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ABSTRACT

This document was developed to provide assistance to individuals in education organizations who want to learn more about what it takes to develop the best possible technology solution for an organization. It identifies the steps needed to determine technology needs, to list options, to acquire the technology, and to implement a technology solution that will serve the organization today and provide a foundation for the future. The document does not recommend specific equipment and software, nor does it describe how to set up network connections. It does, however, provide a list of specific issues to address during the process to ensure that the technology chosen will meet the organization's needs. Written in non-technical language, the document is aimed at decision makers in education settings. It is organized into 7 chapters, as follows: (1) Knowing What To Do; (2) Knowing What You Need-- conducting a needs assessment; (3) Knowing What You Have; (4) Knowing What To Get; (5) Knowing How To Implement Your Solution; (6) Knowing How To Train Users; and (7) Knowing How To Support and Maintain Your Technology Solution. Each chapter includes a list of sources for additional information, and an ongoing case study illustrates the process. Includes a glossary and a bibliography of print documents, online documents, and other online resources. (Contains 87 references.) (Author/SWC)

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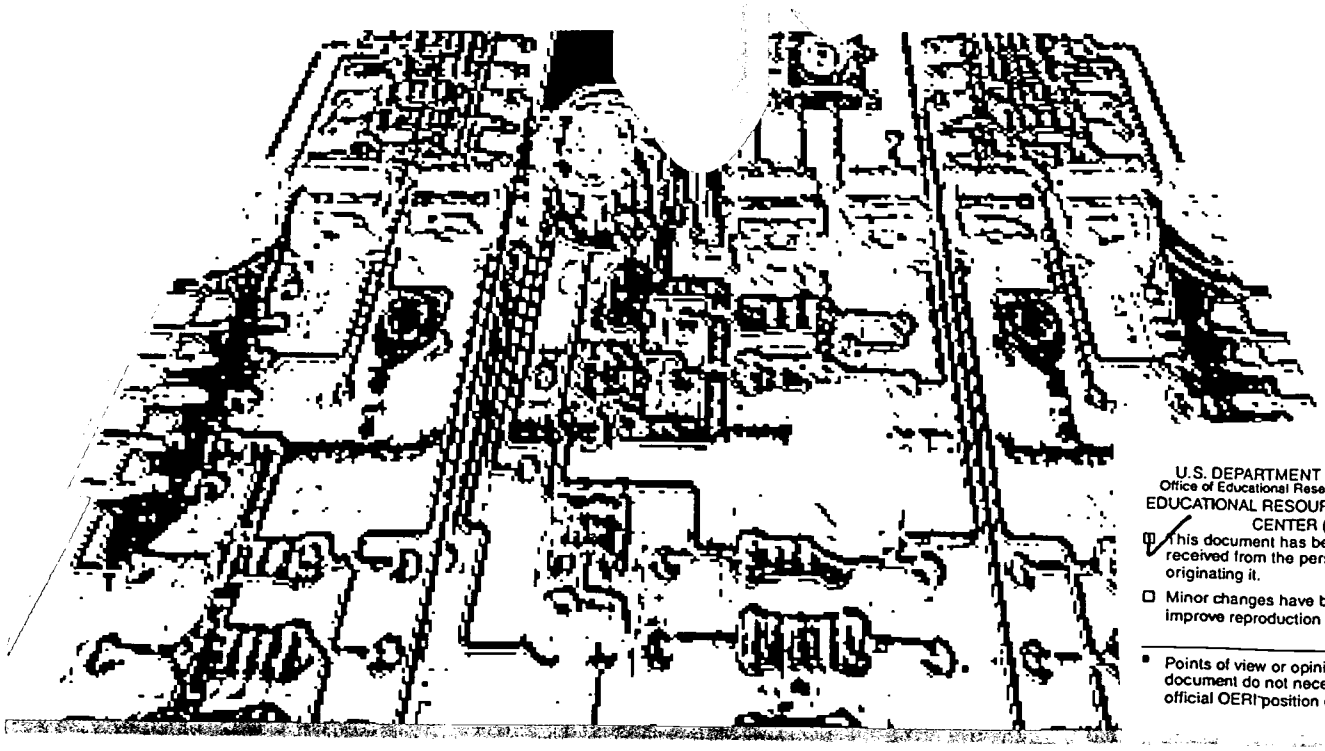
Technology @ Your Fingertips

a guide to implementing technology solutions for education agencies and institutions



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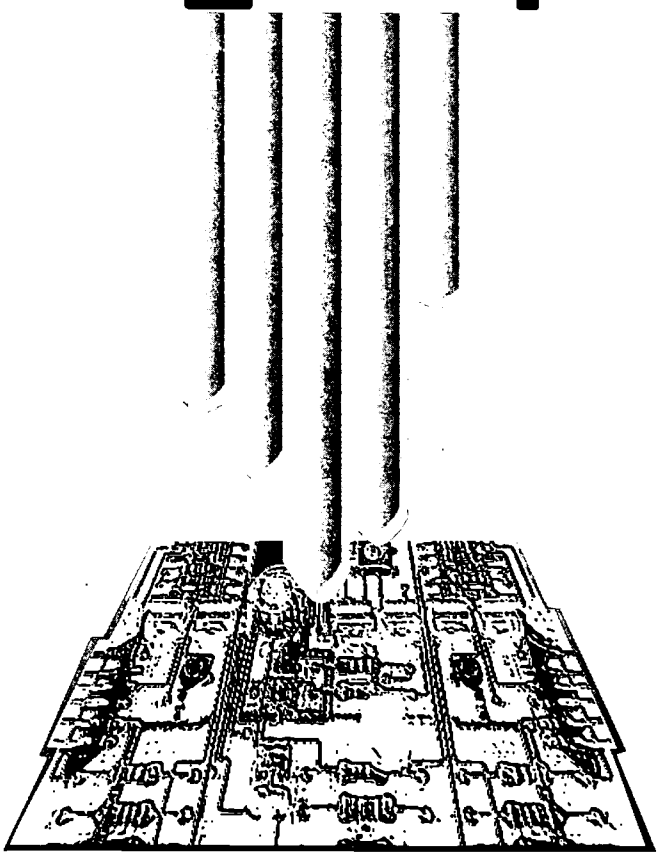

a guide to implementing technology solutions for education agencies and institutions

November 1997

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National Cooperative Education Statistics System

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Acknowledgments

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CHAPTER 1

Knowing What to Do

OBJECTIVE:
By the end of this chapter, you will understand how this book can help you find the right technology solution for your organization's needs.

It goes without saying that all over America, communities are rushing to infuse technology into the schools so that all students will have access to the benefits of technologically sophisticated classrooms that have access to the National Information Infrastructure and provide learning experiences geared toward acquiring the skills needed for the twenty-first century. In addition to providing exciting learning experiences for students, technology is a tool that can streamline administrative operations and make it easier for teachers and other education staff members to do their work.

Some people make it sound so easy. But, many think that acquiring the best technology is very complicated. If you believe that it is difficult to make correct decisions about selecting, acquiring, implementing, and maintaining technology then you are not alone, and this book is for you.

There are many books and materials available that describe how to set up computer and communications technology. Many of these publications are very detailed and complex, and the guidelines relate to any type of business or industry. ***Technology @ Your Fingertips***, on the other hand, is designed to make it easier for people in education settings to make important decisions regarding the right technology solution. This book will enable individuals lacking extensive experience with technology to make the best possible decisions.

What Is the Purpose of This Book?

Technology @ Your Fingertips describes a process for getting the best possible technology solution for your organization. In this book you will find the steps you should take to identify your technology needs, consider your options, acquire the technology, and implement a technology solution that will serve you today and provide a foundation for your organization's technology in the future. This book, however, will not tell you the specific equipment and software to buy nor how to set up network connections to your building. Rather it will arm you with a list of specific issues to address during the process so that you can ensure the technology you choose will reflect your organization's needs and the context in which you work.

Technology @ Your Fingertips **describes steps for making effective decisions about computer and networking technology.**

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Who Should Read This Book?

This book is written for people with one of two roles:

- ✔ Persons who have been given the responsibility to set up computer and networking technology in an education organization.
- ✔ Persons who will be supervising the process of technology implementation.

The persons who might fill these roles include principals, superintendents, Board members, university management staff, teachers, professors, librarians, and others. Persons who use this book may be the ones with the final decision about what will be done, or they may be the ones who make recommendations to the ultimate decision maker.

Written in non-technical language, the book is aimed at decision makers in education settings.

If you are playing one of the roles mentioned above, this book can help you answer real-world questions about how — and how not — to go about the process of putting effective technology in place. The expectation is that as you read this book, you will find a number of useful ideas that can be applied to your specific situation.

This book is not aimed at technical staff who may already be familiar with many of the concepts and the information it contains. The writing style is targeted to non-technical individuals, yet it includes the requisite terminology and issues basic to technology. Definitions are provided throughout the book and can also be found in the glossary.

The guidelines provided in this book are expected to be most useful to persons in schools or districts. However, the guidelines are applicable to all types of education settings, including colleges, universities, libraries and state education agencies. The examples in the book were actually obtained from all these different types of education organizations. The word "organization" used in the text is meant to refer to any educational setting, whether a school, school district, state education agency, college, university, library, or another type of education organization.

What Is Presented in This Book?

Careful planning can ensure that computer and networking technology supports both instructional and administrative needs.

The world of technology is very broad. This publication does not attempt to cover all types of technology that can be used in education settings. The focus is on **computer and networking technology** — primarily software used to meet administrative and many instructional needs, and the hardware, networking and support required to make it function. This excludes many other categories of technology, such as video/television, telephone systems, and certain other tools that can be used for distance learning (e.g., satellite broadcast systems).

The world of technology is also fluid. Technical standards and specific products change constantly. This book contains generic questions that will help you with your decision making process both now and in the future. These are common-sense, experience-based ideas, rather than approaches tied to specific situations or products. These ideas are based on the authors' extensive experience with implementing technology within schools, districts, state education agencies, universities and libraries.

Technology @ Your Fingertips contains information about computer hardware, software and networking, as well as budgetary and human

resource concerns. This information relates to the use of computer and networking technology for:

- ✔ Providing instruction to students (e.g., recording data from experiments, providing computer-based instructional activities, accessing the Internet).
- ✔ Managing activities related to instruction (e.g., grade and attendance reporting, lesson design, accessing information about students).
- ✔ Automating and streamlining day-to-day operations (e.g., student registration, maintaining health records, scheduling classes, determining bus routes, word processing).

This book does not, however, have recommendations for specific hardware, software, or networking services. While there are specific examples mentioned, they should not be considered endorsements by the authors.

Included at the end of chapters and the book itself are pointers to reference documents and other sources of information. These are meant to serve as examples, not as an exhaustive list of all those available. The constant changes in technology make the life of many of these sources fairly brief. There are many resources listed that are available on the Internet because they tend to be more current. They have the advantage of being able to link you to additional resources. Many education resources and examples have not been published anywhere except on the Internet. If you do not currently have access to the Internet, you may want to find someone who does (e.g., someone at the public library or another school, or a friend) and ask that person to help you find some of these useful resources.

Throughout this document, we will follow a hypothetical case study of a school district administrator and his friend from the local college who are both developing technology solutions to meet their organizations' requirements. In addition, there will be mini-case studies describing responses to specific issues. These case studies illustrate many of the key points being conveyed in each chapter.

What Process Should You Use for Making Technology Decisions?

Suppose you travel to a foreign country for a vacation. You've read about several destinations that sound exciting and wondrous. Your only problem is that you've lost your map. No matter how much you may have prepared for this trip, the only place you can go without a map is to the nearest information booth for some guidance — only you don't even know the language....

The key to ensuring that the technology solution you choose will work as desired and that the anticipated benefits will be realized is to follow a logical proven process to decision making. First and foremost, you want to specify your requirements and keep them in the forefront. Solutions that don't meet your requirements aren't really solutions.

There are many published methods for building technology solutions, and they contain similar elements. This document describes the different steps of the process in a way that will help to meet your specific needs in

Case Study - Act I, Scene I

Joe Garcia is the superintendent of a small school district. Mary Taylor is the president of a small liberal arts college in the same town. Joe and Mary became good friends while working on their doctoral degrees in education administration. They continue to talk frequently because they have found that many of the problems and issues they face in their respective organizations are similar.

One October morning, Joe's secretary informed him that she was "Fed up to here!" trying to get the information about students that the school district had to report to the state education agency. She said that there had to be a better way to compile statistics about how many students are enrolled, the number of boys and girls, and how many students graduated and dropped out in their district. She was tired of pulling out file folders and counting each category. She mentioned that District 32 (the district next door) bought a computer software package that contains all the information they need about students and prints out the reports with just a touch of a button, and she wants to get one, too.

Joe seemed to remember that his friend Mary had bought some type of program like that last year. He thought, "I'll give her a call sometime this week to find out what she got, and how it is working out."

That same day, Mary received a request from a faculty senate committee to meet with them about the college's computer technology. It seemed the faculty wanted to have access to the Information Superhighway, and they thought the students should have access as well. Mary remembered that her friend Joe had been learning from his teachers about the wealth of resources available on the Internet through the World Wide Web. She decided to call Joe that week to pick his brain a little.

Two days later, Mary picked up the telephone and called Joe. "Joe," she said, "my faculty wants to get on the Information Superhighway. What can you tell me about your teachers' experiences on the Internet?

"Wow, Mary, we must have psychic connections. I was just thinking about calling you. Some of my teachers have access to the Internet from home, and they say it's great but a little slow because it has so many users now. Also, they complain because they can't use if from school. They have been bugging me about getting something like a dedicated connection to the Internet at school to make their lives easier and the classrooms more exciting. Do you think they want the same thing as your faculty?"

"Probably. I've heard that practically everyone is on the Internet now. Maybe we should do some investigating. Joe, what were you planning to ask me?

"Oh, yes. I was wondering about that student management information system you said you were going to buy. Has it turned out to be useful?"

"Oh, definitely." replied Mary. "I can't believe how easy it is to register and keep information about our students now that we have that package working on our network. Of course, now the staff wants us to get more applications such as a scheduling package. I guess it was inevitable. The more they get, the more they want. Are you thinking about getting a student management information system?"

"I guess I have to do something, or the staff will revolt. I've had some parents come ask if they can help get our district up and running with a network, and they mentioned that the network could serve both administrative and instructional purposes. It seems like it might be fun!"

"Fun!!!!! Are you serious? Can you imagine putting twenty-first century technology in our nineteenth century buildings?"

"I know it sounds crazy, Mary, but I think it's time we entered the information age," opined Joe.

"Well, I have to admit, it might help us with admissions if we beefed up our computer system," said Mary. "If we work together, maybe we can do this job better. But, where do we start?"

"I guess we had better do some research," replied Joe. "Let's talk again in a day or two."

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educational settings. Specifically, the book contains guidance on the following steps:

- ✔ Define the task and the steps needed to undertake the task (Chapter 1).
- ✔ Conduct a needs assessment and define your technology requirements (Chapter 2).
- ✔ Describe your current computing and networking technology resources (Chapter 3).
- ✔ Evaluate options and select your preferred technology solution (Chapter 4).
- ✔ Implement the selected technology solution (Chapter 5).
- ✔ Train the users (Chapter 6).
- ✔ Make plans for supporting and maintaining your technology solution on an ongoing basis (Chapter 7).

These steps are illustrated in **Figure 1.1.** You should note that Steps 2 and 3 should be done simultaneously, and so should Steps 5 and 6.

Think of this document as a map that will help you find your way as you walk through the various steps of the process. This map will lead you to make the decisions that best meet your needs. It will even teach you a little of the language.

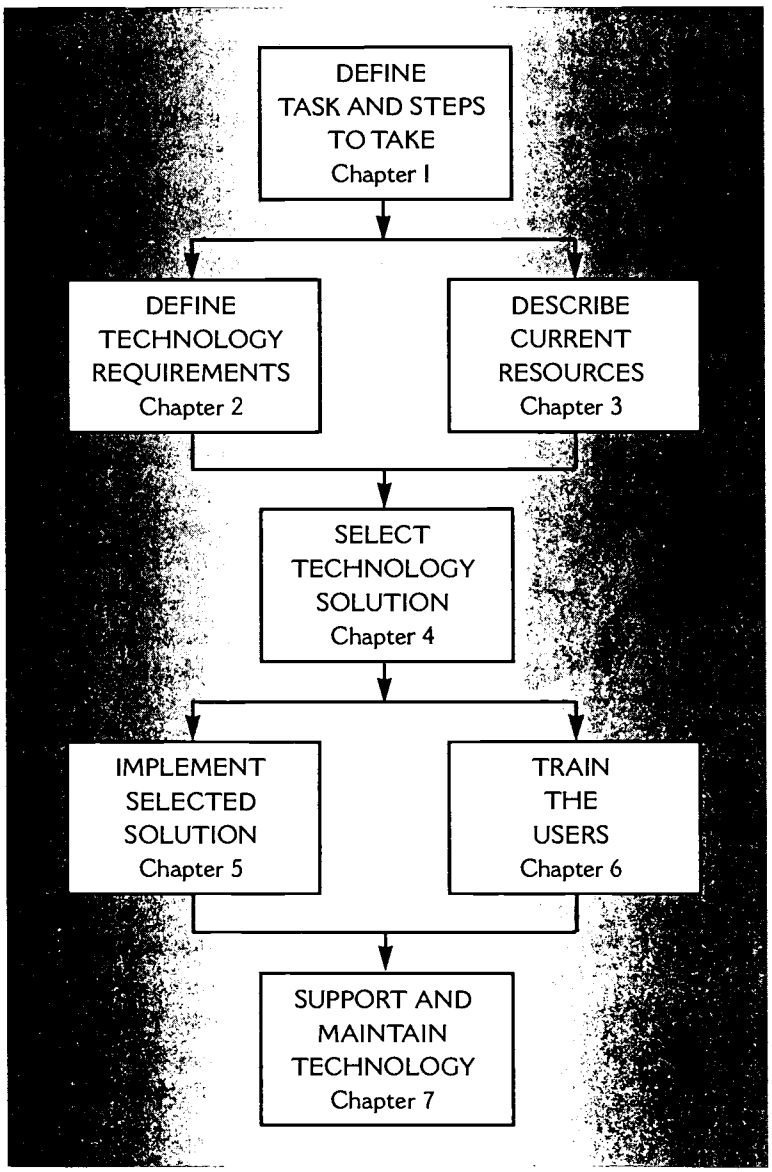

Figure 1.1: Process for Making Technology Decisions

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Case Study ▫ Act I, Scene 2 ▫ Two days later

Joe calls up Mary two days later. "Mary, guess what? I went to an administrators meeting yesterday, and I heard a bunch of people talking about setting up computer networks. I asked a colleague of mine about his new student management information system, and he raved about its capabilities. He said the teachers were ecstatic as well. Can you believe that? He also said that our state education agency has staff members who can help us figure out what kind of computer system we need and how to maintain the system once it's in place. I know it's going to be tough to find the money, but we've got some school board members who work for a computer company. Hopefully they will help us build our case. What have you found out?"

