6Bb−3

Dynamically-Reconfigurable Remote Multimedia Lecturing Support System*

Hiroyuki Ishii, Takashi Jin, Koji Hashimoto, and Yoshitaka Shibata†
Toyo University‡
{hiro,jin,hashi,shibata}@cs.toyo.ac.jp

1. Introduction

In this paper, we propose a dynamically-reconfigurable remote multimedia lecturing support system which can provide flexible connection capabilities, and grouping functions among a number of lecturers depending on the characteristics of the desired lectures as shown in figure 1. The system architecture and connection protocols for the remote lecturing system are precisely specified. Furthermore, a QoS negotiation function which enables users to participate in lectures in spite of various QoS requirements is also proposed.

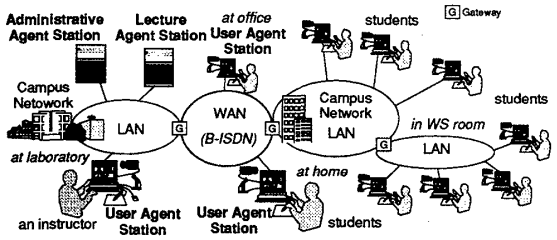

Fig. 1: A remote lecturing support system

2. System Architecture

The network environment is based on the interconnection of WANs and LANs as shown in figure 1. The system consists of three agent stations: *user agent stations* (UAs) which allow users (e.g., instructors, TAs, and students) to exchange voice and video, and to use groupware applications (e.g., whiteboard and shared-window applications) as shown in figure 2, *lecture agent stations* (LAs) which provide means to dynamically change of connection among multiple UAs, and manages the lecture, and *administrative agent stations* which manage all of UAs, LAs, students, and professors at a domain (e.g., a university, a campus, or a faculty), and provide directory services for them.

*動的構成可能遠隔マルチメディア講義支援システム
†石井 弘行　柴田 義孝
‡東洋大学

3. Formulation of Lectures

We classify roughly into 5 types of lectures, namely: 1) generic lecture type, 2) cooperative work type, 3) free discussion type, 4) discussion type, and 5) LL classroom type. Lecture types concern control policies of the "floor" and group configurations.

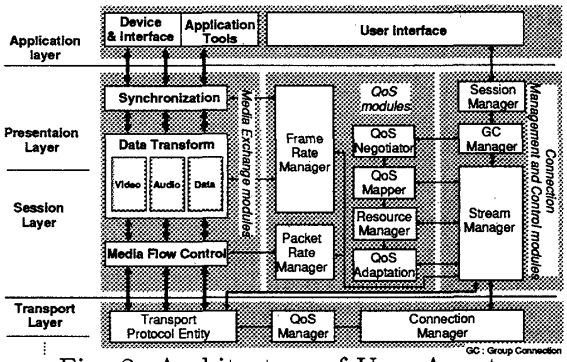

Fig. 2: Architecture of User Agent

A lecture is called as a *session* which means that multiple UAs as proxy for users mutually exchange media data (e.g., voice, video, image, text, and so on) via *group connections* as shown in figure 3.

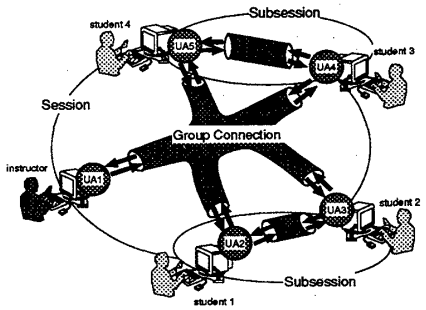

Fig. 3: Conceptual model of lecture

4. Dynamic Reconstruction Functions

In order to support multi-purposed lectures, Dynamic Reconstruction Functions include the following three functions: *Grouping functions* enable an instructor to group the students, and to reconfigure the groups, a *changing type function* enables an instructor to change a type of a lecture, *Joint lecture functions* enable an instructor to merge multiple lectures into a joint lec-

ture. An example of message flows of the grouping functions is showed in figure 4.

