

# A FAULT DETECTION AND RECOVERY SYSTEM FOR DOORAE RUNNING ON HOME NETWORK ENVIRONMENT

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**Abstract:** We propose FDRS (Fault Detection and Recovery System) for DOORAE running on home network environment). DOORAE (Distance Object Oriented collaboRAtion Environment) is a framework of supporting development on multimedia applications for computer-based collaborative works running on home network. FDRS is a system which is suitable for detecting and recovering software error based on distributed multimedia education environment by using software techniques. The purpose of FDRS is to recover application software running on DooRae automatically and repeatedly. All application software running on DooRae returns to a healthy state or at least an acceptable state.

## 1 INTRODUCTION

Nowadays, the use of universal multimedia standards and improvements in processor technology has led to much more powerful systems at lower costs. The development of communication environment based on such technology as graphics, image, voice and video has become the media for interactive information services. These features have made multimedia distant education feasible (Gil C. Park, and Dae J. Hwang., 1996) ( Gil C. Park, and Dae J. Hwang., 1997) ( Jung S. Sung, and Dae J. Hwang., 1996 ). Distant education system must be able to support real-time interaction, temporal/spatial synchronization and floor control for smooth interaction (Seok S.Kim et al., 1997) ( Jae Y. Ahn et al., 1996)( Gil C. Park and Dae J. Hwang., 1995). DooRae provides several functions and features capable of developing multimedia distant education systems for students as well as teachers. It includes session management, access control, concurrency control and handling of late comers.

The field of fault-tolerant computing has evolved over the past twenty-five years. Fault-tolerant computing begins with the assumption that digital systems are susceptible to many kinds of failure (Victor P. Nelson and Bill D. Carroll. Chap.1). In spite of this current trend, however, study on fault-tolerance

of application software has not actually been enough. Generally, fault-tolerance system can be classified into software techniques, hardware techniques and composite techniques (Dhiraj K. Pradhan., 1996). The tolerance of software faults is in most cases more difficult than dealing with hardware faults since most software-fault mechanisms are not well understood and do not lend themselves readily to “nice” techniques such as error coding (Victor P. Nelson and Bill D. Carroll. Chap.5).

FDRS is a system in which a fault-tolerant system running on DooRae. The system is capable of detecting and recovering software error based on Multimedia collaboration. This paper shows a design of the agents which can detect an error and recover it automatically by using API (Application Program Interface) functions in MS-windows XP on the distributed system.

Section 2 describes related works: home network. Section 3 denotes Doorae agent layer running on home network. Section 4 denotes FDRS. Section 5 describes the evaluation of FDRS. Section 6 concludes the paper.

## 2 RELATED WORKS: HOME NETWORK

A Physical device & network layer for home network are as shown in Figure 1. The communication network is being presently developed with UDP broadcasting in order to decrease communication rate and TCP/IP on the Ethernet and ATM. 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 95, but presently Windows 98, Windows NT and Windows XP are supporting the development as well. The multimedia application layer includes general application software such as word processors, spreadsheets, presentation tools and so on.

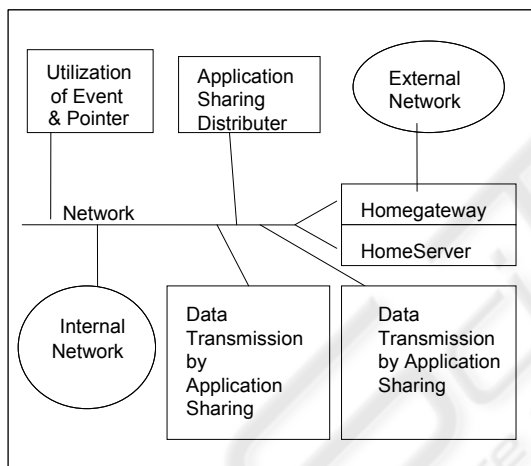


Figure 1: A Physical device & network layer for Home Network.

## 3 DOORAE AGENT LAYER RUNNING ON HOME NETWORK

DOORAE agent layer includes many agents. They are AMA (Application Management Agent), IA(Intelligent Agent), SMA (Session Management Agent), ACA (Access Control Agent), MCA (Media Control Agent) and FTA (Fault Tolerance Agent). The organization of DOORAE agent layer running on Home Network is shown in Figure 2.