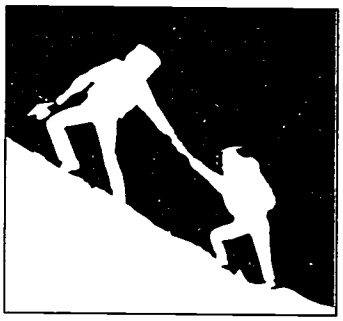
"I've done some asking around," Mary answered, "and discovered that some of our science professors are starting to use their own personal computers in their classrooms. I told them about the faculty senate committee's request, and they said that they would be happy to help the college get the faculty and students networked. We've got a meeting set up next Wednesday to talk about getting started. Do you know if the state education agency has a report that can help us get started?"

"They sure do," said Joe. I called and requested two copies so I could give one to you. I should get them soon. I'll drop a copy by your office."

"Hey Joe, would you like to sit in on our committee meeting? You might get some ideas from our folks who are already using the Internet. You could bring the report with you."

"That's a great idea, but I'm afraid I would be out of my league if they already know about computers," sighed Joe. "But if you'll let me know the logistics for the meeting, I just might try to come. I can use all the help I can get. Thanks, Mary.

Where Can You Get More Help?



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CHAPTER 2

Knowing What You Need

OBJECTIVE:

By the end of this chapter, you will be able to conduct a needs assessment to help you define your technology requirements.

CASE STUDY ◦ Act 2, Scene 1 ◦ The next Wednesday at lunch

"I'm glad you could have lunch with me, Mary. I thought it might be a good idea for us to look at the contents of this report before your meeting. I glanced through it when I got the report yesterday, and it seems like there is a lot we have to do, if we are going to do this right."

Mary flipped through the report, and stopped periodically to read. "You're right, Joe. This report seems to have a lot of steps that have to be taken. I didn't realize there were so many things you could have a computer network do. I wonder what we are going to need?"

"I was reading about a school in a magazine last night. The network they set up connects the teachers to the students' records, to instructional programs they can use in the classroom, and to the World Wide Web on the Internet. They can also see what books are in their library and which ones have been checked out. They even enter their test scores on the computer. I can see where that would be really helpful to teachers. I could have used those things when I was a teacher." Joe pushed aside his plate and opened up the report.

Mary said, "Egad! If we had a system like that, some smart-aleck students would probably break into the computer and change their grades."

"I guess that means that you need to be really careful about security. Come to think of it, so do we. Maybe that would be one of the requirements we would have to establish. But there must be many more. Did you say that your faculty wants to have the students on the Internet, too?"

"I guess we will hear more about that and other things they want at the meeting this afternoon," Mary replied. "I have a feeling we are just beginning to think about how we would want such a system to work. I wonder if this report will help us identify all the things we want our systems to do? I mean, just think of all the potential applications. There are ways to make our administrative offices run more efficiently, there are things that can make instructional management easier for the faculty, and I know that the students will just love all the possibilities such a system would open for them. I hope you are prepared to help me take notes this afternoon. In fact, maybe we should tape the meeting to be safe. Shall we get the check?"

Have you ever tried to construct a lesson plan without a learning objective? Or run a meeting without an agenda? The result is chaos and anarchy. Before you even consider buying a new computer, some software, or networking services, you have to decide what you want the technology to do. This is not an easy task, especially if you don't know everything that technology can do. Technology is changing so rapidly that this book will not even presume to identify all of the functions you might want in your school or district. Still, you must have some ideas about what you want, and chances are there are people who work with you who have additional ideas

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about what would be valuable. This chapter will help you gather all the possibilities (do a needs assessment) and lead you to consider the priorities for your technology solution (define your technology requirements).

What Is a Needs Assessment?

You've probably heard of a "needs assessment" before, but it might be useful to explain what is meant by it here. Often a needs assessment is an evaluation of the existing environment and capabilities of an organization in order to determine what interventions will be needed. In the case of technology, a needs assessment is an evaluation of the functions you want your technology to have or the needs you hope technology will meet. Even if you don't have an inkling as to all the possible functions, you should try to imagine all the functions that would make your life easier. Whether or not technology can meet all your needs right now doesn't matter. When you define your technology requirements, you will strive to identify a structure that will allow new functions to be added as the technology becomes available.

Who Should Do Your Needs Assessment?

You and your staff are the only ones who can identify the technology needs of your organization.

One of the common mistakes many people make is to assume they can't carry out a needs assessment, because they lack an understanding of technology. On the contrary; individuals involved in the daily operations of an organization are the *only* ones who can define requirements because they are the ones who are most familiar with their organization's functions, current needs, and goals for the future. They must define their needs before solutions can be developed. Of course, it is best done with heavy involvement by other, more technologically sophisticated staff.

An important step in defining your technology needs is to look at the big picture for your organization. The needs you identify may be just a small portion of the technology needs of your entire organization. If that is true, it makes sense for you to look for a solution that meets all, or nearly all, of your organization's needs. This takes coordination and cooperation, but the result will be better than if all your separate needs are dealt with independently. Just keep in mind that finding a solution that meets all of your organization's technology needs may have to compete with other potential uses of the organization's scarce resources.

Ideally, the set of needs you identify is the same as the needs identified by other similar organizations. If so, you can look to them for advice and assistance. This book may help you find some of those organizations.

Who Should Participate in the Needs Assessment Process?

Most needs arise from **users,** who are the people who use the technology as a tool to do their jobs. Typically your users are the instructional or administrative staff simply trying to provide effective instruction or administrative support as efficiently as possible. In some cases, most "users" are not really users at all; they are staff who *wish* they had

technology to use. Whether they are actual or "wannabe" users, they are the key category of participants who must be involved in defining needs. They may not have a full grasp of technology, but they are the experts in what they need every day on the job. Many technology initiatives fail because they have been designed for users, but *without* their crucial input.

All potential users of the technology should participate, including instructional and administrative staff and students.

Administrators are an important group of users who should participate in a needs assessment. Administrators generally need summary information at a broader level of detail than their staffs. For these participants, the summary information must be presented in a way that describes the organization's operations and informs decision making. School department heads also need summary information for groups of students as a whole (e.g., pass rates, class enrollments). Computer systems that help process detailed data also need to be able to generate these summary reports, so it is important to involve administrators in defining both what information is needed and how to use this information.

Instructional staff constitute another important category of users. Their needs include having the ability to write lesson plans, develop interactive learning activities for their students, prepare grade reports and record assignment data for specific classes and students. They may have ideas about how they can use technology to address the needs of their students. *Other staff members*, such as librarians/media specialists, registrars and secretaries, will have needs that are either unique to their positions or common to the needs of administrators and instructional staff.

Still another category of users is the *technical support staff*. These are the persons who will be charged with supporting and maintaining whatever technology solution is eventually put in place. Their requirements are often of a different nature than those of users and administrators. They may have concerns related to the following:

- ✔ The new technology solution's compatibility with existing equipment and software.
- ✔ Adherence to technical and ethical standards.
- ✔ The technology's capacity, e.g., how many users it can handle simultaneously, what kind of work it can do, how many transactions it can process per day or per month.

Technical staff may also have insight into the basic information requirements of their colleagues, especially if they are the ones constantly asked to generate reports combining disparate types of information from different sources.

One final group of users you may want to have participate in this activity is your clients, the *students*. Ideally you are considering the development of a technology solution that will include uses by students, such as access to the Internet and use of computers in classroom activities. If so, it's a good idea to bring them into the discussion early, as they may have different ideas about their needs. *Parents* and *members of the community* might also be included if the technology solution you are considering reaches out to them.

All of these groups of participants are key contributors to the needs assessment process. If you cannot contact all of the people in each of these groups in the needs assessment process, at least make sure you include representatives of each group. Your selection process should include both willing participants and less-willing participants; that is, ask for and choose volunteers, but also choose some non-volunteers whose opinions will be valuable.

What Are the Steps in the Needs Assessment Process?

Use a variety of techniques to obtain information from all types of potential users, then prioritize your needs according to what will make your organization more effective.

Once you have decided what you think the major requirements will be, it is time to start gathering more specific information. This information gathering process is necessary so that key decision makers will have what they need to make educated decisions. Though it is really just a phase in the overall process of putting solutions in place, you may want to treat the needs assessment as a mini-project of its own. Once you have identified the specific participants who will contribute to the needs assessment, the key steps are:

1. Gather the needs-related information (usually the most critical and time-consuming part of the process).
2. Sift through and prioritize the needs or requirements.
3. Document the results.

Step 1. Gathering the Needs Information

Information gathering can be time-consuming, so it is helpful to set a reasonable schedule and try to stick to it. You may, however, extend the deadline if important participants still have not offered their suggestions. It is essential to give everyone sufficient time to make their opinions heard.

Information gathering should be approached with caution, as it often suffers from reactions representing two extremes. The extremes are:

- ✔ Reluctant participants may not see the importance of the project and may only be involved half-heartedly.
- ✔ Overly zealous participants, who have been waiting years to unburden themselves of their endless requirements and their difficult jobs, and may go overboard during your quest for information.

Your job will be to distinguish real from exaggerated needs, and give each the importance it deserves.

There are several techniques decision makers can use to gather information. **Table 2.1** contains some examples.

The questions in **Figure 2.1** can be used in a general administrative needs assessment for an education agency. Using this model, a different set of questions could be developed to identify instructional technology needs to be used in either face-to-face interviews or a questionnaire.

Step 2. Reviewing and Prioritizing the Needs

Once information has been gathered, you must review the needs and determine which ones are most important for inclusion in your technology solution. First, you must extract the key nuggets — the statements of discrete, separate needs, each of which can be assessed and addressed. Hopefully, many participants will cite the same or similar needs. Keep these needs to a reasonable number, perhaps by listing the needs at a fairly general level. Remember, at this point there is no need to think about *how* the actual technology will work; focus on *what* the participants need and want to be able to do. One way to organize the needs is the use the following categories:

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- ✔ **Information capture** (e.g., entry of students' course grades and attendance, teacher employment data, new library book titles).
- ✔ **Information access** (e.g., previous student course grades, availability of library books, instructional software, World Wide Web sites).
- ✔ **Information processing capability** (e.g., calculate grade averages, develop trend lines over 5-year time spans, produce finished documents).
- ✔ **Information sharing** (e.g., electronic mail, electronic transcript sharing, electronic data reporting).

TECHNIQUE	DEFINITION	ADVANTAGES	DISADVANTAGES
Personal Interview	Face-to-face meeting with individuals, using prepared set of questions to elicit input.	Good for detail on needs and associated issues. Individual session can encourage candor.	Time-consuming. Difficult to compare inputs from multiple individuals.
Group Interview	Face-to-face meeting with several participants, using prepared set of questions to elicit input.	Covers several participants at once. Time effective.	Some staff may feel inhibited by presence of colleagues. May be difficult to reconcile conflicting input.
Written questionnaire	A set of questions sent to multiple selected individuals, with instructions for responding and returning results.	Consistent set of questions for all respondents. Administered to a geographically dispersed group is possible. Little effort needed to deliver questions.	Generally low response rate. Time-consuming to review responses.
Focus Group	Prepare first-cut set of requirements in advance, then present them to select group of potential users to get their responses in an open forum.	Covers several participants at once. May get further with prepared first cut than by starting from scratch.	Some staff may feel inhibited by presence of colleagues. May be difficult to reconcile conflicting input. Prepared material may exclude other potential needs.

Table 2.1: Needs Assessment Information Gathering Techniques

Now you must prioritize the needs. It is likely that the set of needs you've gathered is a mixed bag of things that could best be addressed in a number of different ways:

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INFORMATION ARCHITECTURE — QUESTIONS

1. What are the principal types of information you deal with in your job?
2. Where does the information come from?
   - Internal sources:
   - External sources:
3. How is the information collected?
   - Process and who is involved:
   - Collection media:
   - Timing:
4. What types of processing do you need to do on this information?
   - Verification/validation:
   - Statistical analysis:
   - Decision support:
5. What types of dissemination of information are required?
   - Format and content:
   - Production process:
   - Distribution media and recipients:
6. What changes can you foresee in your information management responsibilities and requirements in the next 3-5 years?
   - New mandates:
   - Information content and level of detail:
   - Process and procedures:
7. How do you use automated systems today to help you manage information?
8. How well or how poorly do your Department's existing automated systems help you?
9. If you could make three improvements in your Department's information systems, what would you choose?
10. Who else in your organization would you suggest we speak to in order to get a full picture of your information management-related needs and priorities?

Figure 2.1: Sample questions for a general administrative needs assessment.

1. Some needs (such as ones involving repetitive tasks and mass storage and retrieval of data) are best carried out using technology.
2. Some other needs or tasks are best done manually.
3. Some needs are problems that can be solved by changing your organization's policies and procedures ("business process re-engineering" is the buzzword most often applied to this procedural improvement).
4. Finally, there are some needs that, while real, simply don't make the cut. You can afford to defer them or ignore them, and live with the consequences.

There is no magic formula, but keeping the big picture in mind is always helpful. The more features your technology has, the more costly and difficult it may be to implement and support. So, be careful not to promise the participants that all the bells and whistles they would like will actually materialize. Adapt the following questions and use them as a litmus test for prioritizing.

The needs you define at this point, and the priorities you attach to them, will be used during the next phase of the overall process: deciding upon the characteristics of your technology solution.

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Key questions to ask about the organization's needs

ASK:	RESPONSE:
How much would the organization mission benefit if these technology needs are met?	
How many people, including students, would benefit by meeting these needs?	
Would meeting these needs be a pre-requisite to solving other organizational problems?	
Where do other comparable organizations stand with respect to these needs?	

Step 3. Documenting Your Results

There is no one right way to document your results. A good rule of thumb is to pretend your involvement with the project will end at this phase, and someone will have to pick up where you left off. Don't get ahead of yourself by being specific about computers, networking and other components that will be included in your technology solution. A general statement of needs is what you need initially.

Figure 2.2 contains a suggested outline for a Needs Statement document. You can see that there are several types of descriptions you will need to include. Following is a description of what is meant by Functional Needs, Technical Requirements and Security and Ethical Considerations.

Functional needs

The *Needs Statement* captures functional needs as well as some technical needs. We define *functions* (as in Functional Needs) as the tasks or actions that the technology is intended to accomplish.

Your list of functional needs might include:

- ✔ Student records management, including automated student registration.
- ✔ Staff records management.
- ✔ Financial records management, including payroll.
- ✔ School transportation management.
- ✔ Library records management, including inventory and automated check-outs.
- ✔ Word processing.
- ✔ Spreadsheet capability.
- ✔ Database creation and management.
- ✔ Instructional software access.
- ✔ Access to the Internet and other networks.
- ✔ Electronic mail.

Needs Statement Suggested Outline

1. Introduction
   - 1.1 Background
   - 1.2 Objectives and Scope
   - 1.3 Organization
2. Needs Categories
3. Functional Needs
   - 3.3 Need 1
   - 3.2 Need 2
   - 3.3 Need 3
4. Technical Requirement Parameters
   - 4.1 Adherence to Technical Standards
   - 4.2 System Availability and Capacity
   - 4.3 System Access Requirements
   - 4.4 Interface Needs
5. Ethical and Security Standards

Appendix — Information Sources (personnel consulted, documents reviewed)

Figure 2.2: Suggested outline of a needs statement document

Technical requirements

The technical requirements included in the Needs Statement are not heavily technical or complex. They are simply statements of parameters for your technology solution addressing topics such as the following:

- ✔ Technical standards and specifications that must be met.
- ✔ Number of people who would need to connect to the technology solution for each of the functional needs stated above.
- ✔ Potential users, where they are located, and how often they will need to get access.
- ✔ Numbers and types of transactions information system users will need to process, and how much information they need to store and retrieve.
- ✔ Types of technology components that you will want to have interact (e.g., teachers from their classrooms should have access through their computers to the central school data base of resources, as well as the Internet).

This statement of parameters will be useful when the technology design work is being done. These parameters are also useful for prioritizing the functional needs that have been established.

Security and ethical standards

Effective security measures and standards for appropriate use are essential to protect the functioning and contents of your technology from internal and external threats.

Security is defined as protection from threats to the equipment, functioning and contents of your technology. Controlling access to and ensuring the security of the information within your computer system and through your network connections are critical if you are planning to keep confidential or sensitive data, such as the information that is kept in student and staff records.

You should give some thought to the potential internal and external threats to the functioning and contents of your technology solution, such as:

- ✔ Unauthorized access.
- ✔ Snooping or browsing.
- ✔ Tampering with data or programs.
- ✔ Intentionally disclosing data.
- ✔ Sabotage through the introduction of viruses and other destructive programs.

Ethical standards are also important, since you are likely to develop a technology solution that is used by many people, including staff, students and others within the community. You should give some thought to what types of limits you may need on access to your different technology components, as well as any guidelines and disciplinary procedures that may be needed to ensure appropriate use, particularly if you are worried about the availability of objectionable materials. These should be included in an *Acceptable Use Policy* statement to be developed later.

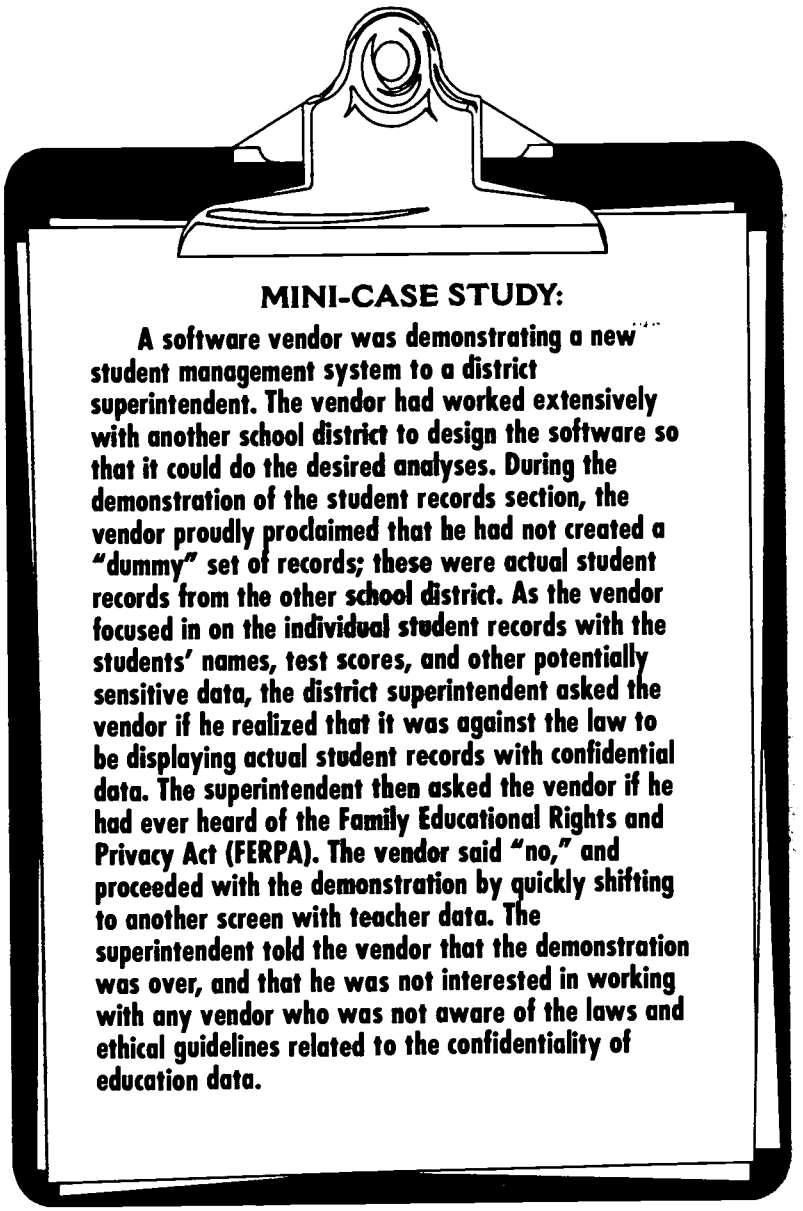
For the Needs Statement, it is sufficient to state: "The technology solution should contain features that allow for the control of access by users of the technology to certain programs and particular information. The control of access must comply with local, state, and federal requirements regarding confidential data. In addition, technology guidelines should reflect established ethics for appropriate usage."

