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# A Concurrency and an Access Control System for a Web Based Multimedia Distance Education Environment

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*Abstract:* - This paper describes a concurrency and an access control system which is running on a web based multimedia distance education environment A multimedia distance education system includes advanced services, coordination services, cooperation services, and media services. Advanced services consist of various subclass modules. This subclass module provides the basic services, while advanced services layer supports mixture of various basic services. Advanced services include creation/deletion of shared video window and of creation/deletion of shared window. Coordination services include session control module, and floor control module. Session control module controls the access to the whole session. Cooperation services include window overlays module, and window sharing module. There are two approaches to software architecture on which applications for a web based multimedia distance education environment are based. Those include CACV(Centralized-Abstraction and Centralized-View) and RARV(Replicated-Abstraction and Replicated-View). The environment of concurrency and access control is based on a hybrid software architecture which is adopting the advantage of CACV and RARV.

*Key-Words:* - concurrency and access control, a web based multimedia distance education system, advances services, coordination services, cooperation services CACV, RARV, hybrid software architecture.

## 1 Introduction

With the rapid development of multimedia and network technology, more and more digital media is generated. With such huge amount of data, efficient means to index the content for future retrieval have to be made available. In addition, various ways for users to search and to browse the data of interests are also necessary. Efforts have been made in the literature along both directions, some in single media domain and some in multimedia domain[1-5]. The multimedia distance education is concentrated on an interest about new education methods by join an education engineering and an information communication technology[6]. A general web-based distance system uses video data and audio data to provide synchronize between teacher and student.

This paper describes a system running on multimedia collaboration works with an URL(Uniform Resource Location) synchronization function. The system for multimedia collaboration works includes several features such as audio, video, whiteboard, etc, running on internet environment which is able to share HTML format. The roles of application program sharing are divided into two main parts; abstraction and sharing of view generation. Application program sharing must take different from each other according to number of replicated application program and an event command. There are two different structures. Those include CACV and RARV. CACV is centralized architecture where only one application program exists among entire sharing agents and centralized server takes care of input processing and abstraction is the same. RARV is replicated architecture at which application data input(event) that is generated when sharing takes place is transferred and executed. This means that only event information is separately performed. The goal of our work is to provide an environment of concurrency and access control that is based on a hybrid software architecture which is adopting the advantage of CACV and RARV. The rest of this paper is organized as follows. Section 2 describes background. Section 3 discusses our approach to a concurrency and an access control system which is running on a web based multimedia distance education environment. Section 4 describes simulation results. Section 5 describes related works. Section 6 provides some conclusion.

## 2 Background

As shown in Table 1, conventional multimedia distance education systems are Shastra, MERMAID, MMconf, and CECED. You can see the characteristic function of each system function for multimedia distance education. Basically, there are two architectures to implement such collaborative applications; the centralized architecture and replicated architecture, which are in the opposite side of performance spectrum. Because the centralized architecture has to transmit huge amount of view traffic over network medium, its performance is reduced to contaminate the benefits of its simple architecture to share a copy of conventional application program. On the other hand, the replicated architecture guarantees better performance in virtue of its reduced communication costs. However, because the replicated architecture is based on the replication of a copy of application program, it is not suit to use for application sharing realization[7,8].

Table 1 Conventional multimedia distance education systems

| Function | Sha-Stra | MER-MAID | MM-conf | CE-CED |
|---|---|---|---|---|
| OS | UNIX | UNIX | UNIX | UNIX |
| Develop-ment Location | Purdue Univ. USA | NEC, JAPAN | Cam-Bridge USA | SRI, Inter-national |
| Develop-ment year | 1994 | 1990 | 1990 | 1993 |
| Structure | Server /client | Server /client | Cent-ralized or Repli-cated | Repli-cated |
| protocol | TCP/IP | TCP/IP | TCP/IP | TCP/IP multicast |

## 3 Our Approach

This paper describes a concurrency and an access control system which is running on a web based multimedia distance education environment. The environment of concurrency and access control is based on a hybrid software architecture which is adopting the advantage of CACV and RARV.

