INTRODUCTION

Computer networks are essential to the operation of libraries. Networks allow staff to work by printing documents, cataloging books, and providing reference services. They also allow library patrons to use library services to search the library catalog and Web resources from within the library or at home. Without a functioning computer network, none of these things is possible. Patrons cannot access network resources within the library or on the Internet. Even the most traditional service, lending books, suffers when the library circulation system network is not functioning.

Since networks were first implemented to connect computer terminals to OPACs (Online Public Access Catalog), their importance to libraries has continued to grow. Although networks could not appear to become any more important, this will happen. The continuing development of information technology will make library networks even more crucial in the near future. During the next few years, one rapidly developing part of information technology, digital audio and video, will have an especially significant impact. The increasingly widespread availability of inexpensive products that enable audio and video communication through the Internet will create new ways to deliver information and new opportunities to enrich communication.

These technologies will also create major opportunities for extending and changing library services. Libraries, long the home of videotapes and music collections, are going to become sites for online access to video and audio. New audio and videoconferencing capabilities will be adopted to improve communication with other libraries and with library patrons. This is not a vision of a distant or uncertain future—many libraries already use these technologies.

To support library services, a network must do more than function; it must also provide a certain level of performance. Performance degrades if the network is poorly designed, poorly implemented, or because it lacks the capacity needed to support all its users. In these circumstances, the network may function, but the performance of network applications decreases.

These technical issues have a human impact. Libraries want to be the place where patrons come and use Internet resources. But patrons who come into the library to access the Internet may stop doing so if they find accessing Web pages takes a long time. Similarly, patrons who use electronic resources stored in the library will not be satisfied when retrieving that information takes a long time. The diminished quality of service from inadequate networks poorly serves library patrons.

The challenge of providing the right network to support high-quality library services grows when new multimedia technologies are used. Audio and video applications place significantly greater demands on networks. They both require more bandwidth than traditional applications and are more sensitive to network design than traditional media. A Web page will remain intelligible even if it downloads slowly, but audio conversations can become impossible if the time delay between speaking and receiving a response is too great.

Properly designed and implemented networks will be crucial for libraries to seize the service opportunities that audio and video technologies present, in addition to supporting current network applications. Librarians need to evaluate their networks and determine how well positioned their libraries are to meet present and future needs. This report provides checklists to use for planning and configuring networks.

Report Contents

The report begins by describing the types of applications that library networks will need to support, from traditional applications like Web browsing to new applications using audio and video. These applications are analyzed to identify what they require from a library network. The general performance requirements and specific bandwidth needs of audiovisual applications are highlighted. The capabilities of library networks should be judged by how well a network addresses the needs of available applications.

With these requirements identified, the report gives two networking checklists. The first identifies the primary components needed in library local area networks (LAN) or in the backbone and campus networks that join those LANs. These internal library networks provide connections among the computers in the library and connect the library's LAN to the network of its parent organization. The LAN checklist discusses the following LAN components: LAN protocols; the type of wiring used for the LAN; the structure of the wiring implementation in the library building; equipment that connects wires and computers together; network interface cards (NIC), network operating systems and servers; and wireless LAN access. The LAN checklist then goes on to cover the alternative technologies for backbone and campus networks.

A second checklist describes what is needed for Internet use. The checklist covers the following items: equipment needed to securely connect a LAN to the Internet; alternative ways of connecting to the Internet, from DSL (Digital Subscriber Lines) and cable modems to T-1 lines; IP (Internet Protocol) addresses; domain names; Internet Service Providers; and E-rate funding. The majority of attention is given to the problem of Internet access. Recognizing that high costs and limited availability of Internet access keep many libraries from being able to obtain the access they need, the majority of this checklist reviews the alternative Internet access mechanisms. Finally, the checklist is supplemented by a discussion of Internet2 and its meaning for libraries.

Each checklist identifies the principal components needed in its respective sections of the library network. The key components are explained so librarians can understand their role in determining how the overall network functions. If alternative approaches are available to supply this needed component, those alternatives are presented. Where alternative approaches exist, the alternative best able to meet the requirements noted in the section on library network applications is identified. In the description of each network component, the costs associated with each item are discussed.

In looking to the future and the need to support more use of audio and video on the network, this report will help prepare libraries for the

future. Plans to expend library funds require the purchase of equipment that can serve the library for several years, not just meet today's needs. But while the need to meet future needs is seen as necessary, this report does not recommend innovative technologies that would create more risk than libraries would want to assume. The recommended technologies in these checklists are in widely used and can both be purchased at reasonable levels of cost, and for which there is probably a reasonable level of expertise widely available.

The checklists are realistic in their assessments of the comparative ability of libraries to implement LANs with the support for high-performance applications and high-speed access to the Internet. The report makes clear that developing a high-performance local area network is easier than providing enough bandwidth to support audio and video applications over the Internet. The recognition of this difficulty and of the broader problem of the digital divide prompt this report's discussion in the checklists of the different ways to obtain Internet access.

The checklist includes a few innovative approaches to networking. These approaches are identified as future or leading-edge technologies. They have been included to make the reader aware of some trends in networking. They are also included to help librarians understand how research and development in new networking technologies have the potential to disrupt current patterns for how networks are built.

Some technologies or services are not covered by this report. The report does not discuss voice services. It does not cover the software packages needed to create Internet services software, such as World Wide Web or e-mail servers. In addition, the report does not cover dial-up services. Although these are offered by some large organizations, libraries are not expected to be the Internet Service Providers (ISPs) through which patrons access library services. Patrons are expected to obtain these services from commercial ISPs. Therefore, libraries are not expected to need to maintain their own modem pools.

Specific brands or models of equipment are not recommended by this report. Networking technologies continue to change, and new products appear all the time. If the report covered specific makes and models of equipment, it would quickly become out-of-date. Further, some network elements identified in the checklist can be implemented with varying levels of equipment; larger libraries may require different equipment than small libraries. The specific model required varies from one library to the next. To build a network requires a more detailed level of expertise to properly analyze the needs of an individual library and then select specific products.

Audience

This report is intended for librarians, not for technical networking experts and not primarily for systems librarians. It is written for the many librarians and library managers who need to understand the principal components of their network and how they affect the ability to delivery library services. It is therefore intended to help librarians become technically literate in this key area of information technology. This technical literacy is crucial if librarians are going to be able to communicate with the technical specialists who run the library network, to understand why those specialists

have made certain decisions about how to build a library network or to understand why they want to invest library funds to improve the network.

The report is written both for libraries that have control over their networking infrastructure, and for libraries whose networks may be under the management of the library's parent organization. For librarians lacking control over their network infrastructure, the checklist helps them understand what the network management organization is doing with their network and why.

Since the report is not written for technical networking specialists, it does not include technical details that would normally be found in a book written for that audience. Each of the network elements listed in the checklist has been the subject of many books. Technical detail such as detailed descriptions of networking protocols and how signals are electrically sent over network media are omitted.

Lacking this level of technical detail, the report doesn't equip its reader to act as a network engineer. Though the report promotes a greater level of technical literacy for librarians, it does not provide the level of detail needed to plan and implement a library network by librarians alone. This task must be undertaken by technical specialists with hands-on experience in networking. In addition to not covering many areas of networking at a detailed level, issues not covered in this report will affect how a network should be designed and how equipment should be selected. Among the additional factors to consider are the problems that result from manufacturers' varying implementations of standards.