Selecting appropriate locations for the equipment and choosing physical security measures are also critical to the security of your technology solution. Threats to the equipment may include:

- ✔ Theft.
- ✔ Vandalism (computers have been short-circuited and bombed).
- ✔ Accidents (such as broken water pipes).
- ✔ Natural disasters.

For the Needs Statement, you should note that physical security measures must be sufficient to prevent theft, vandalism, and other types of harm to the equipment.

Ensuring the security of information and equipment should always be specified in your list of needs, as you may be putting your entire system, information and equipment at risk. This is not a risk worth taking.



MINI-CASE STUDY:

A software vendor was demonstrating a new student management system to a district superintendent. The vendor had worked extensively with another school district to design the software so that it could do the desired analyses. During the demonstration of the student records section, the vendor proudly proclaimed that he had not created a "dummy" set of records; these were actual student records from the other school district. As the vendor focused in on the individual student records with the students' names, test scores, and other potentially sensitive data, the district superintendent asked the vendor if he realized that it was against the law to be displaying actual student records with confidential data. The superintendent then asked the vendor if he had ever heard of the Family Educational Rights and Privacy Act (FERPA). The vendor said "no," and proceeded with the demonstration by quickly shifting to another screen with teacher data. The superintendent told the vendor that the demonstration was over, and that he was not interested in working with any vendor who was not aware of the laws and ethical guidelines related to the confidentiality of education data.

Writing Your Statement of Needs

Okay, you've defined and prioritized a set of functional needs and technical considerations. You've also given thought to security and ethical standards Your next step involves translating these needs into a statement of what your technology solution should do. Now, try to produce a Needs Statement document that is thorough and self-explanatory, so your successor or others will have no trouble seeing what you've done and how you've reached your conclusions.

What Should Be Included in a Set of Functional Specifications?

Up to now, your task has been to describe the needs of your organization that might be addressed by technology. Everyone knows that technology generally means computers. However, there are many components that make up a computer system, and you may not know what all those components are. (In the next chapter, you will learn about computer and networking technology components.) So the discussion, so far, has focused on a "technology solution," rather than a computer system, that will meet your needs.

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Functional specifications contain a description of the technical capabilities your technology solution should have.

Even if you are not thoroughly knowledgeable about computer and networking technology, you may know enough to begin considering how to address your organization's needs through the use of computer systems, including the reengineering of some existing procedures. If so, you will find it worthwhile to follow up the *Needs Statement* document with a *Functional Specifications* document. A *Functional Specifications* document states in detail what exactly a new (or upgraded) computer system should be expected to do (rather than what your organization should be able to do).

Consider this analogy. You're shopping for a new car, but you first create a check list of your needs:

- ✔ Carry your family of four (and perhaps an occasional fifth person).
- ✔ Keep the four of you (and your luggage) comfortable on day long trips.
- ✔ Handle smoothly on rough or unpaved roads.
- ✔ Keep up with freeway traffic.
- ✔ Get reasonable gas mileage.
- ✔ Retain its value after four years of ownership.
- ✔ Can be easily serviced nearby and replacement parts are readily available.
- ✔ Etc.

With a list such as this, you are ready to visit some showrooms and locate some reasonable cars to purchase. (With cars, unlike computer systems, building your own is rarely an option worth considering.) Without such a list as above you're more apt to flounder, and end up with a vehicle that doesn't meet your needs.

The *Functional Specifications* document plays the same role (as the list of car characteristics) in specifying what capabilities the computer system must have. You don't care how such a system works internally; you do care what services it delivers to those who will use and maintain it.

There are many different views on what should go into a set of *Functional Specifications.* Consultants and product vendors tend to recommend their favorite or proprietary methods of data or process modeling, function charts, and other items that most non-technical decision makers find very difficult to understand. The best rule of thumb is to view the *Functional Specifications* as a concise description of a new computer system's capabilities, which can then be compared to what can be bought from a commercial vendor or built by developers.

When developing a *Functional Specification,* determine whether it makes sense to include details related to your current computer system, the information in the system, and processes the system performs. Even though the current system may do some things fairly well, there may be better ways to do the same functions, or there may be ways to combine functions to improve efficiency.

This is a place where you may need to work with someone with technical expertise to help you think through these more technical specifications. It is probably wise to give some thought to your technical requirements now, rather than to expect a vendor or consulting firm to cover all these areas in their response to your bidding and/or purchasing process. Be sure to have a vendor respond to your specific technical and functional requirements. Don't accept a proprietary solution developed by a vendor in response to the needs they perceive you will have.

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Figure 2.3 contains a suggested outline for a functional specifications document. This document is organized somewhat like the *Needs Statement*, but it is concerned more with the characteristics of a system itself than with the requirements it would meet. Include all the information that you feel comfortable with; but don't feel like you must include everything.

While the terminology in the sample *Functional Specifications* document may look technical, it is just a listing of the information your system has to address, the functions you need your system to perform, and performance specifics on how much, how fast, how many users need to use the system, etc.

Here is a description of the types of items that might go into a set of *Functional Specifications*. Section 1 just provides an overview and introduction to the functional specifications, hence the descriptions start with Section 2 — System Contents.

Functional Specifications Document Suggested Outline

1. Introduction
   - 1.1 Background
   - 1.2 Objectives and Scope
   - 1.3 Organization Description
   - 1.4 Contents of the Document
2. System Contents
   - 2.1 Types and volumes of information stored in the system
   - 2.2 Instructional and reference materials
3. System Functions
   - 3.1 Instructional Program Capabilities
   - 3.2 System Storage and Retrieval Capabilities
   - 3.3. Calculation and Processing Capabilities
   - 3.4 Reporting and Output Capabilities
   - 3.5 Telecommunications Capabilities
4. Access and Capacity
   - 4.1 Hours of Operation
   - 4.2 User Categories, Permissions and Security
   - 4.3 Backup Frequency, Restore Capability, and Disaster Recovery
5. Interfaces

Appendix — Information and Process Models

Figure 2.3: Suggested outline for a functional specifications document

Section 2 — System Contents

This section could include a description of the types and amount of information the system is expected to store. In addition, it can address the connections among different types of information.

Section 2.2 might describe the types of files, programs, and materials that will be used specifically for the purpose of instruction. Examples relating to various subjects would be helpful. For instance, English classes may need to have on-line access to reference materials, tutorial programs, enrichment materials, and teacher guidelines, as well as the use of word processing programs and the storage of "portfolios" of student work.

Section 3 — System Functions

In this section you could list specific functions you want your system to be able to do (or your staff to be able to do using the system). These functions could fall under the following categories: System Storage and Retrieval Capabilities, Calculation and Processing Capabilities, Reporting and Output Capabilities, and Telecommunications Capabilities. For example, you might want each of your classrooms to have access to central bank of information resources such as encyclopedias and dictionaries.

Section 4 — Access and Capacity

This section contains some of the specifics that must be considered in selecting a solution for your particular situation. Some of these include:

- ✔ Desired hours of operation.
- ✔ Security requirements.
- ✔ Backup frequency.
- ✔ Disaster recovery.

Also to be considered is the capacity of the system in terms of the number of potential users, the number of users who can use the system simultaneously, and the amount of information that can be stored.

For security purposes, your software and network specifications must allow you to restrict who has access to the system, who has access to specific programs, and even access to data elements within programs. You need to have software that will search and report viruses and vandals to you. You will also need backup and recovery tools, which will help with security as well as other disasters.

Section 5 — Interfaces

This section should specify, to the extent possible, what other computer systems you must be able to communicate with, and what information you must exchange with them. For instance, you will want to specify whether all computers within the system must have access to the Internet or some other network, and what types of information you will transfer across the network (e.g., student transcripts, shared participation in on-line instructional programs). In addition, you may want to specify that you will allow parents to communicate via electronic mail with teachers

CASE STUDY ◦ Act 2. Scene 2 ◦ Later that afternoon

Mary and Joe plop down into comfortable chairs in Mary's office. "Whew," said Mary. "I never dreamed there was so much to think about. I'm glad the faculty and staff have given it some thought."

"You were smart to include some students in the discussion. It's really interesting to hear the different types of experiences the faculty, staff, and students have had with computers. They all seem to have some good ideas about what they want the network to do. Am I saying that right: the network?"

"I think you're getting the hang of it," replied Mary. "I think they made a wise decision to appoint a small group to develop a questionnaire for everyone to complete. I think that will be really interesting information. I didn't know we had so many experienced computer users here at the college."

"Now I'm anxious to see how many folks in my district are already using computers for various things. I plan to send out a memo tomorrow to see who wants to volunteer to be on a technology committee. I know my secretary is interested. Do you think your committee will share their questionnaire with our committee?" Mary nodded affirmatively. Joe looked at his watch and stood up. "Maybe I should head back to the office and get that memo dictated today. It sometimes takes a long time to get memos into the hands of all the staff and teachers. Some principals seem to throw away my memos without even reading them."

"Well, Joe. It sounds like e-mail is just what you need to speed up your correspondence."

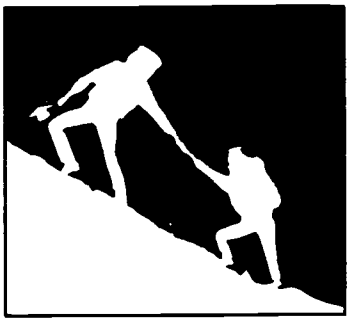
"Oh, no," he replied. "If I get into e-mail, that will mean I have to learn how to type. You can't teach an old horse like me how to type."

"Wanna bet?" asked Mary. "We'll get you computer literate yet!"

and administrators. Another type of interface you might consider is with local, state and federal education agencies for the exchange of routine data.

Beginning with Chapter 3, you will learn more about the technical components of computer systems and functions. The information in Chapter 3 will help you prepare your *Functional Specifications* document.

Where Can You Get More Help?



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CHAPTER 3

Knowing What You Have

OBJECTIVES:

By the time you finish this chapter you will be able to:

- ✔ **Understand basic features of computer and networking technology.**
- ✔ **Describe your current technology environment.**
- ✔ **Ascertain which hardware and peripherals you'll need to accommodate when implementing your technology solution.**
- ✔ **Identify persons who can help you make decisions about new or "upgraded" computer and networking technology.**
- ✔ **Identify ways to fund purchases or otherwise acquire equipment and software.**
- ✔ **Begin the planning process for on-going support for your technology.**

CASE STUDY ◦ Act 3, Scene 1 ◦ A month later

Joe called Mary one afternoon about a month later. "Mary, what do you think of the trees this year? They're gorgeous, aren't they?"

Mory replied, "I'll say. You should see the view from my office! By the way, did you receive the questionnaire put together by our technology committee?"

"We got it last week, and our computer committee went right to work. They rewrote a few questions to make the questionnaire more specific to our schools, then they sent it out. They are planning to start doing interviews and focus groups on the afternoon we have staff development scheduled. Most everyone seems to be pretty excited, although a few are still pretty suspicious. I talked with those two school board members who work for a computer company, and they were pleased about our plan. They have agreed to help us when we are deciding what to get. By the way, didn't you say you have some computers already on campus. That should give you a head start in setting up your network."

"I don't know," replied Mary. "I overheard a couple of faculty members calling the lab computers dinosaurs, and indicating that there were many newer smaller computers that are more powerful. I wince at the thought of big computer purchases. I sure hope we can use at least some of what we have."

"I know what you mean," said Joe. "It seems like only yesterday we bought those computers for the high school computer lab. I think they were Apples. They cost us an arm and a leg, and I think we are still paying for them."

"I didn't know there were any of those still around," chuckled Mary. "I used one when I was working on my dissertation eons ago. There's no telling what else you might have if you still have Apples in your schools, and I'll bet you aren't the only district with those types of computers."

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What Technology Resources Do You Have Available?

Most education organizations have physical, human and fiscal resources on which they can build a new technology solution.

Most schools, universities and libraries have one or more computers; some were purchased, others were donated. All of them have hardware and software, and some may be networked. Another type of resource is people. Some people are quite skilled at using computers; others have no experience with computers whatsoever. In order to determine what you need, you *must* determine the resources that you currently have available.

When we refer to resources, we are talking about any of the following:

- ✔ Existing computers, including hardware and operating systems.
- ✔ Software programs.
- ✔ Networks and networking capacity.
- ✔ Staff with assigned technology responsibilities.
- ✔ Staff who are interested in helping out with technology.
- ✔ Parents and community volunteers with technology "know how."
- ✔ Allocated budget funds.
- ✔ Other current and potential sources for technology support.
- ✔ The current (or planned) context within which your technology solution must function.

To a technology novice, distinguishing between computers, operating systems, memory requirements, peripherals, networks and other technical issues can be daunting. Save yourself time, aggravation and intimidation; find someone who is knowledgeable about computers to help you document the current technology resources that already exist in your organization.

Documenting this information need not take a lot of time; however, the more complete you make the inventory, the better able you will be to determine what existing resources can be used to develop your new computer and networking technology. In the long run, this can save you time and money.

What Hardware Do You Have in Your Organization?

There are many types of computers present in education settings, including newer, more powerful microcomputers.

Hardware, n.:
The parts of a computer system that can be kicked.

Computer hardware is the equipment used to do the work (i.e., operate software programs). It consists of the items you can touch, such as the computer case and the peripherals (e.g., monitor, keyboard, mouse) that are attached to the computer. The following descriptions will help you prepare to document your existing hardware.

Understanding the Different Types of Computers

When we look at Computer Type, the fun (or confusion) begins. Computers are classified according to their storage and computing capacity, the number of users that can be supported, the variety of input

and output options, and their physical size. There are three main types of computers:

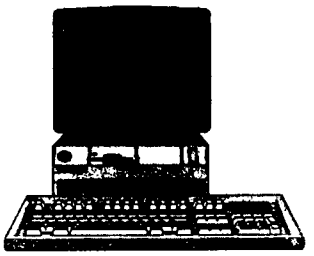
Mainframes are often referred to as the dinosaurs of the computer industry. Mainframes often store data on large reel-to-reel magnetic tapes that require extensive physical storage space. Many school districts, state education agencies, and universities have very large mainframes because they support so many users and have the storage and computing capacity needed for large data sets. Users of mainframes (such as the IBM 3090, the CDC Cyber 90, and the Cray Supercomputer) use dumb terminals or "tubes" that have screens and keyboards to connect to the mainframe.

Minicomputers, such as the Digital Equipment Corporation VAX and the IBM AS/400, are between mainframes and microcomputers in both size and capacity.

Microcomputers, *a.k.a.* Personal Computers or PCs, are today's computers of choice because the speed, power, and capacity of microcomputers have increased and the cost of processing power is much lower than for mainframes. They are small (desktop size) and use a microprocessor chip (the brains of the unit) to run the computer. PCs are generally used by only one person at a time, but can be networked to provide communication with other PCs, mainframes and minicomputers. PCs may also be described by physical size, such as desktop, laptop, and notebook. Both Macintosh and IBM-compatible computers are considered a part of this category of computers.

While the process of putting together a technology system is basically the same no matter what type of computer is desired, our focus will be on microcomputer (PC) systems.

Mainframe Computer System



Microcomputer System

Becoming Familiar With Microcomputer (PC) Manufacturers and Models

There are many different manufacturers of microcomputers, and there are people who create custom computers by putting together the independent parts. There are many computers in use that are no longer made. Schools seem to have more than their share of these types of computers. Following is a list of commonly found computers, some old, some new. This list is not all-inclusive, but it is important to illustrate the many types that do exist.

- ✔ Commodore, Tandy TRS-80, Texas Instruments, Atari, etc.
- ✔ Apple IIe,IIgs.
- ✔ IBM PC, PC/XT or Other MS-DOS 8088 or 8086 Processor.
- ✔ IBM-compatible 286 (or 286 PC), 386, 486, Pentium Processor (or Pentium PC), IBM-compatible other (such as Dell, Compaq, Gateway).
- ✔ Macintosh LC, LCII, LCIII, LC 520, 550, 575, Performa, Power Macintosh, Macintosh AV 660/630, Macintosh other, etc.
- ✔ Amiga — All models.

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Understanding Computer Characteristics

Microcomputers can be described by their speed, the size of Random Access Memory and the capacity of their hard drives.

The *computer* case (a.k.a. the *system unit* or *console*) contains the components of the computer system that enable data to be processed according to a series of instructions. The brain of the computer is called the central processing unit or CPU. The CPU processes instructions and manages the flow of information through a computer system. The speed of a CPU is measured in megahertz (MHz), or millions of cycles per second. The numbers that follow a computer's name most often refer to the speed with which it works. The higher the number, the greater number of megahertz. Speeds of 100 MHz or better are common on the newer Pentium PCs.

Another key parameter affecting performance is the amount of *Random Access Memory or RAM* (space in the computer on which information is temporarily stored while the computer is on). RAM is measured in bytes, where a byte is one number, letter or symbol. One megabyte (MB) of memory is equal to 1,048,576 characters, which is approximately equal to one novel. Many of today's personal computers have about 16 MB of RAM.

Inside the microcomputer is a *hard drive* (a.k.a., hard disk drive) which is a device used to more permanently store information, such as programs and data. Storage on the hard drive is also measured in bytes. Today's newer personal computers usually have between 400 megabytes and 2 gigabytes (or 2,000 megabytes).

The next significant attribute of the hardware is determining which Operating System (OS) it runs on. *Operating system software* contains the electronic instructions that control the computer and run the programs. Most are specific to a type of computer. Commonly used operating systems include:

- ✔ Windows 95
- ✔ Windows NT
- ✔ MS-DOS
- ✔ Macintosh System 7.X
- ✔ UNIX and Xenix
- ✔ OS/2
- ✔ AppleDOS, ProDOS, and Gs/Os
- ✔ MVS
- ✔ VMS

Software applications will not run if the operating system they require is not installed on the computer.

The *platform* that a computer runs on is the hardware and operating system software together. Software applications will not run if the operating system they require is not installed on the computer. Fortunately, some software has multi-platform capabilities which means that it can run, for example, on computers using Windows 95 or the Macintosh proprietary operating system.

Identifying Peripherals

A *peripheral* is any component that attaches to your system unit such as a monitor, keyboard, mouse, modem, CD-ROM, printer, scanner, and speakers. Below is a list of definitions that you may need to refer back to from time to time.

Monitor. A monitor is the computer display screen. Monitors, like televisions, contain *Cathode Ray Tubes (CRTs)*. Monitors may display in black and white (old ones) or color (newer models). The clarity of the images on-screen is referred to as their *resolution*. When purchasing a monitor, a key consideration should be the number of colors it is capable of displaying; the more colors displayed, the more realistic is the image on the screen. A Video Graphics Array (VGA) monitor displays 16 colors, which is the minimum standard. Super Video Graphics (SVGA) monitors display many more colors.

