Performance Analysis for A Web Based Session and Error Management Agent on Home Network Environment

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Abstract: - This paper describes a web based session and error management with a whiteboard agent running on home network environment. It suggests a system that is capable of detecting and recovering software error for distributed multimedia with an integrated whiteboard model which supports object drawing, application sharing, and web synchronization methods of sharing information through a common view between concurrently collaborating users for home network environment. DOORAE is a framework of supporting development on multimedia application for distributed multimedia running on home network environment. This paper explains a performance analysis for a session and error management agent based on home network environment by using the rule-based DEVS(Discrete Event System Specification) modeling and simulation techniques. In DEVS, a system has a time base, inputs, states, outputs, and functions. The DEVS formalism introduced by Zeigler provides a means of specifying a mathematical object called a system.
Key-Words: a session and error management, a whiteboard agent, home network environment, software error, DEVS modeling, discrete event mode

1 Introduction

Now, internet is increased steadily by user an advertisement, WWW and information service business of multimedia based, this variation is effected a field of education . That is, the education is changing from the teacher center, a traditional classroom, limited interval to the student center, a virtual classroom, a lifetime. The multimedia distance education is concentrated an interest about new education methods by join an education engineering and an information communication technology. Internet today represents a potentially effective platform for distance education, since it offers tools that may help the educational process in any of the related tasks, from the definition of curricular to the collection of educational material, from the delivery of this material to the interaction among the involved actors[1, 2]. Recently there has been great interest in multimedia collaboration over the Internet to support teamwork without the need for geographical and/or time proximity[3,6]. Internet today represents a potentially effective platform for distance education, since it offers tools that may help the educational process in any of the related tasks, from the definition of curricula to the collection of educational material, from the delivery of this material to the interaction among the involved actors[4,5,6].

Networked computer systems designed to support collaboration allow multiple users to exchange information, share data, interact with ideas, and cooperate on common goals across geographical and time boundaries. The development of communication and data networks enables collaborative systems to support diverse activities such as crisis management, cross-continental conferencing, and distributed learning. Moreover, multimedia is deployed in collaboration to enhance usability and productivity. For example, in addition to the text and graphics information in text-chat and whiteboard, stream-based media such as audio and video are widely used[3, 6-10]. A home network interconnects electronic products and systems, enabling remote access to and control of those products, systems and any available content such as audio, video, or data[11]. The multimedia distance education is concentrated an interest about new education methods by join an education engineering and an information communication technology. Internet today represents a potentially effective platform for distance education , since it offers tools that may help the educational process in any of the related tasks, from the definition of curricular to the collection of educational material, from the delivery of this material to the interaction among the involved actors[1]. This paper describes a session and error management agent running on home network environment. It is a fault-tolerance system running on multimedia collaboration works with an URL(Uniform Resource Location) and error 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. This paper proposes a method of detection to find an error by polling periodically only the process with relation to session. We would like to discuss a new method of performance analysis of for distributed multimedia based on home network environment using the rule-based DEVS modeling and simulation techniques. In DEVS, a system has a time base, inputs, states, outputs, and functions. The purpose of this paper is to compare and analyze a performance of proposed method with conventional method by using DEVS formalism for a fault tolerance system running on distributed multimedia.

The rest of this paper is organized as follows. In section 2, DEVS formalism is reviewed. In section 3, we show a session and error management agent running on home network environment. In section 4, we propose a modeling for performance analysis by using DEVS formalism. In section 5, we describes related works. Finally, in section 6, we summarize our paper.

2 Related Works

The DEVS-Scheme environment is based on two formalism:discrete event-system specification(DEVS) and system entity structure(SES)[12,13,15]. In this section, DEV is reviewed.

