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Computer Network Security and ARL Libraries

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ABSTRACT:

This article will review current recommendations for computer security practices for staff computing, summarize current practices in US Association of Research Libraries and propose further areas to explore.

Computer and network security has become more and more a part of academic libraries list of concerns. Libraries collect information about their patrons that must be protected and kept confidential. They also utilize many different types of networked applications for the creation, storage, retrieval, and dissemination of information. There have also been an increase in the number and the variety of attacks and reasons why an individual would attempt to break into a computer network. Access to the machines to turn them into drones for other attacks is also a malicious goal of some attacks, ignoring what data is available on the machine. Academic libraries must have a security strategy for prevention and that strategy must include cooperation with other entities, solid risk assessment, efficient technological solutions, strong policy, and education of their staff and faculty. The authors' focus in this article is on implementing these for you staff computing, not in public computing areas such as computer labs or research stations; however, much of what is presented is applicable to the public arena.

Security Strategy for Prevention

The 2002 Federal Information Security Management Act (FISMA) established requirements for federal agencies policies and practices on information security. EDUCAUSE has also developed a series of documents outlining security practices for higher education on their website at <http://www.educause.edu>. The strategies for creating a secure data environment include common threads of cooperation, risk assessment, preparedness, and protection. The first step is developing cooperation between entities responsible for technology and technology policies. Assessing the potential for security risks, developing policies that address the risks and procuring and implementing

technology that reduces risks are the next steps. This is followed by educating faculty, staff and students about the policies and procedures that have been put into effect and how they contribute to a secure environment.

Cooperation

Managing network security in the library requires cooperation among computing areas to put into place policies, technology and technology practices that will reduce threats caused either intentionally or unintentionally by people using computing resources. This cooperation extends to federal, state and academic units. This is important since networks, like other utilities, cross jurisdictions making it possible to launch attacks from both inside and outside the organization. Within the university, the library must coordinate technology practices with other information technology units. “The only way to effectively protect against a cyber attack is by establishing strong risk management policies and procedures that bridge gaps between units within the enterprise.” (“RMs have ...” 2002) Working together, staff from the libraries and other campus units can identify and assess risks, develop policies, and design and implement hardware and software based security systems that eliminate many of the threats. These solutions incorporate best practices for managing data and hardware. Human networking is also an important part of the process. Informal and formal connections between staff working in other areas can assist in the troubleshooting of problems, consolidate training for information technology staff, and reduce reaction times when security incidents occur. It can also help increase the physical security of the in-house systems by controlling access to systems to trusted individuals.

Risk Assessment

In a time of tight budgets no administrator wants to waste dollars on prevention of risks that are unlikely to occur. The identification of risks should ideally be done before policies are formulated. “During the risk-assessment phase you should: identify your important assets (firewalls, e-mail and Web servers, as well as your data); identify the threats they are exposed to; perform a vulnerability assessment to understand current risk levels; identify the costs of rectifying vulnerabilities vs. the cost to repair an attack should one success-fully destroy/steal data, or otherwise render your network inoperable; and take into consideration negligence lawsuits, due to the inadvertent exposure, theft or loss of client data.”(Ellis 2003) Another factor is the damage to an institution’s reputation when resources are compromised. It is an important factor that shouldn’t be ignored, although it can be difficult to calculate the cost of damage to an institution’s reputation.

To determine the probability of an attack it is helpful to look at recent statistics on actual attacks. A 2004 survey conducted by CIO Magazine and PricewaterhouseCoopers included 8,100 IT security professionals. It provides general information on the current state of security across consulting and professional services (13%), government (10%), computer-related manufacturing and software (9%), financial services/banking (9%), education (7%), and healthcare (5%). “In terms the effects of attack, 50 % reported network slowed/unavailable (flat compared to 49% in 2003) and 44 % reported that e-mail and other applications were unavailable (down from 53% in last year’s study.) Twenty-five percent reported unauthorized outgoing spam sent from company servers (we did not ask this question last year) and 20 % listed OS programs or files were altered (again, question was not asked last year.) Only 37 % reported that records or files were

compromised, damaged or lost (combining customer records, employee records, confidential records, internal records) down significantly from last year (58%).” (Ware 2004)

For most libraries, the area of greatest vulnerability is database content that might include personal information on library patrons. The next vulnerable area is damage to operating system software or other virus-like attacks on library computers. The labor costs of dealing with compromised systems can be enormous when it is necessary for technical staff to visit individual computers and remove dangerous code, or rebuild servers.

