes both fixing problems in the Releases, and ensuring that the contents of the Releases meet the needs of the validation projects. The background to the workpackage is given in the following paragraphs.

By the start of MECCANO, the tools provided by the Multimedia European Research Conferencing Integration (MERC I) project [1] were considered vital to proposals like PROSPECT (ACTS), ICE-CAR (Telematics), NICE (Telematics) and various other european and national projects. Thus in supporting these validation projects we have had to ensure that:

- direct deficiencies in our tools are remedied
- the tools meet the needs of these validation and demonstration projects
- tools developed by projects which use MECCANO tools can be integrated into the toolkit.

The detailed activities have been, and are, driven by the needs, activities and desires of the projects which we support. Although we allocate specific effort to the liaison and tailoring tasks which are described in this deliverable, much effort has also been put into the technical workpackages to support these projects.

We also provide a limited *Help Desk* facility, via email lists, to provide users of the MECCANO tools with direct help in their use on the various platforms we support and the network environments in which we operate.

In the following pages we summarise the work we have done during the first year in support of the projects. Each of the partners involved in the workpackage has produced a report and the whole is summarised.

Partner reports

The partners in this workpackage are:

- Academic Computing Centre (ACC), Krakow, Poland
- Communications Research Centre (CRC), Ottawa, Canada
- New Learning AS (NL), Oslo, Norway
- TELES AG (TELES), Berlin, Germany
- Universtiy College London (UCL), London, UK

We review their work individually in the following sections.

ACC, Krakow, Poland

ACC have supported the following user groups which are interested in using video conferencing tools developed or enhanced during the project:

- Medical community of Krakow represented by the John Paul II Hospital;
- A group of scientists from the Faculty of Physics and Nuclear Techniques, University of Mining and Metallurgy, Krakow.

For the purpose of MECCANO WP9, as well as for the future Fifth Framework collaboration, a letter of intention between ACC and John Paul II hospital in Krakow has been signed . John Paul II Hospital (650 beds, 1300 employees) is a specialist medical center with several pulmonological and cardiological wards. The hospital comprises 13 wards, most of them focused on chest medicine. There are also two surgical departments, one for cardiac surgery and the other for thoracic surgery. Two thousand open heart operations are performed in the hospital annually. John Paul II Hospital is one of the most advanced hospitals in the region in terms of the development of information

infrastructure. During 1998/1999 the hospital was equipped with the high-end campus network infrastructure based on 622MB/s ATM and switched Fast Ethernet.

Support provided

ACC provided 2.5 pms of support during the four months to May 1999.

It provides significant support for the fiber link between the hospital and ACC network center. This on-going project, lead by ACC, is scheduled for completion in the autumn of 1999. The 3km high speed link between ACC and the Hospital will allow pan-european conferencing collaboration and telemedicine applications over TEN-155. ACC not only supports high speed Internet connection for the Hospital, but also gives technical support on networking technology, massive data storage and multimedia support. This support includes training on the installation and configuration of MECCANO tools.

As MECCANO tools are oriented towards a wide group of users, ACC has been working on the translation of the VIC, RAT and SDR manuals into Polish. Polish versions of the MECCANO tools documentation allow for easier dissemination of the tools among users with limited English. VIC and RAT manuals are available for free download from the ACC MECCANO web site [2] in the *documentation* section. The final version of the SDR manual is scheduled for mid June 1999.

Having noticed a substantial interest in Internet video conferencing among the scientific community in Krakow, ACC prepared an introductory seminar on the technology and tools developed under MECCANO. This event took place on 24 April 1999 within the framework of the *Open Technical University* [3]. The MECCANO project has been introduced, the goal of individual work packages have been described and the most important MECCANO tools have been briefly presented. A PowerPoint presentation from the seminar (in polish) is available for free download from ACC MECCANO web site.

ACC has been also providing limited technical support for users without Internet multicast connectivity. Those support activities included consulting on multicast routing configuration and multimedia hardware and software installation. In cases where full-featured Mbone connectivity could not be established, RTP packet reflector (rtprans) has been used. This particular technique has been successfully utilised in case of the Faculty of Physics and Nuclear Techniques, UMM.

