Molynda Cahall. Authentication and Access Issues for Electronic Library Resources at the University of North Carolina-Chapel Hill. A Master's paper for the M.S. in L.S. degree. July, 2002. 40 pages. Advisor: Joanne Marshall.

A variety of data collection methods were used to identify access and authentication issues faced by remote users of licensed electronic resources at the University of North Carolina-Chapel Hill.  Five main components must be addressed by users for successful access from off-campus including: 1) a valid identification number with corresponding library borrower's record, 2) a working Internet connection, 3) a compatible Internet browser properly configured to the proxy server, 4) correctly configured firewall and/or filter software, and 5) properly working electronic resources.  Recommendations are made related to support for distance learners in regard to library borrower's database issues, proxy server setup, and usability of online off-campus access instructions.  These findings will be helpful to academic libraries that are providing off-campus access for all remote users as well as distance learning students.

Headings:

Authentication

College and University Libraries

Computers—Access Control

Distance Education

Internet--Security Measures

AUTHENTICATION AND ACCESS ISSUES FOR ELECTRONIC LIBRARY
RESOURCES AT THE UNIVERSITY OF NORTH CAROLINA-CHAPEL HILL

by
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Introduction

Over the past several years, university libraries have changed dramatically in how they deliver information remotely to faculty, staff, and students. With advances in computer technology and the rise of the Internet, electronic indexes and databases with full-text articles have become available via the World Wide Web. Book publishers have also entered the digital world by making selected textbooks and reference materials available online through subscription services. As more published materials are offered in electronic format and with the ongoing advancement of networking and computer technology, accessing library resources from off-campus locations is now easier than ever. Or is it?

Due to strict licensure agreements, libraries have the tough responsibility of ensuring that only those who qualify under the terms of agreement have access to their electronic resources from outside the physical library building. Consequently, libraries must have a built-in mechanism for governing the use of their restricted electronic resources to ensure that only persons who are affiliated with the university are able to connect to them. University libraries have accepted this responsibility through deploying methods to electronically verify the identity of their remote users and to authorize various levels of service, depending upon user affiliation with the university. When the methods work, verification, authorization, and access are almost effortless for users. When they do not, however, the results can be frustrating for both users and library staff alike.

Distance learning students are a special group of remote users who, unlike on-campus students, must rely almost completely on electronic access in order to complete their course work. More than any other group of students, it is paramount that they be able to obtain electronic library resources easily because they do not have the luxury of coming to the library to use them. The purpose of this paper is to explore the issues that remote users at The University of North Carolina-Chapel Hill (UNC-Chapel Hill) encounter when trying to access electronic resources from off-campus and to develop methods that library and distance learning staff can use to help distance learners connect to resources as quickly and effortlessly as possible. Except where noted, the word Libraries will be used hereafter to include both the Academic Affairs (Davis) Library and the Health Sciences Library at UNC-Chapel Hill.

Controlling Remote Access to Licensed Electronic Resources

The primary means the Libraries at UNC-Chapel Hill use to control access to licensed electronic resources over the Internet is through the use of a proxy server. A proxy server is a Web server that acts as a mediator between users' computers and licensed electronic resources to allow affiliated persons to gain access to them from off-campus. Proxy servers are one of several methods of access control that libraries can employ to authenticate remote users who have been authorized to access restricted electronic resources from outside the campus network. At UNC-Chapel Hill, the Libraries' proxy server has its own on-campus IP (internet protocol) address that it uses to get pages on behalf of off-campus users. Since the IP addresses of off-campus users fall outside the university's authorized IP address ranges, they can obtain access by connecting to the

proxy server. To configure their computer, users enter a URL (uniform resource locator) that points to a proxy server configuration file in the automatic configuration area of their Internet browser, usually located within its preferences area or dial-up connections section. When users click a resource link, the URL will then direct the browser to check the Libraries' autoproxy file to see if the proxy server is needed or not. An autoproxy file is a text file centrally located on the proxy server that contains URLs for all electronic resources. It is loaded each time users open their browser. If a URL for a licensed resource is found in the autoproxy file, the browser will request proxy service. The proxy server will send pages back to the Internet browser asking users to identify their affiliation with the university and to type in their identification number. Once the proxy server validates users as affiliated, it passes on the request for access to the resource. The resource receives the proxy server's request and accepts the users because the proxy server sends the request via its own authorized IP address, not the IP address of off-campus users.

*Authentication Versus Authorization*. When proxy service is initiated, remote users must go through a process of authenticating themselves to the library borrower's database to obtain authorization to use the resources. Authentication is the process of verifying that you are who you say you are. Authorization is the process of giving someone permission to various levels of products, services, or privileges based upon an assigned status. Licenses between libraries and publishers or vendors of electronic resources always require remote users to be affiliated with the university in order to be authorized to use them. Therefore, using authentication and authorization as part of access control

measures helps to ensure that the Libraries at UNC-Chapel Hill are not breaching their contracts by potentially providing access to non-affiliated users.

To authenticate to resources at UNC-Chapel Hill, users must possess an identification number, and the Libraries must have a record of them in the library borrower's database. Depending upon the code listed in the class field of their library record, users may or may not be authorized to access electronic services and resources. Persons who are faculty, staff, students, or UNC Hospitals employees are permitted to use all library services including electronic reserves, electronic journals and electronic databases, print materials, and interlibrary loan. Local North Carolina residents and UNC-Chapel Hill alumni with borrower's cards are coded so that they may checkout books and audiovisual materials only. According to most license restrictions, however, they may use restricted electronic resources if they do so from within the Libraries[1].

