

Multimedia Communication System on the Internet

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ABSTRACT

Many of the newest network users are gaining their first network experience as users of the Internet. Because of the universal nature of this exciting new experience, millions of new users are driving the demand for increasingly multimedia oriented applications, especially in communication area. Since the communication via the Internet can use various media forms including audio, video and graphics, it can be very efficient communication method than traditional telephone. In this paper we present *Webber*, a multimedia communication system on the Internet, which allows Internet users to communicate, collaborate, and associate with others. *Webber* provides various communication services, like ACS(Audio Conference System), VCS(Video Conference System) and Virtual Space, in an integrated environment. *Webber* consists of *Service-PUBs*(Processing Unit Plug-in), which process each service, and *Framework*, which manages these PUPs. PUP is so highly independent of each other that it's easy to add, maintain, delete services and also optimally configure the system according to users' terminal performance or network status.

1. Introduction

Telephony is very important mean to communicate with one another living apart. Recently e-mail system in the Internet has become popular due to its rapidness and convenience, and some business is done just using e-mail and phone call. The Internet can carry any media if the media is digital form, whereas the phone network is only devised to carry analog voice signal. Therefore we can communicate using not only simple text as in e-mail but also video and audio in the Internet, and it makes users take a desire of multimedia communication. VCS(Video Conference System) is a good example of solving this desire. We can even construct a virtual space on the Internet as if users being apart are in the same space. In near future we might communicate with others in a multimedia environment or do interaction in virtual spaces using PCs or terminals attached to a global network instead of telephone today.

However, it is not easy to transmit continuous media like audio or video because the Internet is invented not to transmit multimedia but to transmit simple data. It is also difficult to integrate various media and provide a communication environment like real world. In this paper we present *Webber* system which enables users to communicate, collaborate, and associate with others as in real world by providing an integrated multimedia environment in the Internet.

The outline of this paper is as follows. In Section 2, we review some previous works related to this topic. In section 3, we describe the architecture, characteristics, and implementation of Webber system, followed by conclusion and further works in section 4.

2. Related Works

Probably the most popular communication programs in the Internet are e-mail system and some chatting programs using IRC(Internet Relay Chat). And Internet Phone[1] from Vocaltec is very famous in the public, and CU-SeeMe[2] from White Pine S/W and NetMeeting[3] from Microsoft can be mentioned as representative products for business conference. Such systems provide audio and video conference functionality with whiteboard, so that users can collaborate with people over long distances. There are also systems that support one-to-one audio and video communication, like AudioVision and EasyAxess.[4]

There are some systems simulating real world by constructing virtual space, which include NPSNET[5], AVIARY[6], BrickNet[7], DIVE[8], and Diamond Park[9]. As telephone is used to associate with one another, virtual spaces such as PointWorld[10] and Onlive[11] can be used for this purpose by adding entertainment elements.

Above mentioned products use only one or two media types expecting no media rich service. The design philosophy of Webber is that any service can be easily integrated into the system and also easily deleted and maintained. This makes it possible to provide media rich services or to be optimally configured according to user's circumstance(like terminal performance or network status) or purpose.(like entertainment or business) And there is no doubt that when various media all come together, it will truly represent the new age in communication

3. Webber

3.1 Overview

Webber is an application that allows Internet users to communicate with others using multimedia services like VCS(Video Conference System), ACS(Audio Conference System) or virtual spaces etc. The telephone, which is the currently most popular communication device, generally enables two persons communicate with each other, but Webber provides many-to-many communication capability. To do this, Webber introduces what is called as *session*, which is a kind of information about a user group. Session, managed by a server, includes session name, password and user list joining this session as shown in Figure 1. User must join at least one session, and can communicate with others joining the same session. User can create, join, secede from a session, and invite anybody to his or her session. One can also restrict users by password to the session.

Webber has a hierarchical structure using object-oriented paradigm and each component in the hierarchical structure is highly independent of each other so that these components can be easily

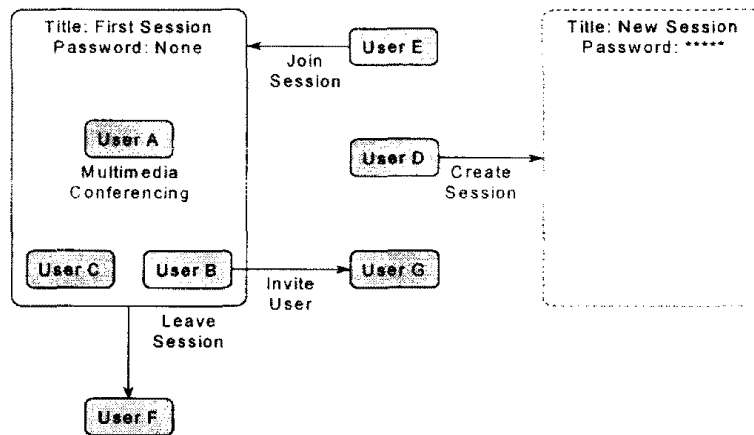


Figure 1. Overview of Session

distributed. Webber's main components are *Service-PUBs*(Processing Unit Plug-in) which process each service, and *Framework* which creates, destroys, and manages these PUPs. The Framework provides a standard interface with service-PUBs and some libraries for communication between PUBs. Therefore, the only things service developers must know about the system are the interface with Framework and these libraries. This makes service developers concentrate their implementation rather than total system knowledge.

