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Implementation and Performance Evaluation for Multimedia Teleconferencing System

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1.Introduction

In order to realize the general multimedia communication services such as video-on-demand and multimedia teleconferencing system, it is required to support variety of presentation which takes account of media synchronization. We have been suggesting a multimedia presentation protocol architecture to provide various synchronization functions depending on presentations in various applications[1]. In this paper, we implemented a simple multimedia teleconferencing system and evaluated performance of lip synchronization method in the prototype system.

2.Multimedia Teleconferencing System

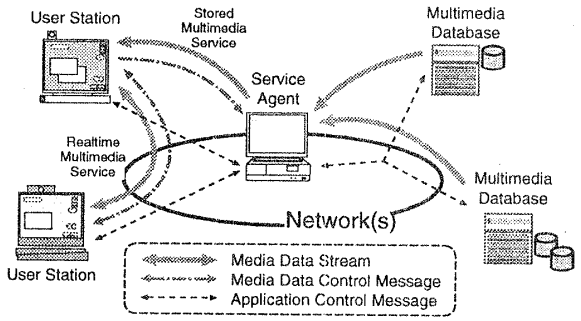

Figure 1: Multimedia Teleconferencing System

In our multimedia teleconferencing system[2], while the live audio/video presentations are provided between participants, stored media multimedia presentations are also concurrently provided as the reference information of the conference. Each media stream used for the stored media presentation is distributed in the databases on the network. Figure 1 shows our multimedia teleconferencing system which consists of User Stations(USs), Service Agent(SA) and Multimedia Data Bases(MDBs). The USs provide presentations to user and capture the live audio/video and transmit them to other users. The MDBs store several media streams as reference information used for the conference, and each media streams are managed by the SA. The SA also manages the conference participants.

マルチメディア会議システムにおけるメディア同期制御機能の実装と評価

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3.Presentation Control Functions

We introduced presentation control functions in the system shown in Figure 2.

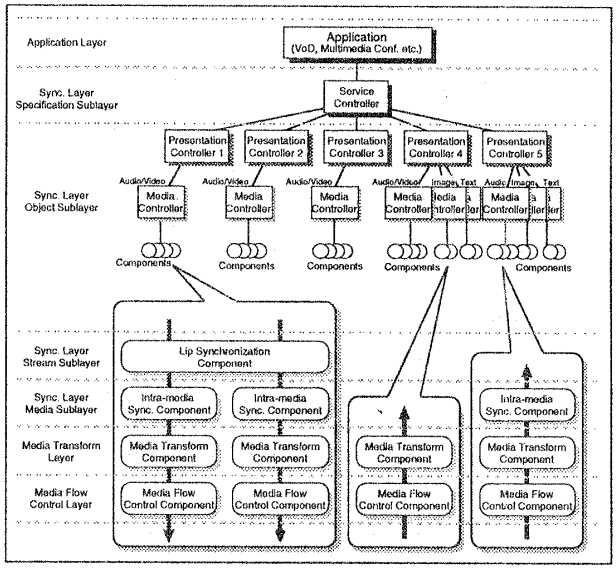


Figure 2: Presentation Control Functions

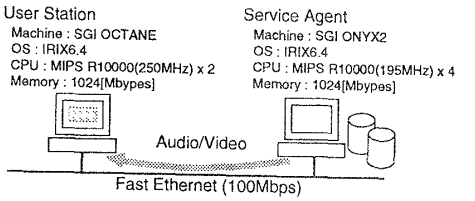
Here, we newly introduce three controllers: service controller(SC), presentation controller(PC) and media controller(MC) to handle multiple different types of presentations independently. The SC controls multiple presentations in multimedia service. The PC controls multiple media streams which consist one presentation. The MC performs the media transmission. Media transmission are realized by several components such as lip-synchronization component, media transform component, which are managed by the MC. These components are selected by the MC according to user's QoS requirements and the characteristics of transmitted media stream.

4.Implementation and Evaluation

In the multimedia teleconferencing system, we implemented the USs, SA and MDBs on several SGI Workstations IRIX6.4 by C-language, and a number of controllers and components are realized concurrently using multiple processes and POSIX thread technologies. Each component is realized by one thread and synchronized by exchanging condition signals between these threads. Figure 3 illustrates the prototype system for evaluation and used media parameters for e-

valuations.

In this system, we could verify that stored presentation which is organized from audio, video, image and text could be provided while audio/video live presentation is also concurrently provided and evaluated a performance of lip synchronization method which takes synchronization between audio and video frame.



