International Journal of u- and e- Service, Science and Technology
Vol. 2, No. 4, December, 2009

Application Protocol Design for Collaborative Learning

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Abstract

This presentation will describe the effort to construct an effective educational support environment and to develop meaningful educational applications, This system is a framework supporting interactive collaboration which enables both teachers and students to interact in real-time from remote sites. The purpose of this collaboration is to bring interactive multimedia learning in real-time. In order to induce collaborative learning, this paper proposes protocol design process that shares knowledge awareness information for learning environments. The protocol helps learner to mediate and recognize collaborators in the shared knowledge space. We are developing an open-ended collaborative learning support system, which is called prototype system for protocol design, and facilities to share individual knowledge and to learn through collaboration. This system architecture can be viewed as divided in four logical parts: the infrastructure, the service functions, the advanced service functions and the application. The session management is creates/destroys the sessions and performs the functions controlling the QOS by detaching the network load. Session manager include: session control, floor control, media instance control, packet interpreter, event interpreter, media server instance, media interface, network interface private application interface and media server control.

Keywords: *collaboration learning, application protocol design, service functions, session management, session control, floor control, media server control*

1. Introduction

Virtual learning communities are information technology based cyberspaces in which individual and collaborative learning is implemented by groups of geographically dispersed learners and providers of knowledge to accomplish their goals of learning. There are no agreements on what constitutes a virtual learning community. However, it has gained widespread acceptance that collaboration learning communities are knowledge based social entities where knowledge is the key to their success[10][30]. An important activity in a virtual learning community is the collaboration. Many virtual learning communities strive to attract new members or encourage members to learn and to contribute knowledge.

However, the knowledge does not assure the success of virtual learning communities. It is the collaborative efforts made by the learners and collaborators to manage the knowledge, to enrich the knowledge reservoir, and to help each other accumulate their knowledge in their domain that is central to the continuous growth of the virtual learning communities.

The ubiquitous learning environment provides an interoperable, pervasive, and seamless learning architecture to connect, integrate, and share three major dimensions of learning resources: learning collaborators, learning contents, and learning services[4][8][23][32].

In recently, ubiquitous learning is characterized by providing intuitive ways for identifying right collaborators, right contents and right services in the right place at the right time based on learners surrounding context such as where and when the learners are time and space, what the learning resources and services available for the learners, and who are the learning collaborators that match the learners' needs [15][19][22]. As a result, the effectiveness and efficiency of ubiquitous learning heavily relies on the surrounding context of learners.

Collaboration in virtual learning communities characterizes itself by heavily relying on interaction among the collaborators [12][17]. The collaborators can be instructors and learners, the interaction can be resources discovery, access, and sharing, as well as group communication and discussion, or simply any collaboration which has occurred among the instructors and learners. In addition, the collaboration should be enacted inside and outside of classrooms without limitation of space and time; it can be over the Internet and beyond the geographical boundary [30].

Nevertheless, such collaboration environment is generally not supported by conventional learning environments. Typical learning services for collaboration in virtual learning communities are content, access of certain learning subjects; making studying notes and annotation on learning subjects; group discussion, brainstorming for knowledge creation and sharing. This make peer-to-peer network particularly suitable for implementing ubiquitous learning environments for collaborative learning [9][12][29].

Collaborative learning is an educational approach to teaching and learning that involves groups of students working together to solve a problem, complete a task, or create a product. Collaborative learning is based on the idea that learning is a naturally social act in which the learners talk among themselves. It is through the talk that learning occurs [6].

