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The Benefits of Wireless Technologies

Information Today [March 2002] The Systems Librarian

by **Marshall Breeding**

An increasing number of libraries are implementing or at least planning for wireless technologies. In this month's column, I'll present a brief overview of how it works--the equipment and standards that underlie wireless networks, and how it all compares to the wired alternatives. We'll explore some of the applications especially well suited for the wireless world. Finally, I'll talk about some library-specific applications.

Wireless basics

A wireless network operates just like a traditional LAN—except without the wires. Instead it uses signals transmitted over radio frequencies to enable computers to communicate with one another. To get started, you need to install what's called an access point, which will serve as a network hub for a group of wireless devices. An access point can support a finite number of mobile computers—the exact number depends on the model of the access point, but most support 8 to 16. The access point connects to your organization's physical network, typically through a 10 or 100 mb/sec Ethernet connection. The access point will be positioned to serve the widest area. Users that roam too far from the access point or that find themselves behind dense walls will lose their connectivity. We have found that our bookshelves fairly effectively block wireless communications. Through the use of multiple, well-positioned access points, a building delivers wireless connectivity throughout.

A person's computer needs to be equipped with a wireless network card in order to participate in a wireless network. These cards perform the same function as an Ethernet adapter, except that they have an antenna instead of a wire jack. Wireless cards are available for desktop computers, laptops, and PDAs. Given an access point in sufficiently close proximity, a computer with a wireless network card will establish a network connection almost invisibly to the user. Most wireless LAN's take advantage of DHCP (Dynamic Host Configuration Protocol) to take care of details such as assigning an IP address with no pre-configuration by a network administrator nor intervention by the user.

Wireless components have become quite affordable. Low-end access points cost from \$200 – \$500, with more industrial strength units priced somewhat higher. Wireless network cards for PC and laptops are typically about \$100.

While wireless LANs work well for mobile computer users with light to moderate data transfer needs, some network users with more bandwidth-hungry applications will find the level of bandwidth available to be inadequate. I can think of no circumstance where I believe that it makes sense to connect a server to a network using wireless rather than a wired connection.

The current standard: 802.11b

Standards insure that wireless networks that consist of components from several different vendors will work properly. Theoretically, cards manufactured by one company will work with an access point from another company. The current standard for wireless networks is known as 802.11b. This standard is in the same family as Ethernet, generally known by the designation 802.3.

Equipment that follows 802.11b standard will be capable of a theoretical data throughput rate of 11 mb/sec. This level of bandwidth is quite respectable, given that many wired networks continue to operate at 10mb/sec. The actual usable bandwidth averages about half the theoretical, though.

The previous generation of wireless networks operated at 2-3 mb/sec. Not surprisingly, wireless networks did not become popular until the emergence of the 802.11b standard that increased the data flow to 11 mb/sec. The emerging 802.11a standard, expected to find more common use in the next 1-2 years, will deliver data at 54MB/sec.

Still a Niche product

Despite the steadily increasing speed of wireless technology, wired networks will always outperform them by long strides. Today 100mb/sec Ethernet cards prevail in most business LANs, with Gigabit Ethernet (1024 mb/sec) finding common use as network backbones and for connecting high-performance servers. 10 GB/sec Ethernet for fibre-based networks is already on the horizon.

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Page 1 of 3

Given the inherently faster capabilities of wired networks, wireless networks will flourish where mobility takes precedence over performance, or where physical cabling is especially problematic. I've often heard wireless enthusiasts overstate its appropriateness and applicability. I remain convinced that copper and fiber-based networks are here to stay, though they are nicely supplemented by wireless technologies in some circumstances.

Security problems remain

Organizations that implement wireless networks have to consider the security implications. Wireless networks suffer from the same basic weakness as wired networks, where some unknown party might be listening in on the network conversation. Any information transported across a network must be encrypted to ensure that it remains private. The problem is amplified in wireless networks since anyone with the right equipment in physical proximity might be able to capture your network traffic, gain unprotected passwords, and launch an attack on your computers.

The 802.11b standard includes provision for protecting data transmissions through the use of encryption. The standard includes a security layer called Wired Equivalency Privacy (WEP) that uses a private key in its encryption. Many wireless networks have been installed without implementing this security feature. The security available on encrypted wireless LANs should be considered as weak, since it has recently been demonstrated that any third party capturing network packets off an access point can fairly easily determine the keys needed to decrypt network traffic.

The basic lesson for wireless networks is to avoid their use by computers with highly confidential or proprietary information. Assume that an unknown third party can intercept any information that isn't separately protected with strong encryption. As with wired network, never transmit a password that provides root or administrative access unless it is protected through strong encryption.