User response

The validation activities have revealed that the current release of the MECCANO tools provides sufficient functionality and stability for the purpose of the collaborative video conferencing over Krakow Metropolitan Area Network. Those of the users evaluating MECCANO tools who had worked with the older versions of the tools noticed a substantial increase in the stability and reliability of the versions released in spring 1999.

An important milestone in MECCANO as far as Poland is concerned was the increase in the bandwidth of the Polish research Internet backbone to 34 Mb/s and its connection to TEN-155 [4] established in March 1999. The improvement of network connectivity in Poland makes it possible to use the MECCANO tools not just on LANs and MANs but also across Poland and the whole of Europe. As many users tend to identify low quality audio and video caused by network congestion with low quality of the tools themselves, ACC's efforts in enhancing network connectivity in Poland, made at the State Committee for Scientific Research level, seems to have had a direct impact on users' opinions on the streaming multimedia tools provided by MECCANO.

Future plans

An initial contact with scientists representing the Technical University of Gliwice, showing big interest in using MECCANO tools in their projects, has been made. ACC offered technical support in establishing and configuring of Mbone connectivity, using MECCANO video conferencing tools, providing multicast traffic monitoring facilities.

ACC's main contribution to MECCANO tools - the Scalable Video Distribution Architecture will be deployed in Krakow MAN. The system will serve as the multimedia repository for the supported user groups, allowing stored multimedia content to be retransmitted on demand.

CRC, Ottawa, Canada

CRC has been supporting the MBone Knowledge Networking Project [5] which has 2 interrelated activities:

1. study, experiment and recommend more advanced MBone networking architectures or configuration on CA*netII than are currently configured.
2. research and evaluate the degree to which specific MBone technology and tools enhance the process of coordinating networked knowledge production in the context of (a) professional research; and (b) graduate curricula.

Support provided

CRC has spent a total of 3.0 pms on providing a regular contribution to monitoring and trouble shooting the multicast network during the distributed course sessions. This work has taken place as part of a broader program of monitoring the national and international multicast support in CA*netII. CRC has exchanged information on MBone tools with other participants in the project.

Future plans

This CANARIE [6] funded project is nearing completion. There are plans to apply for support to a follow-on project when the competition is announced. Discussions about including international partners have been frustrated by the bad international MBone connectivity from CA*netII.

TELES, Berlin, Germany

TELES and UB have closely cooperated in WP9, particularly in providing hardware and software for gateways. In various cases support was given for setting up conference environments using MECCANO tools and/or instructing users how to use these tools in particular scenarios.

Support provided

The German CONTRABAND project dealing with handling of routine work and emergency situations in the harbour environment has benefitted in its last year from MECCANO tools, infrastructure, and expertise. In particular, local coordination of MECCANO tools and their integration with CONTRABAND-specific GUIs and conference controllers is based upon the Mbus concept developed in MECCANO. Support was provided to the harbour institutions to set up and configure a multicast network between the sites involved, based upon their ATM network infrastructure. Furthermore, some of the harbour institution personnel were trained to use MECCANO tools and we gathered feedback with respect to their perceived needs (see below).

Within the Bremen university, a sequence of distributed lectures was held about *media and computer sciences*. All these lectures were transmitted via the Mbone to another Bremen educational institution and to all other interested observers. Two dedicated rooms in the two universities were specifically equipped for teleteaching purposes to establish a virtual classroom. The MECCANO tools were used for transmission of audio and video between the two primary sites. The lecturers and the supporting staff for the lecture series were trained to use the Mbone and to configure Mbone equipment; also, specialized tool configurations were developed and appropriate startup files created to simplify the startup procedure for all the systems. Finally, configuring and debugging multicasting in the relevant parts of the network were supported.

Within the MECCANO project, partner sites were supported in installing gateway components. This support includes providing interested partners with ISDN hardware and drivers for Linux as well as assisting during the installation process.

