Development of CD-ROM-based Online Information Services

Cherdwong Hongsrichinda
Graduate Student
cherd@mail.car.chula.ac.th

Somchai Prasitjutrakul
Assistant Professor
somchaip@chula.ac.th

Department of Computer Engineering
Chulalongkorn University
Bangkok 10330, Thailand
Tel : (66-2)-218-6981, Fax : (66-2)-218-6955

Abstract

This paper presents a development of CD-ROM-based online information services at the Center of Academic Resources, Chulalongkorn University. The service provides various CD-ROM-based informations for academic research purpose, which can be accessed through the university campus network, ChulaNet. We provide two different access methods; network drive mapping and remote access (using telnet and Citrix's Winframe ICA protocol). The network drive mapping generally uses more network traffic than the others do. So it is used mainly in the main library's LAN whereas the remote access allows access via the WWW in the campus network. We developed a telnet Java applet to emulate DOS-based terminal session and capable of downloading saved search result file from the server. This applet is embedded in a Web page for accessing CD-ROMs using DOS-based access software. If the CD-ROMs require Windows-based accesss software, they are installed in a Winframe server where access is done by a thin-client PC with Winframe client installed.

1. Introduction

As digital storage costs go down and computer networks are more affordable and accessible, traditional libraries have to allocate some of their budgets to electronic information services [1],[2]. CD-ROM is one of the high capacity digital storage technology widely used as a media of choice for database distribution. At Center of Academic Resources (CAR) Chulalongkorn University (where the University main library is located), they have subscribed CD-ROM databases such as DAO (Dissertation Abstract On disc), SCI (Science Citation Index), and many more. In the past, one way to access the databases was to go to the main library, fill in a request form, submit the form to a librarian, and wait for the query result. This had been a very time-consuming, but inevitable, process since only one set of databases was subscribed. In 1996, the center acquired a set of ABI/INFORM® and DAO databases in order to provide services for students and staffs in the Joint Doctoral Program in Business Administration (JDBA) project. That was when our CD-ROM-based online information service got started to provide CD-ROM database accesses through campus network, ChulaNet. At present, many more CD-ROM database has been added to the services.

This paper presents a development of CD-ROM-based online information services and performance comparison for each access method. Since CD-ROM databases usually come with their own access and search engine software where certain configuration and environment are expected, ease of use and access become an important issue for the clients. We provide two different access methods; network drive mapping and remote access (using telnet and Citrix's Winframe ICA protocol), each one is suitable for certain constraints. The design also takes access control and licensing issues into consideration. The rest of this paper is organized as follows. Section 2 briefly presents overview of the CD-ROM-based online information service. Section 3 describes service providing using network drive mapping. Section 4 explains how telnet and Winframe remote access are used to provide the service. Section 5 discusses about performance issues for each access method. Then, the paper is concluded in Section 6.

2. Overview of the CD-ROM-based Online Information Service

We adopted two access methods for the CD-ROM-based online service; network drive mapping and remote access (see Figure 1). The network drive mapping allows client computers to remotely map server's shared data area (where CD-ROM's contents reside) to become their own new network drive. By installing appropriate access software (shown as Client #3 in Figure 1), the software reads the network drive (through the redirector driver) as if it is a local CD-ROM drive. and, in fact, uses the network as if it is the system data bus.

The other approach is to use a remote access software installed at the client side to gain access to applications at the server running a remote access service. The remote access software on the client turns the client PC into a remote terminal of the server. With proper authorization, the user can execute CD-ROM access software on the server. If the access software is a DOS-based program, telnet is usually enough to serve the purpose (shown as Client #1 in Figure 1). However, if the access software requires Windows-based GUI style, we need to use Winframe from Citrix Inc., a remote access software capable of handling remote Windows terminal. The client is a PC running Winframe client software (shown as Client #2 in Figure 1).

