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Cooperative System of P2P and C/S Mixed Model

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Abstract: A huge number of resources have been appeared in forms of websites or network resources. A new kind of work or study mode has been formed that people share the digital resources, discuss and solve the relative problems at the same time. In order to break through the space restriction, we research and make a cooperative system which is based on the P2P network. In this system, all the users can see and hear each other, browse the same page and operate in sync, in this way to achieve the allopatric cooperative work and study. The system uses the P2P framework which makes good use of P2P network's highly flexibility, decentration and network pressure relief. Meanwhile, it combines with C/S mode to make full use of the rich and structured network resources and also reduce the network flux, develop the high-performance of network servers.

Key words: P2P, C/S, network resources, cooperative environment

INTRODUCTION

In recent years, most of the office resources, scientific resources and teaching resources are appeared as the digital resources style in the website. People often have cooperative work or study base on these resources. People are all in a room with multimedia equipment and networks, browsing the digital resources on the websites and discussing, studying according to those resources (Liu *et al*., 2008; Yang *et al*., 2009). In order to relive the restriction, some advanced systems use the network cooperative website system which is based on the C/S mode. In this system, all the network users can log in the server to upload one's own video and voice immediately to be transmitted by the server to every client-side. In this way, the fictitious face-to-face environment can be achieved. Meanwhile, server publishes the websites that the presider has browsed by video (Mohamed *et al*., 2005), people can watch the video to achieve synchronous shared browsing. Also, all the communication between users are coordinated and transmitted by the central server.

The above network cooperative system which is based on C/S has the following shortages (Wu and Xiao, 2003; Mallat, 1989): (1) It needs a better performance server. (2) Central serve may take heavy flux pressure. (3) Server's jam or breaking down is a deadly system fault. (4) Comparing with the HTML file which is needed to browse a web page (Wu and Chen, 1999), sharing the browsing web pages by videos may increase the flux to a thousand times.

In order to solve the above problems in the network cooperative system (Zhang, 2007), it is very necessary to research and design a network classroom system (Duan and Xue, 2002) that is based on P2P and C/S combined mode.

NETWORK CLASSROOM SYSTEM WHICH IS BASED ON P2P AND C/S COMBINED MODE

In order to fulfill the needs of the cooperative system, there will be the following functions in the design of the system: (1) Realizing the discovery and connection of P2P and having data communication by P2P. (2) Base on P2P communication, video data, audio data, text data can have many-to-many broadcasting and to simulate a real face-to-face environment. (3) Every user can browse the websites by C/S method. (4) Realizing sharing browsing, that is to sync the web page contents, web pages highlighting and mouse position. (5) Management function (Tang and Tang, 1995).

According to the above function design, there are two information streams in the system. They are P2P data stream and C/S data stream. Figure 1 shows the data stream.

This mode of system makes full use of P2P system (Huang *et al*., 2008; Sripamdkulchai *et al*., 2004), including: (1) Connecting with each in self-organization way without fixed address and equipment. (2) Information can communicate in a "direct" way, reduce the central

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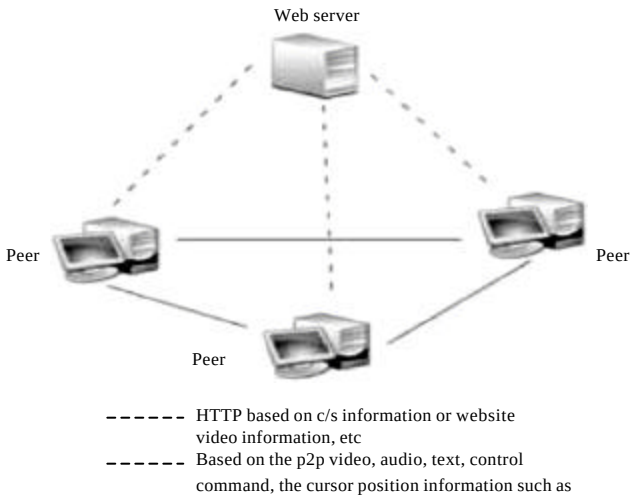