User response

The feedback gathered on tool usability and additional user requirements came primarily out of the CONTRABAND project and the media and computer science lecture series. In both projects, people felt it essential to have support for Windows-based platforms that would enable them to use applications and presentation tools they are familiar with, but were disappointed by the

performance exhibited by the MECCANO tools in the Windows environment (as opposed to Unix workstations).

In CONTRABAND, the people involved explained that they would need application sharing as basis for joint work. Out of the available application sharing systems for Microsoft Windows platforms, Microsoft NetMeeting seemed the most workable and best performing solution. As a consequence, we are investigating how to incorporate Netmeeting into the MECCANO conferencing architecture to be able to provide an integrated conferencing solution for Windows platforms. For CONTRABAND, it should also be noted that users had to be urged to try and use the new technology: the procedure for using the MECCANO tools, even though equipped with simple GUIs and other simplifying control mechanisms developed in CONTRABAND, was perceived as too complex while the potential gains in productivity were not immediately obvious.

In the lecture series, the lecturers used Microsoft Powerpoint's presentation mode. With all the special effects provided by Powerpoint, however, using application sharing tools proved to be insufficient for proper remote presentations: the performance with animation was not satisfactory and application sharing tools could not convey all media types used in presentation (e.g. audio clips could not be shared).

Future plans

As Powerpoint comes with a built-in telepresentation mode, we will investigate the possibility of integrating certain such Windows applications with local control mechanisms such as the Mbus which is used to communicate between MECCANO applications.

UCL, London, UK

UCL has put its major effort into the support of the work of the UK project *Piloting IP Videoconferencing* (PIPVIC2) [7]. This project is a large scale pilot funded by the United Kingdom Education and Research Network Association (UKERNA) [8] following the success of the earlier small scale pilot PIPVIC [9].

On a smaller scale, UCL has worked with the Internet Collaboration Board (ICB) [10] and the Interworking Public Key Certification Infrastructure for Commerce, Administration and Research (ICE-CAR) project [11] after its start in January 1999.

PIPVIC2

The project started in December 1998 and will be completed in October 1999. Its aim is to undertake piloting activities to gain a greater understanding of the issues encountered in running a large scale IP videoconferencing service. It forms a core part of the UKERNA videoconferencing strategy. The project has thirteen partners and is coordinated by University College London. The other Higher Education Institution partner sites are:

- University of Birmingham
- Dundee University
- University of Edinburgh
- University of Essex
- University of Exeter
- University of Glasgow
- Glasgow Caledonian University
- University of Manchester
- The School of Slavonic and East European Studies of the University of London (SSEES)
- St. Andrews University
- University of Wales at Aberystwyth

- University of Westminster

The project is active in teaching, research and administration. The teaching activities provide a number of real courses, including languages, film studies, sociology, computer networking and business. Research activities are in the field of particle physics and collaboration in data archiving. Administrative tasks in which the project is active include external examiners meetings, project meetings of the several projects, including PIPVIC2 itself.

Support provided

UCL has spent a total of 2.5 pms on supporting the PIPVIC2 project during this first year. The support provided to the project by MECCANO can be summarised under these four headings:

- Help with the installation of the tools
- Modification of the tools to provided needed additional features
- Network analysis during events and activities to identify connectivity problems
- Support to project users during events such as seminars and classes

In each of these areas we were able to provide help and to receive important feedback from users of the tools both on their usability and the general utility of the technology for the purposes of the users.

Installation of tools

The actual installation of the tools on PC platforms, which are the most commonly used in the PIPVIC2 project, consists of simply running a self-extracting binary installation file. On workstation platforms the software is provided as a binary file. The source is also provided for local compilation, if necessary.

Most of the problems encountered in this area arose from the variation in the specification of the hardware components in PCs. This variation in the components makes it impossible to ensure that a single version of the software will run correctly on any platform. Typical of these problems were

- inadequate audio cards and/or drivers in the early stages
- unsuitable analogue peripherals such as headsets for desktop conferencing activities and echo cancellation equipment for room-based activities, now the main problem in PIPVIC2

These problems do still occur occasionally, but, in the main, have only to be solved for a new user or when using a new machine.

