

Chapter 7

A Window to the Platform

OVERVIEW

This chapter discusses the issues you'll need to consider when choosing a network operating system—from cost and ease of operation through flexibility and interconnectivity. It also looks at how Microsoft products can fit into your school or district's network, as the sole platform or as a complement to your existing network operating system.

Once you have introduced the infrastructure necessary for networked computing, the potential of your technology program is limited only by the strength and flexibility of your platform—as defined by your choice of a network operating system.

Choosing a Network Operating System

Platform selection is a critical decision. If your school or district has an existing network, everyone will be concerned about potential downtime, the costs of reconfiguring the existing systems, and the capabilities of any new platform. Those schools and districts starting new networks face the daunting challenge of making decisions that will affect many users and maintainers of the network for years to come.

Whether your school or district is just starting out on its technology journey or already has a mature network in place, your choice of network software will be driven by similar issues: for example, flexibility, security, ease of integration and use, and cost, not to mention available expertise and the time constraints on your technology coordinators or technology-savvy teachers.

So how do you go about choosing the "right" platform for your network? Given the reality of often limited staff to support academic networks, you are unlikely to have the luxury of time to configure or troubleshoot a highly complex system. You'll also probably have difficulty justifying the cost of frequent platform changes to support new hardware or to compensate for the limitations of older systems.

Keep It Simple

It's easy to get carried away by the options available in platforms and operating system tools. Each tool on the market has (and aggressively advertises) unique strengths or key tasks it performs very well. Parents, teachers, corporate sponsors, and administrators may also have had positive experiences with specific platforms and want to add their preferences to your school or district's computing environment. The pressure to add more and more platforms can come from every conceivable constituent in your Connected Learning Community.

While mixing platforms can produce rich, dynamic computing environments, the resulting configuration and support needs may prove beyond the time or financial resources available in your school or district. If you are just laying the groundwork for your network, consider the time and financial savings of using a single platform. If you are working with an existing network, plan to bring in technology that can help integrate your heterogeneous environment while moving you toward the technology system you want in the future.

Ask the Right Questions

For tips on working with vendors, resellers, and consultants, see "Hiring a Consultant" in the August 1997 issue of *Microsoft K–12 Connection* at

<http://www.microsoft.com/education/instruction/articles/consultant.asp>.

Choosing a platform for your network goes beyond the technical details of minimum RAM or required server hard disk space. Depending on the level of technical expertise and financial resources at your disposal, you or your technology implementation team will probably seek advice from a software reseller or network consultant when making your purchasing decision.

When you speak to a reseller or consultant, keep in mind that it will be up to *your* technology champions

to maintain the system in the long run. Knowing the key issues to consider when evaluating operating system software, and asking the right questions, will give you the input you need to make an informed purchase. The table that follows outlines those key issues and questions.

Key platform issue	Key questions
Ease of use	Is the software easy to learn, use, and manage? Will users need to learn new interfaces, or can they take advantage of prior knowledge to get started right away?
Integration	Can the software be integrated easily with the existing network? Can it communicate with the computers and peripherals already in place? Can it provide all the necessary services for the users?
Cost	What are the up-front costs? Is licensing a factor? Are there other costs incurred when the software is deployed?
Communication	Does the server software include tools to link to the school's intranet and the Internet? If not, what else has to be bought?
Acceptance	Is this a tool that many people understand? Is there a wide resource base for assistance, configuration, and maintenance? Can the experience of parents and community volunteers be leveraged? Can students and staff communicate with parents and the community over the network?
Security	Does the platform support easy-to-use security tools that can be customized to keep students away from restricted resources and prevent accidental (or intentional) tampering?
Reliability	Does the operating system have a reputation for "crashing," or can it reliably interact with hardware and other software to provide a reasonably stable computing environment?
Flexibility and expandability	Does the product have the state-of-the-art tools necessary to meet the students' and staff's needs now and in the future?

The impact of the answers to these key questions on your platform choice depends on your school or district's unique situation. But to give you a basis for comparison and to support your decision-making process, let's look at the answers for Microsoft Windows NT Server and its related family of products. Along the way, we'll give you tips and information on how to implement these products in your network.

Evaluating the Windows 2000 Operating System

For more information about Microsoft Windows 2000, see.

For more information about Microsoft Windows 98, see <http://www.microsoft.com/windows98/default.asp>.