A set of assumptions about the learning process is described below: [6] Learning is an active process whereby students assimilate the information and relate this new knowledge to a framework of prior knowledge. Learning requires a challenge that opens the door for the learner to actively engage his/her peers, and to process and synthesize information rather than simply memorize and regurgitate it. Learners benefit when exposed to diverse viewpoints from people with varied backgrounds. Learning flourishes in a social environment where conversation between learners takes place. During this intellectual gymnastics, the learner creates a framework and meaning to the discourse. In the collaborative learning environment, the learners are challenged both socially and emotionally as they listen to different perspectives, and are required to articulate and defend their ideas. In so doing, the learners begin to create their own unique conceptual frameworks and not rely solely on an expert's or a text's framework. [6]. The purpose of this collaboration is to bring interactive multimedia ubiquitous learning in real-time.

2. System Configuration

This system is a framework supporting collaboration work using computers and communication vendors in a geographically distributed ubiquitous environment [25]. Figure 1 shows a picture of the system architecture. The layer representation of the system architecture helps one to understand the scope of each service and the relationship with other services. The system architecture can be viewed as divided in four logical parts: the infrastructure, the service functions, the advanced service functions and the application.

The system infrastructure includes: Operating Systems; Communication Services module which supports a data transportation among PCs in distributed collaboration environment,

creates/destroys the network connections and performs the functions controlling the QOS by detaching the network load.

Service functions include: session management, floor management, concurrency management, and media management.

Also, the advanced service functions include creation/deletion of shared window and creation/deletion of video window. Shared window object provides free hand line, straight line, box and text to collaboration work learners.

Application area is a collect of applications and provides a Ubiquitous Learning or Self-Learning, Home Education and collaboration learning, Distance Conference, Self-evaluation. The system provides e-learning with an intuitive shared whiteboard and application program sharing to promote group collaboration.

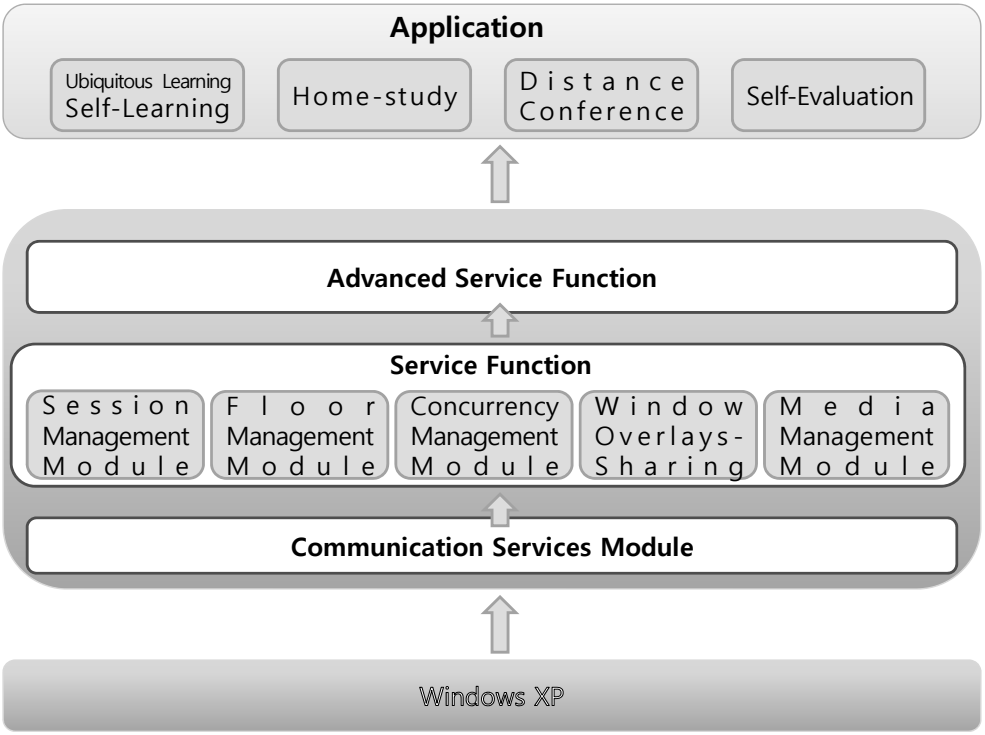

Figure 1. The system architecture

2.1. Application Human Interface

This system provided in lesson plans production, interactive lesson and evaluation of lesson. We developed four applications area: self-learning or collaboration learning, self-evaluation, home-study or collaboration learning, distance conference.