We have also experienced some difficulties in the maintenance of version control amongst users. Although we try to maintain backwards compatibility in new versions of the tools this is not always possible. Technical improvements sometimes mandate the use of new versions to make use of new techniques and sometimes there are errors in early versions which can affect later versions in which the errors have been corrected. An example of the latter is the Network Text Editor (NTE) [12] in some versions of which a specific bug is able to corrupt the shared files for all users, even those running a later corrected version. If only one user in a session is using such a corrupting version, the other participants cannot collaborate properly. In an environment of rapidly changing versions driven by user feedback on both bugs and new feature requests, this has proved to need constant attention.

Modification of the tools

The main requirement which has arisen from working with the PIPVIC2 project has been for changes to the NTE to allow the use of alternative character sets for language teaching. This facility has been implemented for Microsoft platforms (Win95, Win98 and NT4.0) using the Microsoft Multilanguage Support features for these platforms on which the project has standardised. It will only work correctly if all users in the session have the support package installed on their platforms. An additional problem with this feature has been the provision of the correct keyboard mappings. Whilst adhesive labels are available for individual character sets, this

is not a scalable solution where there is the need for several such sets as in language teaching. The PIPVIC2 solution for the Russian classes was to have a small keyboard map of the cyrillic characters displayed in a window at the bottom of the monitor.

The ability to synchronise audio and video streams has long been recognised as necessary in an environment where the media are handled by separate tools. In the wide area of the Internet, it has seldom been possible in the past to achieve sufficient bandwidth for video to make lip-synchronisation necessary. Today, the ability to synchronise is beginning to be an issue once more as more users have access to higher bandwidth networks in Europe. The Robust Audio Tool (RAT) [13] has the facility to use the conference bus feature to communicate with a video tool to allow this synchronisation; at present we do not have a version of the video tool VideoConferencing (VIC) [14] which can make use of this feature. We anticipate that such a feature will be made available in the future.

Network analysis to identify connectivity problems

During the regular weekly project meetings and in the course of other project activities, members of the MECCANO team at UCL have provided analysis of network problems locally and have joined with others at the remote PIPVIC2 sites in collecting statistics. Where problems have been identified MECCANO team members have liaised with UKERNA to solve them. Additionally they have joined with networking specialists at PIPVIC2 partner sites to run diagnostic tests designed to identify structural problems both in the backbone network and in the connections to desktops and conference rooms at local sites.

User support during project activities

This has been provided by the presence of a member of the MECCANO project team at UCL whenever an activity involving UCL was taking place. This team member has provided technical support and trouble shooting for those taking part. Team members also provide a continuous email help line for the supported MECCANO tools and will respond quickly to requests from users.

User response

Part of the PIPVIC2 project deals with user reaction to the use of the tools and so far there have been a number of analyses produced for specific activities. These reports are available from the PIPVIC2 project web site [7]. In general, user response has been favourable. There has been a positive approach to any problems or deficiencies in the tools which has emphasised a willingness to work with the MECCANO project to provide improved tools with the specific features needed for use in these real applications. Examples of this collaboration were given above in the section *Modification of the tools*.

Future plans

We plan to continue the close cooperation which has been so valuable during the past year for the remainder of the PIPVIC2 project.

ICB

Edgar Harmsen and Andrew Tu of the Communications Systems Division of the NATO Consultation, Command and Control Agency (NC3A) represented the ICB. The activities consisted of a number of trials over the Internet between NC3A and UCL. These trials were held during the period 5-9 October 1998. The trials were documented by the team at NC3A. The report which it produced is included with this deliverable as Appendix I.

Support provided

The details of the trials may be read in Appendix I. At the UCL end the network support was provided by John Andrews and the tool support by Roy Bennett.