### 3.1 Multimedia Distance Education System

As shown in Figure 1, a multimedia distance education system includes advanced services, coordination services, cooperation services, and media services. Advanced services consist of various subclass modules. This subclass module provides the basic services, while advanced services layer supports mixture of various basic services. Advanced services include creation/deletion of shared video window and of creation/deletion of shared window. Shared window object provides free hand line, straight line, box, text to collaboration work participant and the participants can use such as the same file in this shared windows. Coordination services include session control module, and floor control module. Session control module controls the access to the whole session. This session can be meeting, distance learning, game and development of any software. Session control also facilities the access and limits the access to the whole session. Session control module monitors the session starts, terminates, joins and invites and it also permits another sub-sessions. Session control module has an object with various informations for each session and it also supports multicasting with this information. Floor control controls the person who can talk, and person who can change the information. Mechanism of the floor control consists of braining storming, priority, mediated, token-passing and time-out, In floor control module, it provides explicit floor and braining storming. Cooperation services include window overlays module, and window sharing module. Window overlays module is laid a simple sketching tool over a copied window. It provides all users with transparent background and tele-pointers. So, all users can point and gesture. Window sharing module is a combination of window copying, window overlays, floor control and session control. All users are able to interact through application shared by them. One user is running a single user application. The other users get to see exactly what this user sees. The application can allow different users to interact with the application by selecting one of the user's keyboard and mouse the source of input. Media services support convenient services for application using DOORAE environment. Supplied services are the creation and deletion of the service object for media use, media share between remote user. Media services modules limit the service by hardware constraint.

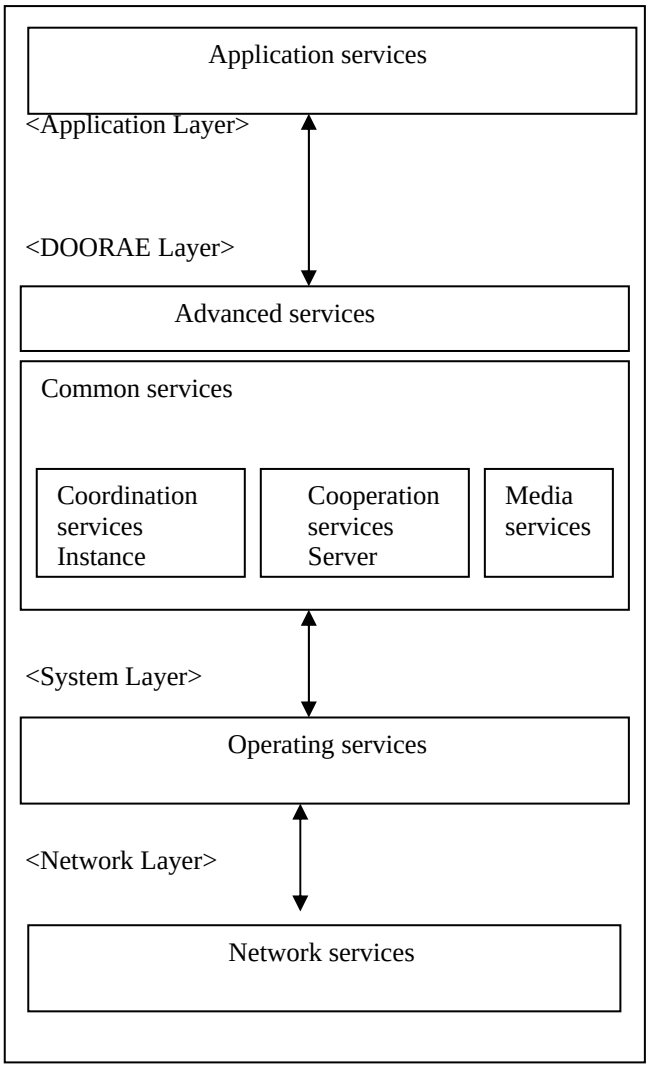


Fig.1 Multimedia Distance Education System

### 3.2 Web Based Multimedia Distance Education System

This paper proposes an URL synchronization function used in WebNote with remote collaborative education system based on CBM(Computer Based Multimedia). It retrieves the common characteristics of these tools and designs an integrated model including all these methods for supporting concurrent collaborative workspace. This paper describes an integrated model which supports object drawing, application sharing, and web synchronization methods of sharing information through a common view between concurrently collaborating users. This proposed model consists of multiple view layout and each layout control, a unified user interface, and defines the attributes of a shared object. As shown in Figure 2, you can see the relationship between WebNote Instance and WebNote SM(Session Manager). This system is used to be one of services that are implemented on Remote Education System. This Remote Education System includes several features such as Audio, Video, Whiteboard, WebNote running on Internet environment which is able to share HTML(Hyper Text Mark-up Language). We have implemented WebNote function to do so either. While session is ongoing, almost all participants are able to exchange HTML documents. For this reason, we need the URL synchronization. To win over such dilemma for centralized or replicated architecture, a combined approach, CARV(the centralized abstraction and replicated view) architecture is used to realize the application sharing agent.

