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ERes - how an instructional technology department is only as effective as its resources

Win Shih

ERes:
How an Instructional Technology Department Is Only as Effective as Its Resources

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SUMMARY. The success of a 24x7 electronic reserves service requires a well configured and robustly managed system. Based upon a five-year successful experience of supporting Docutek's ERes system at Saint Louis University, this paper discusses and examines the technical issues affecting the proper operation of the system. Areas covered include selecting an adequate server and scanner; proper server management; reducing PDF file size using various Acrobat 6 features; and interoperability between ERes and other systems. *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <http://www.HaworthPress.com> © 2004 by The Haworth Press, Inc. All rights reserved.]*

KEYWORDS. Electronic reserves, ERes, document delivery, interlibrary loan, scanners, scanning, server management, Adobe Acrobat, PDF, Saint Louis University

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INTRODUCTION

Information technology has transformed higher education from "just-in-case" delivery of academic resources, to "just-in-time" to "just-for-you," enabling learners to "one-stop shop" for their educational services. In the networked academy, the digital library applies new technology and knowledge management in the collection, organization, production, delivery and preservation of intellectual content directly to the desktop of end users.

As library resources become ever more virtual and ever less physically paper-reliant, our faculty and students are naturally growing accustomed to and demanding to conduct their research online. With this change of the learning and scholarly communication process, the library not only spends more on acquiring online materials, but also allocates more resources to facilitate the access of these materials. Services such as electronic document delivery, electronic reserve, digitizing unique collections, direct full-text linking and remote access authentication are some of the examples. Whether these systems are developed locally or purchased from third-party vendors, they tend to run on a dedicated server (hardware), which is likely managed by the library's instructional technology staff.

The very nature of a digital library is its 24x7 availability and the stability and reliability of its resources. The success of such an operation depends on a variety of factors. A well-configured and managed system is a pre-requisite. A robust and secured instructional technology infrastructure, as well as a competent instructional technology team is also essential. Based upon a successful five-year experience of supporting the ERes system at Saint Louis University, this article shall discuss and delve into the technical issues affecting and influencing the proper operation of the system and by extension, its patrons, administrators and numerous other clients.

LITERATURE REVIEW

Literature on the ERes system covers disparate areas. Kesten and Zivkovic, inventors of ERes, describe in detail their design philosophy as well as major features of version 3 of the system. Both Lorenzo and Kesten provide a historical overview of the ERes system, as well as future product development plans for the company. Several authors discuss the process of selecting an electronic reserves system at their

library, offering comparisons of various commercial and open source systems, including ERes (Kristof and Klingler, Lu, Nackerud).

As for how ERes is used campus wide, DeWeese and McCabe both share success stories from their institutions. However, implementing a new system is by no means merely a technical matter. It also involves changes in workflow, organizational structure, staff skills and the way patrons access resources. Several authors discuss issues related to the implementation of, as well as innovative ways of using the ERes system (Hiller, Kristof, Landes, Walter).

So what do end users think? A survey by Sellen and Hazard shows that ERes is well accepted by students at SUNY, Albany. Some faculty members likewise commented on how ERes enhances their teaching and student learning activities (Birnbaum, Flowers).

Finally, there are several electronic reserve related resources mentioned by many of the authors cited here. The Association of Research Libraries' (ARL) Electronic reserves in Libraries Discussion List is dedicated to the discussion of issues and practices related to the management of electronic reserves. The list archive (https://mx2.arl.org/Lists/ARL-ERESERVE/) should be consulted first for specific electronic reserve questions. The ERes User Group discussion list, set up by Docutek, is dedicated to and participated by ERes customers. Here is where you can seek information specifically related to the ERes system.[1] Jeff Rosedale's Electronic Reserves Clearinghouse (http:// www.mville.edu/Administration/staff/Jeff_Rosedale/index.htm#News) is the most comprehensive portal for electronic reserve resources.

PHYSICAL SERVER SELECTION

As the command center or "nervous system" of the product, the ERes server performs several roles. First, it operates as a database server, based on Microsoft Access database management system (DBMS) technology. It further functions as a file server storing all of the course documents. In addition, the ERes Server is also a web server hosting the ERes website.