Importance of Remote Access Support for Distance Learning Students

Within the realm of libraries, remote access can be defined as obtaining materials and services electronically from a location outside the library building, usually from a distance, via an Internet connection. Since distance learners frequently do not have direct access to the library as a physical place, their primary means of obtaining the materials and information they need is through use of library services such as Ask-A-Librarian, electronic reserves, document delivery, and through searching online indexes and databases. So what makes distance learners unique from other off-campus users? Why must academic libraries make a special effort to ensure that distance learners are

supported in access to electronic resources?  Trends show that the percentage of distance learning programs in the United States is increasing and the increase is expected to continue (Niemi, 1998, Oblinger, 2001).  In a nationwide survey conducted in 1999 by the United States Department of Education's National Center for Education Statistics (NCES), results show that the percentage of higher education institutions that offered distance learning courses during the 1997-1998 academic year increased about one-third from thirty-three percent to forty-four percent since its previous survey in 1995 (Lewis, 1999). Likewise, methods used by higher education institutions to deliver distance learning are increasingly moving toward use of the Internet. Results from the NCES study showed that the percentage of institutions using asynchronous Internet-based technologies rose from twenty-two percent in 1995 to sixty percent in 1997-98, a threefold increase. As distance learning methods change with advances in technology, academic libraries must continue to develop and refine their methods of providing support to distance learners in order to ensure they experience the same quality of service as their on-campus counter-parts.[2]

Another reason to ensure distance learners are well supported is that acquisition of electronic resources is becoming more the standard rather than the exception in library collections today.  While an increase in electronic holdings translates into a greater number of resources readily available to distance learning students, no amount of online holdings will prove helpful if they are unable to retrieve the resources when they need them.

In addition to the above reasons, the characteristics of distance learners tend to be different from those of traditional on-campus college students.  It may be easy to think of distance learning students as having the same characteristics as on-campus students with the primary difference being only geography.  However, looking more closely at the profile of typical distance learning students at UNC-Chapel Hill, one can see that they are quite different from their on-campus counterparts.

Characteristics of Distance Learning Students

One difference between on-campus students and distance learners is life stage. Distance learners at the University of North Carolina-Chapel Hill tend to be over thirty years of age, which is older than traditional twenty-something students on campus. Distance learners also tend to be returning for a second college degree and may not have attended college in several years.  Unlike many on-campus college students, they are usually married, have children, and are working full-time while taking classes at night or once a week for the entire day.  Since distance learners typically work during the day, they tend to complete their schoolwork between the hours of 11:00 PM to 6:00 AM when the rest of their responsibilities have been completed.

A second difference is that distance learners are often less experienced with computers at the start of their degree program.  Unlike most college students today who are relatively computer savvy, many distance learning students did not grow up with computers in their homes or the Internet on which to surf, nor did they have e-mail or online chat with which to communicate. Additionally, a fair number of distance learners at UNC-Chapel

Hill do not own a computer until after they begin their degree program. If they do own a computer, they most likely have never used it to complete college course work or research since Internet access was not widely used at home until the early to middle 1990's.

Another difference is experience with new technologies in libraries. The last time many distance learners used a college library there was no Internet or electronic databases with graphical user interfaces (GUI) from which to obtain information. Library holdings were most likely in print format, and the library catalog was organized on paper cards. Some students may have used networked terminal computers to search the library catalog, but these most likely had a command line interface rather than a graphical one. Prior to the Internet, library services were usually provided over the phone, by postal mail, or in person rather than via e-mail or online chat.

All of these characteristics combined with their remote location make distance learning students distinctly different from typical on-campus students. These differences then create needs that are separate and sometimes more complex for library staff to handle when assisting them.

Supporting Distance Learning Programs Offered at UNC-Chapel Hill

Currently UNC-Chapel Hill has many distance learning programs available through its schools of Social Work, Education, Journalism, Business, Arts and Sciences, Dentistry, Medicine, Nursing, Pharmacy and Public Health. There are also plans for a School Media

Specialist program to start in the School of Library and Information Science in the Fall 2002 semester. Some programs are organized through consortia with other state universities, some are taught in one location once per week at a satellite location, and others are taught solely online. In addition, short courses, self-paced and independent studies, and continuing education courses are offered through The Friday Center for Continuing Education. The Friday Center offers courses to a variety of persons ranging from students who are currently enrolled in classes on-campus at UNC-Chapel Hill to non-affiliated persons who live outside North Carolina. Students enrolled through the Friday Center may or may not be enrolled in a degree program but are eligible to take courses for college credit. Given the various types of programs and methods used to teach distance learning courses at UNC-Chapel Hill, not all distance learners have the same remote access issues. The Libraries have therefore had to identify and develop a variety of methods for helping distance learners access electronic resources for a variety of circumstances.