To learn more about Microsoft Windows Millennium Edition, see <http://www.microsoft.com/windowsME/default.asp>.

More information about mobile devices powered by Windows CE can be found at <http://www.microsoft.com/mobile/>.

The Windows operating system continues to grow and evolve. Today, Microsoft Windows 98, Windows 2000 and Windows CE are providing a stable, reliable platform for a large share of corporate and academic servers and desktops around the world. Windows-based solutions for every kind of information delivery — from pocket PCs running Windows CE to laptops and other devices running new enterprise-level applications — are and will be a significant part of the world's information infrastructure. This strong presence and potential for the future translate into a good choice for your students today.

Ease of Use

Is Microsoft Windows 2000 easy to learn, use, and manage? If you've been exposed to the Windows 98 interface — or even the older Windows 95, Windows 3.1 or Windows for Workgroups — you've seen the basic interface for everything from user administration to printer configuration. Those who have had little

or no exposure to Windows but have worked with the Macintosh operating system will also find themselves at home with a minimum of retraining. This consistency of interface reduces learning time and increases the likelihood that administrators can be brought up to speed with lower investments of time and money.

For information on how to set up a school network running Windows 2000, see TechNet for Education's "Installing Windows 2000 in Education" at <http://www.microsoft.com/technet/education/0100home.asp>. Setup, management, and many periodic maintenance tasks can be completely automated by using step-by-step administrative wizards that guide even novice users through key procedures. Windows NT Server also supplies ready-to-run tools for dial-in remote server control and provides a central control point for your entire network.

Integration

Abandoning your existing network components for new products isn't a practical alternative, from a financial or an educational point of view. But adding capabilities to your network by expanding to new platforms is a realistic strategy if your school or district has a large investment in existing servers, clients, and software.

For tips on integration between Windows NT and NetWare and UNIX servers, see " Learn how to use technologies Microsoft provides in order to manage Windows 2000 integration with Unix and NetWare " at <http://www.microsoft.com/TechNet/events/winter/tnq30011.asp>.

Windows 2000 offers the expected seamless compatibility with Windows 98/95 and Windows for Workgroups clients. In addition, the operating system supports the integration and sharing of services (such as messaging and printing) and data between Novell NetWare, AppleShare, and Windows server and client computers. The Windows 2000 Server platform also offers full support for UNIX and OS/2 servers and clients and supports a wide range of peripherals from literally hundreds of manufacturers.

Cost

The rapid rise of new technologies—and their equally rapid obsolescence — has led to a new approach to assessing the cost of computing. Rather than focusing strictly on price tags and depreciation, technology professionals are taking a more global approach to measuring and managing expenses. The new approach, called *total cost of ownership* (TCO), examines the relationship between how much the product costs originally, its installation and maintenance expenses, productivity gains and losses, and its overall value in terms of getting things done. In other words, how much performance are you getting for your money, from installation through user training, equipment maintenance, and ongoing support?

For more information on TCO and a case study of how TCO was used to justify the cost of a conversion to a Windows network environment, see

http://www.microsoft.com/education/instruction/articles/winnt_BRG.asp.

Calculating total cost of ownership. Total cost of ownership calculations are not going to give you an exact figure to target when you browse for network operating systems. Rather, your focus should be identifying those products that *reduce* the total cost associated with installing, maintaining, upgrading, and using the product. These cost savings can also be expressed in terms of productivity gains—realistic savings in time or significant gains in the ability to complete tasks. In the realm of network operating systems, a product with a lower TCO should do the following:

- Provide centrally managed upgrades for clients and servers, including automated licensing or version control tools
- Require a minimum installation time
- Require the minimum in training for novice users
- Include complete, accessible performance support through manuals, online help, and online support tools such as wizards and troubleshooting applications
- Provide a broad spectrum of services to meet your school or district's needs without additional software investments

Communication

For the latest features in Internet Explorer, see <http://www.microsoft.com/ie/>.

To read about deploying Outlook forms to enable unprecedented communication and collaboration in a

school district or institution, go to <http://www.microsoft.com/technet/education/0500home.asp>.

For an example showing how the Department of Education Training and Employment, (DETE) for the State of South Australia uses Outlook forms to manage communication and collaboration among more than 1,000 schools, go to <http://www.microsoft.com/technet/education/maydetpr.asp>

Another key factor to consider when choosing a network operating system is its ability to let students and teachers communicate with each other and access the Internet. Windows 2000 includes all the software necessary to access your TCP/IP-based intranet or the Internet, plus tools for setting up a school site on the World Wide Web. These tools include Microsoft Internet Explorer, Internet Information Server, and FrontPage. The latest versions of these programs provide unparalleled access, security, and features for introducing students to the Internet.