Fig. 1: Data stream in the system

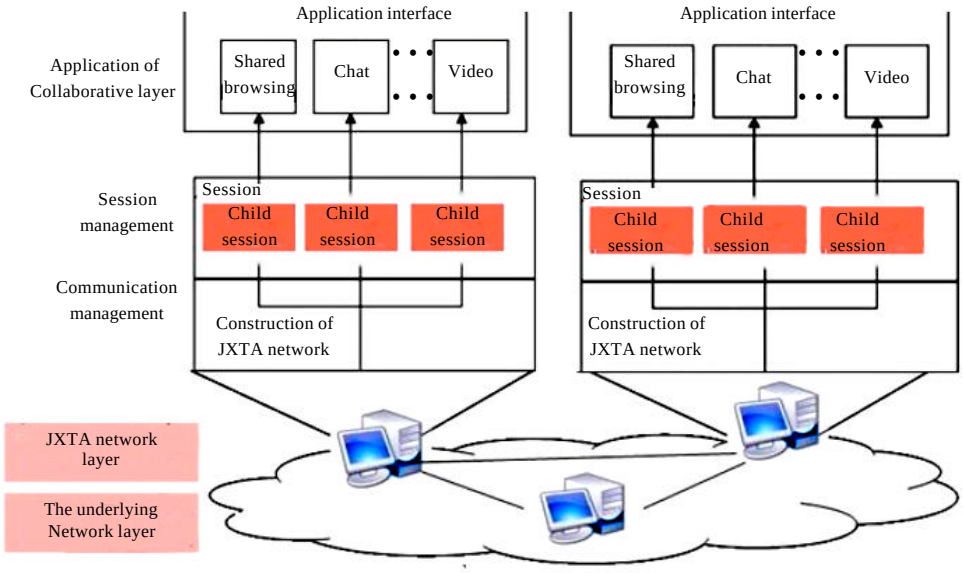

Fig. 2: Network classroom system diagrammatic figure

pressure and also the overall network flux. (3) decentration makes the system stronger.

Combined use of C/S mode makes full use of the rich and structuring resources in the websites in the C/S way. and develop the performance advantages of the teaching website server. Browsing the web pages by HTLM files

According to the above needs, considering the flexibility of the system and the features of its own, the design takes the network software design engineering idea of hierarchical design to divide the mode of the system to 3 layers (Fan and He, 2001). As it is shown in Fig. 2.

In this model, the P2P network is built in the real bottom physical network. The hierarchical design is based on the P2P network. Realizing the system function through substratum's serving the super stratum. It is easier to modify every layer, especially the communication management which can totally use the P2P technology to build a mature P2P network. Designs of every layer are as follows.

Communication management layer: Key function of this layer is to build a P2P network that is based on JXTA technology. The forming process of this P2P network is a process to discover and connect with each other. Discovering each other is realized through having peer information and informing each other by XML. It should be connected to the rendezvous when spreading advertisement message or advertisement index. Through spreading the advertisement, every peer can discover and be aware of each other. After having each other's advertisement information, two sides of peer will bound the pipe to the endpoint. Through data communication between JXTAServerSocket and JXTASocket, the connection is been done and the JXTA network is been formed.

Numerical analysis: SUsers should have conversations between each other when they are having the cooperative application. Information from different conversations are mixing with each other to form the sub-conversation. Major function of conversation management layer is to uild, manage or stop the data communication between peers. The conversation is built on P2P network (Nie *et al*., 2007).

The conversation is achieved by the pipes. In order to realize pipes, it is necessary to be aware of each other's mailing address (endpoints) through P2P network and prepare resources to have communicate. The process of having data communication through pips is the process of conversation. During this process, the data should be packaged according to the data types in the sending end, when it comes to the receiving end, the data will be unblocked to similar types of data.