3.2 Architecture

Webber has server-client architecture. Server manages user and session information, and client processes various media forms. In general server-client model, server is to process client's request as well as to manage global information and, therefore, there can be a bottleneck in server side if there are too many clients. However, in Webber, bottleneck in server side is rare because the server only manages control information such as user and session lists.

Client system in Webber does much multimedia processing for the client's services. The client system consists of LogMan, which is corresponding to Framework described in the section 3.1, and service PUPs that process each multimedia service respectively. Figure 2 show the relationship between server and client, LogMan and service PUPs. As shown in the figure, the LogMan connects to the servers over the Internet and uses libraries named IPC(Inter-process communication) to communicate with service PUPs.

LogMan is a key component of client system and has functionality as followings: 1)LogMan create, join, secede from a session according to user's request. 2) In case of joining a session, LogMan receives information about other users from the server managing the session, and manages this information. 3) LogMan launches or destroy service PUPs and provides users information to each service PUP.

The service Webber provides must be implemented in the form of service PUP. As a view of LogMan, all service PUPs are same programs using IPC. However internal architecture and

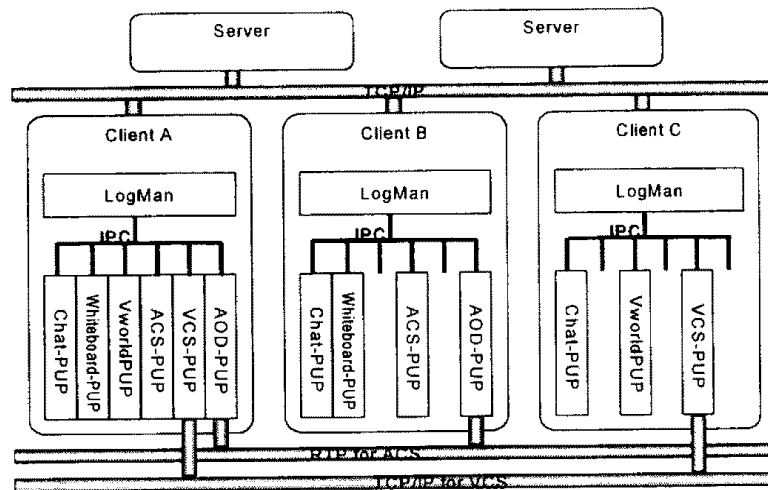


Figure 2. The architecture of Webber

functionality of each PUP can be totally different. For example, text chatting or whiteboard application has not to admit any data-loss, but audio or video conference requires real-time data processing even if a few data-loss occur. So it is very valuable for each service PUP to have its own architecture to satisfy their needs. In Webber, text chatting-PUP and whiteboard PUP uses TCP/IP protocol, which guarantees data-lossless transmission, between LogMan and servers, whereas AVS-PUP and VCS-PUP uses multicasting and RTP(Real Time Protocol) which makes real-time delivery but allows data-loss.

3.3 Implementation of LogMan and Service PUPs

Currently Webber client system consists of LogMan and 6 PUPs described in Table 1. Figure 3 shows the snapshot of Webber client on execution.

Chat-PUP provides a text chatting service that is a traditional method for multipoint communication on networks. Characters typed by user go through the user's LogMan to server. The server multicast these to the all users' LogMan joining the same session, and then to each user's Chat-PUP. Chat-PUP provides RichText and various font colors for easy reading.

Whiteboard-PUP provides collaboration environment rather than simple communication. Whiteboard PUP provides not only simple primitives like box, line and freehand drawing but also file sharing functionality. When a user creates or modifies something in Whiteboard-PUP, all users joining to the same session can see the same thing in their Whiteboard PUPs so that all users can share files or 2D space. If a user is modifying elements in his or her Whiteboard-PUP, other users can't modify the elements in their Whiteboard-PUPs. The data path in Whiteboard-PUP is same as Chat-PUP.