Acceptance

The Microsoft Windows platform has emerged in recent years as the most-used software platform in the world, serving as the interface to 87 percent of the world's computers. This translates into a greater variety of products and expertise available to assist you in your network development and administration. Parents working in technology-rich business environments are very likely to have experience with Windows and may have direct experience with Windows 2000 and its predecessor, Windows NT. Vendors of support services, software, and other infrastructure products have also followed the success of Windows 2000 and offer a wide array of products to help your school or district reach its technology goals.

Security

For the use of Active Directory in controlling and enhancing the security of a Windows 2000 environment, see <http://www.microsoft.com/TechNet/education/0200home.asp> Given a networked computer and enough time, many students can find a way to make network administrators' lives a bit more interesting. Academic network administrators should be prepared to cope with system files disappearing mysteriously, unusual display settings, and the occasional attempt to change a score on the last history exam. Your choice in network operating systems should give network administrators easy access to tools that help them stay one step ahead of overly "creative" technology-savvy students. A technology coordinators have used the Active Directory and related tools supplied with Windows 2000 to provide a consistent, secure interface and controlled file access for their students.

Taking Advantage of the Internet

Until recently, your computing platform needed to extend only as far as your district or institution. With the Internet, you need a computing platform that melds computing and communications in a revolutionary new way, offering you the tools you need to transform the Web and every other aspect of the computing experience. Microsoft supports your need to integrate the Web with your computing environment, through an initiative called Microsoft .NET, and for the first time it enables schools, educational institutions, teachers, administrators, students and technology professionals to harness technology on their terms. Microsoft .NET allows the creation of truly distributed Web Services that integrate and collaborate with a range of complementary services to serve educators in ways that today's dotcoms can only dream of. Microsoft .NET will drive the Next Generation Internet, making information available any time, any place and on any device.

The fundamental idea behind Microsoft .NET is that the focus is shifting from individual Web sites or devices connected to the Internet, to constellations of computers, devices and services that work together to deliver broader, richer solutions. People will have control over how, when and what information is delivered to them. Computers, devices and services will be able to collaborate with each other to provide rich services, instead of being isolated islands where the user provides the only integration. Schools and colleges will be able to offer and share their information and other content and services in a way that lets teachers, students and administrators seamlessly embed them in their own electronic fabric. It is a vision that extends the personal empowerment first offered by the PC in the 1980s.

For more on the Microsoft .NET platform, go to <http://www.microsoft.com/net/default.asp>

Moving On

Finalizing platform decisions brings you one step closer to realizing a Connected Learning Community. Now what? The criteria applied to choosing a platform are fairly straightforward, given an existing set of hardware and clearly defined goals. But what if some of that hardware isn't quite in place? The next chapter examines the tools you'll need to "connect" the Connected Learning Community.

Chapter 8

Planning the Network

OVERVIEW

Planning your school or district's network is more than choosing the right brand names of hardware and software: Planning for the future is as critical a task as meeting user requirements today. This chapter presents guidelines and resources to help you plan the capabilities of a new network or enhance the performance of an existing one.

Planning for the Future

Previous chapters described the hardware and software critical to the success of your school or district's network. But which of the many configuration options available makes sense for you? What capabilities should the client computers, servers, and other peripherals have to ensure success in the classroom, today *and* tomorrow?

Network planning is largely a matter of preparing for the future. In other words, what should your school or district buy today that will meet its needs tomorrow? Deciding what to buy depends on 1) the type of software you intend to run, 2) the school or district's ability (in terms of financing and expertise) to support certain types of hardware and software in the future, and 3) any restrictions you anticipate in coming years. Purchase each component of the network with those constraints in mind.

Computers: Clients and Servers

Computers will serve two roles in your school or district's network: 1) managing information and 2) acting as the interface to students and staff. The information managers, or *servers*, centrally store software, communicate with other computers, and safeguard student and administrative data. The interface computers (sometimes called *clients*) receive data from the server and in turn serve as the conduit for creating and sharing projects throughout the school, district, and larger community. Each role requires a slightly different mix of hardware and software, resulting in very different purchasing strategies. Let's start by looking at the client side of your network—the computers your students will interact with every day.