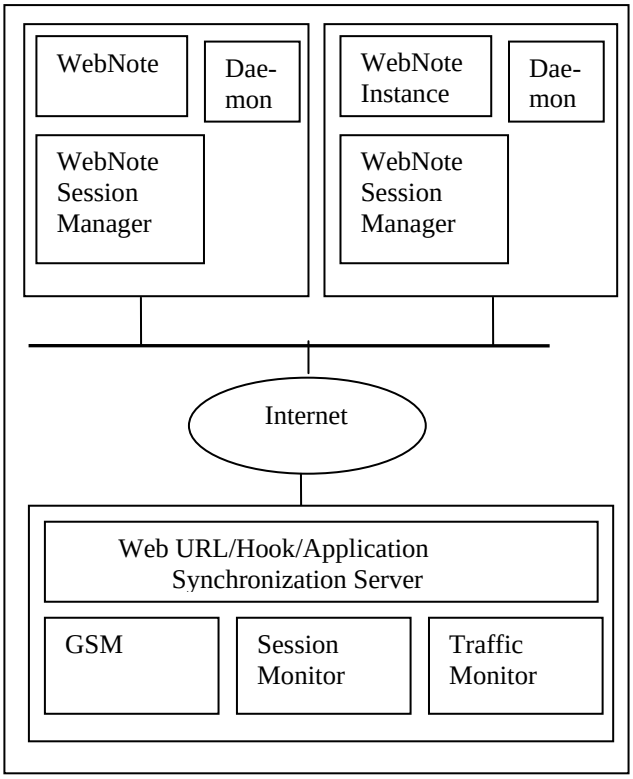


Fig.2 The relationship between WebNote Instance & WebNote SM

### 3.3 A Concurrency Control for Web Based Multimedia Distance Education System

Concurrency control inevitably occurs in a multimedia distance education environment where many users perform collaborative work at the same time. There may be a case where processing cannot be done in order of arrival due to variation according to present load, processing capability of each system and

network delay caused by many participants putting in commands. Concurrency control solves such problems. To win over such dilemma for centralized or replicated architecture, a combined approach, CARV(the centralized abstraction and replicated view) architecture is used to realize the application sharing agent. Figure 3 shows the relationship between WebNote and WebNote Instance for web based CARV architecture.

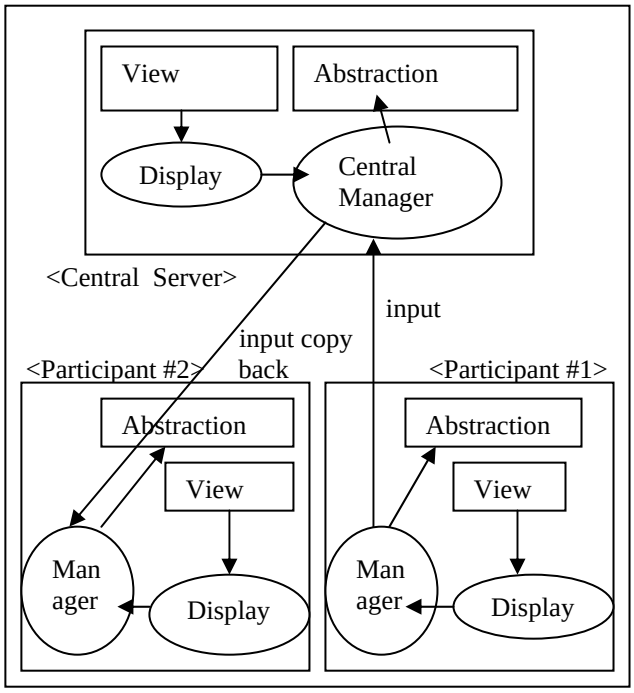


Fig.3 Web based CARV architecture

When many users request for same media device at the same time, media device acquisition order is controlled. Alternation of event input sequence, according to present load, processing capability of each system and network delay cause by participants' use of different computers is another problem that occurs in distributed network environment. We attempted to solve such command serialization problem with centralized serialization server and distributed synchronization clock method. In order to guarantee synchronization control and command serialization, it maintains and manages command sequence history that is mutually exchanged. All input events are transmitted with creating time of event to the serialization server. Serialization server can be processed according to the order of occurrence of events. Command serialization occurs because of necessity to process inputs from several users of different locations using same application program and to see same view. Collaborative work system must have command serialization mechanism. Figure 4 shows the relationship between initiator and participant of a concurrency control for web based multimedia distance education system.