Recent Methods of Troubleshooting Access Issues

In the past year, library staff at the Health Sciences Library at UNC-Chapel Hill began to notice a rise in calls and e-mail requests for help from remote users on how to configure their browser and setup the proxy server to connect to electronic resources from off-campus. From July to December 2001, the Health Sciences Library recorded approximately one hundred sixty-eight e-mail requests for help directly related to off-campus access. The Libraries' distance learning specialist also reported noticing a dramatic increase in the number of calls and e-mails to her office by distance learners

who were trying to work through problems with their student identification numbers, electronic reserves issues, filter issues, and browser issues, in addition to setting up the proxy server correctly. As a result, library staff started to focus on how to provide remote access help more effectively. During this time, both the Health Science Library and the Academic Affairs Library had several measures already in place to assist remote users. The following is a list of the primary means each library used to help both traditional remote users and distance learners with off-campus access problems:

Health Sciences Library

- Personal consultation with library staff via e-mail or telephone

- Health Sciences Library Ask-A-Librarian online help form

- Real-time chat with a librarian via Live Online Help service

- Electronic resource updates/current news page linked from UNCLE (UNC Literature Exchange) and Health Sciences Library Web sites

- Links to Off-Campus Access instructions from all electronic resources

- Instructions linked from Student Services and Distance Learning Web pages

- Internal troubleshooting links to information for front line library staff at the User Services Desk

Academic Affairs Library

- Personal consultation with library staff via e-mail or telephone

- Academic Affairs Library Ask-A-Librarian online help form

- Person ID Number Inquiry Web page (for all libraries)

- Off-campus instructions linked from all electronic resources (for all libraries)

- Off-campus instructions linked from multiple locations online such as e-reserves pages, distance education pages, and library services pages

In addition, the Libraries' distance learning specialist, employed to work with distance learners from all programs at UNC-Chapel Hill, was available by telephone or e-mail. A proxy server team consisting of staff from the Health Sciences and Academic Affairs libraries formed to manage access issues campus wide and within each library's domain. Both libraries also provided links to information about accessing electronic resources and reserves materials on their online course pages for social work students and speech-language pathology students enrolled in distance learning programs. Troubleshooting meetings were periodically held by the distance learning specialist for distance learning program staff such as those at The Friday Center for Continuing Education. The meetings addressed developing solutions for helping students find their identification number, loading student records into the library borrower's database, and setting up the proxy server.

Despite all of the above measures, requests for help continued. To address this issue, the Libraries have taken steps in the past six months to improve services to all remote users of electronic resources. Using monies from their Distance Education budget, they hired one full-time, temporary employee to rewrite the online troubleshooting documentation for off-campus access, to provide additional support pages for library staff, and to work on additional means of providing compatible browsers to off-campus students with dial-

up access only.  They also hired one part-time person specifically to respond to calls and e-mails regarding remote access issues and electronic resource problems at the Health Sciences Library.  Efforts have also by made by the Health Sciences Library to educate its User Services staff (reference and support staff) using an organized set of first line procedures to follow when answering users' telephone calls or e-mail questions about remote access issues.

While the Health Sciences Library has organized a response system for help requests placed by all remote users, this project sought to explore the similarities and differences between problems all remote users experience and those that distance learners face.  Given their unique characteristics, their initial level of computer experience, and their geographical distance from UNC-Chapel Hill, it was hypothesized at the beginning of the project that distance learners may have needs or situations slightly different from their on-campus counterparts.  If those differences could be identified, then library and distance learning staff could be informed of ways to better serve these students.

Project Methods

A number of strategies were used to explore and discover the problems distance learning students encounter when trying to access an electronic resource from off-campus.  The project drew from the investigator's experiences and resources gained through her common flow of work at the Health Sciences Library from September 2000 to the present.  The following methods of exploration were also employed in addition to observations made through the investigator's daily work:

a) Ask-A-Librarian (AskLib) e-mail messages sent by users via the Health Sciences Library's Ask-A-Librarian listserv from January 2002 to present were reviewed to explore the various types of problems remote users have reported regarding access and/or authentication to library resources, b) Current instructions disseminated to the public via the Academic Affairs Libraries' web pages were studied. All Web pages that play a role in instructing or assisting remote users were reviewed to discover the required elements for authentication and access of electronic resources from off-campus. Course Web pages designed for personalized assistance to distance education students were also explored for additional information, c) Consultation was conducted with the Libraries' distance learning specialist for clarification regarding the problems distance learning students report when accessing library resources for their courses from off-campus.

In addition to the above methods, a staff member in charge of writing off-campus access documentation for the UNC Libraries Web pages was consulted for clarification about proxy server and browser configuration issues. Staff from the Health Sciences Library's User Services and Information Technology Services departments was also consulted regarding borrower's database procedures and handling of remote access issues by Health Sciences Library staff.

Results of Exploration

Following review of Ask-A-Librarian e-mail messages, online off-campus access instructions, and various consultations with staff from the Health Sciences and Academic

Affairs libraries, the following observations and conclusions were made. Problems and needs specific to distance learners will be noted where applicable.

Access Issues Common Among All Remote Users

One of the primary observations noted during the project was that distance learners do share some common issues with their on-campus counterparts but they may experience the issues slightly differently because of their differing characteristics or needs. Through exploration and consultation, it was determined that there are essentially five main components that all remote users must handle in order to access resources successfully at UNC-Chapel Hill.   These components are: 1) a valid identification number with corresponding library borrower's record, 2) a working Internet connection, 3) a compatible Internet browser properly configured to the proxy server, 4) properly configured firewall and/or filter software, and 5) properly working electronic resources. Whether users are distance learners or on-campus students accessing resources from home, remote users must address each of these components or they will not be able to access electronic resources.  Differences between distance learners and general remote users will be delineated within the description of each component below.