Client Computers: Price, Performance, and Life Span

What type of client computers should your school or district buy? How much should be invested in each one? What is the ideal combination of internal hardware for a student personal computer? Or for a library research station? What trade-offs should be made if price becomes an issue? And how can older-technology computers be creatively re-used in your network? The answers to most of these questions depend on a thorough investigation of your existing resources and some serious thought to your strategy for deploying learning technologies in the future. Ideally, *how* a computer will be used should matter far more than *how much* it will cost.

Windows Solutions: Designed for the Real World

In an *ideal* world, money would be no object, every student and teacher would have access to a computer, and every component of the academic computer would be state of the art. Unfortunately, budget constraints are the reality in almost every school district.

The real world of academic computing also comprises a wide range of hardware types. After all, how many schools can afford to buy state-of-the-art technology every year? The typical K–12 environment has everything but the kitchen sink playing a role in the network.

With Microsoft Windows-based solutions, you can be assured that a common set of interfaces and tools links all your computing hardware. Windows solutions provide your students, teachers, and administrators with access to all equipment, with minimum retraining and with minimum configuration and maintenance

necessary to keep all components in working order. This critical link of compatibility and commonality across equipment types is known as *scalability*, and it's the cornerstone of lower-maintenance, lower-cost computing.

Different clients, different strengths—same Windows. As you can see in the preceding chart, there is a wide range of tools you can use in your network, from "re-purposed" older equipment to state-of-the-art personal digital assistants and notebook computers. Before looking at the most established client in academic networks, the desktop personal computer, take a quick look at these options:

- *Pocket PCs and other handheld mobile devices* run the Windows CE operating system and are effective as teacher administration aids, student data-gathering devices, and even simple Web browsers. This newest entry into the academic computing environment will find its niche in effective file transfers of field trip notes and pictures to desktop computers for eventual inclusion in school intranet sites. A variety of models is available for \$200–\$900.
- *Windows-based terminals*. Your school or district may have older so-called dumb terminals (with no local processor or storage drives) left over from its mainframe access era. Windows 2000 has all the tools you need to provide remote processing power to these old friends so they can take on new roles as library catalog terminals or research stations.
- *Portable computers* represent the ultimate in anytime, anywhere learning for your classroom, lab, or field experiment site. Flexible, innovative portables, which continue to decrease in price and improve in performance, can be integrated into your network using either Windows 98/95 or Windows 2000.

Desktop Computers: Purchasing Strategies

When education technology teams first consider computers for their schools, desktop solutions come most readily to mind as a practical balance between price and performance. So what is the best strategy for adding these dependable student learning tools to your school or district's network?

The most *common* strategy in school districts today is purchasing with an eye toward keeping the same computers in place for a long time. This is the "brute force" method: Buy as much capability as you can afford, and hope the computers can be upgraded across a reasonably long life span. To ensure that your client computers can keep up with the demands of *today's* educational software, each new personal computer purchased for your network in 2000 should have:

- An Intel Pentium 350 megahertz (MHz) processor with MMX technology (or equivalent)
- 64-128 megabytes (MB) of random access memory (RAM)
- 6 gigabytes (GB) of hard disk space
- DVD-ROM drive
- 4MB video memory
- Ethernet networking card
- USB, parallel, serial, and network interface ports

That is a standard mid-level multimedia, stand-alone system and efficiently runs almost all leading educational and business multimedia software on the market today. Keep in mind that system prices will continue to fall, just as the demands of your software will continue to increase. The ideal configuration will depend upon the unique needs of your technology plan and budget. Regardless of the configuration, matching your systems with the appropriate scalable operating system tools—such as Windows 2000—will ensure that your students can enjoy their computer-aided learning experience with the minimum of system crashes or delays.

So, how long will a PC with those specifications last as an effective part of your network? Only time—and the creativity of software developers—will tell. Many companies are beginning to depreciate the cost of computers over life spans as short as two years. However, your school or district can extend the life of its client computers through low-cost upgrades that require little or no technical expertise to install, thanks in part to the Plug and Play technology built into the Windows operating system. In the table that follows, notice that the cost to upgrade RAM, hard disk, and video card is significantly lower than for other key system components.