Conservation management layer is a connecting link which receive services from substratum P2P network and making corresponding actions according to the data types, that is to serve the super stratum.

Application cooperative layer: Application cooperative layer contains all application and designs of cooperative applications. The interface mainly contains functional button, video window, browser window, text conversation window and the status bar.

The major application of cooperative includes camera video, voice audio, text conversation, shared browsing and synchronous presentation. All the applications of cooperative contain two modes of local processing and teleprocessing which deal with the same application data. That can ensure the synchronous of interface displaying information, so the cooperative work or study between each other can be ensured.

Design and realization of the system: To combine the functions that need to be achieved according to the design of the system model. There are starting module, P2P network construction module, P2P network discovering and connection module, data conversation module, video and audio processing module, sharing browsing module, synchronous presenting module, major window interface module and so on. Each module is relatively independent and accomplishes every function of the system by cooperation. Flexibility of the procedure has been largely improved through the procedure design of module way. At the same time, the overall function can be accomplished by the cooperation between each module. Figure 3 shows the cooperation between each module and the overall workflow.

The major technologies of this system are JAVA (Duan and Xue, 2002), JXTA (general P2P agreement), JMF (multimedia in JAVA) (An, 2013), Swing (JAVA forms) and so on. Design and realization ways of each module are as follows:

System starting module: In the log in interface, information of user's name, room's name, identity, IP address of rendezvous are needed to be input. Those information will correspond with the ID of peer which is necessary in P2P network that is built based on JXTA technology, ID of peer group, if it can be a rendezvous, IP address of the first rendezvous (An, 2013). User's login information will be transmitted to P2P network construction module through ports between modules.

P2P network construction module (Deshpandeh and Garcia, 2001): In this module, the message from the login module will be loaded in JXTA configuration files. The configuration files will form the advertisement which contains some JXTA-P2P network basic element, such as ID of peer, ID of peer group and so on. The advertisement will be published by the rendezvous (Chen, 2009).

Discovery and connection module of P2P network: In this module, the final forming of P2P network will go through two progress, discovery and connection. Firstly, every peer will publish the key message within the net in an advertisement way and store the advertisement in rendezvous caching (Huang *et al*., 2008). Through the rendezvous, peers can get messages from each other in initiative or passive way. Then the discovery part has been finished. Secondly, when two peers finding each other, the connection may happen. The real connection should be accomplished through the pipes. One peer publishes the pipe message first, the corresponding peer