User response

The user response to our collaboration and assistance was extremely positive. This is well illustrated in the summary of the NC3A report which reads, in part:

The trial with UCL improves our understanding of QoS issues concerning multimedia collaboration over the Internet, and promotes international collaboration on related research activities. It is also important to continue collaboration work with UCL which is a both knowledgeable, as well as a reliable and resourceful partner.

A number of the specific points they raised are on our working agenda. For example we have already produced versions of RAT and VIC which operate under IPv6. The group have not requested any further assistance to date.

Future plans

We have no firm plans to do further work with the ICB, but we remain available to assist them in the future should they ask us.

ICE-CAR

The objective of the project is to provide all the technology components to support the secure use of the internet for commercial and administrative applications in Europe. The project will improve and deploy the existing security toolsets from the perspective of usability and interoperability.

Support provided

Since the project started only in January 1999, we have provided little help to the project members in their use of the MECCANO tools. We have liaised closely with them on the improvements which have been made to the Session Directory (SDR) [15] in its ability to handle secure conferences. An improved version of this tool was delivered as part of the first major delivery of MECCANO tools made in March 1999.

User response

It is too soon, as yet, for any response from participants to their use of the MECCANO tools in the ICE-CAR project.

Future plans

There is a commitment on our part to provide a high level of support to the project members in their use of the tools for conferencing, and we expect to have a high level of informed feed back from them, especially on their reaction to the security aspects of the toolset.

The Universities of Freiburg and Mannheim, Germany

UM and UF provide support for the virtual university project, VIROR [16]. This project, which started in July 1998, links the universities of Freiburg, Mannheim, Heidelberg and Karlsruhe to provide higher education independent of a student's physical location. VIROR encompasses several departments ranging from computer science to business and language studies.

The most important aspect of VIROR in the context of MECCANO is that regular lectures and seminars are broadcast as teleteaching events. This is done as a service for real users - lecturers and students. All VIROR activities are observed and evaluated by psychologists in order to provide feedback to tool developers and lecturers alike.

The project uses many of the MECCANO tools including AOFwb, dlb, wb, vic and sdr.

Support provided

During the current semester (April 1999 – September 1999), UM and UF are providing support for four weekly teleteaching events. In detail these events are:

- a regular lecture given by Prof. Dr. Effelsberg about Multimedia Technology,
- a regular lecture given by Prof. Dr. Schintzel about Computer Science and Society,
- a student seminar about Distance Learning and

- one seminar with invited speakers about innovative approaches for teleteaching.

These events are broadcast over the Mbone. However, a dedicated ATM backbone (2 Mb/s) is used between project partners to guarantee high quality and prevent network related unreliability. The toolset varied slightly between the events and included: AOFwb, dlb, MVoD, sdr, vat, vic and wb.

During all events, UM and UF are responsible for setup and maintenance of the tools and network connectivity. For the two seminars the speakers are generally unfamiliar with the toolset and need an introduction on how to use the tools as well as how to do a telepresentation. This training is provided in form of practice sessions which are held 2-3 days prior to the real event. Whenever AOFwb or the dlb are used, the feedback of the participants and the experience of the technical support staff are used to discover, track and fix bugs as well as improve the tools with new functionality desired by the users.

User response

The lectures of Prof. Dr. Effelsberg and the student seminars are evaluated by psychologists. The results of the evaluation will be made available as soon as the analysis of the data is complete. Individual comments, however, show that the acceptance of teleteaching on the student side depends more on the content and the quality of the presentation of the lecture/seminar than on technical issues. The lecturers frequently indicated that the process of getting slides into wb/dlb/AOFwb is still quite complicated, especially when MS Office (PowerPoint/WinWord) applications are used to prepare slides. Very noteworthy is the success of the AOFwb recording for last year's lecture on Computer Networks (Prof. Dr. Effelsberg). The recording is sold to the students on CD-ROM and is now used by the majority of the students for examination preparations.