*Valid ID Number*. The first component that students must address when setting up remote access is obtaining a valid identification number, either a Person ID number (PID) or borrower's identification number (BID) with which to authenticate to the library borrower's database when accessing a resource.   As mentioned previously, they must also have a record of their personal information stored in the database so that the proxy will pass them through to an electronic resource upon validation.  Since the electronic

resources are restricted by strict licensing agreements, only those who are faculty, staff, students, UNC Hospitals employees, or AHEC (Area Health Education Center) affiliated staff are allowed to access these resources from off-campus.

While records for on-campus students are automatically loaded into the library borrower's database at the beginning of each semester and several times throughout, some distance learning students have to be manually entered. Unlike on-campus students who are automatically assigned a PID number when they are admitted to the university, some distance learning students do not matriculate through UNC-Chapel Hill and are therefore not assigned one. Although they are taking classes offered by the university, their home school may be a different one altogether, so they are not loaded into the borrower's database. In order for these students to borrow materials and access electronic resources, the Libraries must assign them a borrower's ID, or BID, and create corresponding borrower's records with their BID number[3]. During authentication to licensed resources, they enter their BID into the Web browser where it asks for a PID. Other students, such as those who matriculate through The Friday Center for Continuing Education, are assigned PIDs. They are usually on a different schedule from other students, however, so their PID may not be in the university's system nor loaded into the library borrower's database with those of the on-campus students. Borrower's database loads usually occur once per month, except at the beginning of each semester when they are loaded more frequently to accommodate the many changes in student records that can occur during this time period. Since continuing education courses and other distance learning programs at UNC-Chapel Hill run on different, or non-traditional academic

calendars, it may take up to a month for some of the distance learning students' records to be loaded depending upon when their course starts.

Students in the Communication Sciences and Disorders (CSD) distance learning consortia program are an interesting example of how matriculation affects identification number assignment.  Every year in the CSD program, five students are admitted to and matriculated through one of five schools in the consortium (UNC-Asheville, UNC-Greensboro, North Carolina Central University, UNC-Chapel Hill, or Western Carolina University) for a total enrollment of twenty-five students per year.  Although the students matriculate through different universities, they all take the same core classes each semester and move through the program together according to a scheduled curriculum. In addition, students can choose to take electives at UNC-Chapel Hill while taking required classes from another university in the consortia. When CSD students take classes through UNC-Chapel Hill, the twenty students who did not matriculate through UNC-Chapel Hill must use a BID to access electronic resources, check out books, and request library services such as interlibrary loan. If students do not yet have a BID, the library must assign one to them and manually enter their information into the borrower's information database upon verification of their affiliation with UNC-Chapel Hill.  In order for the Libraries to verify that a student is affiliated with the university, the director or coordinator of a distance learning program may present the distance learning specialist with a list of incoming students to be entered into the borrower's information database prior to the start of classes. Otherwise, students must fax or mail a letter of affiliation written by their department to prove that they are enrolled in a course or program that is

taught through UNC-Chapel Hill.  Assigning identification numbers and creating borrower's records prior to the start of the semester is usually not a problem when the distance learning specialist receives a list of incoming students from program directors. However, not all directors provide the information immediately if at all.  Additionally, the process of assigning identification numbers to distance learners varies by program or course type.  To add to the complexity of the problem, students new to UNC-Chapel Hill are often not aware that they need an identification number and a library record to access the Libraries' resources until they attempt to complete their first assignment. The result is much confusion between the students, degree program staff, the Libraries, and the distance education specialist. Many personnel hours have been consumed in the past in trying to determine the type of identification number a student should have, who should assign the number, whether or not the student has been assigned one already, and whether or not the number is valid and active in the borrower's database.  Consequently, students have sometimes communicated with three or more library staff before their problem was resolved.

*Working Internet Connection*. The second component every remote user must address in order to access electronic resources from off-campus is a working Internet connection. Users must have an account with an Internet service provider (ISP), or some other means of access to the Internet such as a connection at their workplace, and they must be connected to the Internet at the time they attempt to access library resources. Occasionally distance learners have called with concerns about not being able to get to a resource. After step-by-step discussion on how to set up a compatible Internet browser

for the proxy, checking their identification number, and checking resource status, the problem sometimes turns out to be that students are accessing the Internet via dial-up modem and have lost their connection to the Internet while trying to access an electronic resource.  In other instances, students who have only one phone line and connect to the Internet via modem have called and expected to access the resources while talking to library staff on the phone.

While these issues appear to be basic for most college students, sometimes distance learners do not realize or understand how Internet connections work, and several minutes can be spent on troubleshooting access and authentication issues when the real problem is simply obtaining a working telephone connection to the Internet.

*Compatible Internet Browser.* The third component required is a compatible Internet browser that is properly configured for the UNC-Chapel Hill proxy server.  A proxy server is a machine in the library's networked computer system that acts as an intermediary between users' computers and library resources.  It helps determine if users are affiliated or not and whether or not a requested resource is available.  It then coordinates authentication of users as well as access between users' browsers and the requested library resources. Not all Internet browsers can be easily configured for the proxy server, however.  Students must find out what Internet browser and version they are using to determine whether or not it is compatible with the proxy server.   Once they install a compatible browser, they must enter a specified proxy URL into the browser's advanced settings so it may communicate with the proxy server for authentication to most

electronic resources. Since many issues can arise with browsers as well as configuring them for the proxy server, each one will be addressed separately in the following paragraphs.

There are a wide variety of Internet browsers on the market that can be used to navigate the Web, but not all of them work with the proxy server at UNC-Chapel Hill. Some browsers, such as those made by America Online (AOL), Opera, Microsoft Network, or Web TV, have complex compatibility issues. Other brands such as Netscape Communicator or Microsoft Internet Explorer only work if users have a specific version that is compatible.