The floor control window controls the floor among learners, and it consists of video image window as many as the number of students who learners in the session.

The video window is used for monitoring the video of a remote learner, and it displays the video image of the learner who has the floor control. The video window allows the learner to

select and view the video clip. And the video window can be displayed simultaneously with a document or whiteboard information so the education can stay focused on lecture.

The shared window is a window shared by all the learners, and the modification carried out by the speaker is notified to every other learners.

The local window is not shared except initial file sharing, and each learner can modify it as needed. The local window has the lecture plans which is distributed at the beginning, and enables learners to memo and browsing other parts in the lesson plans, and has functions as a blackboard.

The tool box provides various tools for editing contents of both the shared window and the local window. The toolbox of button are menu box for the AVI file play and Internet service etc,. The whiteboard in top right of the screen serves as a blackboard in conventional classroom which is education assistant tool to write texts, draw pictures, or fill colors and provides application program sharing with other learners and interactive education.

The Process for activation of a collaboration learning is described below.

(1)The teacher prepares a lesson plans using the editor provided by the distance collaboration learning system, and the lesson plans is kept in the DB of the distance learning system.
(2)The teacher dispatches an invitation message of collaboration discussion to the proper students who have joined the environments.
(3)Each student participates in the distance collaboration learning session using his name.
(4)The teacher distributes the lesson plans to the students, and a lesson and discussion starts.

After the lesson is activated, questions, answers and discussion are done interactively in the session.

2.2. Advanced Service Function(Application program sharing)

There are two types of application program sharing. One is centralized architecture and another is replicated architecture. Since replicated architecture can only transmit management data and event data, it can reduced communication overhead. However it has the program where the learner has to have the same application program. A software provides various execution module through different vendors.

Application program that is requires each student to own it. Also the problem of command serialization can be solved through invoking two applications at ones. To solve the these problems, we designed and implemented central architecture. The method of application sharing program made use of windows hook function. A hook is a mechanism by which a function can intercept events (message, mouse action, key strokes) before they reach in application. The function act on event. Functions that received event are called event distributor and are classified according to the type of event they intercepted.

Event distributor send to event data to application program and receive processing result. The result is displayed own monitor and send to remote event distributor. In case of graphic image are transmitted at changing of graphic image which is snatched from GDI(Graphics Device Interface) function. GDI is communications between the application and the device driver, which perform hardware specific functions that generates output by acting as buffer between applications and output devices. Event distributor snatch messages, and send the message to remote site for same operation.

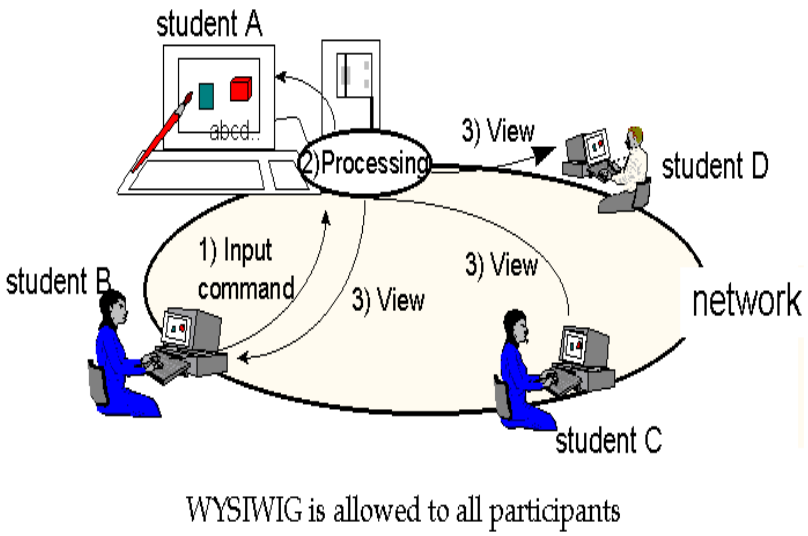

Figure 2. Application Program Sharing Process

2.3. Service Functions

Service functions provide the following services:

2.3.1. Session Management Module

Session management managements access to whole session. Session management not only restricts access, it facilities access. It can also allow learners in a session to find others and bring them into the session. Session management deals with session start/termination, join/invitation/leave, and late comers. It may also allows sub-sessions and permits to join another sessions. Session management has an object with a various information for each session and it also supports multi-casting with this information.

2.3.2. Floor Management Module

Floor management managements the learner who can talk, and learner who can change the information. In this module, initially it is set to teacher mediated floor management, but it can be changed while in session. Mechanism of the floor management consists of brain-storming, priority, mediated, token-passing and time-out. In floor management module, it provides explicit floor management and brain-storming.

2.3.3. Concurrency Management Module

Concurrency management is inevitable to allow multiple learners to be in safe collaboration in distributed multimedia environment.

2.3.4. Window overlays module

This 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.

2.3.5. Window sharing module

This is a combination of window copying, window overlays, floor management and session management. 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 as the source of input.

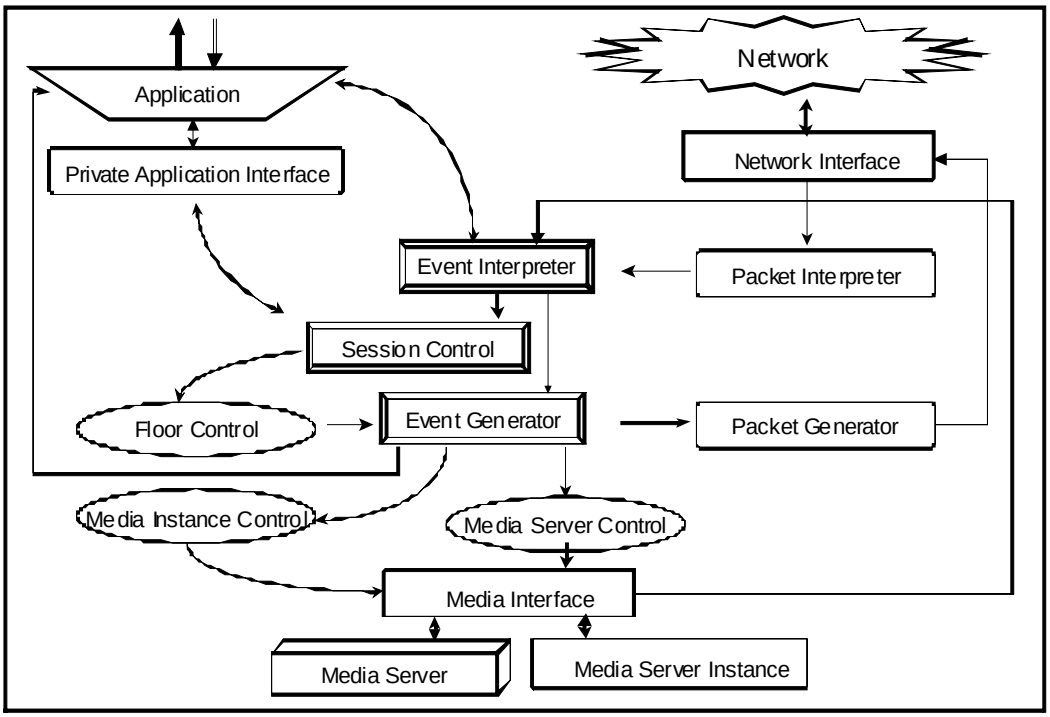

Figure 3. Configuration of Session-Manager

2.3.6. Media Management Module

This module managements the creation and deletion of the service object for media use, media share between remote learner. And it also limit the service by hardware constraint. Media module support convenient module for application using the environment. Supplied module are the creation and deletion of the service object for media use, Media module limit the service by hardware constraint.

