

The Virtual Tea Room: Integrating Video into Everyday Life

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Abstract

The impact of new technologies and systems incorporating high performance video and other multimedia is likely to be significant in the future communications environment. This paper discusses a project to investigate the technological and social issues of these systems.

1. Introduction

The Monash University School of Computer Science and Software Engineering (SCSSE) is one of the largest departments of its type in Australia. It has about 60 full time academic staff, and about 20 support staff, distributed across 2 campuses ("Caulfield" and "Clayton") which are separated by 8 kilometres. The School supports three main undergraduate degrees in computing, namely the Bachelor of Computer Science, the Bachelor of Computing and the Bachelor of Digital Systems, and a host of post graduate coursework and research based degrees. The School was formed in 1998 from four smaller departments - 2 on the Caulfield campus and 2 on the Clayton campus. Accordingly, it supports a wide range of academic cultures, ranging from a traditional research university culture to a more applied industry based technical one. Almost all staff are based on one campus, but occasionally travel to the other campus for meetings or for service teaching.

The academic programs are supported by three small service units, namely *administration*, *technical* and *finance*. Like the academic staff, there is little movement across campuses within the service units except for occasional meetings.

The management of the school is performed by a number of cross campus committees and groups. The committees convene at regular times to develop policy, provide leadership and process formal university regulations (such as those required to create new subjects and courses). An important feature of the School is that

control is devolved to the appropriate groups where possible, which is an essential component in running such a large multi campus school. However, the very processes that support the running of the school, also inhibit the development of a single culture. Very few staff are involved in cross campus activities like committee meetings or teaching. Almost no staff travel the 8 kilometers simply to talk with their colleagues from the other campus. Accordingly, the only opportunities for social interaction and team building are when the entire School meets off campus, which occurs only about once per year.

The issue of building a school culture is sufficiently important that it has warranted the design of a *Virtual Tea Room*; a place where staff can meet over a social cup of coffee and interact without too much concern for the distance between campuses. The Virtual Tea Room has been designed to be a meeting place for people on the same campus as well as across campuses. It has been designed to incorporate all of the activities of the normal campus based tea rooms, but also provide cross campus links. This paper discusses the design of the Virtual Tea Room, and the associated technology.

2. The Virtual Tea Room

Imagine two conventional tea rooms, separated only by a sheet of glass. Staff can sit on either side of the glass, perhaps clustered around a coffee table, and interact. They might be aware that their colleagues on the other side of the glass are not in the same room, because the glass causes some artifacts to appear, the audio might be attenuated, but they are also able to have a reasonable level of interaction in spite of the barriers. This is the goal of the Virtual Tea Room. Until very recently, there has been very little technology which could allow this to happen over any distance for a reasonable cost [2]. It would require full frame rate video, which has been available for years, but at a considerable cost. Digital video compression has changed the cost effectiveness of video transmission, but is only now able to offer acceptable quality and latency. The projection

facilities have only recently become cheap enough, and of sufficient quality, to provide a full size projected image. Echo canceling audio systems have only recently become common place. The time is right to bring together high quality, low latency, digital video and audio, high performance long distance communications and high output video projection. In the next section we will discuss the available technologies, and their relative advantages.

Another important component of the Virtual Tea Room is sociological. Staff must feel that the technology is not intruding on their normal socialisation. They must be able to interact on one campus without concern for the other end of the video link, but also make use of it when they wish. The social factors are as important as the technical ones, and will ultimately dictate whether the facility succeeds in building bridges between the various cultures in SCSSE. To combat some of the concerns of such a system, we have placed special attention to the interior design of the room. The new tea rooms are much nicer places than the old ones - we hope this will encourage staff to utilise them regardless of the video link. The interior layout, paint work and lighting support clusters of chairs and tables. One region is clearly designed for those who wish to communicate with people on the same campus. The other cluster supports inter campus communication. On the other hand, the clusters are not separated by walls, so it is possible to move from one to another freely. In order to overcome suspicion of the facility, it is envisaged that it will be used by senior management for communication, as well as by the service units. For example, it will allow the various service units, which are small and are split across the campuses to communicate over coffee. As an example, the Head of School plans to visit the room regularly to talk with colleagues on the other campus. We hope that by setting a positive example, we will be able to overcome the natural fear of such a system. To a large extent, the system is an experiment in both the technical issues and the social issues of remote collaboration.

3. Technology Issues

3.1 Network Requirements

To provide a suitable supporting infrastructure for its daily operational needs, the University has begun a process of converting the legacy 10 Mbps ethernet-type networks to a switched ATM-backbone network

that connects to 100 Mbps switched-ethernet networks. The network connections between the major campus locations are at 155 Mbps, with inter-building links also at 155 Mbps. Minor campus locations will connect back to the network at 34 Mbps via the University's private microwave network (see fig. 1). The ATM network is an ideal carrier for this task as it both able to provide the capacity for the sustained high data rates as well as the QOS at a level suitable for this type of multimedia traffic.

ATM networks similar to this are the basis for Next Generation Internet (NGI) network developments in the U.S., although they are operating at higher speeds (from 622 Mbps to Gbps) [1].

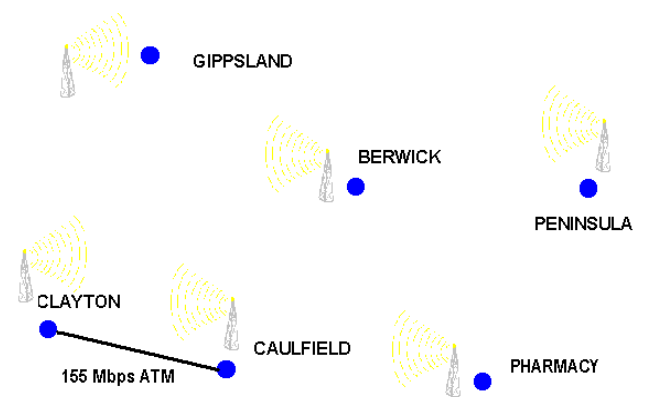


figure 1 The Monash Interactive Teaching Facility Network

3.2 Video vs conferencing

Monash University has had a significant involvement with videoconferencing for both the conduct of meetings, as well as for teleteaching.