Vworld-PUP provides 3D virtual space to share 3D space, and users can navigate and interact with people over long distance. User selects an avatar that is user's representative in virtual space and the

Table 1. Currently Available PUPs in Webber

Name	Description	Note
Chat-PUP	Text chatting Service	Supports RichText
Whiteboard-PUP	Whiteboard Service	Provides Freehand, line segment, and various block primitive
Vworld-PUP	Shared virtual world navigation Service	Supports VRML 1.0 spec and includes internal avatar spec
ACS-PUP	Audio Conference System	Real-time S/W encoding/decoding/mixing
VCS-PUP	Video Conference System	Real-time S/W encoding/decoding
AOD-PUP	Audio-On-Demand Service	Supports RealAudio[12]

user can control his or her avatar's behavior including facial expression, greeting, blinking eyes. VRML 1.0 is used to describe 3D worlds and Vworld-PUP can connect any VRML 1.0 site on the Internet. We implement two version that use OpenGL and DirectX library respectively.

ACS-PUP provides multipoint audio conference functionality. Since ACS-PUP must transmit audio data in real-time, the data are directly transmitted to other users' ACS-PUP using TCP/IP or RTP multicasting rather than to LogMan or server as in Chat-PUP. It uses GSM6.10(13kbps) software CODEC for real-time (de)compression and has a mixing capability to play users' voices simultaneously.

VCS-PUP provides multipoint video conference functionality. The network connection of VCS-PUP is similar to ACS-PUP because video also must be transmitted in real-time. It uses H.263 software CODEC and provides QCIF resolution(176x144).

AOD-PUP is not for communication between users but for multimedia information retrieval, and this service is to show that new multimedia service can be easily added to Webber

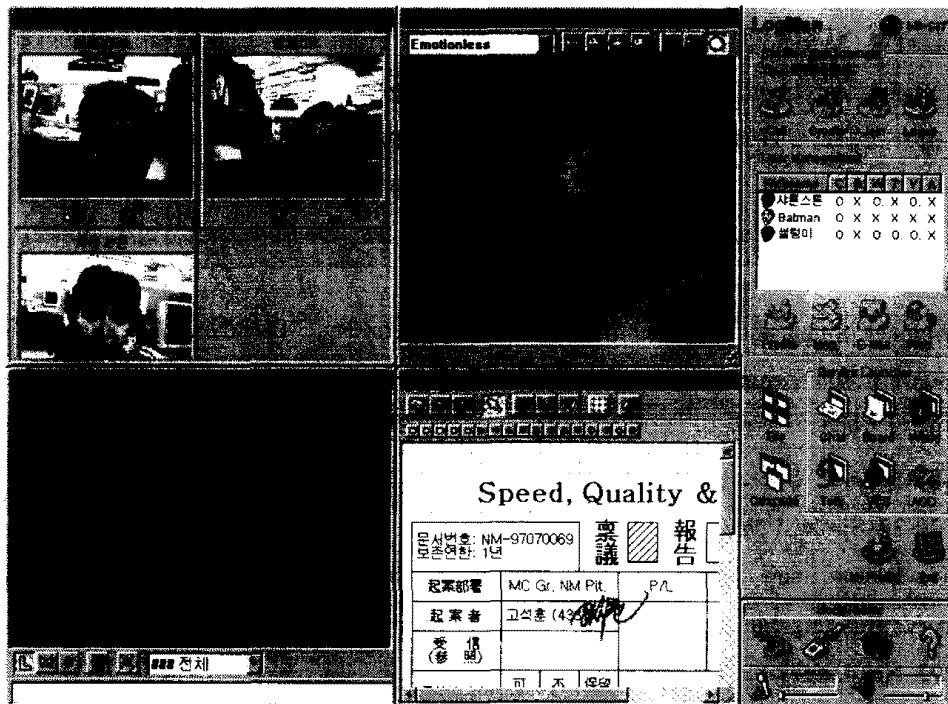


Figure 3. Webber on execution

4. Conclusion and Further Works

We present the architecture using server/client model and features of Webber that is a multimedia communication system on the Internet. Server manages sessions where users can communicate with people over long distance. Client consists of various service PUPs that handle each service, and Framework that manages these PUPs. Since each PUP is independent of each other, it is easy to develop new service, to maintain current service, and to configure client system according to user's circumstance or purpose.

We are going to research in two different ways. The first is to implement Webber on JAVA environment. Currently we consider general PC as client system but, in the future, various hardware such as TV or telephone can be connected to the Internet. So we are concerning implementation of Webber using JAVA that is hardware independent language.

The second is to introduce new network protocol or environment. To increase realism in communication we need to process and transmit the data associated applications. However the Internet based on TCP/IP protocol, which is devised for simple data transmission rather than for multimedia data, is not suitable to multimedia communication. ATM network can be a solution for multimedia communication[13] and we are considering the implementation of Webber on ATM network.

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