2.1 Discrete Event Simulation

Differential equations employed to describe continuous systems have a long history of development whose mathematical formalization came well before the advent of the computer. In contrast, discrete event simulations were made possible by, and evolved with, the growing computational power of computers. Since the early 70's work has been proceeding on a mathematical formalism for modeling discrete event systems. One approach, inspired by the systems theory concepts of Zadeh and Dosoer(1963), Wymore(1967), Mesarovic and Takahara(1975), and Arbib and Padulo(1974), attempted to cast both continuous and discrete event models within a common systems modeling framework. This approach was elaborated in a number of publications primarily summarized in the books(Zeigler, 1976) and (Zeigler, 1984a), and is reviewed in (Zeigler, 1984b). Systems modeling concepts were an important facet in a movement to develop a methodology under which simulation could be performed in a more principled and secure manner. The recent advent of high performance artificial intelligence software and hardware has facilitated the transfer of this simulation methodology from research to practice(Elzas et al., 1986)[12-15].

2.2 DEVS formalism

The DEVS formalism introduced by Zeigler provides a means of specifying a mathematical object called a system. The DEVS formalism is a theoretical, well grounded means of expressing hierarchical , modular discrete event models. Basically, a system has a time base, inputs, states, and outputs, and functions for determining next states and outputs given current states and inputs. In the DEVS formalism are defined by the structure[12-15].

$M = < X, S, Y, \delta int, \delta ext, \lambda, t_a >$

where X: a set of input events,
S: a set of sequential states,
Y: a set of output events,
Int:S->S: internal transition function,
ext: Q x X -> S : external transition function
λ : S -> Y: output function
t_a : time advance function.

Basic models may be coupled in the DEVS formalism to form a multi-component model which is defined by the structure[3,4,5].

$DN = < D, \{M_i\}, \{I_i\}, \{Z_{ij}\}, select >$

where DN: Diagraph Network,
D : a set of component names,
$\{M_i\}$: a component basic model
$\{I_i\}$: a set, the influences of I and for each j in Ii,
$\{Z_{ij}\}$: a function, the I-to-j output transition,
select: a function , the tie-breaking selector.

2.3 SES formalism

The system entity structure(SES) directs the synthesis of models from components in a model base. The SES is a knowledge representation scheme that combines decomposition, taxonomic, and coupling relationships. The SES is completely characterized by its axioms. However, the interpretation of the axioms cannot be specified and thus is open to the user. When constructing a SES, it may seem difficult to decide how to represent concepts of the real world. An entity represents a real world object that either can be independently identified or postulated as a component of a decomposition of another real world object. An aspect represents one of decomposition out of many possibility of an entity. The children of an aspect are entities representing components in a decomposition of its parent. A specialization is a node of classifying entities and is used to express alternative choices for components in the system being modeled. The children of a specialization are entities representing variants of its parent. For example, in an SES for a computer system, the entity printer could have such specialization as: size, typeface, and interface-type. The children of interface-type might be parallel interface and serial interface. These are variants for the interface of printer. That printers also come in various sizes is represented in the specialization size[12-15]. The properties of a SES are illustrated in Figure 1.