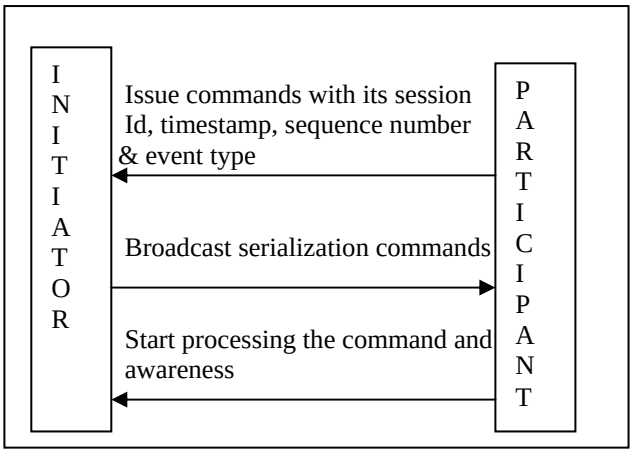


Fig.4 Concurrency Control for Web Based Multimedia Distance Education System

### 3.4 An Access Control for Web Based Multimedia Distance Education System

Access control agent decides who has right to speak and manages distribution of resources along with user status when there is a request for resources. The methods of this system are mediate mode, brain storm, token passing and time-out. Teacher mediated mode is default setting in DOORAE and setting can be changed during lecture. Figure 5 shows the relationship between initiator and participant of an access control for web based multimedia distance education system.

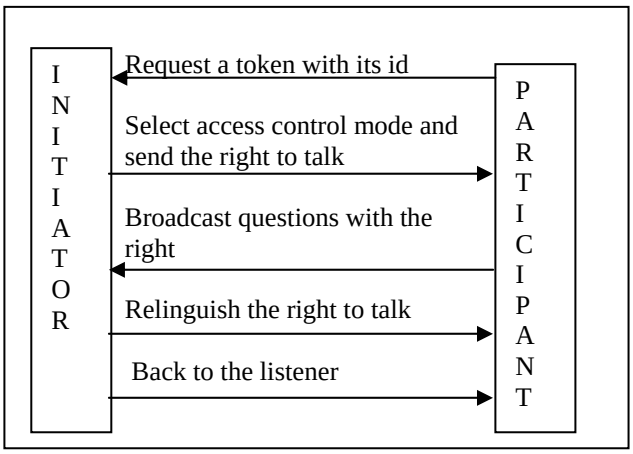


Fig.5 Access Control for Web Based Multimedia Distance Education System

This system provided in lesson plans production and interactive lesson. Figure 6 shows a screen configuration for teacher. The access control window controls the access among participants, and it consists of video image windows as many as the number of students who participate in the session. The shared window is a window shared by all the participants, and the modification carried out by the speaker is notified to every other participants. The local window is not shared except initial file sharing, and each participant can modify it as needed. The video window is used for monitoring the video of a remote participant, and it displays the video image of the participant who has the access control.

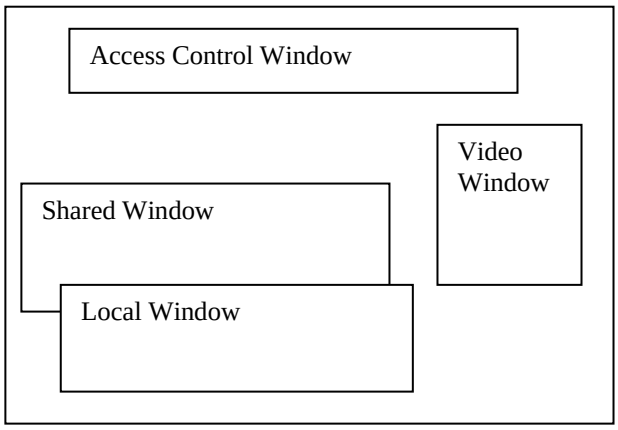


Fig.6 A Screen Configuration for Teacher

Figure 7 shows that teacher and students use their local windows and shared window individually.