Older versions of ERes run on a Linux/UNIX platform. However, Docutek made a strategic decision to switch to a Microsoft Windows-based platform when ERes version 4.0 was released. At the core of the newer command center is the Microsoft Windows operating system (OS). Although ERes can run on older Windows NT 4.0 systems, it is recommended that administrators migrate to or operate their ERes

system on the Windows 2000 OS or Windows 2003 OS server platform for better security, improved manageability, heightened performance and overall strengthened reliability.

Based on the Spring 2004 Customer List provided by Docutek, a survey was conducted to examine ERes operations at each institution. Among the 398 ERes sites, the URLs or IP addresses of 357 sites (90%) were successfully collected. The other 41 sites were not reachable or verifiable due to various reasons, such as the ERes server was behind a firewall or certain kinds of security settings blocked direct access. As indicated in Table 1, over 85 percent of ERes sites are running the Windows 2000 OS. A few sites are running the latest Windows 2003 system, while a small number of customers remain comfortable with the older Linux/UNIX-based version of ERes.

The type of web server used is closely linked to the OS on which the ERes Server is running. It is not surprising, for example, to see that in Table 2, Microsoft Internet Information Services (IIS) 5.0, incorporated within the Windows 2000 OS, is used by the majority of ERes sites, followed by IIS 4.0 (Windows NT 4) and IIS 6.0 (Windows 2003). Apache HTTP software is used by Linux/UNIX-based server systems, while a handful of sites are running Netscape Enterprise Web Server software on their UNIX-based system.

According to Docutek, many of the most common questions raised by new ERes customers center around the hardware specifications of the physical ERes server itself. In particular, customers want to know:

1. How powerful does my ERes server need to be?
2. How much hard drive space do I need?
3. Can I share my ERes server with other applications?

The minimum requirement of physical server (hardware) specifications provided by Docutek (http://www.docutek.com/support/server.html) is a baseline and should be used as reference only. Unless you are converting an older server to host your ERes system, try to purchase a more robust server that includes or can be upgraded in the future to include, additional power and disk space to accommodate the growth and expansion of your electronic reserve operations for at least the next four to five years. Additional capacity furthermore allows you to handle unexpected needs. For example, Saint Louis University's server was capable of hosting a second ERes Server site for our Health Sciences Center Library after the first year's successful operations. In the future, you might want to consider adding Docutek's VRL*plus* component onto the

TABLE 1. OS Used at ERes Sites

Server Operating System	Sites	Percentage
Windows 2000	307	85.99%
Windows NT4	28	7.84%
Windows 2003	14	3.92%
Linux	3	0.84%
AIX	2	0.56%
IRIX	2	0.56%
Solaris 8	1	0.28%
TOTAL	**357**	**100.00%**

TABLE 2. Web Servers Used at ERes Sites

Web Server	Sites	Percentage
IIS 5	307	85.99%
IIS 4	28	7.84%
IIS 6	14	3.92%
Apache	6	1.68%
Netscape Enterprise	2	0.56%
TOTAL	**357**	**100.00%**

same physical server, rather than having to buy and set up a second physical server that will cost significantly more.

Physical Server Specifications

Processing Power, Speed and Storage Capacity

Bigger Brains Mean Faster Request Fulfillment. The microprocessor or central processing unit (CPU) of your server (measured in units called megahertz or gigahertz–Mhz and Ghz respectively–the more of either of these you have, the faster your server) functions as the "brains" of the computer, processing all those electronic reserve requests from your patrons and executing every human command as lightning-fast as humanly possible. Nowadays, forget about megahertz. If you are buying a new server, get as many *gigahertz* as you can afford (1 gigahertz = 1,000 megahertz). "Moore's Law" clearly postulates that the number of transistors per integrated circuit doubles every 18 months. This implies

that the processing horsepower or speed of every new computer rolling out of Dell or HP or wherever, doubles every year and a half. Given the seeming accuracy of Moore's Law, a Pentium IV or Xeon processor should drive your ERes Server system and drive it well. Get the best and the fastest machine you can afford.

