A Novel Internet Radio Service for Personal Communications; The Private Channel Service

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Abstract
   The World-wide Web(WWW) works now as the infrastructure over the Internet for multimedia applications. Internet Radio is one of those applications, and provides the users with streaming services over the network regardless of such geographic restrictions as the traditional radio broadcast service systems have. Its growth is explosive. We have started operating an Internet Radio station with streaming music since April 2000. We are planning to provide users with private channels, so that users can listen to their favorite music. This novel type of service is only possible on the Internet, but not on the traditional radio systems. This paper reports our idea on a private channel, a novel service on the Internet Radio, and its design as well as our implementation of a prototype system.

1.   Introduction

It broadcasts over the Internet regardless of such geographic restrictions as the traditional radio broadcast services have. There are more than 5000 Internet radio stations. One of these stations: *http://www.wolff.m.com.* deals with the various types of streaming such as MP3 streaming and *Windows Media* streaming. This site provide users with a shopping function as well so that users can purchase CDs of their favorite music.

The existing stations provide their services in such a way that a radio station provide their listeners with programs on one or more channels. It is very much like the way that the traditional radio broadcast services do. In the case that a station provides more than one channel, the service is called "multi-channel," and for example, some stations broadcast different types of music per channel.

We propose a novel type of service, what we call a private channel on which a station provides each user with her/his favorite program. Since the station unicasts streaming data to each user site, it is possible for a station to deliver different streaming data to each user site. The idea is that a user creates a program of channel in terms of the list of music for the station to play — a play list.

As our radio station, which has started operating since April 2000, delivers music from unknown artists, we presume that our private channel service is for a user generate a personal channel which delivers her-his favorite music stream.

This paper reports our idea on a private channel, a novel service on the Internet Radio, and its design as well as our implementation of a prototype system. The next section introduces our radio service system with its operational model and the system configuration of the station. Section 3 gives our idea on the private channel service with its model, the system design, and its prototype system. Section 4 describe future work, and Section 5 gives some conclusions.

2.   Flip Over Radio(FOR)

Our radio station is called "Flip Over Radio (FOR)." The station is managed by the university students. At the moment we operate FOR on an experimental basis. We broadcast Indies music which is made originally by unknown artists who work independently from record companies. They have a limited opportunity in publishing their music such that the listeners can obtain the information only from specific magazines and music stores in Japan.
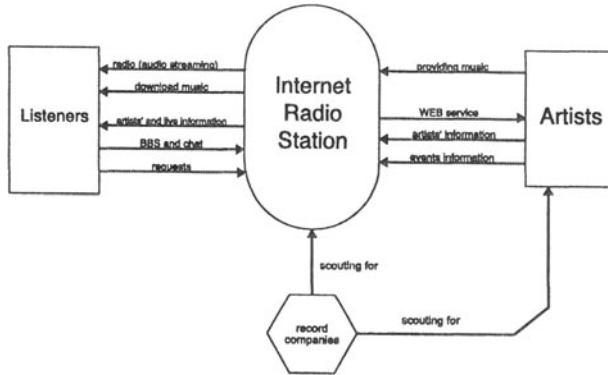
Figure 1. The operational model of FOR

2.1. The operational model

Fig. 1 shows the model of our radio operation. Our Internet radio station provide such an opportunity for both artists and listeners to exchange the information on music and artists. Our radio site is a media for this exchange. The artists provide the music that they composed and played as well as the related information. We provide them with tools such as the one to make their home page as well as the message board so that they can communicate with the listeners. Commercial promoters could make use of the information we provide to find a new artist and music, so that an artist could have an opportunity to get a commercial contract.

2.2. The system configuration

Table 1 shows the configuration of the server system of FOR.