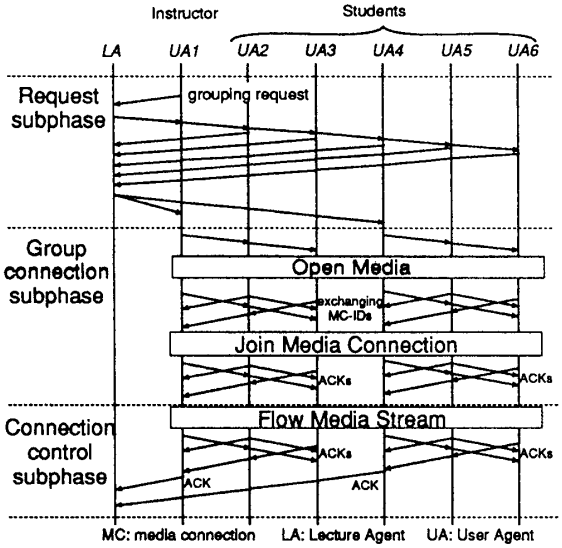

Fig. 4: a flow of a grouping function

5. QoS Negotiation

Group connection is modeled by using the interface group model to perform QoS negotiation as shown in figure 5. The send/receiver interfaces of UAs are grouped together to negotiate their QoSs.

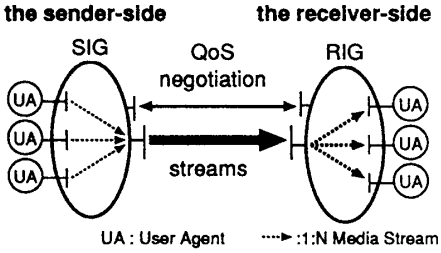

Fig. 5: Interface Group Model

In group communication, the multicasting capability is used to transmit media effectively. Thus, all receivers are served with the same quality. Therefore a QoS requirement is decided in RIG with the consensus of all members. In order to negotiate QoS requirements for multiple streams at once, a QoS requirement is decided in SIG with the consensus. A consensus protocol is used as indicated in figure 6 in which the negotiation is initiated by sender.

6. Prototyping

A prototype of a remote multimedia lecturing support system on several WSs (SUN SPARC station × 14 and SGI Indy × 3) over interconnected LANs (Ethernet 10Mbits/sec) was implemented, and evaluated their functionalities. The prototype consists of a LA and multiple UAs, and supports a single lecture. The implemented Dynamic Reconstruction functions are completely functioned.

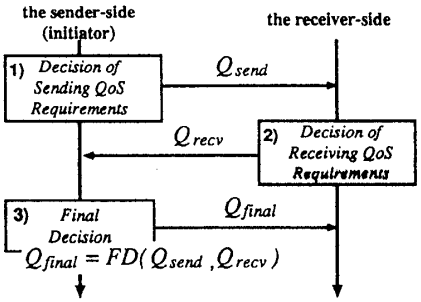

Fig. 6: The flow of QoS negotiation

7. Conclusions

Through this paper, the dynamically-reconfigurable remote multimedia lecturing support system was proposed, and the Dynamic Reconstruction functions which enable the system to effectively use computational resources for multi-purpose lectures were developed and evaluated. Furthermore QoS negotiaion protocol based on the Interface Group Model using consensus protocol were proposed. Currently, this system is implemented on the ATM based computing system in the engineering department in Toyo Univ. to utilize for real lectures such as "Database System."

References

[1] P.V. Rangan, and H.M. Vin: Multimedia Conferencing as A Universal Paradigm for Collaboration, *Multimedia Systems, Applications, and Interaction, chap. 14, ed. Lars Kjelldahl,* (1991).

[2] Moran, M., and Gusella, R.: System Support for Efficient Dynamically-Configurable Multi-Party Interactive Multimedia Applications, *Proc. of 3rd Int. Workshop on Network and Operating System Support for Digital Audio and Video, San Diego, CA,* (1992).

[3] H. Ishii, Y. Shibata: The Design of Dynamic Reconstruction Method for Multimedia Lecturing Support System, *IPSJ SIG Notes,* Vol.95, No. 53, 95-DPS-70, p.13 ~ 18, May 1995.

[4] H. Ishii, T. Jin, K. Hashimoto, Y. Shibata: QoS Guarantee Functions for Group Communication, *IPSJ SIG Notes,* Vol.95, No.85, 95-DPS-72, p.55 ~ 60, Sep 1995.

[5] H. Ishii, Y. Shibata: Dynamic Reconstruction Functions for Multimedia Lecturing Support System, IEEE Proc. of ICOIN-10, Jan. 1996 (will be appeared).