Currently, the compatible browsers are Internet Explorer 5.5sp1 (service pack one), 5.5sp2, or 6.x and Netscape Communicator versions 4.x and 6.2. Remote users must use one of these browsers when accessing a resource or they will get an error, often a page asking for a login and password. The problem is further complicated when users are using a Macintosh computer rather than a personal computer (PC). For Macintosh users, only Netscape Communicator 4.5 or higher or Internet Explorer 4.1 works. Based upon review of help requests posed to the Health Sciences Library's Ask-A-Librarian Service, it has been relatively common in the past for users try to access electronic resources with an incompatible browser. In order to resolve this problem, library staff must direct them to download a compatible version onto their computer before they can access the resource.

For remote users who have a fast connection such as cable modem or DSL (dedicated service line), downloading new browser software may not be a big issue.  However, many remote users access the Internet via dial-up modem with a 56,000 bits per second (56K bps) connection or slower.  For this group of users, download time can exceed two to three hours due to large file size and small bandwidth with which to transfer the information over the telephone wires.  Given the lengthy download time, Internet providers may automatically disconnect users if it appears their account has been inactive after a certain period of time. In other instances, the Internet connection may naturally timeout before the download is finished leaving them with an incomplete file and no way to access the resources from off-campus.

All of the above assumes users are aware of browser and ISP compatibility issues and know how to resolve them.  It also assumes that users understand the terms browser and ISP. Based upon review of Ask-A-Librarian help requests from the Health Sciences Library, many users that requested help were either using an incompatible browser initially and were not aware of it, or they tried to follow the online instructions for browser configuration but were unsuccessful. From my own personal experience answering telephone calls at the Health Sciences Library, I discovered that less computer savvy users, may or may not know what a browser is. There have been instances when a person called in for help in accessing an e-journal or electronic database, and they did not appear to understand the term Internet browser or well-known names of browsers such as Netscape or Internet Explorer.  With some brief explanation, they were usually able to understand and then follow the instructions located on the Libraries' Off-Campus Access

Web pages. Distance learning students can fall into this category of people as well since they too are usually less experienced in setting up a computer for the Internet. Most of them may have experience in sending e-mail and "surfing the Net", but many are not always familiar with the more technical aspects of computers.

Cache retention. Also noted during review of the Ask-A-Librarian help requests that users made to the Health Sciences Library was that some were related to their Internet browser returning a page requesting a login and password when they tried to access a database or e-journal. Since the proxy server requires only an identification number for authentication, remote users should never see a login page. In exploring this issue further with a member of the Libraries' proxy team, it was explained that the problem arises with Internet Explorer's methods of cache retention. Internet Explorer stores copies of previously visited Web URLs on the computer's hard drive so that when they are accessed the next time, the browser pulls in the older stored versions in for a faster download. Users will see the login and password page because Internet Explorer retrieved expired static information stored in the cache rather than obtaining a fresh version dynamically from the resource's Web server.

While the remedy to this problem is simply to click a button to clear the cache, users have no way of knowing that this is the problem. Library staff usually has to direct them to do so. In addition, not every library staff member is familiar with Internet Explorer's caching methods, so they may not know to ask users about installation of a new version when troubleshooting the problem. For distance learners who often work late at night,

the problem is exacerbated. Rather than calling the library or chatting online with a librarian right when they experience the problem, they must wait until the library has resumed hours. They can submit a help request via e-mail, but they will still have to wait until the Libraries open and a librarian or a proxy server support team member can respond.

Enabling Cookies. Like cache retention, another browser issue that occasionally causes problems is enabling cookies.  A cookie is a message given to a Web browser by a Web server that contains information about the user. The browser stores the message in a text file in the browser's cache, or memory.  Each time the browser requests the page from the server, the message is then sent back to the server with the user's information. Cookies from the UNC Libraries' Web servers contain encrypted information that tells the proxy server that a user has been authenticated and is eligible to access electronic resources. When users click on a link to a restricted resource, they are taken to a new page that asks them to identify themselves as faculty, staff, or student and to type in their PID (or BID). The proxy server then verifies that users are affiliated with the University and passes them on to the resource. When users initially click on a resource, a cookie is stored in their browser on their computer.  If they log out of the selected database or click to a different resource, they can return to the initial resource using the cookie as a means of quickly verifying permission to access the resource without having to authenticate again, as long as they do not close their browser.  Once users close the browser, however, the cookie expires.   When they re-open the browser, the Web server must send another cookie to it and users must authenticate again before they can gain access to restricted

resources. As with browser version compatibility, many remote users, including distance learners, are not aware of cookies, nor do they know how to set their browsers to accept them. Yet if their browsers are not set to enable them, they cannot gain access to the resource and are prevented from completing their work until they obtain help.

***Proxy Server Configuration***. As mentioned previously, authorized remote users can gain access to restricted electronic resources by configuring their Internet browser to work with a proxy server. Using the proxy server ensures that they are recognized as affiliated with UNC-Chapel Hill as faculty, staff, or student while they are connecting from off-campus. If a user is not found in the database or if the user's record contains an incorrect class affiliation code, the Internet browser will return a page that reads, "Denied: Patron not found in database." Users can also be denied if they type the number incorrectly. If the user is not affiliated, the ID will fail to authenticate and the system will not be able to validate the information given. Also, if users do not have cookies enabled, they will not be able to authenticate at this point.