Your Computer Can Never Have Too Much Memory. Yet, at the same time, do not forget this corollary to the mantra, "A computer is only as fast as its slowest part." Random Access Memory or RAM is the working memory which stores data temporarily while your physical server and the CPU are "working on it," running application programs, etc. RAM is to your CPU what a great nurse is to an ace surgeon. The more RAM you have, the more efficiently and expeditiously the CPU runs. The more physical memory you have on the server, the better it will handle multiple requests from users and overall, the quicker your server will "rock and roll." Invest as much in RAM chips (512 MB, 1 GB, 2 GB) as you can afford and that your server will accommodate.

Decreased Storage Costs Means Good News for Everyone. The unit price of physical hard drive storage space has dropped dramatically in recent years. According to "Storage Law," optical storage costs decline at the rate of 50 percent every 16 months. Thus, the cost of one gigabyte of raw hard drive space is approaching exactly $1.00 now. Now combine "Storage Law" with "Disk Law." "Disk Law" predicts disk density (the relative "thickness" or "storage capacity" of the magnetic media upon which you house all those jillions and jillions of gigabytes) and increases 25 percent every 12 months, meaning, in a nutshell, that combined with "Storage Law," the hard drive you buy today will store approximately four (4) times the amount of information it could a year ago when you bought it, at nearly half the cost you paid for it one year ago.

As the electronic reserve business burgeons, you want to budget enough room for future growth. Our experience at Saint Louis University indicates that the number of articles scanned into ERes increased more than 350% over a three-year period, with an average of 700 kilobytes stored per article (mostly as Adobe PDF files).

Although the minimum hard drive space recommended for startup by Docutek is 9.1 gigabytes (GB), you will be hard-pressed to find a new server with anything *less* than 18 GB of storage available. That extra hard disk space can easily be allocated for your ERes operations and you do not have to remove old documents as often at the end of each semester in order to make space for new ones. Instead, you can just archive them and suppress them from display to the public.

However, hard drives do crash and they do become corrupted, just by virtue of the fact that they have components which move, produce friction and fail. For obvious safety and redundancy purposes, your mission-critical ERes server should contain at least two hard drives of the same size, with one configured to "mirror" the other one. "Mirror" simply means "shadow" or duplicate. Within a mirrored environment, the data on your primary hard drive is imaged identically onto the second drive. If one drive fails, there will always be a backup working copy of your essential ERes data on the other drive. Budget permitting, it's a wise idea to invest in a fault-tolerant disk system, such as RAID-5 (Redundant Array of Inexpensive Disks–Level 5), where data volumes are "striped" (interleaved or spread out) evenly and intermittently across three or more physical drives, providing even greater protection against data loss. Moreover, combined with an inexpensive, traditional tape-based backup system (to perform overnight replication, for example, of your entire ERes database; these tape(s) can then be stored offsite or in a fireproof vault or both), plus an uninterruptible power supply (UPS) unit providing continuous battery backup power to your ERes server in the event of a significant power outage.

To Share or Not to Share

Should you allow other applications besides ERes Server to run on your physical server? Depending on what other applications are running on the same machine along with ERes Server, the impact on your ERes operations will vary. Our experience at Saint Louis University has been decidedly mixed. We have not experienced any problems setting up other non-ERes-related websites coded using Microsoft application server script (ASP programming). However, we *have* experienced problems when the website is constructed with Cold Fusion software.

Another complication of operating a shared physical server is simply that when a problem arises, it is difficult to determine which application caused the problem. Since ERes is a major service and if your budget can easily afford the hardware to run it, it is definitely worth your peace of mind and the cost of maintenance to support a dedicated server restricted for ERes operations exclusively.