This has been through the use of commercially available videoconference equipment that has been adapted for the purpose (for teleteaching), or is used as supplied (for meetings etc).

The design of videoconferencing systems has been tailored mainly to the restrictions of the available communications networks. Ie, the nx64 kbps ISDN networks that are the common medium for connectivity. This has led to the implementation of systems that perform their tasks adequately but exhibit limitations in areas such as the number of transmitted picture elements (effecting resolution), the frame rate (effecting the smoothness of motion), variation of both colour and image variability (effecting the true-to-life appearance of the image). These systems often display images that have defects such as coding artifacts that appear at times in the video stream.

All of this is as a result of the need to constrain the transmission requirements to that which is both available and affordable.

In recent years, the development of MPEG-2 compression technology and its use in the broadcast and cable television industries has permitted these organisations to transfer video information around their networks using lower bandwidths than would otherwise required if there was no compression of the video and audio data. MPEG-2 at high data rates (10's of Mbps) can provide much higher quality of image at the receiving end (thus its acceptance in the video broadcast and cable areas), although it does this at the expense of the reduction in required transmission capacity. This is of less importance where the network infrastructure is able to cope with this increased need.

A major problem with the implementation of MPEG-2 has been the cost of such systems. This has not been an issue for the commercial broadcasters and cable providers as the high cost can be offset against savings in communications costs for their transmission of high quality video. However, the costs in recent times have been reducing. This is mainly due to the arrival of PC-level products as well as the take-up of this technology within larger organisations where there has been a significant growth in the use of broadcast video for in-house use (meetings, training, etc). This has been as a result of the growth in the adoption of ATM networks where bandwidth reservation and guarantees of delivery (the QOS issues) are supported.

Another problem with the choice of MPEG-2 based systems over traditional videoconferencing systems is that of end-to-end delay. Since many MPEG-2 CODECS have been designed for broadcast situations, the delays in coding may become significant (100s of milliseconds up to seconds). This is not a problem in a broadcast situation but will be a major issue to deal with if the system is being used for two-way communications. Delay times of 150ms is considered to be acceptable for two-way communications [5].

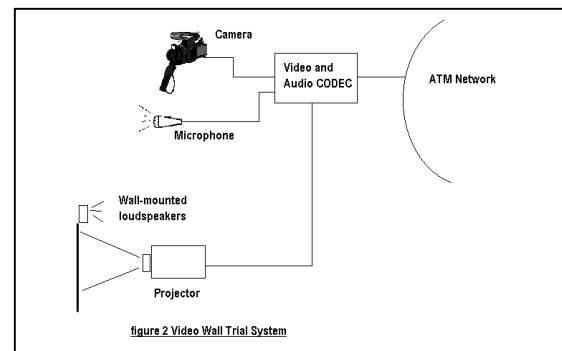
3.3 MPEG vs M-JPEG

Although the adoption of MPEG-2 for television and in-house corporate video distribution has begun to grow, there are organisations that have been using systems based upon motion-JPEG (M-JPEG). This was largely due to the need for high quality image transfer even if there was a significant penalty upon bandwidth required. As well, these systems do not support real-time encoding and decoding at rates that would suit two-way communications.

It is likely that these systems will be replaced in the future by MPEG-2 systems as the cost differential becomes a significant in addition to the bandwidth vs image quality equation being weighted in favor of MPEG-2.

4. The Trial Systems

The trial system is constructed from two MPEG-2 CODECS from FVC.COM. These are connected to the ATM network at 155 Mbps using OC-3 fibre attachment. The systems are designed to support single encoded video streams (as will be used in our trial configuration) or multiple streams (as may be used in a future expansion of this technology). The traffic will be carried using TCP/IP for delivery over the Monash ATM network to the remote tea room site (see fig 2).



5. Conclusion and Future Directions

Due to the delay in acquiring the systems and their implementation, there are no reportable outcomes at the time of writing.

Since the system is based upon the use of TCP/IP and carried over ATM networks, it is possible for the trial system to be extended to any site that has similar CODEC technology and an ATM network connection. Thus an extension of the trial could be for the tea rooms to be extended to an International experiment in connectivity.

A possible extension of the video wall systems may be in the area of replacement of the existing CODEC technology in the University's teleteaching systems. These are limited in expansion in their current configuration due to the PABX capacity limitations. Using the ATM network to carry the videoconferencing traffic, and bypass the PABX facilities could alleviate this. However, this would mean that there would be no opportunity to improve

the quality of the systems, as they would still be based upon a limiting technology designed for a less-capable communications environment.

Thus an opportunity exists to replace the H.320 CODECS in the teleteaching theatres and provide ATM network connectivity to gain an immediate return in the quality of the video of those teleteaching systems.

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7. References

- [1] <http://www.ngi.com.gov/>
- [2] <http://www.internet2.edu/dvn/>
- [3] Littman M, *ATM as a Facilitator for Distance education*, World Conference on Educational Telecommunications June 17-22 1996, Boston, USA pp179-184
- [4] Tritsch B, et al *Video and Audio Communication over LAN*, IFIP Local Area Network Applications: Leveraging the LAN 22 Aug - 2 Sep, 1993, Perth, Australia pp183-196
- [5] Portway P& Lane C *Guide to Teleconferencing and Distance Education 2nd Ed*, Applied Business Telecommunications, 1994