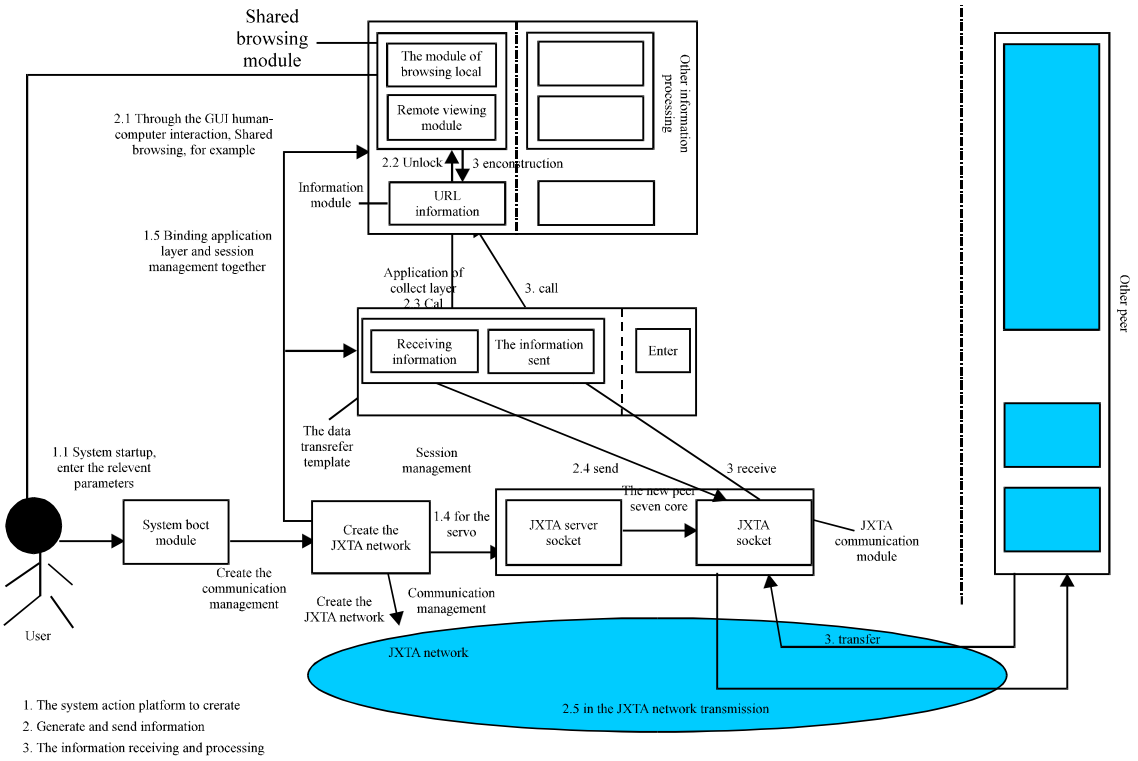

Fig. 3: Picture of cooperation between each module and the overall workflow within the system

discover it and accomplish the connection. After that, JXTASocket and the opposite terminal will form 3 data pipes which are individually responsible for transmitting video data, audio data and non-sustainable information data. Then the connection part has been finished. Through this way, all the peers will connect with each in group of two in the end and then, the bottom layer of P2P network of this system has been formed (Steinmetz and Wehrle, 2008).

Data conversation module: This module makes it possible for the data conversation. Firstly, having data packaging and serialization in the sending end according to the types of the objects. Then, transmitting them in the way of stream within the pipes. In the end, receiving stream in the receiving end, having data deserializing and deblocking. Using corresponding superstratum action according to the types of data object.

Video and audio processing module: This module mainly uses JMF technology. Getting video or audio data by JMF, outputting data with RTP coding through processor, packaging and transmitting data through substratum pipes. The opposite terminal unblocks the data to RTP data after receiving them. A RTP conversation has formed between each other (Hoshi *et al*., 1992; Sripanidkulchai *et al*., 2004; Sun, 2009), RTP conversation is to transmit and play video or audio data as the streaming media. Through a floating video player window in the system, the users can immediately watch others' video frames and talk to each other at the same time, in this way to achieve the face-to-face scene feeling between all the users.

Browser module: There is an embedded web pages browser in this module. After receiving the websites that needed to be co-browsed, the browser can get website files from the website servers in C/S way. All the users can browse the same page. An very important function of this system: sharing browsing has been achieved. In this way, people can transmit and deal with a little of HTML files when browsing the websites instead of sending videos to share the website pages in the traditional cooperation way. It can greatly reduce the network flow and the processing burden.

Syncing presentation and sharing browsing module: This module mainly processes synchronization problems in sharing browsing. The realization way is to divide information processing to local processing and remote processing. When having local processing, the