If price is a strong consideration when mixing and matching PC components, direct your initial purchase toward faster CPU speeds and more advanced interface technologies. Invest in 350+ MHz Pentium II or III processors, DVD-ROM drives, and SCSI or ATA hard disk drive interfaces. Select these and the latest

internal connection bus technologies, such as Universal Serial Bus (USB) and accelerated graphics port (AGP), with your initial purchase rather than more memory (RAM) or hard disk capacity. Memory and hard disk capacity can be easily and inexpensively added at a later date.

Don't feel compelled to purchase all your computers at the same time. That might spell disaster in a few years when you suddenly discover a need for significant upgrades and are faced with replacing every computer in your network! Remember, system prices will continue to drop over time, so in the near future you may be able to invest in Pentium II processors or other advanced system features. A "more advanced is better" approach to selecting processors, interfaces, and disk/CD drive technologies for each generation of computers you purchase will prove to be more valuable than more RAM or hard disk space in the long run.

Servers: Price, Performance, and Life Span

Servers require a slightly different approach to system configuration. They can take on a number of roles: software "provider," central storage space, e-mail processor, and Internet gateway, to name just a few. As a result, your hardware requirements may vary dramatically. For most applications, however, hard disk space and RAM will be more important here than on the students' desktops.

A low-budget server capable of running Windows 2000 can be configured almost exactly the same way as your client computers, with the exception of added hard disk capacity. However, to provide a reasonable range of services for your school's data, your server computer should have a minimum of:

- 133 MHz or higher Pentium-compatible CPU.
- 256 MB of RAM recommended minimum. (128 MB minimum supported; 4 GB maximum.)
- 2 4-GB hard disk with a minimum of 1 GB of free space. (Additional free hard disk space is required if you are installing over a network.)
- DVD-ROM
- USB, parallel, and serial ports
- Network interface adapter (fastest allowed by your infrastructure)
- 24-hour support options for both the hardware *and* the network operating system provided by the vendor

Server prices can range from as low as \$2,000 to \$10,000 and more, depending upon the storage capacity and number of processors and redundant components included in the system. The system you select will depend on the specific applications you have in mind; however, it's important to choose a system that has components (such as multiple disks that can back up your critical data) and one that allows for future growth. Initial hard disk capacity and the *capability* to add disks, processors, and RAM in the future are more important than actually having multiple components at the start.

Servers tend to have a longer life span in a network than client PCs. Why? As the technologies that drive a server age, the server can take on less demanding roles in your network. What was a state-of-the-art file server two years ago today acts as a database server. And today's student multimedia software server may be reconfigured as a proxy server for Internet access or a file storage location for your district office in the future. Servers are also designed with frequent upgrades in mind: The average server has several drive bays and support for a larger number of add-in device cards than most desktop computers have.

Choosing Hardware

Before you start shopping for hardware, be sure to evaluate the exact components—including interfaces and expandability—you need to get the job done. The best computer purchase decisions are based on an evaluation of suitability to the task, environment, and budget.

Suitability to Task

It's easy to get blinded by new, interesting technologies and forget the need to answer one critical question: How will this computer be used? Check the minimum hardware requirements of your students' graphic presentation package, the administrators' spreadsheet, or the teachers' grade-tracking programs, and exceed those requirements to ensure that the software will run efficiently.

If you intend to use a new server for a specific application (such as a CD-ROM server), make sure you are looking at the right combination of hardware to get the job done, and be prepared to ask the right

questions of vendors or resellers.

Suitability to Environment

Will your new systems be compatible with your existing servers? If you are using the Microsoft Windows platform exclusively, the answer is probably yes. However, if you are using UNIX, Apple, or other network operating systems, be sure your server can communicate with those existing resources. If multiple platform support is your primary concern in a server, consider using Microsoft Windows 2000 Server to ensure easy configuration and communication between components.

Suitability to the environment also includes *where* your new hardware will be used. Will the system be used in a classroom, a computing lab, or at home? The choice of how best to deploy computers for student use depends on the resources and constraints of your school or district. Hardware selection should follow the guidelines your school intends to follow for local versus remote file storage, hardware security, and local versus server-based availability.

Suitability to Budget

Budget constraints have significant impact on the kind and number of computers purchased to support an education technology plan. Here are some quick tips for saving money on computing purchases, giving you more flexibility in building your Connected Learning Community.

For more information on partnerships see "Return Through the Looking Glass: Developing Business Partnerships in K–12 Schools" at <http://www.microsoft.com/education/instruction/articles/partner.asp>.