Keyboard. On a computer, the keyboard is used to type information and instructions into the computer. Most have number pads and function keys that make the computer software easier to use.

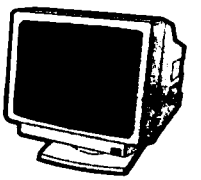
Mouse. The mouse is a hand-held pointing device (used on top of a desk) that gives directions to the computer and moves information around on a monitor screen.

Printer. A printer translates signals from the computer into words and images onto paper in black and white or color. Printer types include dot matrix, ink jet, laser, impact, fax, and pen and ink devices.

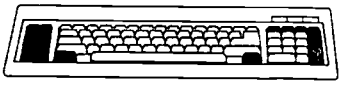
Cables. Cables are the collections of wires twined together to connect peripherals to the system unit.

Modem (a short form of "modulator / demodulator"). The modem connects the computer to a telephone line for communication with another remote computer or information network. Modems may be internal or external to the computer case. Modems send and receive information at different speeds. Today's minimum desired speed for a computer is 28,800 bits per second (bps), but faster is better.

Various Peripherals



Monitor



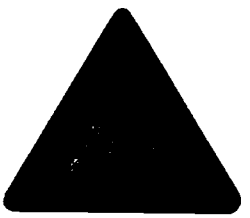
Keyboard

Mouse

Printer

Considering Furniture

Often when an equipment budget is being established for a new technology system, the element that may be forgotten is the need for appropriate furniture to accommodate it. This is important for a variety of reasons, the most important being security, safety, and comfort. Furniture should be ergonomic and receptive to security (wires, bolts, etc.).



Developing an Inventory of Hardware

It is important to determine exactly what hardware you have and its quality. The quality of your hardware refers to age, speed, and capacity. Many older computers can't be connected to networks or use current software; therefore, they are considered obsolete. Many of these computers still have valuable uses, and can be "deployed," or given a new purpose within the organization.

Make a list of your computer hardware, peripherals and furniture for future planning.

In order to make the best possible use of existing hardware, your technology inventory should contain the following information for each computer system:

- ✔ Computer type (e.g., desktop, laptop, mainframe).
- ✔ Computer manufacturer, model, and characteristics (e.g., type of cpu, amount of RAM, and hard disk size).
- ✔ Peripherals and capabilities they support.
- ✔ Intended uses (e.g., classroom instruction, correspondence, record keeping, accounting, graphics).
- ✔ Networking capability.

✔ Location — building/room.

You should also document information about furniture allocated specifically for computer systems.

BUILDING	ROOM	COMPUTER TYPE	PERIPHERALS	USES
Wilson H.S.	Office	3 386 PCs (2MB-RAM, 20 MB hard drive)	VGA Monitor, Keyboard, Laser Printer, 9,600 Modem, Mouse	Correspondence, Budgeting
	Library	1 486 PC (8MB-RAM, 400 MB hard drive)	VGA Monitor, Keyboard, Mouse, Scanner, Printer	Correspondence, Record-keeping
	Room 235	2 Apple IIes	Monitor, Keyboard, Dot-matrix Printer	Teachers' Use
Long J.H.S.	Office	1 286 PC	Monitor, Keyboard, Laser Printer	Correspondence

Table 3.1: Sample Hardware Inventory

If you have computers, you have application software programs that contain the electronic instructions for doing instructional and administrative tasks on the computer.

What Application Software Is Available?

When we talk about *software*, we are referring to computer programs that work with your computer to help you perform specific tasks, such as creating a spreadsheet, creating a database, writing a report or producing a presentation. We have already spoken about Operating System software; now we need to discuss application software.

Understanding the Different Types of Application Software Programs

Applications contain the electronic instructions that let the user accomplish specific tasks. There are three basic categories of application software commonly used in education settings: administrative, instructional management, and instructional.

Administrative software programs perform a wide variety of functions, including maintaining student, staff, and financial records, scheduling students, determining bus routes, and inventorying and checking out library books. There are *utility* software programs that help you manage, recover, and back up your files. Other commonly used administrative applications include:

- ✔ **Word processing programs** allow you to type, revise, format and print documents quickly and efficiently. Microsoft Word, WordPerfect, and Lotus WordPro are among the most frequently used, but there are (and were) many others.
- ✔ **Spreadsheet programs** have efficient and accurate methods of working with numbers. These programs can be used to perform a wide variety of simple to complex calculations. They also offer charting and graphing capabilities. Lotus 1-2-3, Microsoft Excel, QuattroPro, and Visicalc are frequently used products.
- ✔ **Electronic Mail (e-mail) packages** facilitate computer-to-computer communications among users in any location. One commonly used e-mail package is called cc:Mail.
- ✔ **Data base programs** use the largest and most complex structure for storing data. These programs help you store large amounts of information (in a data base) and give you the capacity to search, retrieve, sort, revise, analyze, and order data quickly and efficiently. There are two types: *flat file data bases* and *relational data bases.*
  - **Flat file data bases** store information in a single table (e.g., a table in which there is a list of employees, where data about each employee follows the name).
  - **Relational data bases** store data in more than one table, each one containing different types of data. The different tables can be linked so that information from the separate files can be used together.

Instructional management programs are tools used by teachers to prepare for instruction and keep records. Some of these applications often used by teachers include gradebook programs and curriculum builders such as crossword puzzle generators.

Instructional software typically contains programs that allow students to learn new content, practice using content already learned, and/or be evaluated on how much they know. These programs allow teachers and students to demonstrate concepts, do simulations, and record and analyze data. Often administrative applications like data base programs and spreadsheets are used within the instructional context to help analyze and present information.

Working With Applications Software

Software programs and information are usually stored in *files* (magnetic versions of manila folders) inside the computer on the hard drive or outside of the computer on *diskettes* (formerly called *floppy disks*) or *CD-Roms*. Diskettes are thin, plastic flexible disks on which information can be magnetically stored. There are two types of diskettes. The most commonly used is a 3.5 inch disk that comes in a hard plastic square case. In addition, there is a 5.25 inch disk that comes in a thin pliable case that is like cardboard that is an older format seldom used today. A computer must have a *disk drive* to read the information on the floppy disk, and the drives are different for the two types of disks.

Diskette

Information is also stored and read from CD-ROM discs. *CD-ROM* stands for "compact disc-read only memory." Because of their massive storage capacity, CD-ROMs are also useful for storing large collections of data, such as complete encyclopedias. Software programs also often come on CD-ROMs. While CD-ROMs have the ability to store large amounts of

CD-Rom

information, it is not yet commonplace for the everyday user to be able to save information onto a CD-ROM (hence, "read-only memory); these are currently available with information already embedded. For now, if information needs to be stored on an outside medium, a diskette is still the easiest and most convenient method.

Knowing the Currency of Your Software

Software that runs on an older computer probably will not work on newer machines. This is particularly important with instructional software that is used by many teachers.

You should always know the *version* and *release* of the software you are using because that indicates how advanced and up-to-date your software is. The version is the edition of a product. Each time a software developer makes major changes to the software, such as adding new features, the software receives a new version number. Beware of using *beta* versions (a second test version often distributed to a limited set of users on a trial basis prior to public release) of software. These releases often contain *bugs*, which are glitches that prevent the software from being able to perform all of its capabilities or affect its ability to function. The release number of a software program is usually changed when only minor changes or bug-fixes are done. Installing a higher version or release on your computer system is called *upgrading* your software.

There are several reasons why the version and release numbers are important. If you are using older software, you may find that:

- ✔ Old versions of software may not recognize or be able to use files created in newer versions.
- ✔ It may be difficult to get documentation or support for dated versions of software.
- ✔ Software that runs on an older computer probably will not work on newer machines. This is particularly important with instructional software that is used by many teachers.

While getting the most up-to-date versions of software may be alluring, maintaining the compatibility of software and hardware is more important. This is discussed more in Chapter 7 in the discussion about upgrading software.

Knowing About Software Features

When you put together your Needs Assessment list (see chapter 2), make sure to include the desired software features, or capabilities offered by software that make it easy and effective to use. Features include:

- ✔ Use of a mouse.
- ✔ Pull-down menus.
- ✔ Pop-up windows with pick lists from which to select options.
- ✔ Security sign-on or password.
- ✔ Screen memory that brings the user back to the last screen entries.
- ✔ Ability to save common reports or settings.
- ✔ Drivers for a wide variety of printers.
- ✔ Help menus or windows.
- ✔ Ability to add data elements to screens or reports.
- ✔ Capability to read a variety of data formats.
- ✔ Compatibility with local, state, national or international standards.

- ✔ Direct import and export of text and graphics from other software applications.
- ✔ Feature bars that display a variety of icons for easy selection of features.
- ✔ Zoom capability to change the size of screen images.
- ✔ Cut and paste capabilities.
- ✔ Full word processing features for text fields (e.g., spell check, multiple fonts).
- ✔ Sound.
- ✔ Networkability and multiple user access.
- ✔ Capacity to expand to accommodate growth in the amount of data available or users.
- ✔ Video.

If you feel you need to understand more about the types of features available, or how they can be used, make sure to consult someone who can help you to understand the benefits of each.

Developing an Inventory of Software

When developing an inventory of software include the following types of information:

- ✔ Name and manufacturer.
- ✔ Version.
- ✔ Function.
- ✔ Computer or network on which it currently resides.
- ✔ Operating system on which it runs.

Make a list of available software and characteristics such as platform, version, system requirements, and usage.

Each type of application software specifies the following information, which is useful to record:

- ✔ Type of computer or the operating system with which it can be used.
- ✔ CPU processing speed.
- ✔ Amount of memory (RAM) needed.
- ✔ Amount of hard drive storage needed.
- ✔ Type of monitor capabilities required for minimum optimum performance.
- ✔ Other requirements.

There are literally thousands of software programs available. You may want to inventory your application software according to categories, such as:

- ✔ Word processor (e.g., Microsoft Word, WordPerfect, Lotus AmiPro, or others, such as those associated with specific computer systems like Wang.
- ✔ Spreadsheet (such as Lotus 1-2-3, Microsoft Excel, QuattroPro, Visicalc).
- ✔ Data base (e.g., Borland dBase, Microsoft Access, Oracle, Foxpro);.
- ✔ Application suites (e.g., Corel PerfectOffice Suite, Microsoft Office);.

- ✔ Presentation software (e.g., WordPerfect Presentations, PowerPoint);.
- ✔ Education management package (e.g., MHSS, CIMS, McSchool , SASI, OSIRIS, Columbia School Systems, Pentamation).
- ✔ Instructional management package (e.g., Gradebook)
- ✔ Instructional (listed by subject).

Once you've made all of the requisite decisions discussed in this section and filled out your Software Inventory list, you will want to determine what networking capacity, if any, you currently have.

SOFTWARE NAME	TYPE OF COMPUTER, OPERATING SYSTEM	RAM REQUIREMENTS	HARD DISK SPACE	TYPE OF SCREEN DISPLAY	OTHER REQUIREMENTS
Encarta 96 Encyclopedia	Multimedia PC 486SX, Windows 3.1, MS-Dos 3.1, Windows 95, Windows NT	8MB	Windows 3.1 — 11 MB, Windows 95 — 9MB	256-color or better	4X CD-ROM drive, audio board, speakers, mouse

Table 3.2: Sample Software Inventory

What Networking Capabilities Do You Have?

Many education organizations have networks consisting of hardware, software and communications links that make it easy for people to share information electronically.

For many years if you mentioned the word "network," the three major television networks (ABC, CBS, and NBC) would come to mind. Today, a network has a whole new meaning for computer users. Yet, there is a similarity in that a network is comprised of affiliates (users) who share programming (data) over a common infrastructure. The goal is to ensure that information is transmitted and shared as quickly and efficiently as possible, among as many people as needed.

Some schools, districts, institutions, libraries, and education agencies have established in-house connections between computers or have provided means by which persons working in these organizations can connect with computers outside of the organization. Often individuals establish their own linkages to networks such as the *Internet* (a.k.a. the information superhighway) by purchasing software and using a *commercial service* (a company that will connect you so that your computer can exchange information with other computers). Your inventory will need to take into consideration both equipment and types of networks. But first, let's talk a little about networking in general.

Understanding How Networking Works

A *network* is the complete set of hardware and software used to connect computers together to share information and peripherals, such as printers and modems. Networks allow information to be exchanged directly between computers without having to be transcribed by hand.

There are two types of networks, local area networks and wide area networks. The smallest networks are *Local Area Networks (LANs)* in which 2 to 500 or more computers are connected by cable within a small geographic area, often a single building. Larger networks called *Wide Area*

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Networks (WANs) use telephone lines, dedicated cables, radio waves and other media to link computers that can be thousands of miles apart.

The geometric configuration of the computers is called the *topology* of the network. The standards and rules in which the computers communicate on a network are called *protocols*. Information is stored in networks in two basic configurations:

- ✔ In *peer-to-peer networks*, people store their files on their own computers, and anyone on the network can access the files stored on the other networked computers.
- ✔ In *client/server networks*, all people store their files on a central computer, and files are accessed directly from where they are stored on the central computer. In the client/server network, the server is the central computer that stores the information, and the *client* is the computer that can access information from the central computer. It is generally easier to manage, back up and protect data in a client/server network.

Networks require a variety of different types of equipment. You may have a *hub*, where all the cables linking client computers to the server come together. The hub serves as a traffic cop for client computers within the network. A *router* is a special device that regulates network traffic as it enters another network, such as the traffic from a school LAN as it connects to the Internet.

A Note About the Internet

Perhaps the ultimate WAN is the Internet, which is a matrix of networks. The Internet interconnects hundreds of thousands of supercomputers, mainframes, workstations, personal computers, laptops and more.

Currently the most popular application available via the Internet is the *World Wide Web (WWW)*. It is the primary navigation tool for those *surfing* (scanning and exploring) the Web. Two of the most popular browsers (software which lets you view information on the WWW in a graphical manner) are Netscape and Internet Explorer. Popular search tools include Lycos, Yahoo, Alta Vista as well as many others. More often than not, people who say they are *"on-line"* are connected to the Internet.

To access the Internet, you have to go through a computer with a direct Internet address. This computer can then provide access to the Internet for many people, and each one can have his or her own e-mail address through that computer. In order for those people to connect to that computer, however, they must have their own computers with connections (or lines) to the computer with the Internet address. Typical connections include dial-up telephone lines, ISDN lines, and T-1 lines. The type of line determines among other things how many users can have access to the Internet at once.

Education organizations often do not have a dedicated computer that is directly connected to the Internet. They usually buy permission to use the computer with the Internet address. The organization that provides the usage is called an *Internet Service Provider (ISP)*. There are a variety of *Internet Service Providers*, such as phone companies, as well as "value added" commercial environments such as America On Line (AOL), CompuServe, Prodigy and The Microsoft Network. Internet Service Providers assign electronic mail addresses, provide browsers, and can offer services such as news groups, products, and specialized search capabilities.

Internet Service Providers can provide both the connection and access time to the Internet, but many do not. Access to the Internet requires both a connection (e.g, phone, ISDN or T-1) and the access time to the dedicated computer on the Internet. Each one may have a cost. It is wise to shop around for your best deal before choosing an ISP.

As part of your networking capability inventory, you should also list each provider, all related fees, and any access restrictions. Before deciding which provider will be best for your organization, find out what other organizations that are similar to yours are using, and consult with someone who is familiar with the capabilities of all of these providers.

Developing an Inventory of Networking Capabilities

Take inventory of your networking hardware, software and communications links, as well as any service providers who give you access to a network such as the Internet.

If you have a LAN or WAN, you should develop an inventory of the equipment and software specifically allocated to the network and note where they are located. You should also prepare a sketch of the configuration, such as the one in **Figure 3.1.**

The inventory categories may include:

- ✔ Server (e.g., Macintosh, IBM, Dell network server).
- ✔ Operating System (OS) software (e.g., Windows NT, Novell, Banyan).
- ✔ Cable-type (coaxial, Unshielded Twisted Pair (UTP), Shielded Twisted Pair).
- ✔ Other equipment (e.g., tape back up system, router, hub).

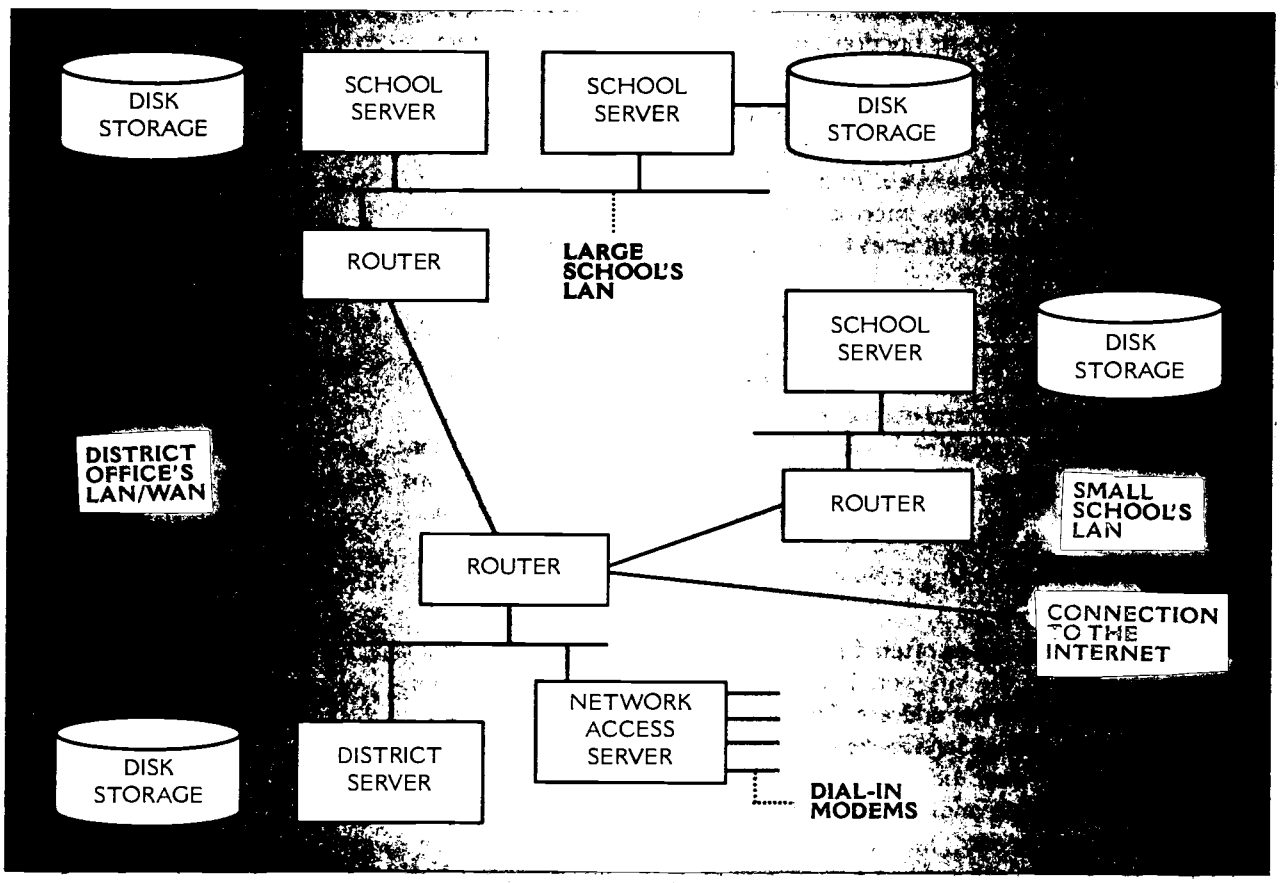

Figure 3.1: Sample District Network Design

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BUILDING	ROOM	SERVER COMPUTER TYPE	OPERATING SYSTEM SOFTWARE	CABLE	OTHER EQUIPMENT	EQUIPMENT CONNECTED
Physics	105	Dell Network	Unix	Coaxial	Router, Hub	10 PCs 2 Printers
Education	Lab	Macintosh	AppleNet	Coaxial	Tape back up	25 PCs 3 Printers

Table 3.3: Sample Network Inventory

What Human Resources Do You Have Available?

