Web Conferencing

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Abstract

Web conferencing is used by businesses and organisations to provide training, interviews, learning, video and audio conferencing, sharing of slides, sharing of desktops, and presentations. It saves manpower, travel time, and money through a communication medium. But hosting online meetings with remote participants is often a nightmare since the Internet is being used and a whole lot of issues need to be dealt with such as power, bandwidth, and security. There are factors which contribute towards Web conferencing such as bandwidth, bandwidth should be low when conducting meetings and latency should be reduced. In this paper the aim is to try and discuss Web conferencing and also solves some of the factors such as latency and bandwidth on how they can be produced.

1 Introduction

Most companies recognize the significance of face-to-face meetings for staff. However some companies can see that most travel time is costly and that alternative options are out there to reduce costs as well as improve environmental friendly initiatives. Web conferencing is an application that allows events that normally take place in the physical world to be done online. Web conferencing can be used by anyone as long as the participant has any mobile device (laptops, cell phones, or personal computers) which has a webcam and is Internet enabled is able to use Web conferencing to collaborate with other participants remotely and in real time but a user has to install some software or use any of the Web conferencing tools that have been made available by different companies like NetMeeting from Microsoft or Adobe Connect from Adobe.

In order to better analyse the factors that lead to Web conferencing being a success, some factors needs to be taken into account these factors are mainly bandwidth, video compression, audio streaming, latency and prefetching. One of the most reasons why Web conferencing is being used is because it provides an increased flexibility for scheduling meetings (Bekkering and Shim, 2006). Web conferencing can sometimes be affected from a user perspective (Baecker et al,2006) since user experience can degrade rapidly as the number of conference participants rises, since it becomes harder to support video and audio from all participants. successful videoconferencing environments often employ dedicated rooms and specialized equipment such as echo cancellation devices.

2 Web conferencing

Web conferencing does have its pros and cons and one of the advantages of using Web conferencing is because it reduces travel time and cost (Ciocco et al, 2005), there is little

overhead or special equipment required, and real-time, synchronous meetings and distance learning classes are now a reality. And the disadvantages are Web conferencing relies heavily on the Internet (Sun and Regenbrecht, 2007), since Web conferencing needs Internet for the communications between participants, issues such as latency (loss of packets), network reliability and accessibility, security and emergency. The quality of service (QoS) relies on the hardware environment such as the computer, webcam and microphone, computers require electricity to work and thus Web conferencing is vulnerable to power outages and results in connections between clients being lost. Some of these issues can be solved-for example, the security problem can be eliminated by better system design-the data can be encrypted at the endpoints and throughout the network, and an additional level of identity authorization features can be introduced through the use of passwords (Sun and Regenbrecht, 2007).

In 2006, Nijholt et al (2006) aimed to capture, store, retrieve information as well as interpret the activities that took place during a meeting. This was to allow browsing through a record of a meeting (be able to review and retrieve what occurred during a meeting), and would want to remotely participate in a meeting when there is no possibility of being physically present. This research was a success as they came up with an online and offline visualization technique-they were able to go from captured data in a smart meeting room situation to a distributed virtual meeting room. The technology used within the distributed virtual meeting room (DVMR) differed substantially from normal video conferencing technology. Rather than sending video data as such, this data is transformed to a format that enables analysis and transformation.

Another study by Olsen (2006) used WebEx as one of their video conferencing tool. The main aim of the research was to demonstrate how training and support professionals can use a combination of any Web conferencing, videoconferencing, remote support tools, and the telephone to provide training and support for their clients with savings in both costs and staff time.

3 Conferencing systems

Web conferencing systems have features all of which depend on what the participants want to use when conducting meetings. The important feature in web conferencing is audio and video and a balance should be obtained so that what is seen on video is the same as what is being said the lips should move accordingly. There is also sharing of documents which allows participant to download files such as brochures, agendas, presentations or slides. Some documents may be downloaded or viewed by different users it depends on how the user who created the slides want to share it with. Chat is also available but some participants may choose to chat privately. Some conferencing systems allows powerful slide show where a participant can do a slide show live. They is a problem when it comes to slide show because some participant maybe using different word documents like Microsoft power point and some might not have Microsoft power point so a good system would be the one which has all the word documents or be a one which will take in participants slide show and transforms them to one word document. Participant should be able to record the meetings.

Conferencing systems allows sharing of desktop therefore image transmission should be fast, it should go through most firewalls, and it should not use too much CPU (your computer's calculating power). Advanced systems optimize image transmission speed and reduce required bandwidth by only sending the areas of the screen that change.

The conferencing system should allow for hand-raising. Hand-raising is the predominant social protocol for requesting to speak in a classroom. Participant who is speaking should be able to give permission to a participant who wishes to speak a button should be pressed for this and an alert should be sent to each participant online. It is always good to see who is online and so the system must provide for this.

4 Bandwidth

The technical quality of the videoconference depends critically on bandwidth availability (Baecker et al, 2006). There is a little knowledge about the effects of narrow-bandwidth digital videoconference systems on group decision quality and thus it is not correct to assume that low-quality communication yields high quality group decision, because if the system is "poor" enough to filter out not only "noise" but necessary information for the task, the decision quality may be lower than with face-face (Takao, 1999).