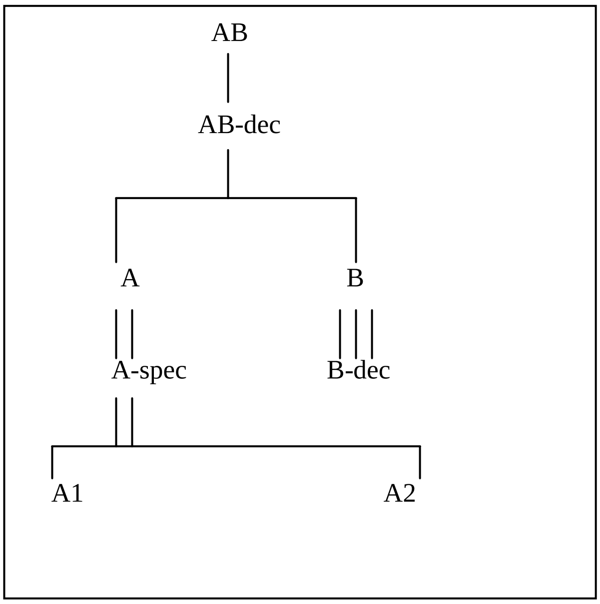

Fig. 1 The example of SES

The root entity is AB. AB is shown as having a decomposition into A and B, i.e., it is a system built from two component systems. The entities of an aspect represent distinct components of a decomposition. A model can be constructed by connecting together some or all of these components. The aspects of an entity do not necessarily represent disjoint decompositions. A new aspect can be constructed by selecting from existing aspects as desired. A has a specialization, shown by two vertical lines, called A-spec entities A1, and A2. The triple vertical bars connecting B and B-dec represent a special type of decomposition called a multiple decomposition. A multiple decomposition is used to represent entities whose number in a system may vary[12-15].

3 Our Approach

This paper describes a web based session and error management with a whiteboard agent running on home network environment. It is a system that is suitable for detecting and synchronizing a software error rapidly occurring on home network environment for a web based multimedia collaboration environment by using software techniques. It is used to realize the application sharing.

3.1 Home Network Environment

As shown in Fig.2, the organization of them includes 4 layers.

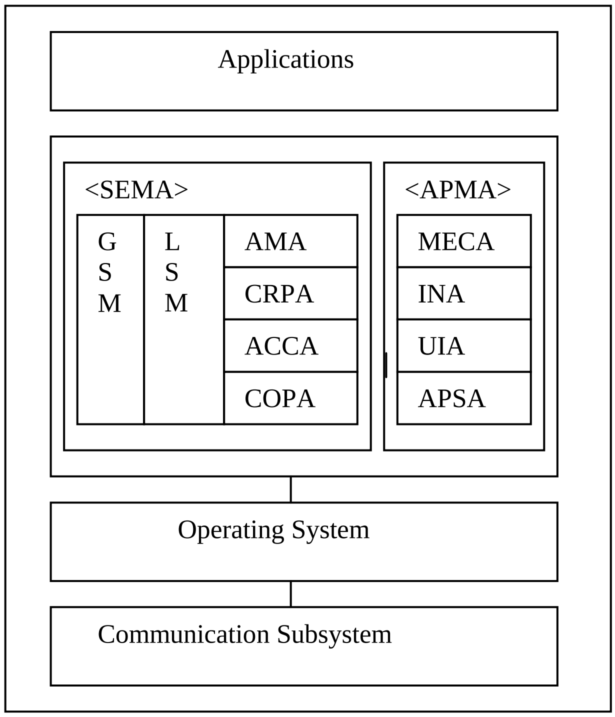

Fig.2 The organization of a session and error management agent

They consist of a communication layer, a system layer, a DOORAE agent layer and an application layer. As shown in Fig.3, a communication layer consists of home network environment. The communication network is being presently developed with UDP broadcasting in order to decrease communication rate and TCP/IP on the Ethernet and ATM. Additional packet form has been defined and expanded for realization of DOORAE's functions.

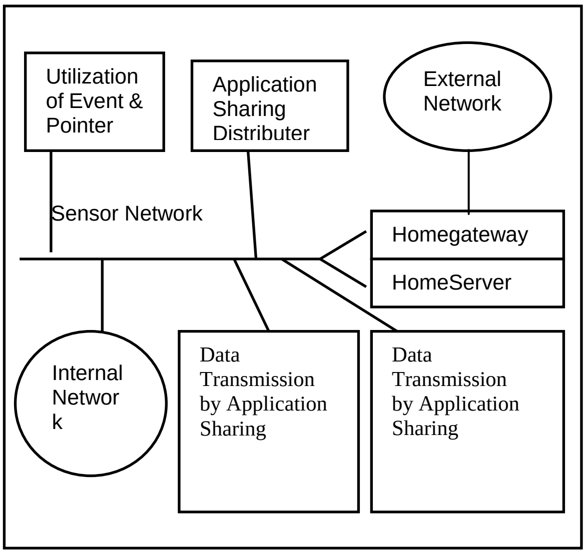

Fig.3 home Network Environment

The hardware environment of DOORAE consists of multimedia PCs, a network adapter, keyboard/mouse, image scanner, microphone, video camera, monitor, speaker, printer, video processor and accelerators. The operating system was first developed on windows 3.1 but presently windows 98, windows 2000, windows NT, and windows XP are supporting the development as well. The multimedia application layer includes general application software such as word processors, presentation tools and so on.