If you have computers in your organization, you are likely to have people who know how to use them. Some may also have knowledge of the mechanics. Even if you don't have any computers, many people in the field of education have used computers elsewhere. Some may be quite sophisticated when it comes to putting together computer systems and developing user-friendly applications. Identify these people; they can be invaluable to your efforts!

There are people in your organization with experience or an interest in the use of computers who can help you.

First, find those people with whom you work who have experience and/or training in developing and managing computer systems and networks. They should be able to help with issues involving computer programming, software development, and computer repair. They can also help you document your technology resources and plan for what you will need.

As part of your human resource inventory process, you may want to ask staff members about their willingness to participate in your technology inventory and development process. If they are computer users, find out about the extent of their usage and ask questions such as whether or not they use a computer to:

- ✔ Play games?
- ✔ Surf the Internet?
- ✔ Balance their checkbooks?
- ✔ Write reports or e-mail?
- ✔ Perform statistical analyses?

Anyone who uses the computer for any of these purposes can be helpful in designing or revamping a technology system. Change agents and champions of the cause within your organization will help you spread knowledge about the uses and benefits of technology among the rest of your staff.

Within your organization there may be someone charged with the responsibility for developing technology solutions and providing support or overseeing the purchase of new technology equipment. This person (or office) is important, because there are many benefits to centralized ordering or decision making, such as:

- ✔ Ensuring the compatibility of computers.
- ✔ Getting bulk discounts.
- ✔ Ensuring support is available.

Additionally, there may be an office at the state level that could provide guidance, training, and support. A state education agency or the office of a

university system may benefit from services available through a specialized office serving these organizations.

A final, and potentially very important group, consists of parents and community volunteers. Many parents are anxious to help their children's schools get new technology capabilities. It would be helpful to identify those parents who have technology skills and experience as well as those who do not, but are willing to help. If you have computer-related companies in your community, they can be asked to provide volunteer staff assistance, or even paid to provide oversight of other volunteers. Often community members will come forward to offer their help. While you must be careful in how you use these volunteers (see the section on Volunteers in the Chapter 7), they can provide valuable help, particularly now when you are trying to identify what resources you have.

What Financial Resources Are Available?

Look for traditional funding sources within your organization as well as other sources of funding and assistance.

Perhaps you've earned a grant, received an appropriation, or recently had a bond issue passed. If so, financial considerations may not be important. If, on the other hand, you have decided to develop a new computer system or upgrade or revamp an old one without such support, funding for purchases, training and maintenance may be problematic.

There are ways other than winning the lottery to get funds to support your technology dreams. One way is to evaluate how funds are currently being spent to see if there are more efficient ways to use your money.

Some school districts, libraries and universities have found that working together has enabled them to share expertise and build a community-wide case for networking.

There are many sources of help in this area. Many state education agencies and federal agencies and programs provide support for computer technology development. In addition, many corporations and foundations will also provide financial and/or technical assistance in response to written grant applications.

CASE STUDY ◦ Act 3, Scene 2 ◦
One Saturday morning before the winter holiday vacation

Mary arrived at Joe's office and saw him sitting at his conference table in jeans and a sweatshirt surrounded by stacks of paper. He looked up and said, "Hey, Mary. What on earth are you doing here?"

"I thought I would find you here. I just wanted to give you a fruitcake to enjoy during the holidays."

Joe chuckled and said, "Oh, is this the ubiquitous fruitcake I keep hearing about? I hear it makes a great paperweight. Did you make it yourself, or is it the same one that keeps getting passed around?"

Mary put her hands on her hips and made an exaggerated pout. "You louse. See if I go out of my way to bring you a gift ever again."

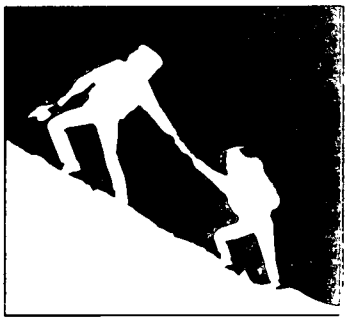
Joe got up, picked up his coffee cup and went over to where Mary was standing. "You know I'm just kidding. I really love fruitcake. Here, let's have a slice with a cup of coffee while I bring you up to date. Have a seat."

Mary sat down at the conference table. "My, you have been busy! I see you have all kinds of lists: school computers, central office computers, library computers. And just look at this inventory of software available in your district!"

"We have really learned a lot over the last couple of weeks, and our situation is just like yours. We have lots of stuff, but much of it is incompatible, and most of it is old as the hills. Here, look at this list. We even have some eight-track tape players. We don't have any mainframe computers like you do, but in some ways our computer list is even worse. I had no idea how many computers were still sitting in their boxes in closets. Unfortunately, a lot of the instructional software that we or the PTSA purchased is so old that some of the techniques used in the software have been declared garbage by researchers. The good thing I found out is that there are a bunch of teachers who use newer computers at home, and have experience using networks like the Internet. One teacher is even taking courses leading toward a computer science degree. I hope we can keep her when she finishes her degree. She and her husband and a couple of parents from the PTSA were a big help in figuring out what we have."

"Joe, I am impressed. You're using computer terminology like you understand what you're talking about. We were also lucky to have some folks who knew about computers to help us with our inventory and to help us figure out what we need; but I wouldn't have hesitated to look for a consultant to give us help. In fact, we probably will have to get some consulting help to figure out what we need to do next. But I'm not going to worry about that now." As Joe reached for another slice of fruitcake, Mary exclaimed, "Joe, you really do like the fruitcake! I guess it's time for me to admit that I baked it."

Where Can You Get More Help?



USDLA Funding Source Book for Distance Learning and Educational Technology lists hundreds of funding sources for technology. For more information on purchasing this publication, call (718) 857-3717.

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CHAPTER 4

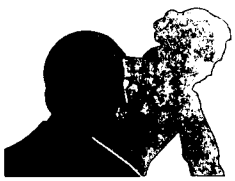
Knowing What To Get

OBJECTIVE:

By the time you finish this chapter you will:

- ✔ **Know what technology solution you should implement**
- ✔ **Understand the process of how to go about getting it.**
- ✔ **Know who can help you get what you need.**
- ✔ **Know who can support what you need.**

CASE STUDY ⊖ Act 4, Scene 1 ⊖ A couple of weeks after New Year's Day



Joe calls Mary late in the day. "Mary, you may be surprised to know that I finally got all those stacks of papers arranged. It took me almost all of the holidays, but I felt like I had to do something fast; my technology committee is chomping at the 'bit' to get moving."

Mary laughed. "That's a great pun, Joe. Our folks are anxious to get moving as well."

"We had a great technology committee meeting last week to pull together the information from the needs assessment and the various inventories, and I think we have a pretty good idea what we want our new computer system to do. But we're still feeling a little insecure about what we're doing."

"I know what you mean, Joe." I look at all the background materials we have generated and all the suggestions my folks keep giving me, and I don't know where to start."

"I'm planning to call some superintendents I know whose districts have been through this process. I am hoping we can invite some of their staff members to meet with our technology committee so they can tell us how they got their systems set up. I'm hoping that will help us figure out what we need to do to get the system we want set up and working. If we get some meetings set up, do you want to join us?"

"That's a great idea, Joe. I should call some of my colleagues as well. You know, maybe we could get some help from the Big State University folks. I'll bet they have state-of-the-art systems, and I know they have lots of technical personnel."

"They probably do, but their systems may be more than we really need. Still, it's worth a try," said Joe. "I think I could also use some help on budgeting for the system. I don't want us to be in the position of paying over a long time for computers that become obsolete and can't be upgraded easily, as happened with our Apples."

At this point in the process, you have defined your needs, taken stock of existing resources, and, in some cases, developed a set of functional specifications describing what your technology solution should be able to do. In other words, you have done a lot of work. The problem is, you still have nothing to show for it. To make matters worse, your organization's requirements may be changing, threatening to make your needs assessment obsolete.

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This is the time you may encounter the dreaded "whisky (or whiscy) syndrome" among users and managers. This refers to the impatience that occurs as the preliminary steps such as the initial analysis and documentation are being executed. This frustration is crystallized in the question: "Why the heck isn't Sam coding yet?" Your job is not only to preserve your own patience, but everyone else's as well.

Take heart. You're on the right track. By taking the time to become educated and informed, you can avoid making big mistakes (i.e., building an inappropriate or useless technology solution) that could cost your organization many times as much money and effort as you've spent so far. These precautions will allow you to progress to the point at which you can start finding solutions.

The results of the needs analysis and the current resource assessment must now be reviewed together. Whether or not the needs analysis and resource assessment were done by different individuals or teams, key decision makers must look at them both in order to draw sensible conclusions and take the next step.

The solution that you are seeking during this phase is how to most effectively fill the gap between what you need for your technology system (e.g., the software you want to run and the hardware and networking needed to run the software) and what you already have. Deciding how best to fill this gap — by building or buying a new system or by making major enhancements to an existing one — is the subject of this chapter. This chapter will walk you through the process of deciding exactly how you're going to fill this gap, how are you going to arrive at a solution, and what it will take to build and support it.

What Kinds of Things Should You Consider?

Select a technology solution that best meets your organization's goals and needs, projected costs and expected benefits.

There are many things you need to consider before making a final decision (or a recommendation to the ultimate decision maker) about the desired technology solution. You know what you want and what you've got, and by now you have seen lots of examples and possibilities. Now you need to weigh these possibilities against your organization's capacity. There are many different labels and buzzwords commonly applied to these types of analyses ("build versus buy analysis," "feasibility study," "alternatives analysis," etc.). Rather than focusing on the jargon, keep in mind these basic questions that must be answered:

1. What is the best approach to meeting your requirements, i.e., filling the identified gap?
2. How much is this solution going to cost?
3. What will my organization gain from this solution? Is it worthwhile?

The first question embodies many more detailed ones (e.g., Should we build or buy? Who will do the work? How long will it take?). Answering these questions should help you decide on what is the best technology solution for your organization. Deciding on a solution is not enough, however. You need to look at what the solution will cost and consider establishing priorities and looking for other funding to make the solution happen. Finally, the decision will have to be put into perspective as it relates to the goals of the organization. It should be answered partly through a comparison of projected costs to some measures of the expected benefits

of meeting the needs you have uncovered. So everything you do in this phase will be critical for the final decision.

Because this phase is so important, you may need some help with these types of questions. If so, you may want to develop a small advisory team consisting of:

- ✔ Someone very familiar with the functional requirements (perhaps a teacher, administrator or instructional supervisor).
- ✔ Someone very familiar with current system capabilities (perhaps a technical support person).
- ✔ Someone who has been through the system implementation process before, ideally in your organization.

If the solution must meet the needs of several types of users, it is probably best to have all types represented.

Considering Your Software Options

In years past, many organizations and businesses chose "a custom-developed solution" because there were fewer software programs on the market, and those that did exist were limited in scope. If you wanted a computer system to do something, you had to write computer programs or hire someone to write programs that would address your needs. Today, there is a much wider and richer commercial market of software products to meet many of the needs of education organizations. Still, it isn't safe to assume there are products that will exactly meet your requirements. You need to consider an array of possible solution approaches.

Chances are, your technology solution will include a number of different software products and applications. Some of these software products may work together efficiently because they are part of a suite (such as Microsoft Office Suite or Corel Office) or because they have been specifically programmed to take advantage of a particular operating system. Often, however, you will be choosing a set of software packages that do not relate to one another and may need custom programming to make them work together. For instance, you may choose a student information system package, a personnel information system package, and an accounting package from three different companies. If you want to use information from two or more of these packages (such as personnel and payroll), you may have to have special programming done to create an interface among them.

Figure 4.1 lists the key software design options you should consider for each type of software application you need.

Figure 4.2. illustrates that there is a trade-off between the amount of effort needed to implement these types of solutions and the cost of the solution. The trade-off between these components may be

Software Design Options

Custom product development: Software programs are written specifically to meet your organization's needs, and are placed on a computer system located on the premises of your organization.

Customized product modification: A commercial software product is purchased that can be modified to the point where it meets your needs on your own computer system.

Non-customized product: A commercial software product is purchased with the intent of using it and supporting it as-is on your own computer system.

Use of a Service Bureau: An external company or agency is contracted with to supply your organization with access to a software product/system that resides on their hardware. Your users operate the system from your premises, but the service bureau maintains the hardware and software at its site.

Outsourcing the Function: A contractual agreement is made with an external company or agency that not only provides and maintains your organization's hardware and software, but also does the day-to-day transaction processing, data storage and retrieval, etc.

Figure 4.1: Software design options

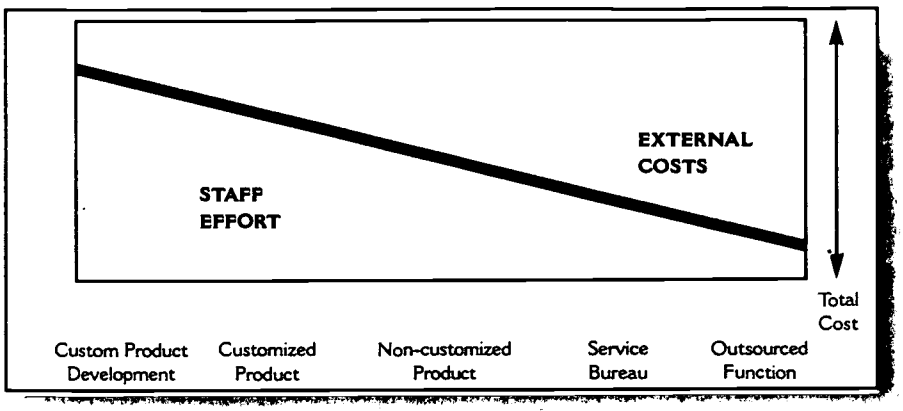

Figure 4.2: Solution Trade-Offs

vitally important to your organization.

As you can see in the figure, the options are listed in ascending order with regard to the cost your organization would incur, and in descending order with regard to the amount of effort your staff would need to dedicate to implementing and maintaining the technology system. Note, however, that the diagonal line doesn't quite touch the corners of the rectangle, because *all alternatives involve a bit of both*. Even custom development is likely to involve some additional costs above and beyond the cost of program development such as having to purchase software development tools. On the other hand, completely outsourcing a function still requires some internal effort, if only to negotiate and administer the outsourcing contract.

Many education organizations find that many of their technology needs are handled best by service bureaus or outsourcing agents. If you decide this is the best solution for your needs, you need not limit your search for service bureaus or outsourcing agents to the commercial world. In many parts of the country, there are county and regional education agencies, college/university consortia, and state information management offices that offer technology services to individual institutions or school districts on a cost-recovery basis. Some states have well-developed cooperatives providing information processing to education agencies.

There are several key questions to ask when looking for a service or product that will meet the needs of your organization.

If you opt for a market survey in search of a software product, there are several published compendiums that you could consult, such as those published by DataPro and Auerbach. There are also many sources available on the World Wide Web that can provide copious information on commercial products available, and listservs where you can ask questions of colleagues in other parts of the country. Some of these sources are listed at the end of this chapter.

Doing a Build Versus Buy Analysis

There are many aspects to deciding whether to buy or build a new computer and networking system. As you read in the last section, widely distributed, commercial software applications may not meet all the needs of your organization, either initially or over time. Modifications or additional features may be desired. If you identify a software product that meets most — but not all — of your requirements, you should determine the options, costs, and staff needs for modifying it to accommodate these remaining needs. If the product still seems to be a viable option, then contact should be made with the software manufacturer to ensure that support can still be provided even after you have modified the product.

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Key questions to ask before looking at software products

ASK:	RESPONSE:
Is yours the only organization likely to have these requirements? (If so, it's unlikely a commercial market has sprung up to provide software solutions to meet them.)	
Are your requirements peculiar to education (e.g., student administration, teacher certification), or generic across industries (e.g., payroll system)?	
How big is the potential market for the functions you need, and how long-lasting? If vendors exist today, is there a risk they will abandon the market in the near future?	
If other organizations comparable to yours have similar requirements, how have they chosen to meet them?	

Modifications that add or change a software product's functionality are generally feasible. Modifications to improve the speed or other aspects of a product's performance, or to enable it to run on different types of hardware, are usually not feasible. Therefore, you should not attempt to make them. Technical software compatibility and performance problems may reflect deep-seated aspects of the product's code (i.e., formula for operation) that can be changed only with great difficulty and by persons with a thorough knowledge of the functioning of the program.

While customizing a current software product's features to match an organization's needs can increase the software's usefulness, and may eliminate or postpone the need to replace it with a different software product, the organization must determine that the costs of the modifications can be justified by the anticipated benefits. On a cautionary note, be aware that customizations to any commercial software product may cause your organization's copy of the software to become out of sync with the basic product, so that future releases or updates from the developer may not work with your customized edition.

Once you have answered these basic questions about software products, you still may have some questions about hardware to answer. In some education organizations, some staff use IBM-compatible computers and software, while other staff use Apples and Macintoshes. Accommodating existing hardware may be more trouble than it is worth, if the equipment is outdated or if your organization has computers using different platforms. There are still many glitches encountered in networking different computer platforms, although it is possible if the equipment is not too outdated or if the software is available and can be used on both platforms. You may prefer to accommodate the platform wishes of your various staff members by spending the extra money and effort to develop a system that keeps everyone happy (rather than declaring that everyone must use the same platform). New solutions to networking are being developed every day.

Key questions to ask about software products

ASK:	RESPONSE:
Is there a commercial software product that meets most of your specifications?	
Is it affordable?	
What modifications are required to add needed functionality that is currently missing?	
What resources are available for any required customizations?	
Would such customizations invalidate your license?	
Would it be more efficient to customize an existing software product than to upgrade an existing system or develop a new system?	
Are the modifications unique to your organization, or would other users benefit from them?	
What are the modifications worth in terms of productivity? Would their cost be justified by the benefits anticipated?	
Will the developer provide the source code, and at what cost?	
Does the developer have a current copy of the source code in a secure location from which it can be copied in the event the developer discontinues support?	
Can the source code be purchased? What is the cost to obtain the source code upon initial purchase/development?	
What software development platforms or programming languages are required to make modifications to the source code?	
Is there another company or organization that is designated to maintain the source code and support the software application if the developer discontinues support?	
Do you have a staff person who can customize or provide support if you choose to modify the software application?	