- *Look into direct purchasing.* Several computer manufacturers have made reputations for themselves by providing low-cost, high-quality computers by mail. These companies can offer custom configurations and significant discounts over retail computer outlets.
- *Seek out corporate sponsorship.* Companies are often willing to donate technical assistance or to underwrite the purchase of computers as a contribution to your Connected Learning Community.
- *Team up with other schools for volume purchases.* Almost every computer manufacturer offers price breaks for multiple system purchases. Your neighboring district or school may be able to combine your order with theirs to reach order quantities that qualify for these discounts.
- *Research best practices.* Take advantage of the experience of others, through your own contacts or research. Other schools that have purchased similar equipment or are farther down the road to the Connected Learning Community may have valuable insights to share.
- *Explore relationships with Microsoft Solution Providers or Solution Developers,* who may be able to provide a complete solution. Your system and budget may benefit from single-source solutions for installation, maintenance, and support.

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Upgrading or Adding to an Existing Network

And how about adding devices to an existing network? You may be interested in adding a new server to bring much-needed network storage to the sixth grade, or in adding a shared printer to the district office to serve administrators. Here are some quick tips that will help you with some common network upgrades.

Adding a CD-ROM Server

CD-ROM servers are designed to provide access to multimedia software over a network. Investing in a CD-ROM server *may* be a cost-effective alternative to purchasing and tracking many copies of a multimedia program for your school (prices depend on the number of drives, interface type, and options; typically a 4- to 10-drive server costs \$3,000–\$10,000). Before investing in a CD server, apply the same decision criteria used for other computers in the network:

- *Suitability to task.* Can the software you wish to serve over the network be accessed by more than one user at a time? If not, how many drives will you need to meet user demands? Remember that Windows NT can provide shared access to one or more CD-ROM drives within an existing server. Is investing in the server necessary, or can you add a CD-ROM drive to an existing server to meet demand?
- *Suitability to environment.* Does your network have the bandwidth and hardware necessary to handle multiple multimedia titles executing over the network at once? Which is more important based upon your current computing policies—one copy of the software administered from a central location, or multiple copies stored in many locations (to restore to local hard disk drives)?
- *Suitability to budget.* What licensing fees will you need to pay or what special versions of software will you need to buy to meet demand? What are the cost implications of upgrading multiple single-user copies versus upgrading one network-capable copy plus any relevant per-site or per-seat usage

agreement fees?

Adding Printers and Scanners

See *The Windows 2000 White Paper on Active Directory* at

<http://www.microsoft.com/technet/education/0200home.asp> for more information.

Active Directory in Windows 2000 allows you to easily add printers, scanners and other network devices, and to set access to those resources. Windows 2000 users can "see" printers and scanners connected to computers where access has been made available.

Mixed-platform environments can benefit by connecting the new device by means of a Windows 2000 Server, which can provide the necessary file and print services to NetWare servers or UNIX print queues (with the purchase of additional software).

Assessing the Status of Existing Components

How can you tell when it's time to upgrade a portion of your school or district's network? Do the client PCs seem too slow? Are the servers running out of space or stalling when a certain number of users are online to the Internet? As with the physical world, the Connected Learning Community can sometimes benefit from well-planned expansion.

Planning for renovation rather than outright replacement of the network is a far more complicated process than starting from scratch or adding new capabilities. Each of the existing computers (and other devices) in your network can be judged by the same criteria discussed earlier for justifying and planning hardware purchases. This time, you are trying to judge whether or not the hardware is meeting current needs, and what has to be changed, what must stay, and what needs to be done to bring the whole network in line with future requirements.

Getting Help

Like urban renewal projects in the real world, major renovation projects in the Connected Learning Community should not be undertaken lightly. Just as in the initial technology planning process, each member of the community has a stake—financial and/or educational—in your school or district's technology overhaul. Their concerns will need to be addressed while reconciling with the all too familiar constraints of time, money, and expertise. Fortunately, a lot of resources are available to help you—especially if your school or district already has or is considering computers, servers, or other devices using the Windows platform.

For more information on Microsoft Solution Providers, see <http://www.microsoft.com/education/partneropp/default.asp>.

Microsoft Solution Providers. Microsoft Solution Providers are private industry resellers and consultants who have teamed with Microsoft to meet a standard of excellence in designing Windows-based solutions and providing technical support.