SDU Interval	$1.0[sec]$, $2.0[sec]$
Video Format	$SoftwareMotionJPEG$
Video Size	$320 \times 240[pixels/frame]$
Video Frame Rate	$30[fps]$
Audio Format	$\mu - law$
Audio Sampling Rate	$44100[Hz]$
Audio Channel	$Stereo$

Figure 3: Prototype System and Used Audio and Video Parameters

Figure 4, 5 and 6 show in the cases where lip synchronization was taken on every $1.0[sec]$. In the case where no synchronization is executed as shown in Figure 4, the time difference between the audio and video graduately increased. The actual audio/video presentation was not natural. In the case where lip synchronization is only executed at sender side as shown in Figure 5, the video immediately delayed at the beginning of video transmission then approached to constant value while audio is almost constant without delay. As results, the time difference between the audio and video are delay of the video about $0.3[sec]$ in average. The reason of the delay of the video against for audio was that the processing load by software JPEG decoding at receiver is so large depending on the size of the video frame, the actual video output could not maintain within the frame rate. In the case where lip synchronization is executed at both sender and receiver, as shown in Figure 6, the time difference between the video and audio is almost same although both audio and video initially delayed but approached to the constant value. This was because the audio SDU is buffered to synchronize with the delayed video to be output at the same time.

Through this performance evaluation, our suggested synchronization method could be effective and useful.

5.Conclusions

In this paper, we described multimedia presentation control functions to support variety of presentation types such as both stored and live presentation. We implemented the multimedia teleconferencing system

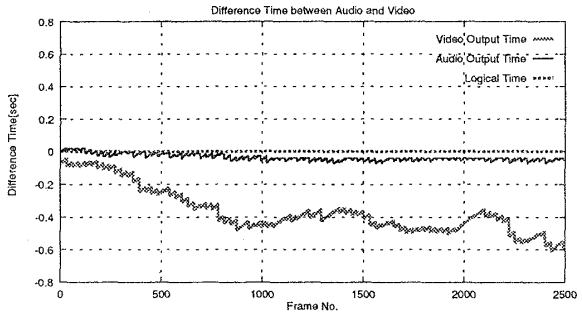


Figure 4: Without Synchronization(Interval=1.0[sec])

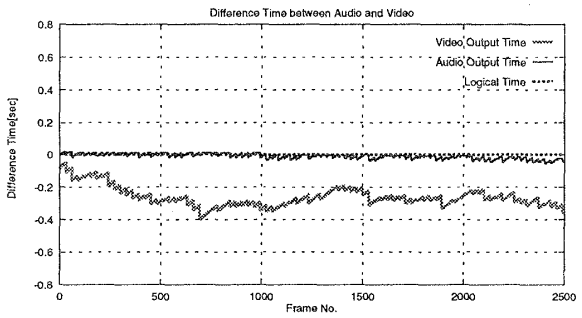


Figure 5: With Synchronization at only Sender (Interval = 1.0[sec])

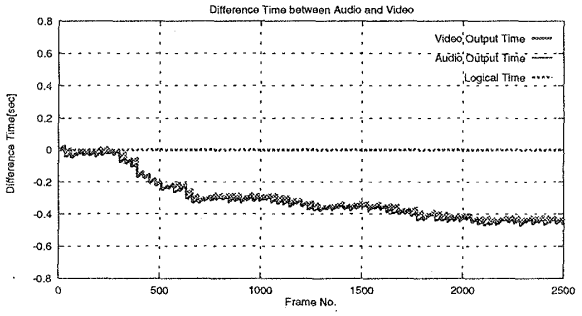


Figure 6: With Synchronization at both Sender and Receiver (Interval=1.0[sec])

and evaluated performance of lip synchronization. As a result, audio and video streams could be display and played concurrently when lip synchronization was applied at both sender and receiver stations.

We will evaluate media synchronization methods combined with rate control under more various environments and apply the QoS guarantee functions in the synchronization methods in future research.

References

[1] G. Blakowski, R. Steinmetz: *A Media Synchronization Survey, Reference Model, Specification, and Case Studies*, IEEE J. Select. Areas Commun., Vol.14, No.1, pp.5-35, January 1996.

[2] J.Sato, K. Hashimoto, M. Katsumoto, H. Mori and Y. Shibata: *Implementation of Multimedia Conference System Based on Unified Multimedia Transmission Protocol*, Proc of ICOIN-13, Vol. 2, pp. 11C-2.1 - 11C-2.6, 1999.