1.0 Introduction

Over the past twenty years, computers have increased in number and importance in libraries. [1] At first, many librarians, administrators, and patrons considered them to be frills, but now computers are relied upon to an ever increasing extent, both for access to information and to support library management functions.

The nature of the computer systems used in libraries has changed greatly throughout the years as well. Large-scale computer systems, such as mainframes and minicomputers, dominated the library scene at first. When personal computers (PCs or microcomputers) were introduced in the late 1970s and early 1980s, they gradually became the machines of choice for many tasks.

The contrast between mainframes and PCs is striking. Mainframes required highly trained support personnel who were schooled in the art of system management. Regular multiple backups, uninterruptable power supplies, air-conditioned rooms, regular system maintenance, and seriously applied security procedures were the norms.

Microcomputers, on the other hand, were placed on the desks of end users and managed by them. Many of these people picked up their computer skills on the job and did not have a grounding in the finer points of computer system management.

When PC networking became popular toward the middle of the 1980s, it allowed libraries to approximate the capabilities of large-scale systems using cost-effective microcomputers instead of expensive centralized processors. Users could share expensive peripherals, such as laser printers, and make use of sophisticated email and office productivity products. Networked PCs provided great flexibility in terms of licensing and sharing software.

As an end-user technology, networks tended to spring up outside of the traditional systems "shop" in many organizations. Employees were chosen to manage networks based on interest rather than training. On the one hand, this allowed networks to grow faster than they might have otherwise, since their managers and users were not trapped in the expectations and mind-set of traditional computer system managers. On the other hand, many of the people managing the new technology lacked the background in system management practices which had been developed over many years by the managers of large-scale systems.

Complicating matters, more and more applications were moved to
Complicating matters, more and more applications were moved to the new PC networks. With the advent of CD-ROM networking in the late 1980s, libraries began building vast collections of data on PC networks. Initially, most of the electronic products mounted on networks duplicated paper products already housed in the library. As the technologies proved themselves, libraries began canceling paper subscriptions and relying on electronic access alone. The networks became so important that when they occasionally went down, patrons' pursuit of information was seriously impeded, and administrative and technical services operations were paralyzed.

2.0 The Perils of Downtime

The result of all this growth and dependence has been the realization that computerized systems have become mission-critical to library organizations. If the systems do not perform well, patrons do not have access to important bodies of information, and employees are idled.

Unstable systems can lead to many problems for the library. If library systems are not perceived to be reliable, users may simply bypass the library altogether. User constituencies, such as departments in a college or university, may decide to create separate collections of information resources or may deal directly with an information vendor rather than working through the library.

The result for the library is a weakened position and a decreased ability to gain the resources necessary to grow. The institution loses resources due to inefficiency in the purchasing and licensing of information sources and possible duplication of effort and materials as both the library and the department build separate collections. Users within the "rogue" department lose since they do not have access to trained librarians to help them develop the expertise necessary to make the best use of information products.

In the electronic age, the bypassing of the library has become a greater problem than in the past. CD-ROM networking and the World Wide Web (WWW) have made it easier and cheaper to create vast virtual collections of information and to make them easily available to a wide audience. Libraries should be alert to the problem. Many vendors are perfectly willing to market directly to users, cutting libraries out of the transaction.

Competition from groups inside and outside of library parent organizations can be encouraged when a library's electronic systems are unstable. With the move to advanced information technologies, libraries are beginning to encroach upon the perceived turf of computing centers and information technology departments, and vice versa.

3.0 Maximizing System Reliability

There are many factors affecting the actual and perceived reliability of a library's computer systems. Some are under the control of the library, while others are not. The library must strive to control those factors that it can and to make the proper decisions to minimize the potential damage from factors.
that are beyond its control.

The major factor under the control of the library is the creation of a satisfactory in-house computing environment by developing a good system support staff, instituting proper routine system management procedures, and selecting and installing quality hardware and software components. The library has less control over external factors, such as the quality of vendor data products and the networking infrastructure of the organization as a whole.

3.1 Computer Support Staff

Development of a professionally oriented computer support staff is at the heart of constructing reliable, bulletproof information systems. A professional orientation is important whether the staff member is a librarian, technician, or student worker. Staff members with a truly professional attitude have good knowledge of industry trends and products, have the desire to continually develop their skills, and have the ability and desire to manage systems to meet high standards. Professionalism can be encouraged in a number of ways.

3.1.1 Training

Technology in the computer field is developing rapidly. In order to develop and maintain a highly reliable system, the support team staff must continually be retrained. Staff members should be encouraged to take advantage of all appropriate training opportunities. They may include short, two or three day commercial seminars (expensive, but highly concentrated doses of knowledge and hands-on training), training sessions held at trade shows, vendor-provided training, and training sessions sponsored by the library's parent institution.

College and university courses are another good source of training. Staff at libraries in academic institutions should check their course catalogs to see if appropriate courses exist which may be audited by employees, usually at little or no charge. Community colleges frequently offer hands-on courses in specific technologies or products (such as programming, multimedia development, and networking). These courses are semester-long, and can offer extremely in-depth instruction at a reasonably low cost, particularly when compared to the commercial seminars mentioned above.

The library should also ensure that the support staff has a good supply of third-party books on products that are being used in the library. Vendor-supplied documentation is becoming skimpier and free support is almost a thing of the past. Books may provide the best and cheapest sources of answers to technical support problems.

The WWW is another good source of information, particularly for vendor-specific technical information. Microsoft, for example, offers free support for Windows 95 through its Web pages.

3.1.2 Certification
Hand in hand with training goes certification. Certification carries with it a certain amount of prestige and marketability. Of course, well-educated, certified staff will cost more to retain.