Library applications

Wireless networks have found a number of successful applications in libraries. A wireless LAN can be a natural extension to a library's existing wired networks. Many library buildings, for example, present difficulties to installing traditional network wiring. Older buildings provide few natural pathways for cables, making installation of a physical network prohibitively expensive. In such cases, providing wireless connections makes it possible to provide network connections at more affordable costs.

As more library users come to the library with their laptop computers, wireless networks provide the means to extend the library's electronic services to them. Many colleges and universities encourage—or even require—their students to have laptop computers. Wireless technologies can enable these students constant Web access as they roam from their dorm rooms, to the classroom, to the library. Wireless access points distributed throughout a campus become part of the network infrastructure. Students with wireless networked laptops can take advantage of the Web-based services offered by the library—the online catalog, research databases, electronic journals, e-books, and the like. In cases where most students have their own wireless laptops, the demand for public access workstations provided by the library diminishes.

Practically all libraries offer public access workstations that use a standard desktop computer with a wired network connection. Library users go to these fixed locations to use the library's Web-based services. This arrangement may not be well suited for the researcher that needs to spend extended amounts of time using these resources for research. Some libraries go beyond the fixed-workstation approach and offer wireless laptops that can be checked out and taken to carrels, study rooms or other locations within the library that are more conducive to thoughtful research and writing. Offering mobile as well as fixed public access computers seems to be a nice bonus in service that a library might offer to its clientele.

One of the interesting applications of wireless networks in public libraries that I've observed involved a mobile computer lab. This lab consisted of a dozen laptop computers each equipped with wireless cards that were easily transported along with an access point. This equipment could be set up in community centers, schools, or remote meeting rooms for use in computer workshops or other outreach programs offered by the library. The wireless equipment allowed the computers to be networked with each other and to the Internet.

Wireless computing also finds handy applications for library staff. Some examples that come to mind include performing remote circulation and inventory tasks. A library staff member might be able to take a wireless laptop that also has a barcode reader, to the bookstacks, for example, to scan in books as part of an inventory project. Most library automation systems have an inventory control feature that allows you to scan in all the books from a range, and then receive a report of books that are missing or out of place. Libraries often want to measure the use of books consulted in the library but not checked out. Having a mobile laptop connected to the library's automation system via the wireless network allows a staff member to record such use as books are collected throughout the library, saving a trip to the circulation desk.

WAP: the other wireless technology

In addition to computers and PDA's, cell phones can also be wireless devices. While the computers in a wireless LAN connect to an access point provided as part of the local infrastructure, cell phones rely on transmitters operated by the telephone companies. Most wireless phone services offer Internet connectivity, at a set monthly charge, in addition to voice communication. This service enables one to surf the Web, though on a tiny display. I understand that these services are enormously popular in countries in Scandinavia and Japan, even though they aren't quite as prevalent here in the U.S.

Through Wireless Application Protocol (WAP) cell phone networks can access Internet resources. Servers called WAP Gateways live within a wireless provider's infrastructure to enable Internet access. Web servers that intend to provide information to cell phone users must offer pages delivered in Wireless Markup Language (WML) instead of HTML. Web pages designed for computer monitors will probably not display in any useful fashion to the micro-browser in a cell phone. WML delivers pages of text optimized for tiny displays. Even within these constraints, very useful services can be offered.

The natural library application for Internet-enabled cell phones would be to provide access to the library's online catalog. If an individual can look up stock quotes on their cell phone, why shouldn't they be able to see if the library has the book they want to read?

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Page 2 of 3

Library-oriented products are beginning to emerge in this arena. Innovative Interfaces, for example, recently released a product called AirPAC, which enables a library to make its online catalog available to Internet enabled cell phones and PDAs. Expect other library automation companies to deliver wireless products in the near future.

I definitely expect the use of wireless technologies to grow in libraries. But like any other technology, wireless networking is appropriate in some circumstances, but not for others. Keep in mind the relative advantages and disadvantages of wired versus wireless technologies. Wires prevail when high performance is needed; wireless finds its niche where mobility is the top concern.

Permalink:

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Publication Year:

2002

Type of Material:

Article

Language

English

Published in:

Information Today

Publication Info:

Volume 19 Number 03

Issue:

March 2002

Page(s):

42

Publisher:

Information Today

Series:

Systems Librarian

Place of Publication:

Medford, NJ

Notes:

Systems Librarian Column

Subject:

Wireless networks

Record Number:

9643

Last Update:

2024-08-06 17:36:00

Date Created:

0000-00-00 00:00:00

Views:

1633

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