3.2 DOORAE Agent Layer

As shown in Figure 4, DOORAE agent layer includes advances services, coordination services, cooperation services, and media services[8]. Advances services consist of various subclass module. This subclass module provides the basic services, while advances services layer supports mixture of various basic services. Advances 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 permit another subsessions. Session control module has an object with a various information 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 telepointers. 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 module limit the service by hardware constraint.

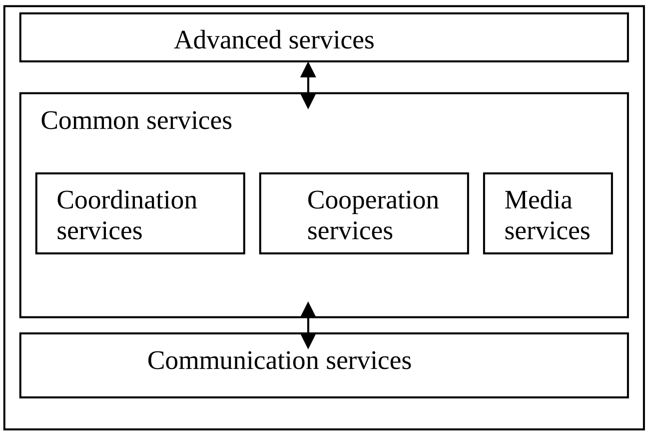

Fig.4 DOORAE agent layer

3.3 Suggested Integrated Whiteboard Model

This paper retrieves the common characteristics of these tools and design an integrated model including all these methods for supporting concurrent collaborative workspace.

3.3.1 Integrated Whiteboard Model

As shown in Figure 5, this paper describes an integrated whiteboard model which supports object drawing, application sharing, and web synchronization methods of sharing information through a common view between concurrently collaborating users.

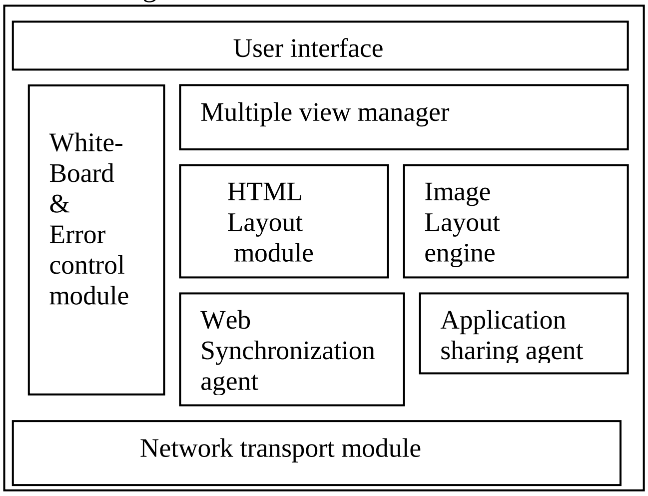

Fig.5 The organization of whiteboard model

As shown in Figure 6, this proposed model consists of multiple view layout and each layout control, a unified user interface, and defines the attributes of a shared object.