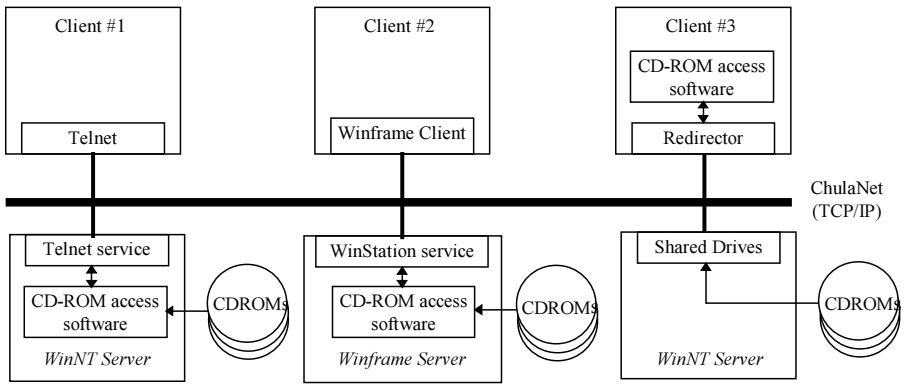

Figure 1 CD-ROM-based online information service configuration

3. Network Drive Mapping

By allowing authorized clients to remotely access server's shared CD-ROM drives, these clients can map the shared drives and access their information through CD-ROM access software installed on the client computers. Sharing drives in a network can be done using several protocols. NFS (Network File System) protocol is normally used in TCP/IP network whereas SMB (Server Message Block) protocol is used in NetBIOS environment. The SMB's server and client modules are readily available as part of the Microsoft Windows95 operating system which is our basic PC client configuration whereas NFS requires additional installation and cost. Therefore we choose to use SMB as a protocol for sharing drives in the network and enable NetBT (NetBIOS over TCP/IP) feature so that the communication can be routed in the TCP/IP network [3].

To map a shared drive, the client simply uses the uniform naming convention of the Windows networking which is in the form *\\serverName\\sharedName* as its network drive in the DOS's `NET USE` command, in the *Map Network Drive...* dialog box, or in the related Wins API (e.g., `WnetAddConnection`, `WnetCancel-Connection`, `WnetGetConnection`). In addition, if the NetBT is being used, we need to add a line in the system `LMHOST` file to map server's NetBIOS name to server's IP address [4].

Network drive mapping is an access method with minimum setting on the server side. Only enabling shared drive service is enough for the server whereas installing access software is needed for every client. Controlling access right is done by using username/ password during login. The username/password is obtained after client's application and registration is approved and then the user right is added to the access control lists of the resources. Controlling the number of accesses not to exceed the number of CD-ROM licenses can be done by setting maximum number of users connecting to the shared resources which can be set on the server.

4. Remote Access

While network drive mapping only uses the server machine as a file server with the CD-ROM access and search engine software running at the client side, using remote access requires the server machine to act as an application server with a thin client acting as an input/output terminal.

If the CD-ROM access software is text-mode in DOS environment, using telnet is enough to enable the service with minimum amount of client and service configurations. However, saving search results can only be done on the server, not on the client's local disk (since the search engine software runs on the server). Therefore the user needs to first save the result on the server and then manually file transfer the saved file back to his/her machine. This process is too cumbersome and not as easy to use as it should be. Another minor, but sometime annoying, is that some telnet service requires a special keying sequence for entering function or control keys (which sometimes are needed for access software).

To solve the two mentioned problem, we developed a new telnet Java applet embedding into a Web page (so that the service can be accessed via the WWW). The applet correctly maps and sends a correct sequence of codes for the keyboard issue. For the search-result saving problem, if the user saves the search result in the designated area (each user has his/her own area) and clicks a special `GET FILE` button shown on our telnet Java applet, then a new Web window will automatically popped up with the saved search-result file automatically downloaded to be displayed on the new window so that the user can manually save the page to his/her own local disk.

If the CD-ROM access software is GUI-style in Windows environment, we have the server running Winframe operating system from Citrix Inc. (which is actually a version of Windows NT server with multi-user terminal server extension). With all the access software installed on the server, any authorized client with Winframe client installed (or a Windows terminal) can remotely execute the CD-ROM access program where only screen updates, keystrokes, and mouse clicks travel the network using Citrix ICA presentation protocol. It also supports client drive mapping allowing local drives to be accessed from server application (this is actually the opposite direction of network drive mapping discussed earlier). Therefore, the users can save the search results directly to their local storage drives.