Evaluating Your Human Resources

Once you have an idea about the approach you want to take, you need to look at your organization's human capacity to handle the implementation and support of the solution. The choice is generally among:

- ✔ Internal user staff.
- ✔ Internal technology or computer systems staff.

- ✔ External technology/systems staff — employees of another affiliated agency responsible for implementing technology (e.g., a state MIS department doing a project for a state education agency).
- ✔ External contractors or product vendors.

Often a combination of several of these categories makes the most sense.

Contracting for customizations or development makes sense when:

- ✔ Staff are not available, or are not trained or experienced for the task.
- ✔ The cost for contracting is less than the equivalent cost of staff time.
- ✔ The time line for completion is short, and the contractor can meet it more easily than staff.

On the other hand, using internal staff makes sense when:

- ✔ Local staff are trained and experienced for the task.
- ✔ They fully understand the required solution and its functions.
- ✔ Staff are available at the time of implementation, and their availability through the life expectancy of the software application is reasonably assured.

Resist the urge to make your decision only on the basis of who can get the solution initially implemented. Remember, someone will also have to support your technology on an ongoing basis afterward.

How Do You Decide What to Get?

Unfortunately, there are no easy answers to this question. Ultimately, you must weigh the pros and cons of several options, and decide upon the one that gives you "the best bang for your buck." Of course staff happiness is also a factor.

There are a couple of things you can do to help you with your decision, if it is not already crystal clear.

Reviewing Organization Guidelines and Procedures

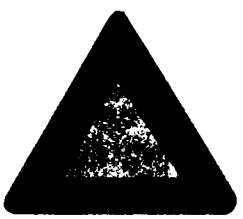
If your organization, or a similar organization, has a set of guidelines for selecting a technology solution, now is the time to bring them back out, and compare them to what you want. For instance, your school district or state education agency may have a contract with specific vendors who can provide you with what you want. Or there may be specific procurement procedures you must follow to get bids on the solution you think fits your needs best.

A typical accounting requirement is the use of a **Request for Proposals (RFP)**. The purpose of an RFP is to request an actual proposal that will spell out specifics such as the product, equipment, costs, delivery dates, etc. Your organization may have a rule that contracts over a certain dollar amount must be awarded as a result of a competitive bid process. If so, there is no point narrowing a market search down to a single preferred product. The product's vendor will have to respond to an RFP anyway, so you can save time by simply defining the category of vendors/developers you want to have bid, then concentrate on writing the RFP.

Request for Proposals Suggested Table of Contents

1. Introduction
   - 1.1 Background
   - 1.2 Overview of Requirements
   - 1.3 Proposal Delivery Instructions (due date, submission address, etc.)
   - 1.4 Organization of RFP Document
   - 1.5 Required Organization of Proposals
2. Required System Capabilities
   - 2.1 Functionality
   - 2.2 Technical Parameters and Capabilities
3. Support Considerations
   - 3.1 System Accessibility and Downtime
   - 3.2 Maintenance Responsibilities
   - 3.3 User Account Maintenance and Security
4. Proposal Evaluation
   - 4.1 Mandatory Criteria
   - 4.2 Point-rated Criteria
   - 4.3 Evaluation Process
5. References Required

Figure 4.2: Table of Contents of a typical RFP.



Of equal importance, be sure to involve the correct set of people in the procurement process. If state or local purchasing administrators or the management information systems (MIS) department needs to be included, delays are likely to result if you wait too long before doing so. Besides helping you decide how to request what you want, they can help to avoid delays that will further frustrate impatient users and erode the currency of the needs assessment.

Figure 4.2 contains a listing of requirements that are often included in an RFP. Your organization may have a specific format you must use. Be sure to request all of the information you think you will need to choose from among various bidders.

Seeking Outside Advice

If you feel you do not have sufficient in-house expertise, you may want to hire an independent consultant or consulting firm to design specifications for the system you want and to give you a bid on implementing the system. There are some advantages to doing this in two phases. If you are not satisfied with the first phase, you can choose someone else to redesign and implement the solution. On the other hand, if you approve of the work done during the first phase, there are advantages to using the same group for implementation. This assumes, however, that you are aware of organizations who you trust to do the work.

Another way to find out who is available to provide certain goods and/or services is to issue a **Request for Information (RFI).** This can not only help to identify sources of assistance from outside the organization, but can also be an important step in arranging for your solution to be implemented. There are two ways you could use the RFI at this stage:

1. Use the RFI to enable you to select a specific desired vendor of a product or services.
2. Issue an RFI specifying only what you want a system to do (i.e., the essence of the Needs Assessment, Product Inventories and Functional Specifications documents). Let bidders propose products, custom developed systems, outsourcing contracts, etc., as long as they can convince you that their solutions are cost-effective ways of meeting your needs.

Checking User References

Have you ever been to a restaurant and thought something looked appealing, but you just weren't sure, so you waited until someone else tried it first? The same principle applies to selecting technology solutions. If you know someone else has implemented and used technology that your organization is considering adopting, user information serves as a litmus test for your organization.

Talking to users should occur early in your considerations because you want to learn key information about the system or software before making your decision. There are some questions you should ask to help you compare the usage to your own situation.

If you choose to work with an unknown vendor to set up your system, you will want to get references and ask the references the same questions about the vendor.

Key questions to ask of references

ASK:	RESPONSE:
What features attracted you to this product or system?	
What are the features that you find most useful?	
Are there any features that are a hindrance?	
Are all departments of your organization satisfied with this product?	
If not, what departments are dissatisfied and why?	
To what degree has productivity changed at your organization?	
How often is training and/or retraining required?	
Do you find that the benefits of the product outweigh the expense?	
If you had to make the decision again, would you make the same choice?	

How Do You Analyze Costs and Establish a Budget?

In the process of making the various decisions covered so far, you have amassed a lot of information that related to the approximate costs of your solution. It's now time to develop some tangible cost estimates.

When establishing a budget for your technology purchase, watch for hidden costs. Don't let "unanticipated costs" be part of your vocabulary. Plan for the worst, and your results will be best. The initial technology budget should contain adequate funds to support key tasks for the level of implementation envisioned. The initial purchase price is typically only a fraction of the full cost to implement and operate a system. In addition, how funds are acquired (e.g., bonds, maintenance and operational funds, donations, etc.) and applied (purchase, lease, lease/purchase) has an impact on the level of acquisition possible. There are several key elements of anticipated costs to consider. Some are presented in **Table 4.1** below.

Include in your estimated budget both short-term purchases as well as long-term maintenance and operations.

Again, resist the temptation to think short-term. The annual maintenance and operations budget is typically appropriate for most budgeting categories listed in Table 4.1. However, hardware purchases and facility acquisition/renovation may be appropriate for longer-term capital financing, which often is budgeted separately. When considering costs of a new or upgraded system, remember to think in terms of your long-term investment. Life-cycle costs, which include the expenses to support and maintain a system over its expected life span, are far more important, useful and realistic for planning than simple implementation costs.

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Once the gross amount of anticipated costs is estimated, you need to start thinking about potential sources of funding to meet those costs. Education organizations often have a number of possible financing options, including some unique ones. School districts may be able to fund certain initiatives through bond sales. Universities may have endowment funds from which to draw. Additional sources include grants, foundations, donations, joint projects, etc. If any of the financial resources have accompanying restrictions and conditions, they should not be in conflict with the organization's objectives and strategic plans. Wherever the money comes from, the financing method should be appropriate for the expenditures being made. For example, issuing 15-year bonds to purchase hardware with a life expectancy of 3 to 5 years may not be appropriate, unless there is a built-in plan to continue to make upgrades and purchases throughout the life of the bond.

CATEGORY / BUDGET	EXPENSE
Planning	In-house staff release time. Contracting for technical expertise, as needed. Travel to inspect other locations, etc.
Design and Specification	Development of technical specifications and selection criteria.
Purchase/Acquisition	Software. Hardware. Networking equipment. Other infrastructure arrangements and facilities.
Staffing	Reassignment costs. Redefinition of job descriptions. Hiring costs for new positions.
Training and Certification	Initial training. Ongoing training. Maintenance of training records.
Support	Help desk services. On-site technical assistance. Maintenance of equipment.
Replacement and Upgrades	Planned obsolescence. New releases. Growth requirements.

Table 4.1: Key cost elements to consider

Comparing Costs to Benefits

Once costs are known, the next step is comparing them to benefits so that the potential payback from the project can be estimated. Remember, a key reason for acquiring the new technology is to support the learning of students. Providing an enriched education environment for students cannot be measured in dollars and cents.

The cost-benefit ratio of technology acquisitions is difficult to determine. Education organizations do not routinely look at "Return On Investment" (ROI) and justify purchases and programs as do private sector companies. A standard methodology for determining benefits often is not available.

Estimating benefits is the most difficult aspect of this analysis. While technology systems seldom actually reduce the organization's cash outlays, they may free up staff time (whose value can be estimated) currently spent on unproductive tasks or provide additional time for more important tasks, such as instruction. Because of the increased efficiency of an organization, there may be a dramatic improvement in staff morale (which cannot be estimated) by allowing staff to do what they were trained to do (e.g., teach students or analyze information, instead of transcribing information or verifying data on forms).

MINI — CASE STUDY:

The Far West Laboratory for Education Research and Development (now WestEd Laboratory), in association with the California Department of Education, analyzed the potential cost savings from electronic exchanges of student records and determined that the cost for implementing such a process statewide was clearly less than the ongoing costs for the current paper and mail system. The choice was clear — technology was the way to go.

Another benefit to acquiring a new technology system is that maintenance costs are often lower than for the technology being replaced. Converting from existing systems to new ones may provide the opportunity to roll current costs for maintenance and support into purchases of hardware and software with warranty periods and lower future maintenance and support charges. Creative funding plans may be possible using reductions in current maintenance costs to offset purchase costs. Some districts have found that by replacing old telephone systems with new ones that provide better service and connectivity, they have reduced their annual phone bills in addition to getting more capacity and capabilities, such as providing a telephone in each teacher's room. If the acquisition of technology to perform a service, such as registration, is replacing a service that is currently being outsourced or done manually, the ROI may also be reached in a short time.

How Do You Document Your Decision

It's now time to document the recommended technology solution that has emerged as a result of your thinking and analysis. The purpose of doing this is to present to the key decision makers in your organization (or to consider yourself) enough information for them to approve, modify or reject your recommendations. (If you feel that the likely outcome is rejection, then you are better served by developing a stronger case before presenting it.) Even if the decision making process is very informal, or if few people are involved, it is usually still a worthwhile exercise to document your plan as a check on its viability and your own thoroughness. If you can't articulate it, there may be a key element missing.

Develop a business case to describe your recommended technology solution and the anticipated costs and benefits.

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A *business case* is the most useful format in which to prepare such documentation. It not only includes a description of your recommended solution, it also should document the anticipated costs and benefits. In short, it should give key decision makers all the information they need to make an approval decision.

Business Case
Suggested Table of Contents

1. Project Overview
   - 1.1 Project Name
   - 1.2 Statement of the Organization's Needs
   - 1.3 Objectives and Scope
   - 1.4 High-level Solution Requirements
2. Alternative solutions considered (include making no changes to the current situation as a baseline for comparison)
3. Assumptions
4. Costs
   - 4.1 Quantitative/hard/tangible
   - 4.2 Qualitative/soft/intangible
5. Benefits
   - 5.1 Quantitative/hard/tangible
   - 5.2 Qualitative/soft/intangible
6. Cost / Benefit Analysis
   - 6.1 Analysis approach to be used
   - 6.2 Recommendation
7. Project Plan
   - 7.1 Resources Required
   - 7.2 Time frame

Figure 4.3: Suggested table of contents for a business case

CASE STUDY ◦ Act 4. Scene 2 ◦ A month later

Joe called Mary all excited after a meeting with his school board and asked Mary to join him for dinner to celebrate. When Mary arrived at the café, she saw Joe sitting in a booth working with a stack of papers and a calculator. "Joe, what happened? You look as if the IRS has called you in for an audit."

Joe looked up from his calculator and said, "You're a laugh a minute, Mary. I just finished presenting our plan for the system to my school board, and they said they will support it if I can cut 10% out of the budget. Mr. Washington, my "techie" school board member, had warned us that we should be prepared to prioritize what we want if we couldn't get permission from the board to spend all we want, so I'm ready for this."

"That's great!" said Mary. "Tell me what you have decided to do."

"Let's order first, then I will give you the details." After they ordered their meal, Joe continued, "Those meetings we had with the other district folks and the BSU people convinced us that we need to get some

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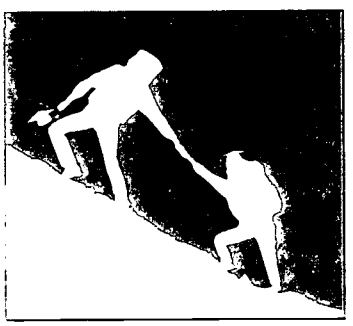
consulting help to set up our system for us, but that we also need to hire some technical people to help us with set-up and provide on-going support. We talked with a number of vendors, and found that there are management information systems available that will fit our needs with little or no modifications. The one we chose has adopted the data elements used by our state education agency and can provide for sending student transcripts electronically via electronic data interchange (EDI). Those were the deciding factors for us on that software. We've also discovered that the computer and network system configuration we have chosen can easily handle all of our administrative needs as well as providing easy access to instructional applications for teachers in their classrooms. In addition, we've decided to require that our LANs support both PC and Macintosh computers, a factor that convinced our school board that we are looking out for our teachers' and students' interests. I could go on and on, but I want to hear what happened at your regents meeting last week."

Mary smiled. "I am pleased to say that our regents were supportive of our plans for implementation. We all agreed that the library needs to be computerized and that our priority should be on getting faculty members up and running as soon as possible, especially in our Education Department. It seems that our faculty is very excited about the possibilities of being able to train prospective teachers on instructional applications to use in elementary and secondary classrooms. Luckily we can use much of our administrative software as it is compatible with or upgradable to the computers and network we have planned to use. We have decided to consolidate the various technology support staff on campus into a single office and hire additional expertise for the network. I think we are also going to hire someone to customize some of our software so that it better meets our needs. We still have some budget issues to work out, but I am hopeful that we can get what we want for a reasonable price."

Just then, the waiter arrived with their meals, and Joe and Mary agreed to stop talking about work. Little did they know that the fun was just beginning.

Where Can You Get More Help?



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CHAPTER 5

Knowing How to Implement Your Solution

OBJECTIVE:

By the end of this chapter, you will know how to staff and direct an effective technology implementation team and how to monitor the progress of the implementation.

CASE STUDY ⊖ Act 5. Scene 1 ⊖ Mid-August. six months later

(Allowing to how this is a fictitious story and these are small organizations, we'll assume that their funding has been received, they have selected the computer and networking system they want, and they are ready to get going.)

Mary and Joe decided to meet for coffee one Saturday morning before their schools were scheduled to open. Both were carrying their planner notebooks, which they were never without. Joe greeted Mary as he walked toward the table where she was sipping her Cappuccino. "Mary, I almost didn't recognize you with that tan! You look terrific! It appears the vacation in the Yucatan really agreed with you."

"So much so that I never thought about a computer all the time I was there. Were you able to get away this summer?"

Joe laughed. "Are you kidding? I spent the summer buried in paperwork concerning the technology system. I sure hope it will be worth it. Are you ready for school to start?"

"In general, I would say I'm ready. I have already received some complaints from our faculty about why we don't have our network yet. But I tell them I am confident we can have the system up and running by the winter holiday. Do you think I am delusional?"

"Perhaps." said Joe. "Do you have all your staff hired, the equipment purchased, and everything?"

"I think so, but I'm not sure where or how to start," said Mary. "It seems like I need to have someone other than a technical person to oversee the process, but I'm not sure who to appoint. Have you started putting things in place?"

"Not exactly. Our consulting group is supposed to start work the day after Labor Day, but they have a lot of questions. I really don't have time to keep answering their questions, especially the ones about where equipment should be located in the schools. I guess I'm going to have to find someone to oversee the process as well. But who should that be?"

Congratulations!

If you are reading this chapter, it probably means that you've gotten approval to implement a technology solution. Now the *real* work begins.

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How Do You Implement the Solution?

Develop an implementation project plan and enlist the help of key staff members to ensure a successful implementation process.

There is no "canned" plan for implementation that will apply to all cases. The specifics of what must be done and what constitutes a reasonable schedule for doing it, to a great extent depend on the choices you have made with regard to computer hardware, software packages, instructional applications, custom products and network linkages, as discussed in Chapters 4 and 5. In addition, your plan will reflect the scope of your project, whether it's clusters of computers in a classroom, a computer lab with stand-alone machines or a fully networked building, campus or school district.

Implementation project plans will be specific to your circumstances; therefore, the focus of this chapter will be on key activities that are critical to a successful implementation process, as well as the importance of project management and monitoring.

Though the implementation process is just a phase in the overall process of putting solutions in place, it's very useful — even essential — to treat it as a self-contained project, just as you did with the needs assessment. Once viewed this way, you can apply project management rules and practices to it.

How Do You Assemble an Implementation Team?

You may have been able to accomplish a lot to this point through "guerrilla action," but now it's time to get some official recognition and visibility. The commitment of funds and the amount of work involved in successfully implementing your technology solution warrants oversight by senior decision makers in your organization.

Selecting an Implementation Project Manager

The *implementation project manager (IPM)* is the key player to whom everyone else involved with this project will report and look for direction. This person needs to have enough authority to direct the team and make day-to-day decisions. An effective IPM will avoid deferring to the steering committee too often to resolve issues.

The importance of selecting the right person for this job can not be over emphasized. Choose someone who can make it happen; someone with proven leadership skills. Ideally it will be someone who has successfully managed similar implementations in the past or has been a member of comparable project teams. If no one suitable is available within the organization, it may be worthwhile to look toward other sources of help, such as external contractors.

Establishing a Project Team

The IPM oversees the efforts of the *project team*, which consists of people who are focused on the success of the project. Make sure the project team has sufficient manpower, but make it no larger than it needs to be to get the job done. The IPM should keep in mind that more is not always better, and that throwing more people at a project can often lengthen — not shorten — the process because of the need to get everyone oriented and coordinated in their efforts. If the project team is

assembled uniquely for this project by borrowing staff from other parts of the organization, make clear agreements up front about the percentage of each member's time the project will demand. Also, it is important to give the project team the resources (money, time, equipment, and authority) it needs to get the job done.

Appointing a Steering Committee

In the spirit of checks and balances, you might also consider organizing a *steering committee.* This group should meet periodically to evaluate the work of the IPM and the planning team by reviewing the progress, and addressing the issues that can't be dealt with effectively by the project team itself. Members should include:

- ✔ Users who will eventually have to accept and reap the benefits of your solution.
- ✔ A technical authority from your organization.
- ✔ Knowledgeable outside advisors.
- ✔ The implementation project manager (IPM), but not as chair.

Remember technology doesn't implement itself; people implement technology.

How Do You Develop a Project Implementation Plan?

Critical to making the team's effort efficient and getting the job done is having a thorough and realistic *project plan.* Other documents prepared in the overall project will have covered the rationale for the project, the expected cost, the needs to be addressed, etc. The project plan doesn't need to repeat any of this; it should focus only on what is to be done, when, and by whom. As the project progresses, the plan should also capture what has already been done, when and by whom.