Libraries will also be impacted by vulnerabilities in less obvious ways such as the amount of time staff spend dealing with spam e-mail or cleaning infected computers.

Calculating the potential cost of damage to library systems can be difficult. There are different formulas for expressing this risk. One commonly used formula is the total amount of loss to the institution times the probability that the event will happen. For example, a rare book housed in a secure location will have a low probability of loss but a high value. The formula would be the loss of a rare book valued at \$10,000 times a probability that a loss will actually happen of 1%, gives the damage estimate of $\$10,000 \times .01 = \100 . Overall, this might be evaluated as a small risk. However in the event that it was actually lost, the real cost would be \$10,000 plus the damage to the library’s reputation.

Another way to look at this problem is to consider system down time. In the modern academic library, down systems are more than an inconvenience, down systems cause a loss in productivity as staff are forced to find “off-line” work they can do while they wait

for the systems to come up. In addition, most patrons walk away when they discover the computer(s) are down. Using the previous formula we developed the estimated costs in Table 1.

**TABLE 1
ARL Library Data
2002-03**

Amount of Downtime	Median Combined Salaries & wages	75% Prod with 50% chance	50% prod with 50 percent chance	25% prod with 50% chance
1 day	\$2,785.59	\$348.20	\$696.40	\$1,044.60
4 hours	\$696.40	\$87.05	\$174.10	\$261.15
1 hour	\$348.20	\$43.52	\$87.05	\$130.57

According to the 2002-2003 Association of Research Libraries (ARL) statistics, the median expenditure for library staff in a university library is \$724,253. (Kyrillidou and Young 2002, p. 41) Table 1 illustrates how the calculation changes as dependency on automated systems increases. The 50% probability factor was taken from the CIO Magazine and PricewaterhouseCoopers survey. (Ware 2004) The first column shows the combined salaries of staff for one day, four hours and 1 hour time periods. The second column indicates the cost if the staff are able to continue to work with 75% of their productivity. The fourth column shows an estimated cost if the staff could only be 50% effective. The final column shows the calculation if the staff can only be 24% effective. As predictable, the cost increases dramatically with the dependence on technology and the length of down time. This is just one measure of potential risk. A complete picture of losses would include any additional factors that were identified during risk identification.

Policies can be put into place that will articulate the institution's regulations and expectations for computing behavior once risk assessment has identified the greatest

areas of vulnerability and targeted the areas of greatest loss. These policies will provide the foundation for selecting security technology, developing procedures for handling data and hardware, and for educating staff on acceptable computing behavior.

Policies

Information technology policies are the cornerstone of a security program. They must provide clear information to those using computing facilities and data about what is and what is not acceptable behavior. These policies will both inform people on acceptable computing practices and provide the basis for enforcement in cases of non-compliance. The CIO Magazine and PricewaterhouseCooper 2004 survey indicates that organizations are increasingly developing policies to address security. “Eight percent of those surveyed said their organization had no formal security policy, down slightly from 10 percent reported last year.” (Ware 2004)

Effective policies must be in a format that can be easily communicated with very unambiguous wording on acceptable and responsible behavior. They should be written in plain English that requires minimal interpretation, more like “10 commandments” instead of a large manual that would only gather dust. (Nicolle 2004)

Technology

Technology is often the first choice to solve the security problem after an organization is attacked. The 2004 CIO Magazine and PricewaterhouseCoopers survey indicates that expenditures for information security are consuming a larger portion of expenditures for technology. “Infosecurity budgets remained relatively flat compared to last year;

however, infosecurity budgets as a percentage of the overall IT budget rose slightly (3% on average) from 10.93 percent in 2003 to 11.27 percent in 2004.” (Ware 2004) On university campuses security includes on-site departmental computers and personal computers that students and faculty bring to campus. Technology based solutions try to address both of these areas by protecting the network and individual resources on the network through a combination of hardware and software solutions.