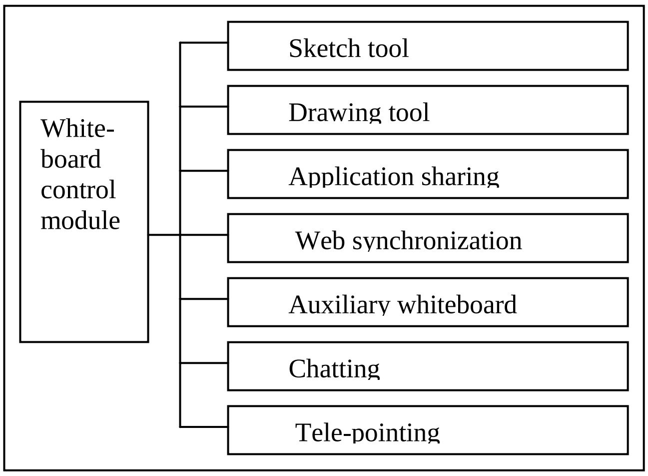

Fig.6 User interface

Remote education system is an example of a web based multimedia collaboration environment. This remote education system includes several features such as Audio, Video, Whiteboard, WebNote running on Internet environment which is able to share HTML. While session is ongoing, almost all participants are able to exchange HTML documents. For this reason, we need the URL synchronization.

3.3.2 Web based CARV Architecture

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. 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. The tool box provides various tools for edting contents of both the shared window and the local window. Figure 7 shows that teacher and students use their local windows and shared window indivisually. 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.

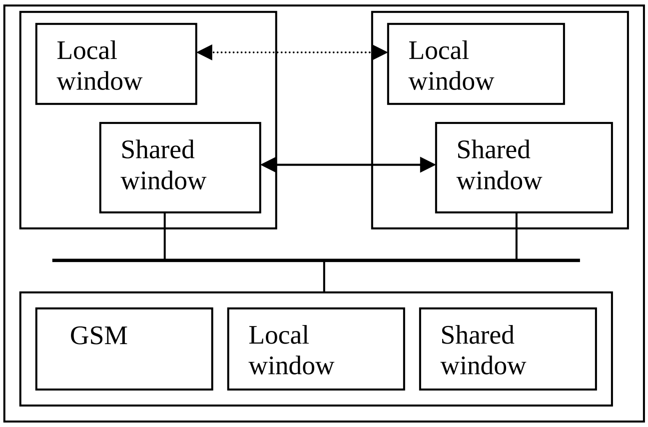

Fig.7 Web based CARV architecture

3.3.3 Error Control for Integrated Whiteboard Model

To ensure required reliability of multimedia communication systems, EC_IWM(Error Control for Integrated Whiteboard Model) consists of two steps error detection and error correction. You can see message flows in EC_IWM. DOORAE consists of Daemon, Whiteboard Session Manager and EC_IWM. The relationship among EC_IWM, Daemon and Whiteboard Session Manager are as shown in Figure 8 and Figure 9. First, before an error is to be detected and recoverable, you must create sequences below. This system creates a session with initial configuration information. It requests port ids for audio, video and Whiteboard servers to build up a Whiteboard Local Session Manager. It assigns port ids for audio, video and Whiteboard servers of an application. It invites to the session and build-up a Whiteboard Session Instance Monitor. It sends invited messages to start build-up of Whiteboard Session Instance Monitor. It builds up Session Instance Monitor using the configuration information from Whiteboard LSM. It sends joint message to the Whiteboard Local Session Manager. It sends session information to Global Session Manager for set-up of GSM Table.