Future plans

In the following semesters the VIROR teleteaching activity is scheduled to be increased from semester to semester. The final vision is the establishment of a virtual university, where students can choose which lectures they want to attend independent of their physical location. One important aspect of this location independency is remote examinations. The first such examination is scheduled to take place at the end of this semester.

During the next semester we plan to incorporate the remaining tools of the MECCANO toolset into the VIROR teleteaching efforts. Especially interesting will be the usage of RAT/FreePhone for high quality audio transmission and MBus for session invitation/setup.

Summary

The project has made good progress in the support of projects and users who are actually using the MECCANO tools for real applications, not just for trials. We also continue to respond to the feedback from our users by improving the tools and modifying them to meet new needs.

During the first year our manpower efforts have varied with the pattern of needs of our user community. Some partners, such as CRC and UCL have had an ongoing programme of support at a modest level since the start of the project. Others have applied a more sporadic effort in line with the needs of their particular users. ACC have recently begun a collaboration with a major hospital in Krakow and will continue to develop this relationship during the second year of the project. In the table below we summarise the effort (pms) of the partners.

Partner	Reporting Period						TOTAL
	Jun/July 98	Aug/Sep	Oct/Nov	Dec/Jan 99	Feb/Mar	Apr/May	
C1 UCL	0.25	0.25	0.45	0.73	0.53	0.40	2.61
C2 ACC					0.75	1.75	2.50
C3 CRC	0.50	0.50	0.50	0.50	0.50	0.50	3.00
A6.1 NL		0.20	0.10		0.50		0.80
C8 TELES	0.25				0.25	0.50	1.00
TOTAL	1.00	0.95	1.05	1.23	2.53	3.15	9.91

Table 1: Effort expended (pms) on Work Package 9.

References.

- [1] MERCI Project web site
URL <http://www-mice.cs.ucl.ac.uk/multimedia/projects/merci/>
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URL <http://www.ics.agh.edu.pl/Meccano/>
- [3] Open Technical University, Poland
URL <http://galaxy.uci.agh.edu.pl/~amber/Tuo.htm>
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URL <http://www-mice.cs.ucl.ac.uk/multimedia/projects/rat/>
- [14] VideoConferencing (VIC)
URL <http://www-mice.cs.ucl.ac.uk/multimedia/software/vic/>
- [15] Session Direcory (SDR)
URL <http://www-mice.cs.ucl.ac.uk/multimedia/software/sdr/>
- [16] The virtual university project (VIROR)
URL <http://www.viror.de/>

Appendix I

A summary of multimedia collaboration trials between NC3A and University College London, 5-10 October 1998

By

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Abstract:

This document provides an executive summary of multimedia collaboration trials conducted between the NATO Consultation, Command and Control Agency (NC3A) and the University College of London (UCL) over the public Internet. The test results, a summary of lesson learned and future test plans are also included.

1. Introduction

As part of our practical investigation into the operational use of Internet and Internet technologies and our support for collaboration activities sponsored by the Internet Collaboration Board (ICB), we participated in a series of multimedia collaboration trials with UCL over the public Internet.

The focus of the tests was on performance evaluation of multimedia conferencing services over the IP Multicast Backbone (Mbone) overlaying the public Internet, using multimedia conferencing tools developed by UCL. The tests were conducted between 5-9 October 1998.

2. Test tools

The tests were conducted using the following UCL-developed Mbone tools:

- RAT -- A reliable audio conferencing tool
- VIC -- A video conferencing tool
- WBD -- A whiteboard collaboration tool
- NTE -- A text editor
- SDR -- A session directory service
- SHRIMP -- A Mbone tool kit encompassing the above Mbone tools

These tools were pre-compiled by UCL and we downloaded a copy of the binaries or executables from a UCL WWW server. Table 1 summarizes the version of the test tools used in the tests.