Chat, when used for informal communication along with video, is considered to have low bandwidth [Scholl et al, 2006].Slide presentations also have low bandwidth as the streaming happens immediately when downloaded. Microsoft NetMeeting integrates audio, video and data conferencing into a single packet. A study, Hargreaves and McCown(2008) on the use of low-cost, low-bandwidth information and communication technology (ICT) to support online meetings between farmers and scientists in rural Australia used this software tool to conduct meetings. This method was found to be effective and feasible for farmers and can be on effective substitute for face-to face meetings- as long as certain criteria are met. Missing

5 Latency

Web conferencing connects small numbers of individuals or groups or rooms together to speak and view one another in almost real-time, response time delays may be up to a quarter second (Baecker, 2006). Audio is presented ahead of video in some videoconferencing systems since audio requires less time to process(Chen, 2003) thus reducing latency as well as bandwidth. The conventional approach to synchronizing audio and video is to delay the audio so that the audio and video latencies are matched, however the time required to process video can exceed the maximum perceived audio latency that is acceptable in a conversation. Videoconferencing systems may not synchronize the audio with the video since supporting perceptually instantaneous audio is more important than maintaining lip synchronization

In 2003, Chen (2003) produced videoconferencing system to achieve lip synchronization with minimal perceived audio latency. The system maintained a balance between minimizing audio latency and supporting lip synchronization. Audio latency was minimized by stretching the time at the beginning of each utterance so that the audio and video latency are matched.

6 Video compression

As the bandwidth available on networks and the speed of computers increases, real-time transmission of video between general purpose workstations becomes a more realistic application. However, even with a high speed network, video has to be compressed

before transmission (Turletti and Huitema, 1996). Video conferences usually occur in environments with a static background. Thus, there is little local motion per frame. Also, multiple videos may originate from a conference location. These factors can be taken into consideration in developing a compression scheme meant for conferencing (Kamath, 2005).

Different algorithms exist for video compression and the standardised ones that exist are mainly JPEG (Joint Photographic Experts Group) for still images, or MPEG (Motion Joint Photographic Experts Group) and H.261 for moving images. MPEG- 1 coding is suited for high definition video storage and retrieval. MPEG-2 extends MPEG- 1to high definition television (HDTV) coding applications. The H.261 standard describes a complex video compression algorithm that allows achieving a very high compression rate (Turletti and Huitema, 1996).

In 2005, Kamath (2005) a compression scheme for video conferencing called MJPEG-DPCM (differential pulse-code modulation) with segmentation was proposed. Most compression schemes compress one video at a time but in the case where more than one video stream originates from a location in the situation of videoconferencing the proposed method was implemented to exploit redundancies in portions of the video without motion and static background between consecutive video frames. The system allowed user interaction at both the encoder and decoder in order to allow selection of video streams. The system was based on modified motion JPEG in order to achieve low complexity. Compression ratios of the order of five times that of motion JPEG were obtained.

MPEG was compared with the proposed method and it was found that there were improvements from MJPEG to the proposed method with little degradation in the image quality. But further processing will be carried out to reduce the degradation due to scaling and possible saturation during reconstruction.

7 Audio and Chat Streaming

Audioconferencing and multipoint videoconferencing are typical examples of methods that are part of Web conferencing (Baecker, 2003), which are mostly used for real-time communication, collaboration, and knowledge sharing over the Internet. Audioconferencing allows the real-time multipoint transmission of voice. Yet it lacks the media richness, sense of presence, and ability to engage participants that is afforded by video and other dynamic media. Internet desktop video conferencing supports real-time multipoint audio and video, chat communications as well as shared workpaces. Yet it still does not provide reliable Internet video performance, and is not scalable to large numbers of participants.

In packet-switched networks, audio transmissions are typically subjected to several latency components (Blundell and Mathy,)-for example sampling, pre-processing(silence-suppression and compression), network transmission, network propagation delay being typically the least-predictable and most dominant component for audio transmission over the Internet.

A study in 2006, Scholl et al (2006) was conducted to compare chat and audio usage within multimedia conferencing systems using two case studies of informal group communication in a naturalistic setting. The first case study is of workplace users participating in a “virtual

shared office", and the second case study focused on an educational setting where students are provided with tutoring via a multimedia conferencing tool instead of having an instructor physically available. The results from these studies showed that in a media-rich environment supporting both audio and chat alongside a video channel more users preferred chat to audio and found chat to be more useful than audio for both private and public communication. It was found that chat enables asynchronous communication, can lower the cost of interrupting others, and can make it easier to communicate in a second language.

8 Conclusion

Web conferencing a small number of people is often infeasible due to the high network bandwidth required. Bandwidth can be optimized by minimising latency and video compression. Latency can be minimized by reducing audio.

References

Baecker, R. (2003). A principled design for scalable internet visual communications with rich media, interactivity, and structured archives. *CASCON '03 Proceedings of the 2003 conference of the Centre for Advanced Studies on Collaborative research* , (pp. 16 – 29): IBM Press 2003.