While typing a URL for the proxy server into the advanced settings area of an Internet browser does not seem all that complicated, there are several problems that can arise. First, users must become aware of the need to setup their browsers as the means to access electronic resources. While the Libraries' have placed instructions about off-campus access in several locations around their Web sites, users do not always notice the links. If they do notice the links, they may not always understand the instructions, including the technological vocabulary used such as proxy, authenticate, LAN, etc.

Problems may also occur with entering the automatic configuration URL into the browser. At base level, users may not enter the URL correctly, which will prevent the browser from communicating with the proxy server. Distance learners often encounter more complex problems when they take classes from multiple schools as a part of their program, such as students in the CSD distance learning consortia program mentioned previously. In the CSD program, students take classes from multiple universities depending upon the classes being taught and the particular semester. Each time they switch universities, they switch libraries as well. When they switch libraries, they must also change their browser configuration to access the respective library's resources. For example, CSD students may take classes at UNC-Asheville (UNC-A) one semester, which uses a different proxy URL to authenticate to their libraries, and then switch to UNC-Chapel Hill the next semester. When they switch, they must replace UNC-Asheville's proxy URL with UNC-Chapel Hill's or the browser will connect to UNC-A and not UNC-Chapel Hill. Most students initially do not realize they must change the proxy URL. Therefore, when they try to access electronic resources from UNC-Chapel Hill for the first time after taking classes at another school, they are not able to communicate with UNC-Chapel Hill's proxy server. They may be able to fix the problem using the Libraries' online help pages, but if they require further assistance, they may have to wait until the next day if they are trying to access restricted resources late at night.

A similar situation arises with changing the automatic configuration URL back and forth when others in the home use a different proxy configuration. Unlike most typical on-

campus college students, distance learners tend to share their computer with spouses or children in the home. Sometimes family members use a different proxy configuration to connect to a place of business or another Internet service.  While it is possible to reconfigure the Internet browser each time a different service is needed, family members do not always think to tell each other that they changed the proxy settings.  For distance learners who have walked through configuring their browser for the UNC-Chapel Hill proxy server, they may come back later to find they are unable to access library resources without any apparent reason.  They have the correct browser version, they setup the proxy server correctly, perhaps using the online instructions or library staff help, and they were able to access resources previously.  After troubleshooting with library staff or the distance education specialist, they are able to determine that the proxy settings have been inadvertently changed or uninstalled by someone else in their household.  Since there is only one location in Internet browsers to store autoproxy URLs, a solution to the URL switching problem is for the distance learners to store all the relevant proxy URLs in a text file on the computer. They can then copy and paste the correct URL into the browser's settings every time they switch services or, as in the case of the CSD students, when they switch university libraries.

*Firewalls and Filter Permissions*. For those who use methods of Internet security and filtering, a fourth component that must be in place is the correct setup of firewall and filter permissions.  Some students access library resources from work or home where a firewall has been installed to provide extra security when using the Internet via local area network (LAN) or higher bandwidth connections such as DSL. Special instructions must

be followed when using these technologies so that a connection can be made to the proxy server. One problem with firewalls for remote users is what to do if they are not the person who set up the firewall on their computer. If they are connecting from their workplace, most likely that business has its own policies and procedures for the type of software allowed on the computer and how much autonomy employees have over changing network and browser configurations. Some businesses do not allow changes in firewall settings; at which point the distance learners will not be able to use their computer at work to complete their studies. In other situations, users may be trying to access a restricted resource after hours when their information technology consultants have left the office. Since changing firewall configuration takes some knowledge of computer terminology and understanding of how firewalls are setup, some distance learners may be hindered from accessing the resources until they receive help from the Libraries.

In addition to firewall issues, some users may have installed filters or other child protection software to block out unwanted adult content while they or their children are using the Internet. These filters may need to be turned off or removed in order for the browser to access resources successfully. A problem that can occur with filters is that users may forget they have the filter on or not even realize it is an issue when speaking with library staff who are trying to help them troubleshoot. They may also have spouses or other family members that have set up or changed the filter without the their knowledge. When users then call or write for help, library staff may spend a considerable

amount of time in trying to figure out why they cannot gain access, even though their browser settings are correct.

*Working Electronic Resources*. The fifth and final component that must be addressed is properly working resources.  Even if students have a reliable Internet connection, a browser that is compatible and correctly configured, and an active identification number with a corresponding record in the borrower's database, they can still experience trouble accessing the resource they need due to problems with the resource itself.  Any number of problems can occur with resources including: the resource's servers are down, the Libraries' Web servers are down, the Libraries' license or subscription has expired, the publisher of a resource has changed its IP address, or the method of accessing the resource has changed such as creating a user account or typing a specific login and password to access it.  If students experience problems with any of the above issues, they will not be able to access the resources they need even if they have completed all the other steps required for remote access and authentication.

During review of these five technical components, it was noted that distance learners often experience problems with more than one component during initial setup. Managing all of these components at once can be especially difficult for students who are not residents of North Carolina and are taking only one or two short courses online. Distance learners from out-of-town, such as those enrolled through The Friday Center, have a disadvantage because they do not receive a full orientation to library services, as is the case with other distance learning programs. They must rely fully on the Off-Campus

Access   instructions pages located on the UNC Libraries Web site. After they setup their browser to work with the proxy server, they will also have to figure out how to use library resources such as the online catalog, e-reserves, electronic journals and electronic indexes and databases.  Additionally, since short courses run on a different schedule from regular campus classes, their associated patron record may not be uploaded when their course begins so that even with a proper ID and browser configuration, some students may initially be blocked from accessing library materials. Also, since distance learners of this type may not be a part of any UNC-Chapel Hill degree program, terms such as BID or PID may mean little to them at this point.