Mbone tool	Evaluated Version	Latest Version
RAT (Robust Audio Tool)	3.0.28	3.0.28
VIC (Video Conference)	2.8s5	2.8ucl1
WBD (WhiteBoard)	1.0ucl1	1.0ucl2
NTE (Network Text Editor)	1.5s3	1.5.31
SHRIMP	V1.0s1	
SDR (Session Directory)	2.4a6s5	2.5.6

Table1: Evaluated precompiled binary software version

3. Test configuration

As our Internet service provider (i.e. UUNET) has not yet resumed the support for Mbone, a temporary Mbone feed was tunneled from the UCL IP multicast-capable router to our "pseudo" multicast-capable router which is a Sun workstation running a special kernel patch (i.e. Mrouted 3.8) supporting multicast routing. The bandwidth of this Mbone tunnel was set at the UCL router to a maximum of 128 Kbps.

GSM- and PCM-compliant audio and H.261-compliant video constituted the audio and video components of a multimedia conferencing session. The host machines are PCs running Windows 95 and NT. These PCs were attached to the same LAN segment to which the Sun-based mrouted router was also attached.

4. Test concept and procedures

We created a Mbone session that was then advertised to Internet via the SDR tool. We conducted several Mbone sessions locally over the unclassified LAN, as well as with UCL over the public Internet, using the RAT and VIC tool and the SHRIMP tool kit. The tests were conducted during the normal working hours (i.e. between 8:30 to 17:30) and after the normal working hours (i.e. before 8:00 and after 18:00). Additionally, we participated in several publicly announced Mbone sessions. Furthermore, an attempt was also made to conduct a secure conferencing session with UCL, using the publicly available PGP-DES facilities.

5. Test results

As expected the performance or the quality of the multimedia conferencing was pretty good over the LAN (i.e. with clear audio and about 10 QCIF frames per second) even during the peak normal working hours. The quality of the conferencing was also found to be acceptable over the public Internet/Mbone when the traffic intensity over the Internet was relatively low (i.e. before 8:00 and after 17:30). The quality however started degrading when the traffic load over the Internet became heavier, noticeable between 9:30 and 15:30. The degradation was exacerbated (i.e. with frozen video, choppy voice and about 50%-70% packet lost) when the incoming traffic on the NC3A Internet connection was close to saturated which was caused by WWW traffic, as indicated by our IP traffic management/monitor manager. This happened about the noon time as people started browsing the Internet at their lunch breaks. However, this problem only occurred at the NC3A (or the receiving) end as the quality of our audio and video received by UCL remained pretty good and nearly the same. This can be explained as outgoing traffic from NC3A was relatively much lighter than the incoming traffic over our Internet connection pipe.

Additionally, we experienced some pruning problems, which were then resolved, when a newer version of Mrouted software (release 3.9) was used.

Furthermore, problems were also encountered during the trials of secure conferencing facilities using PGP facilities. These problems (e.g. cannot enter a PGP path at a SDR session setup) are still being investigated in collaboration with UCL.

6. Lessons learned

- The UCL Mbone test tools are very useful and are well structured.
- Bandwidth remains a critical factor for the quality of multimedia conferencing over the public Internet.
- Mechanisms capable of providing improved best-effort QoS and preferential treatment of different traffic streams are required when operating multimedia collaboration over IP-networks with limited resources.
- Inclusion of security services such as authentication and encryption are important for operational use of Internet/Mbone.

7. Near-term test activities

The objective of near-term test activities is to further our investigation into the practical use of Internet technologies for operational use and related QoS issues, as well as to support future ICB collaboration activities. Examples of near-term test activities include:

- Integration Mbone test tools with COTS multimedia collaboration packages.
- Trials of secure conferencing using publicly available PGP-DES facilities.
- Trials of multimedia conferencing over a VPN.
- Use of IP bandwidth manager devices for improved QoS through their admission control capability.
- Modification of selected UCL Mbone test tools to support IPv6 addresses.

Summary

The trial with UCL improves our understanding of QoS issues concerning multimedia collaboration over the Internet, and promotes international collaboration on related research activities. It is also important to continue collaboration work with UCL which is a both knowledgeable, as well as a reliable and resourceful partner. Resources permitting, we should also consider to request our ISP provider to resume Mbone support.