Security does not stop at the physical boundaries of the campus. Most universities support telecommunicating activities for their staff and students. This is particularly important for universities engaged in distance education. This requires security to authenticate and control off-campus access to private information. Another growing concern is managing lap-top computers that may carry sensitive information when employees store confidential information on their personal computers for work purposes. This information is then transported back and forth from home in and out of the campus security measures. Five years ago, this would have been about 5% of the users, but now it could be close to half. (Conry-Murray 2002) Although off-campus computers are outside the direct control of the university, campus data is certainly under the protection of the university and should be covered by security policies. This problem is beyond the control of most technology based solutions but it can be addressed with policies and staff education.

Education

Most security holes in a networked environment are not technological ones, but human ones. A majority of those holes are created unintentionally by users not understanding

fully the policies that are in place, or not knowing the consequences of their actions.

“Although there are many methods and tools for breaking into systems, a vast majority of attacks are aimed at what are likely the weakest and most easily exploitable aspect of your security—human users and well-known software bugs.” (Banerjee 2003) This is one reason why the federal government put emphasis on training in FISMA. “FISMA requires agencies to provide security awareness training to inform personnel, including contractors and other users of information systems that support the operations and assets of the agency, of information security risks associated with their activities and their responsibilities in complying with agency policies and procedures designed to reduce these risks.” (USGAO 2005 p. 18)

Too much reliance on technology based solutions can lead to staff complaisance about security; the attitude that security is someone else’s job. “Higher education offers many examples of security incidents leading to confiscation of hardware by federal authorities, loss or corruption of critical research data, and worse...most could have been prevented with better education.” (Payne 2003) An educated staff and library clientele adds an additional layer of protection by creating a “human firewall” against social engineering ploys used in computer attacks and unsafe activities that would compromise security. “Employees can play a big part in keeping sensitive information inside the organization and out of the wrong-hands. But without the proper education and training, a well-meaning worker can negate the success of your security products.” (Coe 2003)

There are two goals for a staff security education program: first to generate a culture of security vigilance- where it is second nature to be aware of concerns for privacy and

protection of information resources, and secondly to cultivate cyber ethics. Cyber ethics often gets lost in the fast moving world of technological developments. An individual who would never consider shop-lifting a CD from a store might nevertheless think nothing of downloading copyrighted music or movies off the Internet. Education about the importance of intellectual property rights and acceptable computing behavior is becoming just as important as showing people how to use a database.

A network and data security education program should include topics such as:

- good password practices
- safe email habits on how to avoid viruses, scams and hoaxes
- applicable policies on computer use from the university, local, state, and federal levels including HIPAA, Gramm-Leach-Bliley, and the Patriot Act information
- related physical security aspects such as needing ID proof, with no exceptions, for access to restricted areas or preventing unauthorized viewing of screens containing protected data
- what to do in the case of an actual computer emergency such as a wide spread virus infestation
- requiring proof of identity before providing or confirming patron information to a patron

A successful education program will concentrate on explaining the reasons for having certain policies and why certain behaviors are considered “bad” as much as informing users on what the policies are, and defining unacceptable behaviors. A successful program not only improves security at our institutions, it may actually reduce information

technology costs as other IT training has proven. “The positive impact of formal user training has been shown by a study of NHS staff in Manchester who have achieved the qualification, It found that the number of people calling regularly on IT support dropped from 71% to less than 5%. In addition, these staff were saving an average of 38 minutes a day because they were no longer struggling with IT.” (Kavanagh 2004)

Survey of ARL Libraries

In light of current recommendations for information security programs the authors sent a survey in March of 2005 to 100 academic ARL libraries in the United States to solicit information on security practices in their institutions. Thirty-four institutions responded for a 34 % response rate. This survey revealed some interesting trends among the ARL academic libraries.