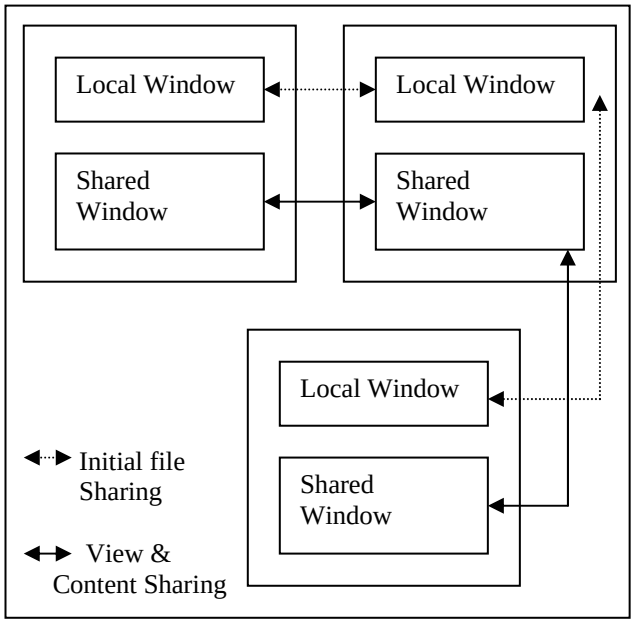


Fig.7 Use of local and shared window individually

The local window has the lecture plans which is distributed at the beginning, and enables participants to memo and browsing other parts in the lesson plans, and has functions as a whiteboard.

## 4 Simulation Results

As shown in Table 2, you can see the characteristic function of each system function for multimedia distance education. A proposed main structure is distributed architecture but for application program sharing, centralized architecture is used. The problem of rapid increase in communication load due to growth in number of participants was solved by letting only one transmission even with presence of many users, using simultaneous broadcasting.

Table 2 Analysis of conventional multimedia distance education system

| Function | Sha-Stra | MER-MAID | MM-conf | CE-CED |
|---|---|---|---|---|
| OS | UNIX | UNIX | UNIX | UNIX |
| Develop-ment Location | Purdue Univ. USA | NEC, JAPAN | Cam-Bridge USA | SRI, Inter-national |
| Develop-ment year | 1994 | 1990 | 1990 | 1993 |
| Structure | Server /client | Server /client | Cent-ralized or Repli-cated | Repli-cated |
| protocol | TCP/IP | TCP/IP | TCP/IP | TCP/IP multicast |
| Concu-rrency control | No | No | No | No |
| Access control | No | No | No | No |
| Web based | No | No | No | No |

Basically, there are two architectures to implement such collaborative applications; the centralized architecture and replicated architecture, which are in the opposite side of performance spectrum. Because the centralized architecture has to transmit huge amount of view traffic over network medium, its

performance is reduced to contaminate the benefits of its simple architecture to share a copy of conventional application program. On the other hand, the replicated architecture guarantees better performance in virtue of its reduced communication costs. However, because the replicated architecture is based on the replication of a copy of application program, it is not suit to use for application sharing realization.

## 5 Related Works

The technological issues between these two architectures are communication load, synchronization and command serialization. Replicated architecture has an advantage of reducing communication load. However, every participant must possess the same application program and command serialization and synchronization that happen to each of the participants are costly and difficult to handle. On the other hand, if abstraction and view generation take place in the same location, the problems of synchronization and command serialization are solved [8].

## 6 Conclusion

This paper described a concurrency and an access control system which is running on a web based multimedia distance education environment. The roles of application program sharing are divided into two main parts; abstraction and sharing of view generation. Application program sharing must take different from each other according to number of replicated application program and an event command. There are two different structures. Those are CACV and RARV. CACV is centralized architecture where only one application program exists among entire sharing agents and centralized server takes care of input processing and abstraction is the same. RARV is replicated architecture at which application data input(event) that is generated when sharing takes place is transferred and executed. This means that only event information is separately performed. This paper described a concurrency control and access control for a hybrid software architecture that is running on a web based distance education system which has an object with a various information for each session and it also supports multicasting with this information. Our future work includes a hybrid software architecture which is analyzing performance evaluation for two methods of CACV and RARV.

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