The use of remote access for CD-ROM-based online information services reduces the software installation overhead compared to that of the network drive mapping technique. This is because only one set of CD-ROM access software needed to be installed on the server rather than on all client machines. One drawback is a big server configuration especially when using the Winframe. An application server usually requires more computing power and memory than a file server. Controlling access right is also done by using username/ password during login. Also setting the maximum allowable clients to be equal to the number of CD-ROM subscribed solves the licensing issue.

5. Traffic Comparisons

We have set up a testing environment on the purpose of measuring network traffic when using the three access methods using ProQuest access software for DAO CD-ROM. Experimental results are shown in Figure 2 to Figure 3. As expected the number of bytes transferred during information search for the network drive mapping is significantly more than the other two methods since the network is being used as if it were the system data bus (Figure 2). However saving the current record (after a query) requires no network traffic for the network drive mapping since the current record content is already in the client computer memory whereas it takes some traffic in the others (Figure 3). If we want to save more records of the search result, the network drive mapping method consumes the most traffic since it needs to access the network drive (Figure 4). Note that when comparing the two remote access methods, using telnet requires less network bandwidth than using the Winframe technology in all cases.

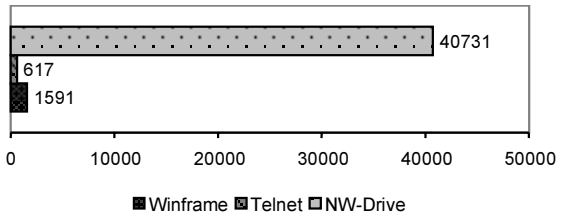

Figure 2 #bytes transferred during search

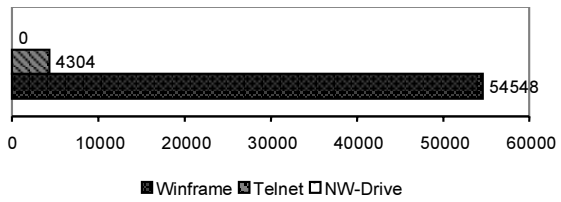

Figure 3 #bytes transferred during saving a record

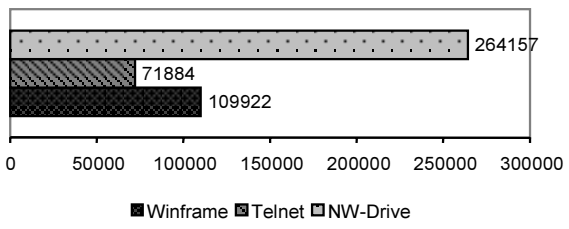

Figure 4 #bytes transferred during 50-record saving

6. Conclusion

This paper a development of CD-ROM-based online information services at the Center of Academic Resources at Chulalongkorn University. We provide two different access methods; network drive mapping and remote access (using telnet and Citrix's Winframe ICA protocol). Table 1 summarizes access and configuration constraints for each access method.

Table 1 Comparison of CD-ROM-based access methods

	Network drive mapping	*Remote access using telnet*	*Remote access using Winframe*
Server complexity	File server (least complexity)	Small application server	Big application server
Client complexity	PC	Web terminal or NC	Thin-client PC or NC
Access software	DOS / Windows	DOS	DOS / Windows
Access software installation	At clients	At server	At server
Network traffic during search	High	Low	Low
Maintainability	High	Low	Low
Network	LAN	LAN or WAN	LAN or WAN

From the result shown, the network drive mapping generally uses more network traffic than the others. So it is used mainly in the main library's LAN whereas the remote access allows access via the WWW in the campus network. We developed a telnet Java applet to emulate DOS-based terminal session and capable of downloading saved search result file from the server. This applet is embedded in a Web page for accessing CD-ROMs using DOS-based access software. If the CD-ROMs require Windows-based accesss software , they are installed in a Winframe server where access is done by a thin-client PC with Winframe client installed.

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