Establish a realistic schedule for what, where, by whom and when each phase of the process will be done.

Using Project Management Software

Any project that lasts longer than about two months or that has more than 8-10 component tasks, will probably be made easier by the use of *project management (PM)* software. PM software such as Microsoft Project, Timeline, or SureTrak Project Manager can be run on standard desktop computers. These software packages all tend to offer the same basic tools to help you manage your projects, such as: integrated calendars, report generators, scheduling, charting, tracking, prioritizing and more. Choose the package with the interface (look and feel) you prefer, and one that will function on whatever computer you can use for this purpose. The initial effort required entering the data into PM software generally pays off many times as the work unfolds. PM software also makes it easier for team and steering committee members to view, comment on and participate in the project on-line, if they are connected on a network.

Establishing a Schedule

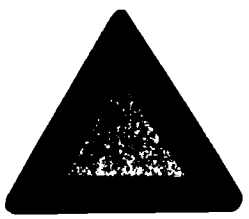
The schedule is an important part of any project plan. It tells you when you'll arrive where you are going. A schedule is only effective, however, if the goals are attainable. If the goals are unrealistic and deadlines are missed, later deadlines lose their credibility as well. Some people in the

computer industry estimate the amount of time they think it will take to do the job, then double it. This may not apply to your situation, but the point is that it is complicated.

If you are using a consultant or contractor, establishing a schedule will be a part of your contract. If you are using internal staff, they should be included in establishing a schedule. Your schedule should cover what will be done, where it will be done, by whom it will be done, and when it will be done for every phase in the implementation process. Following are some additional suggestions.

Considerations in Developing an Appropriate Schedule

- ✔ Define the situation under which the implementation would succeed.
- ✔ Specify critical target dates, such as an accounting year-end, academic year milestones, or a particular business event that may dictate the need for the system to be in place.
- ✔ Develop an implementation strategy either based on a fixed implementation date, or establish an implementation date as a result of the strategy.
- ✔ Don't allow desired dates to overrule technical estimates of the time necessary for a task to be completed. This usually results in missed deadlines unless some alterations are made in resources or methods used. Such alterations are not always practical or effective.
- ✔ If necessary, reduce the scope of the project using a phased approach, or treat the first use of the technology as a "pilot" or "demonstration."
- ✔ Implement large projects in phases whenever possible. Benefits become available earlier while practical implementation problems are reduced.
- ✔ Phased-in functionality generally lengthens the total project, but allows early implementation of your solution. The opportunity to adapt the later phases to reflect user experience in early phases can improve quality.
- ✔ Review initial installations when you have multiple sites. This allows you to evaluate initial function and performance issues and resolve them early in the process.



WARNING Signs When Scheduling!

Watch out for:

- ✔ Projected dates, arrived at by detailed estimates, being overruled for "political" reasons, especially in the absence of additional resources.
- ✔ Schedules that assume early implementations will be as smooth as later implementations.
- ✔ 'All or nothing' implementation strategies; in other words, large projects with no phasing.
- ✔ Outside pressures that result in unrealistic schedules that are doomed to failure.

Monitoring the Progress of Implementation

A key role of the implementation project manager is to monitor progress on an ongoing basis. It works best to set up a routine where progress is reported on a regular cycle (e.g., weekly or bi-weekly) by the project team members to the project manager. The project manager then integrates these progress updates to produce an overall status update for the project.

Gantt charts produced by project management software are a good vehicle for displaying and updating information on a project's current status and progress to date. An example of a Gantt chart is included in **Figure 5.1.**

TASK/ MONTH	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6
Select committee members	X					
Invite committee members to first meeting	X					
Arrange for committee meeting	....X.....	.....	.....	.....	.....	X
Do research on types of instructional software	.....	.....	.....	.....	X	
Prepare report for committee's review					.....	X
Hold committee's meeting						X

Figure 5.1 Example of a Gantt chart.

Handling Schedule Slippage

A key issue that often comes up in the course of a project is "schedule slippage" and how to deal with it. Honesty is generally the best policy. If slippage is occurring, it's usually worse to try to disguise it because the news will come out eventually. Breaking bad news gradually may make it more palatable than waiting to deliver a monumentally bad update all at once.

What Do You Need to Do to Choose and Prepare a Site?

Select locations that accommodate both the equipment and the people who use and maintain it.

Big screen televisions are nice, but not when placed in a room that is 10 ft. by 10 ft. The TV would be too big, and the room would be too small. What if the TV needed to have major repairs done? You would have to remove half of the furniture in the room just so the repairman could do his job.

A big part of putting a technology solution in place involves literally working on the location of equipment, electric power, ventilation, etc. The locations selected must accommodate both the equipment and the people who use it. Prerequisites include good ventilation and breathable air, comfortable temperature ranges, usable lighting, easy access, safe passage around wiring and equipment, etc.

Knowing the Characteristics of a Good Site

Once reasonable locations have been established, there are a number of additional elements necessary to making the room practical for use:

- ✔ Controlled access using security locks for doors and windows and careful monitoring.
- ✔ Physical restraints such as nailed down tables, and the ability to lock equipment to tables.
- ✔ Sufficient and properly grounded electric power connections.
- ✔ Sufficient space for maintaining and fixing the equipment, as well as for using the computers.
- ✔ No nearby water pipes that could leak or burst and cause irreparable damage.
- ✔ Sufficient lighting for maintaining and using equipment, but with minimal annoying reflective light.
- ✔ Easy access to peripherals such as printers.

Reasonable locations for equipment are included in **Table 5.1.**

REASONABLE LOCATIONS	UNREASONABLE LOCATIONS
✔ Classrooms	✘ Attics
✔ Offices	✘ Bathrooms
✔ Wiring Closets	✘ Coat Closets
✔ Science Laboratories	✘ Boiler Rooms
✔ Media Centers	
✔ Libraries	
✔ Computer Laboratories	
✔ Data Centers	

Table 5.1 - Locations for computer equipment

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Some Helpful Hints in Site Selection and Preparation

- ✔ When building a special space for equipment, retrofitting the building, or doing major remodeling, seek out architects with experience providing for technology support infrastructure. Check their references and the sites of their previous work, if practical.
- ✔ Locate network support equipment close to the termination point (point of entry into the building) of the outside communications line.
- ✔ Provide for both on and off-site storage of backup files in a fireproof and secure location.
- ✔ Review the building asbestos plan.
- ✔ In heavily trafficked areas, make sure cables and wires are out of the way. For instance, in classroom and laboratory facilities, outlets may be safer from unplugging and easier to use if they are located above computer desks, rather than below.
- ✔ Take into consideration the amount of space necessary for the number of people and additional materials they will need when working with a computer.
- ✔ Develop rules about the location and use of computer equipment that will keep it safe from vandalism and accidents. For instance, don't allow food or drinks around equipment. Additionally, make provisions to minimize and remove dust and other foreign materials.

Key questions about installing equipment

ASK:	RESPONSE:
Do you have logical places for equipment, or will you have to build new spaces?	
Have you taken into consideration the need for equipment you will add in the future?	
Has the chosen space been surveyed for technological readiness before initiating the project (determining what equipment to choose or installing equipment)?	
If you need to renovate your building, has the architect you have chosen had previous related experience?	
Have you visited other sites that have installed similar technology?	
Have you consulted with the telephone service provider or fiber provider about the proposed location for the network infrastructure?	
Has your electrical contractor had experience with technology implementation? Approved the location you have chosen? Is he or she a certified electrical engineer?	
Does the physical location have sufficient electrical power and outlets, air conditioning, and security in place?	
If you have a technology department have any of them been involved in site selection?	
Have end-users been involved in decisions regarding site selection and design?	
Have you reviewed the building asbestos plan and considered its impact on the project?	

How Do You Make Sure Your System Works?

Now, suppose your implementation process is well underway. The software is coming together, classroom aplications are being developed, the site is right, and equipment is being installed smoothly. You are approaching the day when your computer system will be "complete." (Remember a computer system can be a single stand-alone computer as well as multiple computers connected to a LAN or WAN as described in Chapter 3.) How will you measure its success? You don't want to do this when the system is fully in use; you want to verify the system's completeness and proper functioning in advance.

Proper system testing is a three-step process. Each component must be tested individually, then the system as a whole should be tested to ensure that the pieces work together. Finally, it should be subjected to "live" testing" that simulates real usage, with a similar workload and with a distribution of users and processing volumes similar to what will occur on a typical day.

Testing the System

There are three important steps to conduct when your system is in place. The opinion "It works well enough" is not sufficient.

Hardware and software testing — Technical team members who are developing, integrating or customizing your system must include hardware and software testing as part of their routine work to verify that each product does what it was designed to do. Whether the project is a custom development process or implementation of a product, each product must be tested as it is brought on-line. In any situation, there should be a pre-approved objective specification to which testers can refer. This reference point could be a *Functional Specification* (see Chapter 2), product documentation supplied by a product vendor, or a design document prepared earlier in the implementation process.

Integration testing — The fact that each product works in isolation doesn't mean the entire system will work. The functioning of the overall system generally requires the set of components and software applications to work together. Computers that are networked need to be able to exchange information with one another or share access to

Hints for Successful Performance Testing

- ✔ Know what to do with problems. Keep a log of system problems or bugs, and route them to the people with the authority and knowledge to prioritize and correct them.
- ✔ Prepare a system test plan when testing large or complex systems. The plan should include the data to be tested, the way data are obtained, the hardware and software tests, the integration tests and the expected results.
- ✔ Proper statistical sampling techniques may be useful for large systems.
- ✔ Make sure representatives of all the different types of users participate in performance testing, especially teachers and students.
- ✔ Pre-determine who has sign-off authority for test results.
- ✔ Delay correcting test errors that are minor matters of format or convenience until a later phase.
- ✔ Performance tests should include the complete physical environment, including communication lines, remote printers and the screens and keyboards expected to be used.
- ✔ Carefully test interfaces (how systems relate to other systems) as the effect of an initial minor error can be large on a downstream system or department.
- ✔ Some inexperienced user groups tend to be cursory in their tests and rely on development thoroughness; don't make that mistake.
- ✔ Rerun tests until no corrections are required both in manual and computerized procedures as correcting errors often creates new errors.
- ✔ Auditors may wish to participate in late stages of both procedural and computer based tests.

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software programs and peripherals. The only way to verify this is to enter information into one part of the system and check to see if it is properly dealt with and reflected in other parts, or check to be sure all networked computers have access to all programs and information. For example, in a simple software package that provides for storage and retrieval of student information, enter student information in the data entry screens, and verify that you can limit access to the data as needed and generate a report from it. In transaction processing systems (such as financial packages), try carrying out each of the types of transactions the system is supposed to handle. With instructional applications, make sure all computers used by teachers and students can access the software and use it as planned. For example, check to be sure that all student computers on the network can access a particular CD-ROM, such as one containing an encyclopedia. This integration testing often must be done repeatedly, to verify that the system handles information properly.

Performance testing is the final stage. Here, you may need to enlist some volunteers to bang away at the system, simulating "normal" usage levels to see if the software system itself holds up under pressure and to make sure other components (network, desktop workstations, printers) can carry the load. Don't confuse system functionality with user approval.

Things to Avoid in the Testing

- ✔ Insufficient time planned between the first system test and implementation.
- ✔ Untried manual procedures.
- ✔ Lack of testing of interfaces to other systems and networks.
- ✔ No user sign-off.

Testing the Software Interface

If your new system involves interfaces to other external systems, the importance of planning, testing and carefully verifying that the new interface works cannot be overstated. A new or revised software application may not communicate with other software applications in the same way that the old application did. Your new system may need specifications for how other software applications will interact with it. Keeping all of the applications used by an organization compatible is a major challenge, just as is keeping all hardware compatible with the requirements of new software. Changes to existing applications should be identified, specified, and included in the implementation process for your new application.

How Do You Convert from Old Information Systems?

Conversion is the task of moving information from an existing computer system (or from paper files) to a new software application, such as a student information system. Conversions can open the doors to welcome changes — out with the old, in with the new! But the process of making that transition must be gradual in order to maintain the integrity of the old and build from it. In the case of technology, a conversion of data systems is an opportunity to dispose of unneeded files and records (as long as laws related to maintenance of records are followed) and to establish new and streamlined, efficient systems. Beware, however, that there may be some staff members who are reluctant to abandon the old, reliable, comfortable system for the new one.

Conversion planning requires a detailed effort. In addition to converting data, conversion plans necessitate mapping old to new logic files, detailing needed manual data and sources, and defining conversion (old to new).

Conversions are most successful if plans have been made for automating the conversion, testing translators more than once, and operating old and new systems for awhile until the changeover is completed.

Hints for Converting Your Data

- ✔ Use automated tools rather than re-entering or recreating data and files in the new system. This saves time and effort and minimizes keystroke errors. (Obviously, this won't work if you're converting from paper.) Be aware that already automated data may change in length or nature in conversions.
- ✔ Test all conversions and translations more than once.
- ✔ Back-up and save the old system to provide a safeguard during the conversion process.
- ✔ Run a complete production or reporting cycle with the old and new systems running simultaneously to ensure that the new system is working as it should.
- ✔ Clean up manual files and data from old computer systems before automating, no matter how accurate they are believed to be. The amount of work required is hard to estimate accurately in advance and may turn out to be extensive, but it is worthwhile.
- ✔ Conversions should have stringent controls on amounts and records.
- ✔ Try to keep the old and new systems synchronized during conversion. While this may be difficult, it serves as a safety net in case something goes wrong.
- ✔ Initial small-scale conversion tests are advisable. These help ease your way toward the full-scale process.

Knowing the Process for Conversion

The conversion process must be well planned and implemented to avoid costly delays and loss of productivity. This process is the joint responsibility of developers and users.

- ✔ The developer is responsible for the technical, automated side of the process and computer-related planning.
- ✔ You and your users are concerned about validating the results of conversions, especially where manual information is being computerized for the first time.

Avoiding Problems in a Conversion

Organizations typically underestimate the time and resources required for a smooth conversion. Moreover, conversions sometimes fail. A well thought out fallback plan prevents serious business interruptions. However, fallback plans are not always practical due to data synchronization problems.

The following planning errors could bring about a major setback:

- ✔ Extensive manual record conversion.
- ✔ Not enough small scale tests.
- ✔ Few controls or audit trails.
- ✔ Absence of a fall back plan.

Fore warned is fore armed.

How Do You Implement the Changeover of Information Systems?

Make sure all phases of implementation have been completed successfully before any warranties take effect.

Once the information has been converted, the new system may be physically ready for use. (User training is, of course, another prerequisite.) However, this transition involves much more than simply "flipping the switch." The changeover process requires careful management. It's generally a good idea to run the two systems in parallel for awhile, to ensure the new one performs as advertised. While this will involve extra work for both users and technical support-staff, the risk reduction and peace of mind it provides is usually worthwhile.

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How Do You Arrange for the System Handover?

The final step in the implementation process is the handover — the point when your organization deems that the technology system is complete and ready for routine usage.

Knowing Handover Prerequisites

Before the turnover takes place, a number of steps must be completed:

- ✔ Complete physical installation.
- ✔ Complete system testing, including performance testing.
- ✔ Conduct user training.
- ✔ Convert information and successfully complete a period of parallel operation (although in some cases, this follows handover rather than preceding it).

Be sure to check out all components and all users. The best way to turn off new users is to have things not work when they are supposed to.

Achieving the Milestone

Handover can be an exciting, rewarding, nerve wracking milestone — the culmination of a lot of exhaustive work and worry. It also can be critical from a contractual viewpoint. If your system is based on a commercial vendor's product, this is the date that warranty periods commence. If you've hired a contractor to do custom development, they also typically provide a warranty period for their code (i.e., during which they will fix bugs at their expense), and handover is when the clock starts ticking.

To cap off this discussion of implementation, here's a poetic look at the process.

'Twas the Night Before Implementation

'Twas the night before implementation and all through the house,
Not a program was working, not even a browse.
The programmers hung by their manuals in despair,
With hopes that a miracle soon would be there.
The users were nestled all snug in their beds,
While visions of graphics danced in their heads.
When out in the computer room there arose such a clatter,
I sprang from my desk to see what was the matter.
And what to my wondering eyes should appear,
But a super programmer (with a six-pack of beer).
Her resume glowed with experience so rare,
She turned out great codes with a bit-pusher's flair.
More rapid than eagles, her programs they came,
And she cursed and she muttered and called them by name.
On Update! On Add! On Inquiry! On Delete!
On Batch Jobs! On Closings! On Functions Complete!
Her eyes were glazed over, fingers nimble and lean,
From weekends and nights in front of a screen.
A wink of her eye and a twitch of her head,
Soon gave me to know I had nothing to dread.
She spoke not a word, but went straight to her work,
Turning specs into code; then turned with a jerk.
And laying her finger upon the "ENTER" key,
The system came up and worked perfectly.
The updates updated; the deletes, they deleted;
The inquiries inquired, and closings completed.
She tested each whistle, and tested each bell,
With nary a bomb, and all had gone well.
The system was finished, the tests were concluded,
The users' last changes were even included.
And the user exclaimed with a snarl and a taunt,
"It's just what I asked for, but not what I want!"

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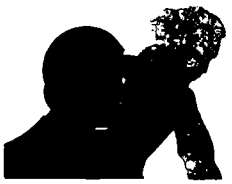
CASE STUDY ◦ Act 5, Scene 2 ◦ Early the following January



Mary and Joe decided to go out for dessert after attending a meeting. After ordering apple pie a la mode, Joe said, "I really shouldn't be eating this after all the weight I gained during the holidays."

Mary protested, "Oh, you don't look like you've gained an ounce in the ten years I have known you. I hope your holiday was fun."

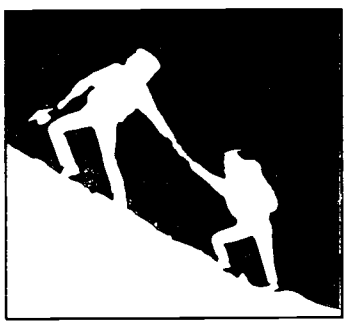
Joe replied, "I can't complain. After a short visit with my parents, I came back home to learn more about how to use our system. I can't believe that the consulting group got it up and running so quickly. I think it's because I put my assistant superintendent in charge of the project. She managed to keep the consultants on the timeline, despite all the problems we had finding space for the equipment in the schools."

"Well, we're not on-line yet, but we're making real progress. We have the library set up, and the equipment is in place in all of the buildings. We just have to finish testing the software. Hopefully we can stop running duplicate systems by the beginning of next school year. By the way, do you remember that shy young professor I introduced you to in December? He's the one I put in charge of our implementation."

"You're kidding!" said Joe. "Has he done a good job? He seemed too meek to be able to provide that kind of leadership."

"You'd be surprised. I surmised there was some forcefulness in him somewhere, and he seemed really knowledgeable about computers. He has done such a good job, that I made him the Director of Technology."

Where Can You Get More Help?



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CHAPTER 6

Knowing How to Train Users

OBJECTIVE:
By the time you finish this chapter you will be able to plan an effective training program both for new technology implementation and for on-going training.