Confusion for Library Staff

Another main observation made during the project was that front line library staff  were sometimes confused about one or more of the remote access components.  Depending upon the complexity of the issue, instructions from multiple library and technical support staff were required in order to solve users' access problems. Given all the possible combinations of ISPs and browser issues as well as borrower's database issues, dealing with remote access to electronic resources often takes the expertise of more than one staff member to understand the problem.  Mixing in additional factors unique to distance learners such as some needing to be manually entered into the library system, perhaps only for one semester, or some belonging to a consortia program with another institution as their home school, increased the complexity of providing remote access support to distance learners.

Recommendations

Based upon the above observations, the following recommendations are proposed to help distance learning and library staff when assisting distance learners with remote access problems:

***Require that distance learning program directors send a list of their new students to the Libraries prior to the beginning of each semester.*** As mentioned previously, not all distance learning students are automatically loaded into the library borrower's database at the beginning of each semester. Requiring a list of incoming students will help ensure that none are missed during the manual input process. For programs with students who take classes that do not follow the university's semester calendar, an electronic form could be created for staff to complete each time a new student enrolls in a course that requires use of the Libraries' electronic resources. Since the library borrower's database is updated only once per month after the semester has begun, using a list or form for entry of new students will facilitate their inclusion to the database in a more timely and accurate manner with less confusion between program staff and library staff. Use of electronic format submission is in keeping with methods already required of departments by the UNC-Chapel Hill One Card office and may therefore be more likely adopted by distance learning program staff.

***Train library staff on procedures to follow when they cannot find a record for a distance learner in the borrower's database.*** Since library records of distance learning students are not always automatically loaded into the library borrower's database each

semester, front line library staff such as reference and circulation staff, need to be trained on steps to follow if they do not find a distance learning student in the borrower's database. The flow chart listed in the appendix outlines an overview of a step-by-step process developed by the investigator for Health Sciences Library User Services staff to use when they cannot find a distance learner's record in the borrower's database. Staff could be trained in person initially and a copy of the flow chart with additional notes could be kept in a handy spot for future referral at the User Services Desk or on the library's internal computer network. Increasing staff awareness of how and why distance learning students differ in identification number assignment can save much confusion and increase the speed with which identification number problems are solved.

***Set aside additional time to explain remote access issues during orientation sessions with first year distance learning students.*** While it may seem that the most important part of orienting off-campus students is to show them how to use electronic resources to find information, the resources themselves will prove useless if students are not able to connect to them. Since many distance learning students have limited experience with computers when they first begin their program, pointing them to the Libraries' off-campus access instructions may not be enough. More time needs to be spent with distance learning students in comparison to their more computer savvy on-campus counterparts. During the traditional distance learning orientations, library and/or distance learning staff could set aside time to explain the five technical components of remote access in order to reduce potential confusion and to reduce the number of hours library staff will spend in helping them later. Print handouts with screen shots could also be

given to them during the orientation sessions to act as a visual reference guide for when they setup access in their home or office.

For programs where students do not meet in person, a virtual group meeting could be setup between a librarian and the students using live online chat software. The librarian could walk through how to setup the proxy server, how to check for their ID number, and how to address browser issues. Multiple time slots could be setup so that students could participate from the convenience of their home or office using their own computer. As part of the orientation session, the librarian could "take over" students' Internet browsers to show them how to find off-campus access instructions as well as to review basic principles of locating electronic resources and materials. The librarian could also push a slideshow file of Internet browser configuration screen shots so students could setup their own browsers during the session and ask questions immediately. Since both the Health Sciences Library and the Academic Affairs Library at UNC-Chapel Hill subscribe to online chat services, orientations of this nature could be held for all Health Affairs and Academic Affairs distance learning courses and degree programs.

***Continue to improve usability of off-campus access help pages with distance learning students in mind.*** While drastic modifications to the online documentation for setting up off-campus access to electronic resources have been made over the past six months, there are some additional changes the Libraries can make to their instructions to aid distance learning students and other less computer literate users.

a) <u>Define technical terms</u>. First, technical terms such as firewall, automatic configuration, Internet protocol, and URL could be modified or clarified.  These terms could be replaced with more basic vocabulary words, or they could be written as hyperlinks that lead to definitions that pop up as small boxes when users click on them.  If pop-up boxes are unfavorable, the hyperlinks could be linked to a glossary page of definitions to all technical terms found anywhere on the Libraries' Off-Campus Access Web pages. Users could browse all technical terms or read only specific ones of interest linked from the instructions they were reading.

b) <u>Provide screen shots with written configuration instructions</u>. A link to a set of step-by-step screen shots could be added to each page of browser configuration instructions to visually outline how to set up proxy server for various browser types.  Once users click on a particular set of browser instructions, they would have the option to follow the written instructions alone or click a link to view the instructions with screen shots embedded. Providing screen shots would assist the understanding of all remote users who are not familiar with technical computer terms and issues.  Increased understanding may then translate into fewer requests for help.