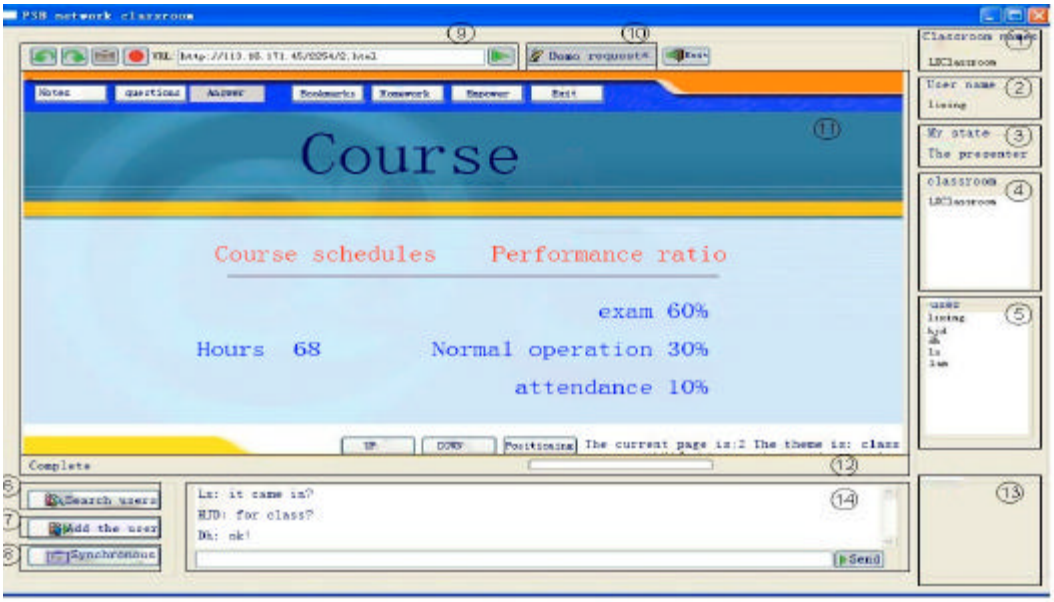

Fig. 4: Major interface of the system

synchronization parameters will be sent to other users. When receiving this parameter, the opposite side should have remote processing to ensure the two sides are dealing with the same business information. Then the synchronization can be achieved. Besides syncing the website address to share the website contents, it also realizes the synchronous focusing when the websites are rolling and the synchronous skip control of the web pages and the web pages's frame. The accomplishment of these synchronization is achieved by inputting JAVAscript order with synchronous parameters to the browser. Also, the module manage to sync the website words that are selected by the compere and compere's mouse trail. Through the above synchronization, syncing presentation and sharing browsing can be realized.

Text chatting module. It contains a text chatting window: Users can input the chatting content that all the users can see that text. It increase the interactivity of this system.

Main window interface module: It realizes the major interface of the system, as it is shown in Fig. 4.

Number 1, 2, 3, 4, 5, 13 on the right side mainly present all kinds of status, such as the room where the users are, the users in the room and so on. The central zone of 9 and 11 is the embedded browser. Number 6, 7, 8 on the left side are buttons to search users, join users and have synchronous presentation. Number 14 is text chatting window. Compere identity can be changed through Number 10 and 13. Besides, the window module also includes a floating video window.

TEST AND CONCLUSION

The performance test to this system mainly includes time to build a P2P network, the delay of applications and occupation of the network bandwidth. We can make a conclusion from the test data that the building time of P2P network in the local area network is within 30s. The building time can be within 90s in a remote and different network. For the delay of applications, although there are changes between users and each applications, the delay time is from 100ms to 900ms but for some important sensitive delayed application, it won't delay a lot when syncing sharing browsing. Large delay happens in video communication. For the occupation of the network bandwidth, audio occupies about 260KB/S, non-sustainable network bandwidth occupies about, 44+X: KB/S. The X depends on the websites which are being visiting.

We have the following conclusions for this system based on the performance test data and the users' questionnaire who practically use this system.

Applications in this system basically meet the needs of network cooperative system. Each application can be made good use of in teaching, especially the featured sharing browsing which can better combined with the websites, make full use of website resources and meet the

cooperative needs by synchronous presentation and sharing browsing. The audio conversation and text chatting also fully simulate a real face-to-face environment.

The construction of P2P way is flexible. It owns the advantage of decentration but also has disadvantage for lacking of stability. It needs a better base network environment to develop its features and advantages.

The design of the interface is reasonable and easy to be operated but the artistic respect of GUI needs to be improved.

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