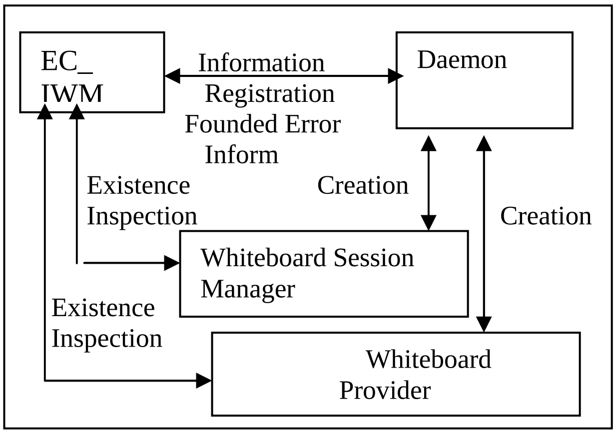

Fig.8 Relationship between EC_IWM & Daemon

It begins a session. It exchanges message or command between Whiteboard LSM and PSM and media data between media or Whiteboard server based on interpretation of message handler. After it, you can create Whiteboard Session Manager. Second, you must run EC_IWM. Third, you must register information of creation of service handle and Whiteboard Session Manager handle by Daemon. Forth, you must register Information to on Whiteboard Session Manager of creation of instance handle and application handle by Whiteboard Session Manager. Fifth, You must EC_IWM can receive registration information from Daemon or Whiteboard Session Manager. This method detects error by using polling and GetExitCodeProcess() function when events occur with relation to DOORAE's Whiteboard session. Daemon provides EC_IWM for an information on application to be necessary for session's process and instance of Whiteboard Service Provider. It informs the detection of error in the process to Daemon to create the watched object.

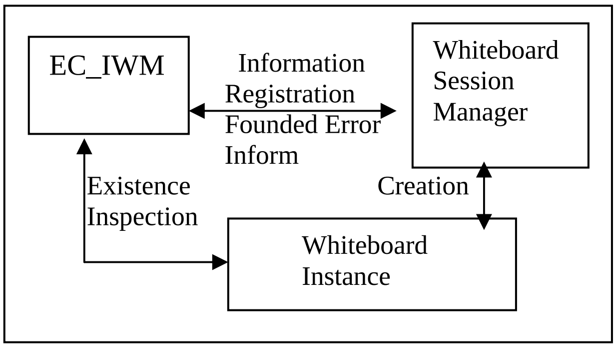

Fig.9 Relationship between EC_IWM & Whiteboard Session Manager

3.3.4 URL synchronization

This system is used to be one of services which is 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. As shown in Fig.3, you can see the relationship between WebNote Instance and WebNote SM. 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.

3.3.5 Distributed Multimedia Environment

DOORAE(Distributed Object Oriented collaboRAtion Environment) is a framework technology for computer collaborative work. It has been running since April 1996 at SKKU(Sung Kyun Kwan Univ.) in Korea. It has primitive service functions. Service functions in DOORAE are implemented with object oriented concept. We call agent layer. As shown in figure 10, the organization of DOORAE includes 4 layers. The four layers consist of a communication layer, a system layer, a DOORAE agent layer, and a multimedia application layer.