AMA (Application Management Agent) consists of various subclass modules. These subclass modules provide the basic agent, while AMA supports a mixture of various basic services. AMA includes creation/deletion of shared video window and creation/deletion of shared window. For providing heterogeneous platforms with interoperability, it is necessary to share media data and to furnish awareness to the remote users involved in collaborative work. To solve the problem, we set the IA (Intelligent Agent) that modifies the transmitting packets by using TCP/ IP or UDP. Event messages including information about shared objects is by passed among the homogeneous. SMA (Session Management Agent) controls the access to the whole session. This agent can be used in meeting, distance learning, playing games and development of any software. Session control also facilitates access and limits it to the whole session. ACA (Access Control Agent) controls the person who can talk, and the one who can change the information. The mechanism of floor control consists of brainstorming, priority, mediated, token-passing and time-out. MCA (Media Control Agent) support convenient application using DOORAE environment. Supplied services are the creation and deletion of the service object for media use, and media share between the remote users. This agent limits the service by hardware constraint.

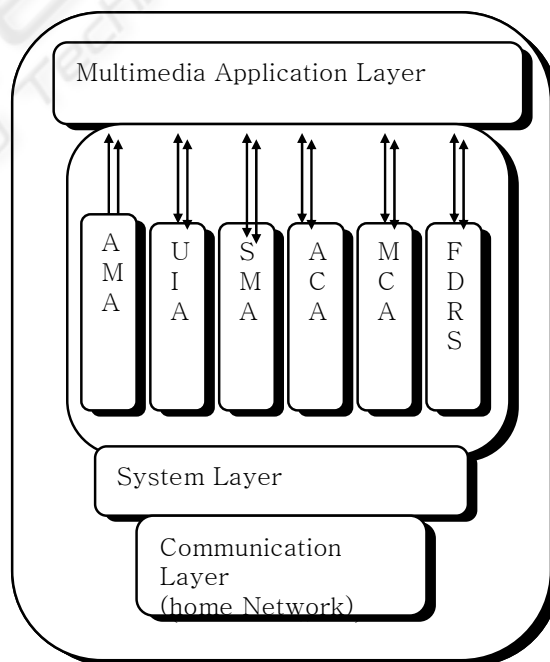


Figure 2: The Architecture of DOORAE Agent Layer Based on Home Network.

## 4 FDRS FOR DOORAE RUNNING ON HOME NETWORK

This paper describes FDRS. It is a fault-tolerant system for DOORAE running on Home Network.

### 4.1 The Organization of FDRS

As shown in Figure3, you can see the message flows in relationship between FDRS and the application software. It consists of a user, FDRS and the watched application software.

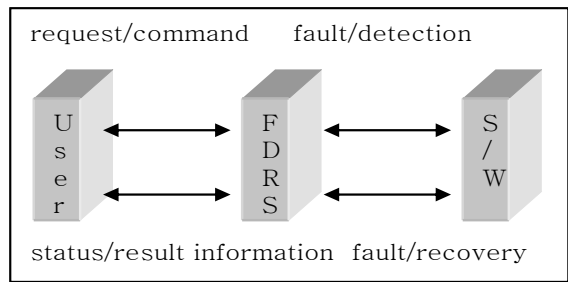


Figure 3: The relationship between FDRS and application software.

FDRS consist of FDRA (Fault Detection and Recovery Agent), UIA (User Interface Agent) and SMA (Session Management Agent). As shown in Figure4, you can see the message flows in organization of FDRS. UIA is an agent which plays a role as an interface to interact between the user and FDRA. UIA is a module in FDRS. UIA has functions which receive user's requirement and provide the results for the user. SMA is a agent which plays a role in connection of UIA and FDRA and as management for the whole information. SMA consists of GSM (Global Session Manager), Daemon, LSM (Local Session Manager) and PSM (Participant Session Manager).