Server Management

Like any operations, a properly configured and well-managed server not only performs efficiently, but also reduces the risks of hardware and

software malfunctions, let alone malicious intrusions or attacks. To ensure the health of ERes server, the engine for 24x7 operations, Docutek provides its customers with a detailed set of guidelines for proper system administration. Among the most important of these are:

- Maintain good documentation and a logbook of your server. The documentation should contain detailed hardware specifications, major software applications installed, as well as the phone number of technical support of the manufacturer. Make sure to include your server's serial number and date of purchase. Nowadays, vendors such as Dell and Hewlett-Packard let you retrieve product information, as well as download the latest system files based on the product's serial number. Record any major problems or system alerts, as well as actions taken.
- Keep disk space healthy and lean. As your ERes documents increase and the database expands, the original capacious reservoir will quickly fill up. As the disks become crowded, it takes longer and longer for the server to locate and retrieve the information requested by patrons. It also takes longer to back up the system. Docutek recommends regularly performing "disk defragmentation," a process ensuring data on the disk is better organized and thus retrieval of its data is speedier and more efficient.
- Reduce your vulnerabilities. A properly-defined and proactive patch management program and set of security procedures for your network will reduce the vulnerabilities of that network and enhance the stability of all your operations generally, as well as maintain the complete integrity of your data. Poorly configured and badly managed Microsoft Internet Information Services (IIS) servers have been the major targets of many serious worm and hacker attacks. From "Code Red" to "NIMDA," to the "Denial of Service (DOS)" attacks, Microsoft IIS is notorious for being a relatively insecure and vulnerable web server. ERes Server, running Microsoft IIS, should be configured and perform the following tasks on a continual basis:

    - Installing Only the Minimal Setup of Microsoft IIS. When setting up your Windows 2000 server, the IIS are automatically installed as well. The key here is–do not install components such as Front Page Server Extension, Indexing Service or SMTP, if you are not planning to use them. Also, be sure to

turn off unnecessary Internet services, such as "anonymous FTP," and the "default Web site."

- Always Applying the Latest OS Patches. Install Microsoft patches and updates when they are made available. In the past, Microsoft issued patches and critical updates irregularly and frequently. In 2003, there were at least 37 Windows 2000 server patches and in 2002, there were more than 60 Windows 2000 patches. This caused a lot of concerns, complaints and often confusion amongst Microsoft's customers. Because of customers' feedback, in October 2003, Microsoft announced a new process of releasing new updates in a more streamlined fashion. Instead of publishing updates irregularly and unpredictably, they are now released on the second Tuesday of every month. These scheduled updates enable server administrators to install multiple updates with a single install and a simple reboot. Of course, if there is immediate risk of security problems, Microsoft will release the necessary patch or update outside of its scheduled timeframe, which is understandable. We have found that the best way to keep informed when there is a new release or update from Microsoft is to subscribe to Microsoft's free e-mail notification service (subscribe at: http://www.microsoft.com/technet/security/bulletin/notify.mspx). You will receive an e-mail notification whenever there is a critical update or a major security alert from Microsoft. This is really the best way to keep your server well patched and secured.
- Continuously Maintaining Proper Protection. Ensure that the anti-virus software on your physical server is configured properly. Make sure that your latest virus definition file is up-to-date. All major anti-virus software allows you to configure your system automatically to download and install the latest virus definition files, as well as to scan your system at scheduled intervals. Take advantage of all of these protective, timesaving mechanisms.
- Maintaining Proper Physical Server Configuration. Close unnecessary network ports. Information and requests are communicated through certain ports. For example, web servers typically "talk" on port 80. Be sure to close ports that are not used by ERes and other applications running on your server. This will reduce the possibility of being attacked through unused ports. Change the default home directory of

your ERes site from "c:\inetpub\wwwroot" to a different path and hard drive partition.
- Subscribing to the ERes User Group Discussion List. From this list, you will receive helpful alerts, product updates and news from Docutek and fellow colleagues regarding any ERes related topics.

SCANNERS AND SCANNING SOFTWARE

Selecting the Scanner That's Perfect for You

Scanner price varies from a low-end, consumer model costing under $100, to high-speed, commercial-grade behemoths ranging over $10,000. Staff must choose the appropriate scanner with "futurethink" in mind. Choose a scanner that will meet your future scanning quantities and, within budget too, can be a daunting decision.