c) <u>Include more detailed information about identification numbers</u>. A third recommendation is to add information about borrower ID numbers (BIDs) to the Off-Campus Access pages where authentication information and troubleshooting tips are listed. Adding BID information to the How Do I Authenticate page can alert users to the difference between BID and PID numbers. It can also explain who should have a BID

and how to get one if they do not yet have a BID. Adding troubleshooting tips to the Authentication Problems page can serve to inform users who may be having problems with using their BID for authentication and to remind library staff when they help users troubleshoot.

d) <u>Place links at the top of library course pages for distance learners</u>. Placing a link to off-campus access instructions at the top of all distance learning library course pages will help users find the information more quickly. The Health Sciences Library already has a link to the pages on its Speech and Hearing and Social Work course pages, but the link is located at the bottom of the pages under Library Services where students are less likely to notice it unless they scroll to the end. The Academic Affairs Library also has a course page for social work distance learning students, but there is currently no link to off-campus access instructions. Since pages such as these contain resources selected specifically for their needs, distance learning students tend to bookmark the page so they may quickly return to it when looking for articles. It is therefore important to place a link to the off-campus access instructions on the library course pages in a highly visible location. Students can then refer to it quickly rather than having to search around the page or on other Web pages to find help.

<u>Future Electronic Access Issues</u>

This project sought to explore the current issues that all remote users face when trying to access electronic resources from off-campus and to specifically define methods that library and distance learning staff can use to enhance support for distance learners. As

computer technology and methods of network access evolves, ongoing exploration of remote access issues will be needed.

One issue to consider is how to deal with an increasing variety of software and hardware technologies available to libraries and their patrons. Internet browsers, for instance, continue to proliferate in brand and version. How will the libraries keep up with compatibility issues for every type of browser? Also, since much of the State of North Carolina is rural, how will remote users in these locations be able to keep up with new remote access methods if networking or communications services in their community do not support it?

Another issue to consider is advancement in authentication and access control technologies. While the proxy server meets the Libraries' current needs, better methods of providing access control for licensed electronic resources are sure to come. Will more secure networking methods such as virtual private networks (VPN) be the next step? If so, how will the Libraries transition their users to this new form of technology?

A third issue to consider is the dissemination of published electronic information on various hardware devices. For instance, the use of wireless mobile technologies in health sciences professions continues to gain speed. Publishers of medical information such as MICROMEDEX are now offering their content via personal digital assistants (PDAs) in addition to their regular electronic version for personal computers. As health sciences libraries move to support their patrons who use PDAs, will they also extend their

electronic holdings to licensed PDA content accessible via wireless Internet connections? If so, how will they maintain control over access? Will the proxy server method work with handheld browsers, or will a new method for authentication be needed?

Finally, a question to be kept in the forefront is how these future issues will play out for distance learners.  As the number and type of distance learning programs offered by higher education institutions rises, and as the modes of technology in which distance learners take courses proliferate, libraries will be faced with new remote access issues. Ongoing exploration of innovative methods and discovery of best practices for supporting remote access to licensed electronic resources will become paramount in a world that continues to change how information is exchanged.

NOTES:

[1] An exception to this policy exists for members of Friends of the Health Sciences Library.  They may access certain electronic resources from off-campus through the AHEC Digital Library (http://library.ncahec.net/) by pledging a preset annual donation fee. Last accessed 6/27/2002.

[2] As set forth in the Guidelines for Distance Learning Library Services created by the Association of College and Research Libraries, "Access to adequate library services and resources is essential for the attainment of superior academic skills in post-secondary education, regardless of where students, faculty, and programs are located. Members of the distance learning community are entitled to library services and resources equivalent to those provided for students and faculty in traditional campus settings." Retrieved June 27, 2002 from  http://www.ala.org/acrl/guides/distlrng.html.

[3] As a rule, the Health Sciences Library verifies affiliation and assigns BIDs for all programs in the Health Affairs division, and the Davis Library verifies affiliation and assigns BIDs for all programs in the Academic Affairs division of campus.  Distance learners and/or their program directors must work with their corresponding library in order for borrower's records to be created in the database.

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<u>Appendix</u>

Procedures for Health Sciences Library Staff When
Assisting Distance Learners Not in the Borrower's Database

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                    ┌──────────────────────┐
                    │ Is the student enrolled │
                    │   in a DE program?      │
                    └──────────────────────┘
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Is the student enrolled in a DE program?

If *yes*, in what program or course is he/she enrolled?

If *no*, is he/she currently affiliated with UNC-CH?

If related to Academic Affairs, Friday Center, or other, refer to Davis Library

If *yes*, in what program or course is he/she enrolled?

If *yes*, proceed to proxy server troubleshooting

If *no*, explain borrowing options for non-affiliated borrowers and refer

What university is the student's home school for the current course?

If UNC-CH, are they enrolled on-campus, off-campus, or both? Request verification letter from degree program

If *not* UNC-CH, request letter of verification from home school then go to next question below

Does the student know his/her ID# for UNC-CH?

If *yes*, is it a PID (7XXXXXXXX) or a BID (890XXXXXX)?

If *no,* check PID Inquiry database for a PID number

If person *is not* in PID Inquiry database, check print borrower's cards for BID; re-enter into DRA if found and date not expired. Refer to online borrower's application and request verification letter

If BID, check for print borrower's card. If no card, request verification letter and complete borrower's application

If it is a PID and student has been verified, create a record in borrower's database

If person is in PID Inquiry Database, refer to borrower's card application and request verification letter

Proceed to proxy instructions as necessary

If problems continue, refer to AskLib and copy email to Distance Learning Specialist

Proceed to proxy instructions as necessary