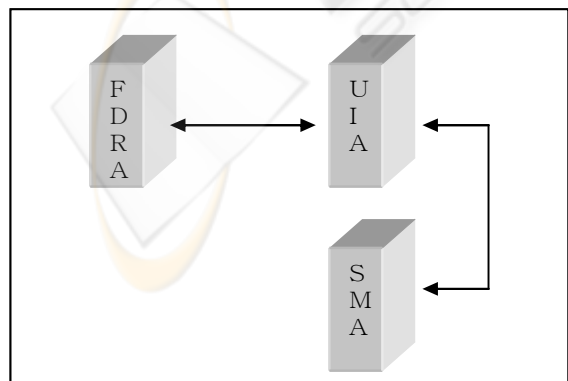


Figure 4: The organization of FDRS.

### 4.2 The Algorithm of FDRS

Session management can create the sequence below and you can see the message flow in Figure 5.

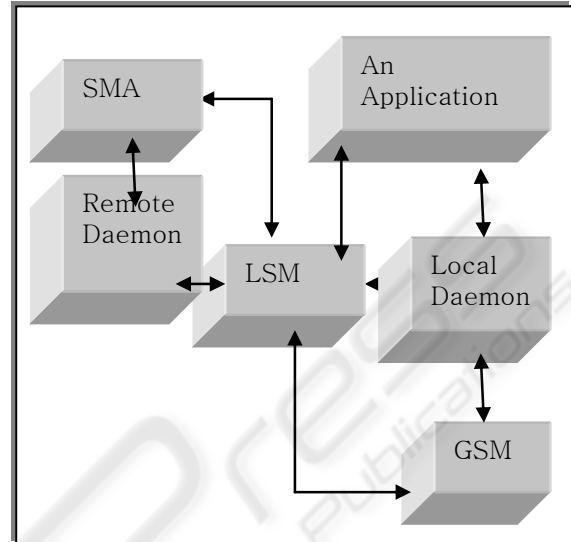


Figure 5: The relationship between GSM, Daemon and LSM.

FDRA is a agent which plays a role in detecting error and recovering it. That is, FDRA becomes aware of error occurrence after it receives requirement of UIA. FDRA informs SMA of the results of detected errors. Also, FDRA activates a fault application software automatically. It informs SMA of the result again.

## 5 THE EVALUATION OF FDRS

FDRS has been implemented by using VISUAL C++. The merit of FDRS is convenient to detect and repair autonomously in comparison with manual methods. But, its defect is overload by polling method when detecting whether an error exists or not. As shown in Table 1, conventional multimedia distance education systems are Shastra, MERMAID, MMconf, and CECED (A. Anupam and C.L.Bajai, 1993) (T. Ohmori and K. Watabe, 1992) (Torrence Crowley and Raymond Tomlinson, 1990) (Earl Craighill and Keith Skinner, 1993). You can see the characteristic function of each system function for multimedia distance education.

Table 1: Analysis of conventional multimedia distance education system.

Function	Sha- Stra	MER- MAID	MM- conf	CE- CED
OS	UNIX	UNIX	UNIX	UNIX
Development Location	Purdue Univ. USA	NEC, JAPAN	Cam- Bridge USA	SRI, Inter- national
Development Year	1994	1990	1990	1993
Structure	Server /client	Server /client	Cent- ralized or Repli- cated	Repli- cated
FDRS based on Home Network	No	No	No	No

## 6 CONCLUSIONS

Multimedia has been applied to various fields since the 1980s. A distant education system, a region of the education field has also been in process of development. The focus of distribute environment for development of multimedia communication has increased. A distributed system has a good condition of design on fault-tolerant systems because it does not affect the total system, though it occurs in defect of a node or resource. Therefore, it is important to increase the detecting capability required and be able to recover the defect automatically without the need for manual network management. This paper explains the design of the FDRS (A Fault Detection and Recovery System for Multimedia Collaboration Environment) application system on DooRae(Distributed Object Oriented Multimedia Application Crafting Environment for Collaboration) framework, which has been to support session control, floor control, media control, window control and communication control. This paper shows a design of the agents which can detect an error and recover it automatically by using API (Application Program Interface) functions in MS-windows XP on the distributed system.

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