Major Selection Criteria Include

Scanning Speed

When you have a large number of reserves to be scanned at the beginning of a semester, speed makes a major difference. Our Saint Louis University stats clearly demonstrate that the average reserve article is 14 pages. For a 14-page article, it takes 2.8 minutes to scan on a five-page-per-minute (ppm) scanner, compared to about 34 seconds on a 25-ppm scanner. The difference is 2.24 minutes. If your library scans 500 articles per semester with all else being equal, you will save a total of 18 hours (1,120 minutes) of scanning time using as fast a scanner as possible. It is important to think about the time you save as well as the staff salary dollars conserved (see Table 3).

Scanning Resolution

A scanner's resolution or reproduction quality is measured in dots per inch (dpi). The higher the dpi, the better the resultant image quality. Because higher resolution quality connotes more information (more dots), the size of the file created will be larger given the greater dpi. By extension, it will take patrons longer to download larger files from your ERes website. For example, when scanning at 300 pixels per inch a

TABLE 3. Scanning Speed Comparison

Scanning Speed	Time Required for Scanning a 14-Page Document
5 pages / minute	2.8 minutes
10 pages / minute	1.4 minutes
25 pages / minute	0.56 minutes (34 seconds)

page of 6 inches across by 8 inches down, the total pixels scanned will be the product of horizontal pixels (300 × 6) vertical pixels (300 × 8), which is 4,320,000 or 4.32 million pixels. The same page scanned at 100 dpi, the total pixel count drops to 480,000 or .48 million pixels, one-ninth the size of the 300 dpi scan. Thus, file size is proportional to the square of the image resolution. If an article to be scanned is text-based or if the quality of graphics, charts and other pictorial information within the article are not critical in terms of their "high legibility," it is recommended by Docutek to scan your articles at 75 to 150 dpi.

Clearly, file size of your documents can be a determining factor in the overall satisfaction of your customers and the ultimate success of your ERes operations.

The ("Must Have") Automatic Document Feeder (ADF)

This an indispensable feature when scanning vast quantities of pages and is highly recommended as a "must have" add-on feature by Docutek. Instead of loading page after page after page after page of article materials manually, the automatic document feeder empowers you to scan multiple page documents nonstop. Your typical ADF will accommodate up to 50 through 100 pages, enabling you to go on and do other things without wasting valuable time and energy feeding source pages to the scanner.

Paper Size

Most flatbed scanners are designed to handle letter-sized articles (8 1/2" × 11"). Some can go beyond this and handle legal-sized documents (8 1/2" × 14"). Scanners with larger flatbeds obviously can process larger-sized documents, but be prepared to pay more.

Duplex Capability

Instead of scanning one side of a document at a time (simplex mode), the ability to scan both sides of a page simultaneously (duplex mode) will save you and your staff further time and energy, especially in dealing with two-sided documents. Document scanners that can scan in duplex mode are frequently described in the product specifications as "ipm (images per minute)." Therefore, 20 ppm on a simplex scanner may be rated as 40 ipm on a duplex scanner. As expected, duplex scanners will cost you more, but the price offset may be well worth the pain to your pocketbook if you frequently deal with double-sided documents.

Color Scanning

The capacity for rendering color may be quite crucial for some documents such as works for an art history class, pie charts for a course in business statistics, slides of the human body or cells for a medical seminar. At Saint Louis University's Health Sciences Center Library for example, we operate a Fujitsu 4210C Color Scanner with ADF that can scan color documents at a rate of 25 ppm, with a resolution of 150 dpi.

Selecting the Best Scanning Software

To Capture or Not to Capture

Besides a decent scanner, you need the Adobe Acrobat software application to convert paper images into PDF files. Some libraries opt to use another Adobe product, called Adobe Capture, to create Adobe files. Adobe Capture is designed to convert a higher volume of paper documents into searchable Adobe PDF files. It also offers OCR (Optical Character Recognition) capability, automatic page and content recognition and powerful clean-up tools. However, version 6 of Adobe Acrobat, which released in 2003, also includes a built-in OCR feature, called Paper Capture. At Saint Louis University, we use Adobe Acrobat for our ERes scanning operation.