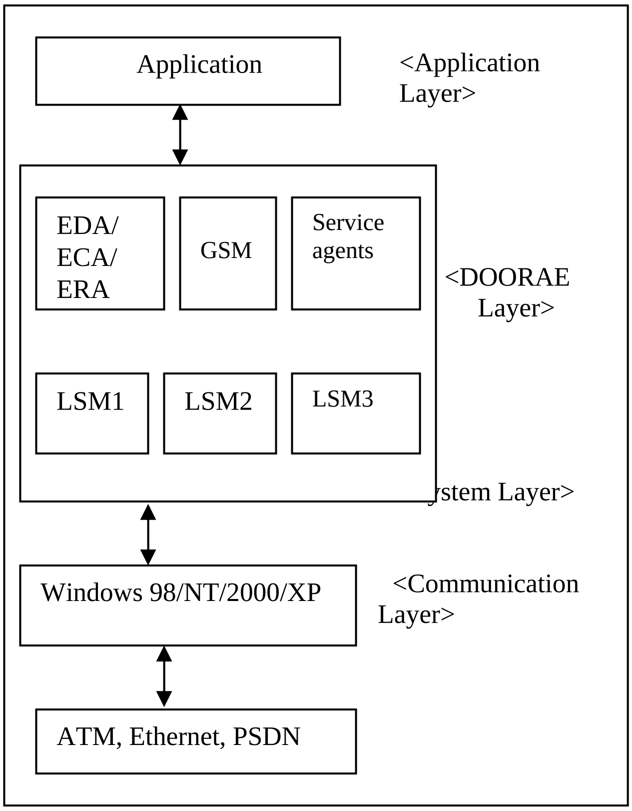

Fig. 10 The organization of DOORAE layer

3.3.6 EDA

EDRA consists of EDA(Error Detection Agent) and ERA(Error Recovery Agent). EDA consists of ED(Error Detector), EC(Error Classifier) and EL(Error Learner). EDA is an agent which plays a role in detecting, and classifying errors. ED is an agent which plays a role as an interface to interact among an application, EC and EL. ED has functions which detect an error. ED informs EC of the results of detected errors. ED inspects applications by using process database function periodically to find an error. EC and EL deal with learning in reactive multi-agent systems. Generally, learning rules may be classified as supervised or unsupervised. It uses a perception training. Hence, the training set consists of a set of input vectors, each with its desired target vector. Input vector components take on a continuous range of values; target vector components are binary valued (either zero or one). After training, the network accepts a set of continuous inputs and produces the desired binary valued outputs. KB has a registration information of creation of service handle and session manager handle by Daemon and GSM. EC can decide whether it is hardware error or software error based on learning rules by EL. In case of hardware error, it cannot be recoverable. In case of software error, it can be recoverable. This approach is based on the idea of comparing the expected error type which is generated by an EL with the actual error occurred from sites.

3.4 A Session Management for Multimedia Collaboration System

AMA is an agent that has functions of application management. CRPA is an agent that has functions of managing formation control of DOORAE communication protocol. ACCA is an agent that has functions of managing floor control and concurrency control. COPA is an agent that has functions of providing participants same view.

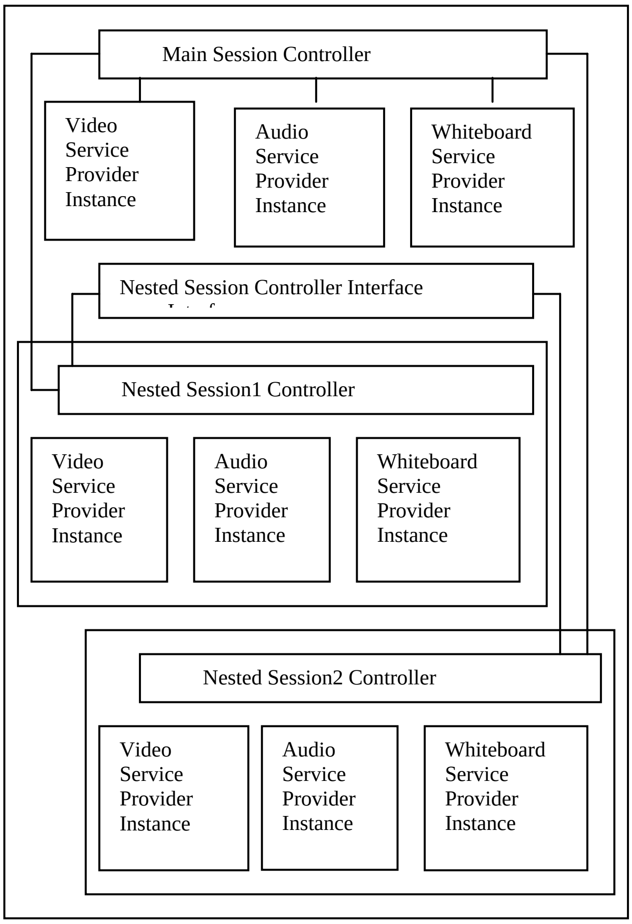

Fig.11 The Organization of Nested SEMA

SEMA is a session management agent that controls and manages the whole session access. As is shown in Fig.11, nested SEMA have functions of media service provider control, the method to support multiple