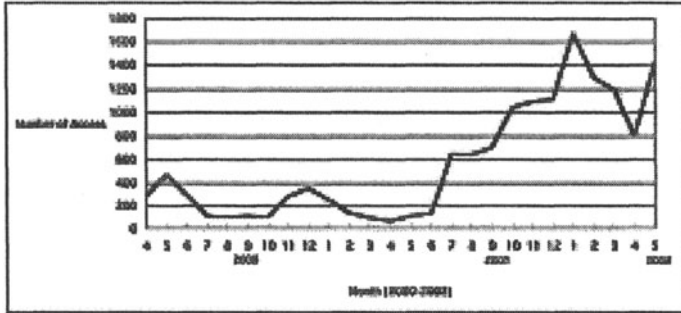| CPU	Pentium2 333MHz
MEMORY	80M
OS	Kondara Linux
HTTPserver	Apache
Streaming Application	Icecast [5]
	Shout [5]
	Icedj [7]
	Liveice [8]

Table 1. The server system of FOR

Figure 2.   User access per month (2000 - 2002)

Icecast is used to broadcast music. *Shout* selects a music to broadcast, and passes the music data to *Icecast*. *Liveice* is a real-time re-encoder and passes the encoded data to *Icecast*. We can mix several MP3 streams and audio inputs from mic(microphone) and *Liveice*. *Icedj* is used to run an *Icecast* radio station such that broadcasts a music at a certain time as scheduled in a program. It can be used together with *Icecast* to show the information on music being broadcast on the radio station's WWW page.

3.   The Operation Report

We have been operating FOR since April 2000. Fig. 2 shows the number of total user access per month. We have not had so many users, presumably it is not because of Indies music, but due to poor amount of contents. Users would not listen to an Internet radio station if it broadcast the same songs repeatedly. During July and August in 2001, we revised icecast in the latest version, so that the facility of the registration function started working well, which registers our radio server to the access ranking server on the Internet. 3 percent of connections were from our university, and 20 percent of connections were from Japan.

4.   The Private Channel Service

4.1.   The operational model

Just as we give a copy of our favorite music on a tape cassette to some friends, we include the case that one may want to share herhis private channel with some others.

We propose our private channel service in three different ways, the very private channel, the shared channel and the public one. The very

private channel is used only by a user who generate the channel — *the channel owner*. The shared channel can be used by a group of users whom the channel owner give an access to the channel. The public channel is allowed anyone to listen to.

The operational model of our private channel include the followings four participants: an Internet Radio operator, a music sound originator, the private channel owner and a user. A music sound originator provides an Internet Radio operator with the original music sound as well as its copy right for delivering it to the users. The operator delivers it to the users in turn. The users give the music sound originator some feedbacks. Those feedbacks can be used for other users to select music possibly for a private channel.

On the shared channel, the channel owner is a user as well as a service provider together with the Internet Radio operator, because the user gives herhis channel information — the play list of music to some others based on the access control list; the channel owner generates the list and manages it. The others who are given an access to the private channel can listen to the music played according to the play list. Such users could give the channel owner some feedbacks on the play list as well as on a particular piece of music; the latter could be passed on to the music sound originator.

Like the channel owner, those users give the Internet Radio operator the information on the music they have chosen as well as the channel they have listened to.

In case of the public channel, there is no control over the channel access as the channel is publicly available. Other uses than the channel owner may well tell the owner their willingness to recommend the channel to their friends; this may rank the channel. Accordingly this public channel looks like an Internet Radio station operated by an individual, however, the difference is that the former does not require the user to deal with copy rights and all that associated with the original music sound. From this viewpoint this type of private channel is best suited for a user who likes to set up herhis personal radio station easily.