Size Does Matter

Since the file size of PDF documents directly impacts the speed at which patrons can download and display these documents to their desk-

top, the smaller the file size, the less time your patrons have to wait. Fortunately, Version 6 of Adobe Acrobat introduces a series of new and improved ways, as described below, to optimize the file size of PDF files.

Use the "Save As" Command. For PDF files created with older versions of Acrobat, use the "Save As" option from the "File" menu to save your document with the same name. Acrobat will overwrite the original document in a more efficient way. Furthermore, it will allow the file to be downloaded one page at a time from the web, by virtue of a new feature called "Fast Web View." In Acrobat 6, that feature is enabled by default and permits the document to appear more quickly at the user's end instead of displaying only after the entire document has been downloaded.

Compatibility Level. The easiest way to ensure compatibility of your documents is to use the "Reduce File Size" option from the "File" menu when saving your documents. You can set the file compatibility level from Acrobat version 4.0 to 6.0. If you are sure that none of your users will be using versions of Adobe Reader older than 4.0, this will be a good way to keep file sizes as small as possible.

PDF Optimizer. This new feature is only available in Acrobat 6 Professional, not the standard edition. PDF Optimizer improves the performance of PDF files by allowing you to modify various Adobe settings, including compression methods, fonts embedded in the document and bookmarks, forms, comments and thus effectively reduces file sizes.

Paper Capture. All paper documents are initially scanned into Acrobat as bitmap images. Even though they are displayed as text through Acrobat Reader, they are just pictures of text and are not searchable or editable. The new "Paper Capture" feature of Acrobat 6 not only can convert scanned image files into searchable text files, but also potentially reduce PDF file sizes as Adobe Capture does. Its built-in dictionaries support 16 languages. Adobe 6 offers three PDF output styles when performing OCR.

1. "Searchable Image Exact" will make the image identical to the original image (foreground) and place the searchable text behind the image. Thus, the file size here tends to be larger than the other two options. It will not allow users to edit or modify existing text. Yet this option is ideal for documents such as contracts and legal documents whose integrity you wish to maintain, but also offer search capability of its contents.

2. "Searchable Image Compact" lets you further reduce the scanned image file size through a compression technique, such as JPEG for color images and ZIP for black and white, to the foreground image. Choose this option when both file size limitation and search ability are important.
3. "Formatted Text and Graphics" will substitute the scanned image with searchable, editable vector characters, similar to the process of PDFMaker (a macro for converting Microsoft Office documents to PDF files) or Acrobat Distiller (a standalone application that creates PDF files by simulating a printer). If the OCR engine cannot recognize a word or the word is not in its dictionary, it will remain as a bitmap and is not converted to vector-based text. The file size will consistently be the *smallest* among the three options listed here. However, since the original image is replaced by "OCRed" text, mistakes are unavoidable. "Paper Capture" provides a utility for you to go over all suspicious words and correct them as necessary. However, the interface is clumsy by comparison to "Adobe Capture."

To better understand each of the file size reduction options mentioned above, an experiment was conducted. Ten PDF documents originally produced by Adobe Acrobat 4 were randomly selected. They were retrieved into Adobe 6 and then processed and saved with each of the options mentioned above. The results, shown in Table 4, provide a good comparison/contrast of these file-size reducing techniques.

As Table 4 indicates, the average size of a document reduced in size varies from a little more than 8 percent to close to 70 percent. If search ability is not a mandatory factor and all of your users are equipped with at least Adobe version 4 or higher, method B probably is the optimal option. If searching text is obligatory and you are willing to invest the time and effort to correct OCR "suspects," then the three Paper Capture options (C thru E) are good enough choices. You might want to experiment with all the options in any event and compare the quality of each, the times required and the consistency of results before committing to one method only.