Only 6% of the ARL libraries responding to the survey reported that they had no security policies. This is lower than the 8% reported in the CIO Magazine and PricewaterhouseCooper survey. Eighteen percent reported that decisions or policies were made by a central authority at their system-wide or state level. Fifty-three percent reported that policies were formulated at the campus-wide level, with 6% reporting responsibility at the library level. Thirty-two percent reported a shared responsibility between multiple units. Since most libraries do not control all the vulnerable points of security, it is imperative that staff in the library coordinate and work closely with IT staff from the campus.

Libraries are struggling with ways to control threats to systems while supporting beneficial flexibility in computing. A combination of software and hardware technology is being employed to protect sensitive data and the network infrastructure. Table 2 summarizes the technologies employed by the libraries responding to the survey.

TABLE 2

ARL Academic Libraries Security Technology	% of All Respondents
Automated anti-virus updates	100%
Automated operating system patches	88%
Using profiles and permissions to restrict activities	88%
"Turning off" functions/features	82%
Password expiration	79%
Requiring complex passwords	79%
Filtering extensions in E-mail	71%
Networked based security	68%
White lists of allowed executables	38%

These results show that ARL libraries are doing what they can, as far as using technological solutions. The majority of respondents were doing every technological aspect that the authors asked in the survey, except using “white lists” of allowed executables. White lists are lists of programs that are explicitly allowed to run on a computer. Programs not on the white list will not be allowed to run. For example, you could put a web browser, word processor, and the automated library system client in the white list, but leave out everything else to lock down a computer. White lists are often easier to define than black lists, or lists of prohibited executables, but it does cut down on the flexibility to make changes in software packages on that computer.

Education is another area where libraries are making progress. Six institutions (14%) reported that they had some type of required education on security. Table 3 shows the areas covered during instruction and the percentage of libraries reporting training in that concept.

TABLE3

ARL Academic Libraries with Education Programs	% of Libraries with Education Programs
Information on academic (university) policies/regulations that affect personnel.	100%
Information on library policies that effect personnel.	100%
Privacy and confidentiality of personal information.	100%
Password security including tips or requirements for strong passwords.	100%
Information of computer viruses.	83%
Information on email scams and hoaxes.	83%
Patriot Act procedures.	67%
Information on federal/state laws and regulations that affect personnel.	50%
Security hazards or restrictions on installing “free” software from the Internet.	50%
Information on Spyware and/ or Adware.	50%
Institutions requiring sign-off documents	33%

Of the institutions who reported they had education efforts, we found that the focus was mostly on policy. All education programs had curriculum that included university and library policies. All institutions also reported covering privacy, confidentiality, and proper password protocol. A majority also gave information on network security topics

such as computer viruses, email scams and hoaxes and Patriot Act procedures. Only one half discussed federal and state laws and regulations which may leave staff without a complete picture of their legal obligations. Also only being covered by half was distributing information about possibly hazards of installing software that had not been investigated and could be spyware or other malicious programs

Only a third required their staff to sign-off that they had participated in security training. Having a signed document gives administrators better footing if employee discipline problems arise, preventing a scenario where a staff member could claim they did not know their responsibility to protect their password or that the records they worked with were confidential.

One important finding from the survey is that training in security seems to have similar benefits as general technology training. Respondents to the library survey that have no mandatory training covering security estimate that they spend an average of 20 hours per week on security issues. These issues included updating software, virus cleaning, managing passwords and training. Libraries with mandatory education programs reported an average of 10 hours per week. That is a fifty percent reduction in technical support for libraries with security education programs. This survey covered a small sample of libraries but it is certainly worth further research to verify that staff education programs helps to counteract the increasing cost for security. One specific example is at the authors' home institution where a security education program was implemented. In the year after the program was instituted, virus and other malware infestations were down 39% from the year before the program was instituted.

Conclusions

Libraries are becoming more involved in the security area, not only as users of networked resources, but also as repositories of protected or confidential data. A comprehensive security defense relies on cooperation between technology units and requires risk assessment, sound policies, technology and education. Our survey reveals that libraries are cooperating with other units and are beginning to respond to the educational challenges posed by security questions. Our survey also suggests that a strategy that emphasizes using education as an important element can improve security and reduce the labor costs associated with security. Libraries have always embraced their call to share information, but they must also be cognizant of their responsibilities to protect information and the systems that information resides on.

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