4.2.   System design

An Internet Radio system is based on the server and client architecture with a station as a server and a user site as a client. The server has the functions for streaming distribution and delivery, channel generation, and music selection. Moreover, it maintains the information on the use of a channel as well as music sound database. It provides users with a WWW interface for access to a private channel. We design the system
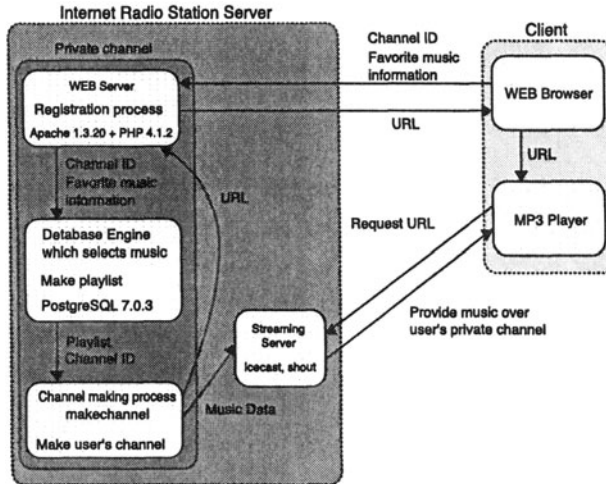
Figure 3.   the system configuration

so that the server provides a user with a private channel. The client system has the functions for receiving music stream and playing it.

A user who would like to own a channel passes the information such as the server the user's name, the private channel name, channel type and the play list. Making a play list, the channel owner may well look up the whole list of music maintained by the server. The more music the server has, the more difficult for the channel owner to find the one shehe likes. In this case, the server may recommend some to the owner based on the hit chart as well as the list of music recommended by the other owners and users who have the similar tastes. In case of the shared channel, the owner needs to specify the access control list for the channel.

The users including the channel owner get the URL of a private channel from the server, comes to the URL site — i.e. the private channel, receive music stream and play it on the client system.

4.3.   A prototype system

We implemented a prototype system, and the figure 3 shows the system configuration.

With our prototype system, a user can generate a private channel. The information on the users and the music sound originator is maintained as a database using PostgreSQL. We use PHP4 for a WWW interface.

There is a problems with this service. If we provide users with private channels on demand, we will require to run as many private channel

processes as the number of user requests. The more private channel processes we have, the more loads the server gets and the slower the system operates. We may need to explore the tradeoff between the performance of the server and the number of private channels. We may well need dynamic channel management.

5.   Campus Radio with a Wireless LAN

Some universities have the campus radio stations with the traditional radio wave, run by students. They are broadcasting towards the campus areas and have their studios located within the campus. Their listeners include students, teaching staffs, and those listeners use traditional radio tuners.

Our radio station, FOR is an Internet Radio, but has system structure similar to a the traditional campus radio. One needs a PC and the a network connection to the Internet instead of a radio tuner, to listen to FOR. Within the campus, a listener needs a LAN connection such as the Ethernet.

Indeed one could use various system nowadays to listen to the Internet Radio, such as a PDA, a Handhelds computer and PC. We would need the plural wireless LAN access points in a campus so that listeners have wireless connections throughout the campus area.

6.   Related Work

MP3.com,Inc. [9]provides users with a service called my music which is similar to our private channel service.The service lets a user to create a play list on the mp3.com web site.The user downloads the play list in which each entry of music is specified in terms of the URL of the mp3 file. A connection to the server from the user site has to be renewed each time a music file is downloaded,whereas in our system the initial connection is used throughout the operation of a play list.

MP3.com, Inc. is not a radio station, but offers a transfer service for mp3 files. In our private channel service, the play list stays on the radio station site.

They do not provide the shared channel service. This is presumably due to the difference in the viewpoint of the user between the file transfer service site and the Internet Radio station. Just as one gets a music CD from a store, the primary purpose of the user is to get a music file in the MP3.com service. There is less desire for a user to share the CD which the user get, with the other users. On the other hand, on Internet Radio users get into a radio station site and are likely to share their interests in music.

7.   Conclusion

We introduced on our Internet radio station and report its operation. We presented our idea on a novel service, a private channel, on the Internet Radio in terms of model, system design and a prototype system.

Future work includes implementation of the other two types of private channels, the shared channel and the public channel. Moreover, a hit chart based on the users' feedbacks could be useful for the channel owner in selecting music. We may look into some visual interface for this, and incorporate CSCW filtering tools for recommending music based on the use history. Kansei database could be used as well.

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