INTEROPERABILITY

With more campus services and resources available electronically, how to make all these disparate and heterogeneous systems residing on

TABLE 4. File Size and File Saving Techniques

Document	Pages	Adobe 4	A	B	C	D	E
1	9	1232	919	533	493	342	301
2	9	798	800	465	431	241	225
3	6	331	333	230	198	94	67
4	1	104	107	64	107	95	80
5	14	1419	1421	1045	833	536	560
6	7	800	691	397	429	206	249
7	6	638	640	389	334	174	152
8	9	1380	1111	680	587	351	279
9	9	997	999	584	512	314	241
10	5	420	422	273	302	249	343
Average	7.5	108.25	99.24	62.13	56.35	34.69	33.29
% Change		0.00%	8.33%	42.60%	47.95%	67.95%	69.24%

Adobe 4–File sizes (in Kilobytes) for documents scanned and converted to PDF files using Adobe Acrobat version 4.

Experimental Methods (results in Kilobytes):

A–Saved file as "Acrobat 6 PDF File."

B–Saved file using "Compatibility with Acrobat 4.0 and Later Features" option.

C–Saved file using "Paper Capture with Searchable Image Exact" option.

D–Saved file using "Paper Capture with Searchable Image Compact" option.

E–Saved file using "Paper Capture with Formatted Text and Graphics" option.

multiple domains, running on atypical system platforms, with irreconcilable and incompatible metadata formats, managed by different system owners and requiring separate authentication, work seamlessly is a monumental undertaking. However, ERes can serve as a gateway to many course-related external resources to which libraries subscribe or generate. For the same reason, with proper configuration, ERes also permits other external systems to point to its resources at the course or article level. With such flexibility, libraries can decide the most efficient way to integrate ERes with its other resources based upon their local situation and needs.

Integrating ERes with Your Library's Online Public Access Catalog (OPAC)

Before electronic reserve, information on course reserve collections was kept in a library's OPAC. Patrons consulted their OPAC to find the

information and availability of reserve materials for their courses. With implementation of ERes, containing a subset of course reserves, libraries are facing a decision as well as dilemma. What is the best way to integrate the two independent systems? In many cases, the OPAC is still the place to look for traditional reserve items like books, multimedia reserves (audio/video tapes, computer software) and other objects. We actually have human bones on reserve in our Health Sciences Center Library. In a survey of ARL libraries, the capability of integrating with OPAC is one of the desired functionalities of an electronic reserve system (Kristof). Other authors echo this as well (Driscoll, Kristof and Klingler, Laskowski, Lu).

The 300-plus functioning ERes sites provide us with a glimpse of how libraries are dealing with this dilemma. As Table 5 shows, more than 80 percent of the libraries have a direct link from their main home page to ERes' main page. An additional 11 percent of the libraries provide direct links to ERes, but require authentication. In such an arrangement, a library has two options in dealing with reserves:

1. Maintain a dual system: Keep both ERes and OPAC as separate and independent. Patrons use ERes to find reserves in electronic format and consult the OPAC for traditional reserve materials housed in the library. This is similar to the situation of electronic journals, where some libraries maintain a separate A to Z list or searchable database for electronic journals. However, patrons still go to the OPAC for their printed journal collection. Maintaining a dual reserve system requires less work for the library since there is no need to create any records or links between the two systems. However, a dual system will cause confusion for students. Some libraries do provide instruction on the difference between the two systems on their Reserve website.
2. ERes functions as the single access point for both electronic and traditional reserve materials. There are links from ERes course pages to item records in the OPAC for traditional reserves. At Saint Louis University, we are in the process of implementing this option.

A minority of libraries, as Table 5 illustrates, prefer that the OPAC remain the single system for all reserve materials. There is no direct link from the library's home page to ERes' main site. Instead, patrons will find and link to ERes items through OPAC. Some libraries, for copyright reasons, further require authentication before patrons can reach the

TABLE 5. ERes and Library OPAC

Accessibility	Sites	Percentage
Link to ERes from library's home page with no restrictions	259	83.01
Link to ERes from library's home page with a logon requirement	36	11.54
Access to ERes through library's OPAC. No direct link to the ERes site.	10	3.21
Access to ERes through OPAC with logon requirement. No direct link to ERes site.	7	2.24
TOTAL	**312**	**100.00**

ERes course item. With ERes' MARC Writer utility, a library can generate bibliographic and item records containing URLs of specific ERes items in any of its 856 fields. These records can then be uploaded into the OPAC database.