2.4. Communication services module

The communication service module is in charge of data transportation among PCs in distributed environment, and used by other service modules. The communication service module creates the network connections which altogether form a collaboration work, destroys and experiment of effective system.

3. Application Protocol Design

Process in Figure 3 shows configuration of session-manager. The session management is creates/destroys the sessions and performs the functions controlling the QOS by detaching the network load. Session manager include: session control, floor control, media instance control, packet interpreter, event interpreter, media server instance, media interface, network interface private application interface and media server control.

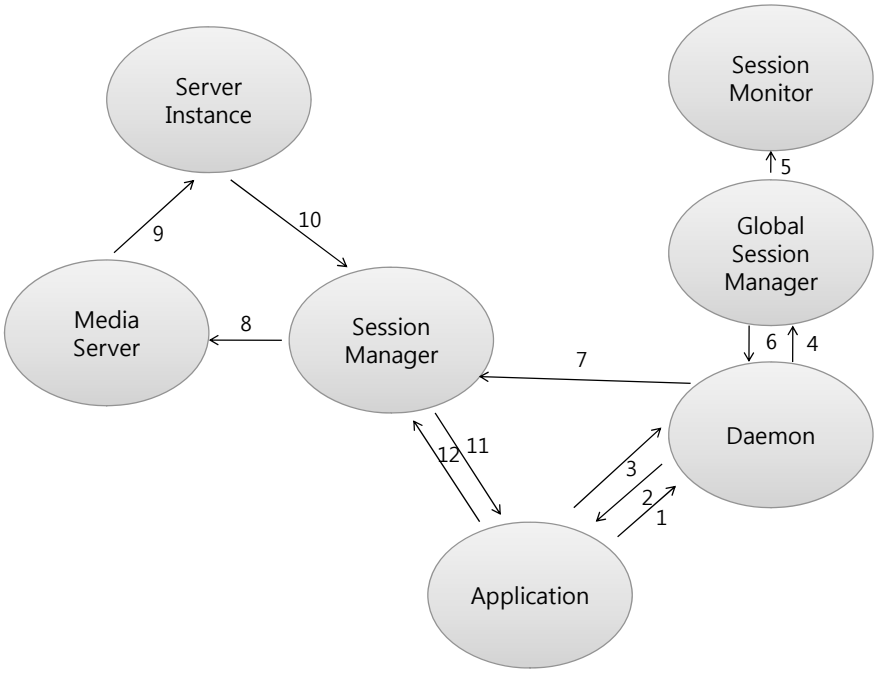

Figure 4. Application Protocol for session creation

Figure 4 shows the steps for creation of a session for application which provided by session management service. When application starts running, application request registration as an application by identifying the demon objects. (step 1) Demon assigns useful unique number of application on appropriate platform and approaches private application interface with the assigned unique number. (step 2) Application requests the creation of a session after notifying the requirements for creation of session such as various media resources, floor management, daemon through public application interface. (step 3)

Daemon registers application to total session manager and requests assigns of necessary network resources at the same time. (step 4) Total session manager assigns necessary network resources and creates appropriate session monitor (step 5) and assigns network resources to requested daemon. (step 6) Then demon creates session manager with assigned

network resources. (step 7) Created session manager requests creation response to media resources to media server through assigned network resources. (step 8)

Media sever by using assigned network resources from session manager creates server instance which will perform services response to requested media resources from the application. (step 9) After the media server instance is created, server instance informs successful creation to the session manager and passes the handle which can be approached to the server instance. (step 10) When all requirements for the creation of session are ready, session manager notifies the application through private application interface that session is created. (step 11) Then application can request all services through session manager.(step 12)

4. Conclusions

The objective of this research is to construct an effective educational support environment and to develop meaningful collaboration learning applications. It is designed for learners of educational multimedia to help them develop understanding, knowledge and confidence and to promote the effective use of multimedia in supporting teaching and learning.