instance, nested session which is a side meeting to resolve same issue, and session recovery.
DOORAE has distributed architecture so that initial session initiator becomes session manager, which means that all the platforms connected DOORAE environment can be se- ssion initiator and/or session manager session control permits access to the session or restricts it. Also, SEMA supervises beginning and ending of each session, permits access to participants and visitors and controls and manages permission to open other session. This module, to control several lecture class at a time, is composed of LSM(Local Session Manager) and GSM(Global Session Manager). DOORAE supports simultaneous multi-session when more than one session is opened, GSM lets each session to run independently. Each LSM manages only its own session. To ensure each session's independent communication, GSM maintains session management table which manages LSM and prevents collisions between LSMs. One of functions of LSM is to admit late comer to the session and if on early student's withdrawing occurs, LSM automatically cuts off the student's communication system to reduce traffic within the network.

4 Performance Analysis by DEVS

To evaluate the performance of the proposed system, an error detection method was used to compare the performance of the proposed model against the conventional model by using DEVS formalism.

(Simulation 1)
In the first simulation, we have considered composition component as shown in Table 1. The atomic models are EF, RA1, UA1, and ED1. The combination of atomic models makes a new coupled model. First, it receives input event, i.e., polling interval. The value is an input value in RA1 and UA1 respectively. An output value is determined by the time related simulation process RA1 and UA1 respectively. The output value can be an input value in ED1. An output value is determined by the time related simulation process ED1. We can observe the result value through transducer.

Table 1. Atomic Model and State Variable

Component	State Variable	Contents
EF(genr)	Poll_int	Polling interval
RA1	Ra_re_time App_cnt1 Ra_re_t_a	Response time The number of application program Accumulated response time
UA1	Ua_re_time App_cnt2 Ua_re_t_a	Response time The number of application program Accumulated response time
ED1	Ra_re_t_a Ua_re_t_a Tat_t_a	RAaccumulated response time UAaccumulated response time RAaccumulated response time + UAaccumulated response time

(Simulation 2)
In the second simulation, we have considered composition component as shown in Table 2. The atomic models are EF, RA2, and ED2. The combination of atomic models makes a new coupled model. First, it receives input event, i.e., polling interval. The value is an input value in RA2. An output value is determined by the time related simulation process RA2. The output value can be an input value in ED2. An output value is determined by the time related simulation process ED2. We can observe the result value through transducer.

Table 2. Atomic Model and State Variable

Component	State Variable	Contents
EF (genr)	Poll_int	polling interval
RA2	Ra_re_time App_cnt1 Ra_re_t_a	Response time The number of application program Accumulated response time
ED2	Ra_re_t_a Sm_t_a Tat_t_a	RA accumulated response time Accumulated time to register information in SM RAaccumulated response time + UAaccumulated response time

We can observe the following. The error detected time interval is as follows.

Conventional method:

Poll_int*(App_cnt1 + App_cnt2)

Proposed method:

Poll_int*(App_cnt1) + Sm_t_a

Therefore, Poll_int*(App_cnt1 + App_cnt2) > Poll_int*(App_cnt1) + Sm_t_a That is, proposed method is more efficient than conventional method in error detected method.

The strong point of this system is to detect and recovered automatically in case that the session's process come to an end from software error.

5 Related Works

As shown in Table 3, 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.

Table 3 Analysis of conventional multimedia distance 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
Applica-tion sharing	No	No	No	No
Error control	No	No	No	No

6 Conclusion

This paper is proposed a fault-tolerance system running on home network environment for a web based multimedia distance education system with an URL and error synchronization function. The system for web based multimedia distance education includes several features such as audio, video, whiteboard, etc, running on internet environment which is able to share HTML format. It detects an error by polling techniques with session management. This paper explained a performance analysis of an error detection system for distributed multimedia running on home network environment using the rule-based DEVS modeling and simulation techniques. The weak point of this system is limited to DOORAE. Our future work is to extend to autonomous agents for detecting and recovering error and to generalize it to adjust any other system.

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