Supporting a single point of access to reserve materials, either through ERes or the OPAC, requires additional staff time and effort to generate hyperlinks and maintain records on both systems. However, from the vantage point of patrons, it is simpler and more straightforward to locate all reserve items, no matter what their formats, through a single system.

Integration with Other Library Electronic Resources

Several authors discuss the desire of linking their library's electronic reserves system to other commercial resources to which their library subscribes (Armstrong, Cody, Kesten, Smith, Sylvester). With increasing chunks of library resources already earmarked for acquiring, processing and facilitating access to licensed electronic resources, how to efficiently utilize these resources and to link them effectively with existing library systems, for ease of access and interoperability, is "the next big thing" on the table. In his article on their operation of "deeplinking" to online resources from electronic reserves, Warren points out various incentives for linking to library paid subscriptions to full text articles:

- Saving copyright costs. This is especially true considering the recent hike of copyright fees in general.
- Efficient use of subscribed resources for which the library has already paid.

- Reduce duplication of effort. With full text already available online, there is no need for a library to redigitize its articles repeatedly.
- Higher quality of images. The library does not have to rely upon a downgraded photocopied version of its material for scanning.
- Accessibility to patrons with disabilities.

Nevertheless, there are innumerable complications related to each of the above goals and operations. For example, the identification of the structure a vendor used for their URLs, variation of reliability and stability across URLs amongst vendors, basic quality control and staff training are just a few of the ongoing hurdles to overcome. Additionally, compliance with contract agreements between commercial vendors is necessary to configure ERes at certain levels to enable authentication for patrons from non-institutional IP addresses. The placement and location of authentication varies. Some libraries place it at the reserve main entrance level (Nackerud, Walter), while at others it dwells at the level of each article itself (Armstrong, Cody, Laskowski, Sylvester, Warren).

Interpenetration with Courseware Systems

In higher education, traditional classroom instruction is now complemented and supplemented by online course management systems such as Blackboard and WebCT. ERes Server can be configured to establish a "one-way trust," so that the traffic coming from Blackboard or WebCT does not require the regular ERes logon prerequisite. At SLU, we support both Blackboard and WebCT. Therefore, our ERes Server is configured to accept links coming from both courseware servers. Some of our faculty members use one or both courseware systems in conjunction with ERes. They leave all the work related to library reserves, such as scanning, copyright clearance and so forth, to the library. Our reserve staff provides faculty with ERes URLs to include in their course pages on Blackboard or WebCT systems. Their students access ERes reserve materials directly from the links posted on their Blackboard or WebCT course sites. It all works like a charm.

CONCLUSION

The success of the ERes operation requires a dedicated teamwork approach committed to making it work across disparate functional units

and to the satisfaction of a diverse end user base. When we implement a new system, such as ERes, we not only need to ensure that we have adequate hardware, infrastructure and instructional technology expertise, but we also need to adjust our organizational structure, workflow and staff skill sets responsively and responsibly.

From Instructional Technology's point of view, minimizing downtime and maximizing our system resources required tight server configuration, highly effective patch management practices, tamper proof security settings, scheduled backups, regular file archiving, constant disk cleanup and decent documentation. Producing the best quality output possible requires well-dressed scanning equipment and right-thinking software applications. Instructional technology personnel need to work cordially with reserve staff to identify the most efficient workflow and to resolve any technical concerns. Open communications is more than just a buzzword and free exchange of information facilitates ERes operations efficiently so that further innovations are constantly encouraged.

NOTE

1. To join the Docutek Users Group, simply send an e-mail to: usergroup@docutek.com with the word "Subscribe" in the subject field. Unfortunately, because of our Web site reorganization, if you had already subscribed to the Users Group you will need to subscribe again.

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