This system is a framework supporting collaboration work using computers and communication vendors in a geographically distributed ubiquitous environment[3]. The layer representation of the system architecture helps one to understand the scope of each service and the relationship with other services. The system architecture can be viewed as divided in four logical parts: the infrastructure, the service functions, the advanced service functions and the application. The system infrastructure includes: Operating Systems; Communication Services module. Service functions include: session management, floor management, concurrency management, and media management. Also, the advanced service functions include creation/deletion of shared window and creation/deletion of video window. Shared window object provides free hand line, straight line, box and text to collaboration work learners. Application area is a collect of applications and provides a Ubiquitous Learning or Self-Learning, Home Education and collaboration learning, Distance Conference, Self-evaluation.

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The system provides e-learning with an intuitive shared whiteboard and application program sharing to promote group collaboration[11]. There are two types of application program sharing. One is centralized architecture and another is replicated architecture. Since replicated architecture can only transmit management data and event data, it can reduced communication overhead. However it has the program where the learner has to have the same application program.

Group discussion is another important learning issue in collaborative learning. It is a process in which a small group assembles to communicate with each other using speaking, listening, and nonverbal processes in order to achieve instructional objectives. Group discussion addressed the optimal group size for discussion to be between five and eight learners. Through the discussion, learners can review their ideas and get valuable opinion from another’s aspect. The purpose of group discussion is to form a learning group based on a specific topic for a learning objective. This involves group formation, the mechanism to form a group based on individual knowledge level and capability level as well as interest. There are two approaches of group formation; one is based on the learning objective, the other is

learning on demand. For a specific learning objective, group members should have various knowledge and capability levels in order to compliment each other and form a team work. For learning on demand, the grouping is based on certain needs, for example, post a question and looking for help.

In this case, the collaborators with certain interests and knowledge are the priority choice. We are designing our message service from a group collaboration point of view, that is, to provide message services for group collaboration, such as discussion, instant messenger, message exchange, message filtering, push message, and message synchronization within a group. In our design of group collaboration, each peer is free to initiate a special interest group and free to apply to join any special interest group initiated by other peers in the peer-to-peer network. The peer who initiates a special interest group is the default special interest group manager who has the authority to grant a pass to other peers who are interested in joining the special interest group[22][23][27].

Typical special interest group management includes granting a pass, maintaining the discussion and file sharing which has occurred in the special interest group etc. Our multimedia real-time group discussion system provides typical services such as group formation, email and instant message services for the entire peer-to-peer network, special interest groups, audio and video conference, electronic whiteboard, personal or group calendar services, personal ontology, groups, ontology for ontology management, and session management and synchronization management when peers reconnect to the network.

Adaptive learning[13] is based on the idea of adapting learning methodologies to students' learning styles. The concept is that an individualised method of teaching will help students learn at a faster pace, more effectively, and with greater understanding. Some of the elements of adaptive learning include: monitoring student activity, interpreting the results, understanding students' requirements and preferences, and using the newly gained information to facilitate the learning process [1][5][14].

An ongoing version of this research, we report on the adaptation of ubiquitous learning environment(ULE) in an educational setting. The ULE resides within the physical environment[7][8][11]. Microprocessors are embedded in objects, or devices. The use of wireless and mobile technology makes them easily accessible and contributes to educational functionality. The wireless and mobile devices include mobile phones and PDAs. A ULE can provide the props and stimuli needed to easily encourage student involvement but without needing the active attention of the student. The benefits of the many to one relationship found in u-learning include the potential for one ULE to service an unlimited number of individuals at once. Essentially, the many to one relationship exists for every one of the students within the environment[2].

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