3.1.3 Participation in Professional Groups and Listservs

Libraries frequently make the mistake of treating their nonlibrarians as nonprofessionals. Computer support staff should be encouraged to join professional organizations. Travel funds (full or partial) and release time should be provided to allow computer support staff to attend meetings and conferences.

3.1.4 Industry Trends

Systems personnel frequently fall into the trap of managing on a day-to-day basis while not keeping up with industry trends. A computer support team will not be able to build stable, reliable, up-to-date systems if they do not know what products are available, what standards are currently popular, or what companies are in danger of folding. While librarians are generally expected to keep up with trends in the library profession, it should be a condition of employment that computer support staff members set aside some time to at least scan the trade literature on a regular, ongoing basis.

3.1.5 Ethics

Another important aspect in the development of a professionally oriented staff is the encouragement of ethical behavior on the part of staff members. Membership and participation in professional groups, course work, and certification programs will all help to develop an awareness of ethical issues in the area of computing. Libraries have particular needs for computer support staff who have an understanding of the importance of privacy and copyright issues.

3.2 Methodical and Aggressive System Management

The computer professionals who ran library mainframe and minicomputer systems learned the importance of good management techniques in providing stable computing environments. Centralized processing systems were relatively simple systems in comparison to today's PC networks. There was only one CPU (Central Processing Unit) to worry about (workstations were dumb terminals), there was generally a single standardized application (the online catalog or integrated system), and communications networks were uncomplicated.

Microcomputer networks are much more complex and chaotic. There are numerous CPUs (each workstation is a separate computer), many applications are run simultaneously, and the networks themselves have gotten extremely complex. There are far more factors interacting and potentially many more problems. For these reasons, good system management practices are more important than ever.
Follow the KISS Principle: Keep it Simple, Stupid! Don't make a system more complex than it already is. Wherever possible, use standard hardware and software configurations across the entire network. Standardizing on a particular piece of hardware rather than buying based on price or momentary personal preference will pay off in lower support costs and a more manageable system. There will also probably be an increase in buying power since orders to a particular vendor will become larger and/or more frequent.

Of course, even when a library standardizes on a particular product, technology is constantly evolving. Today's model XYZ network card may have a different ROM BIOS version than one made just last month. Even so, sticking with a single vendor and model will result in fewer support headaches than will be the case if the library mixes multiple manufacturers and products.

One of the main concerns when selecting a standard component is quality. The product life cycle in the computer industry is short. If you follow the leading edge at some distance, prices will fall dramatically without necessitating the purchase of low quality, no-name products. Select items from major manufacturers. Magazines such as PC Magazine, PC Week, and InfoWorld all provide information on product quality. With some items (laser printers, expensive scanners, and laptop computers), it pays to buy maintenance plans.

Software is another area in which the adoption of a standard is important. The job of providing support for word processing, for example, is made much more difficult if one must deal with several different word processing packages with various revisions of each product. Rather than allowing each individual to decide on which brand or version of an application to use, set up a committee to evaluate products with the condition that a single product be selected for use throughout the network. Then be sure to update the product on a periodic basis and support it with training.

It is also important to develop standards for organizing the network. Develop a standardized file and directory structure and stick with it. Use available tools to restrict the places where users may deposit files and periodically encourage them to delete unused files. System managers should also purge the network of unused and unneeded files on a regular basis. Some people are of the opinion that lower disk storage prices mean that the effort expended to clean clutter is no longer cost-effective; as disks fill up, they simply purchase more space. The result is a chaotic system choked with excess files in which it becomes easier to lose files. Applications slow as it takes longer to read through directory listings. Backups take longer and more tapes are required. The moral: keep your directory structures well organized and clean.

Another important system management concern is security. All of the major networking systems provide extensive security tools. Be sure to use them. Users should be required to use passwords where appropriate. Minimum password lengths should be established and passwords should be set to expire on a regular basis.
Users should be given rights to the minimum number of areas required to do their jobs. Modern networked applications do not require that the user be able to write and delete files in program directories. Providing full access to these areas can have disastrous results as users change configuration settings, delete important files, or spread viruses throughout the network through a shared executable file. Users should only have full rights to a single private directory. Library employees may have one or two other shared directories in which they have read/write/delete capabilities. When an employee leaves, a mechanism should be in place to notify system support staff that they need to remove that account.

While some management tools are provided as a part of the network operating system, there are other tools which can greatly add to the utility of the system. These include menu systems, metering software (to keep track of simultaneous usage to meet licensing requirements), network monitoring utilities (to aid in troubleshooting -- especially to track bottlenecks due to overuse of bandwidth), and help desk software systems.

3.3 A System Based on Standards and Quality Components

As mentioned above, it is desirable to standardize on a minimum number of components when constructing a system. It is equally important to pay attention to industry and organization/campus standards when designing the system.

If a library's parent organization has adopted Ethernet as the networking protocol, it makes little sense for the library to run Token Ring. Have someone from the library involved in the organization-wide decision-making process. Once a standard is adopted, try to find a way to go with it. Since one of the strengths of the new technology is its ability to make information resources available throughout an organization, it is important to make sure that the library can easily interconnect with other systems on campus.

Following industry standards is important to avoid becoming trapped in a technology that is obsolete or that is never widely accepted. Mistakes in this area can be extremely costly. While libraries sometimes do need to be on the "bleeding edge" as they solve problems with computer technology, they should strive to adopt technologies that are as close to the mainstream as possible. Adopting the wrong technology can tie a library into a proprietary system with few choices of vendors. Being sure to follow industry trends through trade publications can help avoid this mistake.

4.0 Conclusion

Libraries have received many benefits from the microcomputer revolution. Exercising care in the management of information systems will maximize those benefits and help to avoid disasters.

Notes

1. This article is based on material presented by Arne J.
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