Baecker, R., Baran, M., Birnholtz, J., Chan, C., Laszlo, J., Rankin, K., et al. (2006). Enhancing interactivity in webcasts with VoIP. *Proceeding CHI EA '06 CHI '06 extended abstracts on Human factors in computing systems*, (pp. 235-238) Canada: ACM New York, NY, USA 2006.

Barakonyi, I., Fahmy, T., & Schmalstieg, D. (2004). Remote collaboration using Augmented Reality Videoconferencing. *GI '04 Proceedings of Graphics Interface 2004*, (pp. 89-96). Canada: Canadian Human-Computer Communications Society School of Computer Science, University of Waterloo, Waterloo, Ontario, Canada 2004.

Becker, K. (2007). Using Elluminate in CS. J*ournal of Computing Sciences in Colleges* , 23 (2): (pp. 73-75), December 2007.

Bekkering, E., & Shim, J. (2006). Trust in videoconferencing. *Communications of the ACM - Services science* , 49 (7): (pp. 103 – 107), July 2006.

Chen, M. (2003). A low-latency lip-synchronized videoconferencing system**.** *CHI '03 Proceedings of the SIGCHI conference on Human factors in computing system*, (pp. 465 - 471). ACM New York, NY, USA 2003

Ciocco, M. D., Toporski, N., & Dorris, M. (2005). Developing a synchronous web seminar application for online learning. *SIGUCCS '05 Proceedings of the 33rd annual ACM SIGUCCS fall conference* (pp. 36 - 39). ACM New York, NY, USA 2005.

Egido, C. (1988). Video conferencing as a technology to support group work: a review of its failures. *CSCW '88 Proceedings of the 1988 ACM conference on Computer-supported cooperative work* (pp. 13 - 24). ACM New York, NY, USA 1988.

Gong, F. (1994). Multipoint audio and video control for packet-based multimedia conferencing. *MULTIMEDIA '94 Proceedings of the second ACM international conference on Multimedia* (pp. 425-432). ACM New York, NY, USA 1994.

Hargreaves, D. M., & McCown, B. R. (2008). Low-cost, low-bandwidth online meetings between farmers and scientists. *OZCHI '08 Proceedings of the 20th Australasian Conference on Computer-Human Interaction: Designing for Habitus and Habitat* (pp. 271-274). Sydney: ACM New York, NY, USA 2008.

Heeler, P., & Hardy, C. (2005). A preliminary report on the use of video technology in online course. *Journal of Computing Sciences in Colleges* , 20 (4): (pp. 127-133), April 2005.

Kamath, S. (2005). A compression scheme for video conferencing. *ACM-SE 43 Proceedings of the 43rd annual Southeast regional conference - Volume 2* (pp. 345 - 346). ACM New York, NY, USA 2005.

Koh, E. (2010). Conferencing room for telepresence with remote participants. *GROUP '10 Proceedings of the 16th ACM international conference on Supporting group work* (pp. 309-310). USA: ACM New York, NY, USA 2010.

Nijholt, A., Rienks, R., Zwiers, J., and Reidsma, D. Online and off-line visualization of meeting information and meeting support. In Proceedings of The Visual Computer. 2006, (pp. 965-976).

Olsen, L. (2006). Being there: a "teach them to fish..." approach to training and support using WebEx™, videoconferencing, and the telephone. *SIGUCCS '06 Proceedings of the 34th annual ACM SIGUCCS fall conference* (pp. 295 - 300). ACM New York, NY, USA 2006.

Sabin, M., & Higgs, B. (2007). Teaching and learning in live online classrooms. *SIGITE '07 Proceedings of the 8th ACM SIGITE conference on Information technology education* (pp. 41-48). ACM New York, NY, USA 2007.

Scholl, J., McCarthy, J., & Harr, R. (2006). A comparison of chat and audio in media rich environments. *CSCW '06 Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work* (pp. 323 - 332). ACM New York, NY, USA 2006.

Scholl, J., Parnes, P., McCarthy, J. D., & Sasse, A. (2005). Designing a large-scale video chat application. *MULTIMEDIA '05 Proceedings of the 13th annual ACM international conference on Multimedia* (pp. 71 - 80). ACM New York, NY, USA 2005.

Sun, J., & Regenbrecht, H. (2007). Implementing three-party desktop videoconferencing. *OZCHI '07 Proceedings of the 19th Australasian conference on Computer-Human Interaction: Entertaining User Interfaces* (pp. 95 - 102). New Zealand: ACM New York, NY, USA 2007.

Takao, S. (1999). The effects of narrow-band width multipoint videoconferencing on group decision making and turn distribution. *WACC '99 Proceedings of the international joint conference on Work activities coordination and collaboration* (pp. 109 - 116). Japan : ACM New York, NY, USA 1999.

Turletti, T., & Huitema, C. (1996). Videoconferencing on the Internet. *IEEE/ACM Transactions on Networking (TON)* , 4 (3): (pp. 340 – 351), June 1996.