CASE STUDY • Act 6. Scene I • Same evening

In the car, as Joe was driving Mary home, Joe asked, "I spent some time during the winter break trying to learn how to log on and use our network. I still haven't figured very much out, and the manuals we received are hopeless. My secretary came back from vacation and tried to answer some of my e-mail correspondence. She got so frustrated, she nearly quit. I don't know what we are going to do to get people trained. Have you thought about how to get your faculty and staff trained?"

"Oh, gosh, no! I guess I assumed that our technical staff would do the training. I wonder how much training they'll need to have?"

Joe said, "I don't know how much. I don't even know if we have anyone who knows how to do training. Maybe we'll just have to wait to train the teachers until school is out for the summer."

"Oh, that will go over big," replied Mary. "You think maybe we should have planned for this ahead of time?

Organizations installing new or upgraded technology should commit to establishing a training program for the technology support staff and for each category of user to ensure that staff obtain adequate skills for implementation and independent use. Beyond the initial training, ongoing training for new users and refresher training for experienced users remain essential for success.

Who Should Receive Training?

Everyone within your organization who will have access to your computer system and responsibilities for maintaining the system should receive training. If you estimate that there will be few users, your staff development plan may be very simple: train everyone at once on everything they need to initially know. Later on, when users seem ready, you can arrange for additional training. If your organization has hundreds or even thousands of users, your staff development plan will be more complex and training may have to be provided in phases.

The first step is to determine exactly who your potential users are and the types and levels of training they need. This information should be available from the needs assessment you conducted. In general, all users will need training on the use of the system itself. In addition, they will need

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Everyone who will use and help to maintain your computer system should be trained, including students, teachers, administrators, administrative staff, and technical support staff.

training on the various types of applications that are available. Not all users will need training on all applications, however; just the ones they desire to or will be expected to use.

- ✔ Your technical support staff, who will be responsible for installing and maintaining your technology infrastructure, will need specific technical training. They should also attend the various types of user training sessions so that they will be able to learn about potential problems and user needs that are related to both the equipment and the applications.
- ✔ Administrative staff members who will use the system for daily management purposes will need training on the various applications they will use. This includes staff who may "use" the system for limited purposes, such as other personnel who enter information about students who are registering.
- ✔ Administrators will also need training and a general understanding of the system. This includes administrators who do not access the system directly, but request information that comes out of the system. They should be aware of the steps they need to take to get the desired information and what types of information they may be able to obtain.
- ✔ Teachers who have access to the system will need training on the various types of applications and resources available. These applications could include instructional management software that assists with record keeping (e.g., grades, attendance), the standard office applications (e.g., word processing, spreadsheets) that can be used individually as well as in the classroom, and instructional software specifically designed for integration into classroom lessons. This training would include the use of the Internet and its applicability to the classroom.
- ✔ Students who will be using the system within the classroom as well as outside of the classroom will need to be trained. This training will probably be more limited than the training provided for organization staff.

Since staff will be providing most of the training to students, the focus of this chapter is on training staff.

When Should Initial Training Be Provided?

Training ideally should occur while the system is being installed; it should not be done so early that people will forget, or so late that the system sits unused.

You should plan for initial training to be provided before the system is fully implemented. During equipment installation is a good time to provide training, so that users will be ready to begin using the system as soon as they return to their offices or classrooms. Nothing is more frustrating than having a new computer sitting on your desk and not having the skills to use it or the right applications or resources available. On the other hand, make sure that you wait to provide training until the equipment is being installed, because it is also frustrating to have training too soon. Many people complain that by the time the system finally gets implemented, they have forgotten how to use it.

If possible, it is a good idea to release users from their regular duties to receive training. Training that occurs outside of regular office hours may be perceived as an extra burden and users may be tired and less able (or willing) to absorb information. Keep in mind, however, that this may necessitate using substitutes — especially for teaching staff — and incurring additional associated costs.

What Types of Training Are Needed?

Illustrating how your new technology improves the potential of reaching your organizational goals should be a cornerstone of your training. This along with the need to develop a high comfort level with the computer system, especially for novices, will be essential to your training objectives.

Training should be geared toward the skills and experience of the users. All users should be provided training materials for later reference.

Training should be based, to the extent possible, on the user's prior knowledge. If users are currently using a computer system and you are merely upgrading the system, a certain level of understanding can be assumed, and training can proceed without too much basic information. You may be able to classify some users as beginners and others as advanced, and plan two levels of training. However, it is critical not to assume too much — it is better to err on the side of being too basic, particularly when a new system with many new possibilities is being installed.

You should plan to have manuals and other materials to give to users in the training sessions. They may be developed in house or by a consultant, or bought from a store. These materials are important because they give users something to refer to after the training when they have questions. The materials should refer both to your system and how to use it, as well as to the applications available. In addition, examples of success stories of how technology is being used elsewhere might further motivate staff receiving training.

In general, the manuals that come with applications are often hard to understand for novice users. A whole publishing industry has been created to develop user-friendly manuals for computers and applications. Some are just less technical and easier to read; others are more entertaining. Whether or not you use these published manuals in your training, you may want to purchase a few to have around as references.

Planning Basic Training for All Users

All users will need basic information about your computer system and what applications are available. Topics should include:

- ✔ System fundamentals, such as identifying components of the system and their location, and learning how to turn on the system.
- ✔ *Logging on* (or individually signing on) to the computer.
- ✔ Establishing passwords.
- ✔ Opening the desired applications.
- ✔ Basic applications features.
- ✔ Closing applications, logging out, and turning off the computer.
- ✔ Network resources available.
- ✔ Acceptable Use Policy (covered in Chapter 7).
- ✔ Frequently Asked Questions (FAQs).
- ✔ Seeking help.

Establishing passwords is an important part of everyone's training. Passwords should be easy to remember, but not easy to guess. It is recommended that passwords contain around seven characters, including letters and numbers (with a letter at the beginning because some systems won't accept a beginning number). It is better to have a password that is a

nonsense word rather than a recognizable word. One idea is to choose a phrase and then make your password an acronym of the phrase. For example, "To be or not to be" becomes the password "tbontb." Most systems suggest that you change your passwords periodically. A number at the end of the password can be sequentially changed every few weeks or months as needed (i.e., tbontb1, tbontb2, etc.). If your security is case sensitive, you might choose a password with a random mix of capital letters (i.e. tBonTb) to help foil any good guessers.

Training Novice Users

Users with virtually no knowledge of computers will require more basic training than those with some advanced technical knowledge. This distinction needs to be taken into account when providing user training. Many novices fear that they will destroy the system by touching the wrong computer key or typing in incorrect information.

For this group of users, training should focus on basic functions of computer systems and uses of applications. For instance, both Windows and Macintosh operating systems have functions that are used with most applications, such as file and edit commands. Novice users should be taught about using files prepared by others as well as those they prepare themselves, including what happens when the user requests a file and saves a file. Losing a file on which a lot of work has been done is traumatic, especially for novice users. Providing basic training in these functions will make it easier to understand the related applications when they are introduced.

For novice users, it is critical that the training materials you provide are simple and easy to understand. You may want to develop training materials that have graphics showing what computer screens will look like for the various system applications. Novice users should be encouraged to try to figure out the answer to problems before asking someone for help; however, they should be encouraged to ask for help if they cannot figure out the problem, no matter how small the problem may seem.

Training Advanced Users

Training for advanced users, those who have experience with and feel comfortable using computers, should contain much of the information included in the novice user training; however it can be abridged and presented in much less time. In addition to providing overview training on all applications, you will want to provide more advanced training on applications for those users with an interest in becoming proficient. The training materials provided can be the same as those used with the novice users or different.

You may want to provide even more advanced training for persons who are "power users." Certain people enjoy learning new bells and whistles, particularly with computers. These are generally people who already know more than just the fundamentals about applications. If they are willing, these same people could be effective resources within schools, university departments or offices, and libraries, who can answer user questions and be available to offer information that will refresh the memory of those who forget what they learned in training sessions. These people can be given periodic update training for new versions and releases of software before the upgrades are installed in the system and then train other users how to

use the upgrades. They can also provide information on new Internet resources that can be employed in the classroom.

Training Technical Support Personnel

Although you may be contracting with a company to provide technical support for your computer system, you should still have someone in your organization with fundamental technical knowledge, as there may be a delay before your support arrives. Training for these persons will vary according to the design of your system, but it should include:

- ✔ Understanding the hardware and network components.
- ✔ Setting up computers or new components.
- ✔ Loading software.
- ✔ Answering questions of users.
- ✔ Trouble shooting problems.

Training on Classroom Uses of Technology

Just as they need to learn how to use a computer system and the applications that are available, teachers also need to receive training on the use of available instructional software and how to access other technology resources. Ideally, teachers already have been given material on how to integrate technology into their lesson plans. If not, you need to include this in your training. Training on specific instructional software should cover the content and value of the programs as well as how to use them. In addition, since your system most likely provides access to the Internet and other network providers, you will want to include training both on how to access the network(s) and how network usage can be integrated into classroom learning activities. Finally, there may be general computer applications that can be used for instruction for which special training is needed. For instance, teachers may need special training sessions on setting up data bases and spreadsheets for usage by students in the classroom.

Key questions to ask about who will receive different types of training

ASK:	RESPONSE:
Are different levels of training needed?	
If so, who will receive novice user training?	
Who will receive advanced user training?	
Who will receive "power user" training?	
Who will receive technical training?	
When will initial technical and user training occur?	
What types of materials will be needed? Who will develop them?	
What special types of training will be needed for teachers?	

An important part of your training program should be on how to test and evaluate instructional software. Teachers may see software demonstrated at professional meetings that seems useful. It is important that any software purchased can be used within the infrastructure of your system and that the concepts in the software fit with the learning goals of your school. Teachers also need to see the importance of practicing the use of software so that they can avoid interrupting classroom sessions trying to make the software work. Finally, teachers should also be encouraged to note successful technology practices in their classroom that might then be replicated in other settings.

Who Should Deliver the Training?

Deciding who will deliver the training may depend on how many people need to be trained, how many applications you have, and your budget. It may also be contingent upon support arrangements made in conjunction with the purchase of your computer system.

Classroom and individual training is often conducted by:

- ✔ Software or hardware vendors.
- ✔ Consulting firms that install technology systems.
- ✔ Training firms, consultants or service bureaus.
- ✔ In-house staff.
- ✔ Staff from comparable organizations to your own (e.g. teachers from other schools).

Training may also be available on diskette, CD-ROM, videotape, the Internet, or another medium.

Selecting the right type of trainer for your staff is critical. Trainers who work for software vendors know the software backwards and forwards, can anticipate questions, and know how to explain the software in several different ways. Consultants who develop computer systems or who specialize in training can also provide excellent training. However, if your system or software has been customized for you, then beware that these consultants may not be able to provide specific training on your system or adapted software.

Key questions about who should deliver the training

ASK:	RESPONSE:
Do we have staff members who can deliver the training?	
Does the vendor or consultant offer standard training? Where is it given?	
Does the vendor or consultant offer custom training?	
Is there a cost? Can we afford it?	
Are the trainers available on the desired date(s)?	
Are there tutorials and good documentation available for the applications we selected?	

Developing an In-house Training Staff

Having in-house training staff is desirable for large organizations, particularly if there is frequent turnover. Some school districts have technology coordinators who offer training for all newcomers and whenever there are system upgrades. Many schools have technology coordinators who work full-time at the school sites. These technology coordinators should receive extensive training themselves prior to providing training to others. Make sure you select as potential trainers persons who have the ability to convey technical knowledge in ways that novices can understand.

Training can be provided by your organization's staff or by outside consultants and vendors.

Using Software Application Training Materials

If you are using off-the-shelf software, such as word processing software (Microsoft Word, WordPerfect, etc.) and spreadsheets (Excel, Lotus 1-2-3), you may want to purchase tutorials. These have the advantage of being self-paced, easy to use, network compatible and readily available. Often there are videotapes developed to accompany a training manual. In addition to those tutorials developed by the software publishers, there may be tutorials, manuals or other training materials developed by consultants that would be useful to purchase.

Where Should Training Be Conducted?

Because of the technical nature of computer training, it is best to keep the training sessions small, so that all users get the individualized help they need. A critical component of effective training is to have a computer available for each person being trained, or no more than two people per computer. For this reason, it may be most efficient to have a training session held in a laboratory setting with 10-20 computers available. You may have such a lab available at your location. If not, you may want to choose a training organization that has laboratory classrooms available.

For the more advanced technical training, it may be necessary to include both classroom-type training as well as on-site training.

Training should be provided in locations where there is at least one computer for every two trainees.

Key questions about where training should be held

ASK:	RESPONSE:
Do we have a space where computer-based training can occur? If so, how many persons can be accommodated at once? What additional equipment will be needed, if any?	
Can all of our users be trained at once? If not, how many sessions will we need, and when will the training sessions occur?	
If there is not adequate training space where will training be conducted? How many persons can be trained at the same time? How many training sessions will we need?	

What Should Be the Training Outcomes?

Keeping track of staff training can help identify when new training is needed. If you have staff who are required to take training, you should plan for certifying that the staff members successfully completed the course and record the information in their files.

Just as it is important to define goals and measure expected outcomes from classroom instruction, it is important to define goals for computer system training and then measure user performance against those learning goals. Your primary goal for the training should be to have users feel comfortable and competent to use the computer system. An indication that this goal has been accomplished is that users actually utilize the system in the ways you desire. You may have additional goals related to efficient operation of your organization and the provision of continuing professional development for staff members. Your will want to come up with specific indicators that these goals have been met, and monitor your progress toward goal accomplishment.

If your goal is computer system usage for greater efficiency, you will want to look at an intermediate indicator such as whether or not your staff has been trained to use the system. Keeping records of successful training can help you monitor your progress toward the goal and identify where there are additional training needs.

Users should be "certified" based upon both the time they have participated in training and, if possible, the level of skill they have demonstrated. Successful students should receive certificates, and copies of the certificates, or some other notation indicating they have successfully completed the course, should be added to their personnel files. This will be helpful in determining which users need additional or updated training in the future.

The importance attached to such certificates depends on the nature of the computer system and your goals. For many generic tools (e.g., word processors, spreadsheets), it makes sense to issue a certificate that simply verifies that the person attended a course. In other cases (e.g., a financial system used to allocate and commit funds), certification of training may be necessary to authorize someone to use the system, because the risks of allowing access by untrained users are perceived to be significant. In these cases, course completion usually involves testing to ensure the trainee can demonstrate proficiency with the required knowledge.

With regard to classroom uses of instructional applications, there may be a local mandate requiring that teachers receive training. Teachers may even be required to be certified to teach these applications. Often teachers who complete courses related to technology are given Continuing Education Units (CEU's), and these are applicable to inservice training requirements or other conditions required for re-licensure or continued employment. Whoever is planning the training of instructional personnel on your new or revamped computer system should keep these requirements in mind and ensure that training is neither redundant or inappropriate for instructional staff.

Common shortcomings of training programs are the failure to document that the training actually occurred and the evaluation of the effectiveness of the training. It's a good idea to keep a current list of all training classes that have occurred and when they occurred, so that you can see when it is time to offer new training. It is also helpful to have participants evaluate both the trainer and content of the courses to ensure that the users' needs are being met and to help improve the quality of the training program.

When Is Additional Staff Training Needed?

A common mistake that organizations make is not to budget the resources for adequate training after the implementation phase. It is important to provide for periodic retraining as experience reveals needs. In addition, you will want to provide new training when changes occur in the software. It is also important to have a plan for training new users to the system. Some school districts and universities offer an on-going series of computer system classes so that staff can take initial training or refresher training when it is convenient. Others survey staff once or twice a year to get an indication of what classes should be offered. It's a good idea to hold regularly scheduled sessions to introduce teachers to newly purchased instructional software and new curriculum and resources available on the Internet.

Additional training is needed when there are new users and when there are significant changes to the system.

There are various times and ways to offer on-going training. One school held problem-solving sessions over breakfast called "Stop and Grow Breakfasts." If there is interest, you can schedule sessions after work hours or on Saturdays. Planned staff development days are good times to schedule training sessions. You may want to have a district, university or library technology liaison staff member who can be available to work with persons needing individualized help. Another option is to compile lists of user questions as they arise and then include them, with the answers, in a newsletter or in a brief document. This can help users figure out where they are having problems, and may help solve some of the problems.

Key questions to ask about additional training

ASK:	RESPONSE:
How often are the applications upgraded such that additional training is required?	
How often does my selected vendor or consultant offer additional training?	
How often will we need to offer new training?	
What new types of training do we need?	
What is the quality of the training staff's instructional delivery?	
Did the training meet the needs of all users and technical support staff?	
How useful is the documentation for all levels of users?	

Students who will be using the system must be trained in the applications they will use.

What About Training Students?

In many schools, students are expected to use computers either during classroom activities or after school hours. For instance, some universities place homework activities on the Internet, and expect students to access the homework, complete it, and send it back to the instructor. In these cases, students need to know how to access their network from home or school, do interactive lessons, and e-mail the results. In other cases some students in elementary/secondary schools might be able to access resources on their school's network from home or a public library.

Some schools and school districts consider students a human resource, training them on the maintenance and support of computer systems, as well as allowing them to do training. If you decide to use students for these activities, they will need the same types of training provided to staff members with similar responsibilities.

When your new computer system is in place, you will need to plan training for those activities you expect students to do using the system. Training may occur in the classroom, with the training done by the teacher or a specialized trainer. Training can also be provided outside of the classroom, through regularly scheduled training sessions or sessions developed when new training is needed. Training on the use of the Internet is one particular type of training that will be of interest to students.

CASE STUDY • Act 6, Scene 2 • One Saturday in late March

Mary and Joe picked a nice day to go bicycling. Along the way, they stopped to have a cup of coffee. As they sat on a bench with their coffee cups, Mary said, "It's good to get out now that the weather is getting nice. Fortunately the nasty weather for the last two months has not hampered our efforts to get our staff trained."

"It's nice to see the trees budding out," replied Joe. "It's getting to be the time when it's hard to keep folks inside after school. I'm glad we got our initial training done during the winter as well. Who actually did your training?"

"We had our technical staff go get the official hardware training. That way they can help us maintain the equipment. Then we brought in the various software vendors to do training on-site for both the technical staff and everyone else. We were lucky, because we had the training center set up in the library. The library folks also received some specialized training on their own software and in general computer usage so that they can help the students who are having trouble. We've planned a whole series of classes that will be offered on a rotating basis for students and staff. That way, if people feel they need a refresher, they can take a class. What did you finally arrange?"

"We arranged for our technical staff and our technology steering committee to get extensive training in the software we are using. Our technical staff got some training on the equipment, and the consulting firm we are using to maintain our system is going to provide additional training for them. We arranged to use the computer labs in the schools to do the training. With some of the money we set aside, we paid for substitutes so that teachers could be trained during working hours. Our technology steering committee developed training units with the help of the software vendors and our consulting firm. Then they trained three people from each school. We call those people our technology liaisons. The technology liaisons continue to provide some before-school and after-school training at the request of the teachers. There are also a few liaisons who travel to the different schools to demonstrate new instructional software when it is purchased. These liaisons are also planning training activities for the students, although many of the students already know more than the liaisons. It's amazing how pleased most people are with the training opportunities. Of course, we still have a few recalcitrant folks who don't want to have anything to do with computers. We're requiring that they do attendance reporting and a few other things

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on the computer right now. We're hoping they'll warm up to the possibilities. Say, do you think some of our folks could come to your training classes, if they want?"

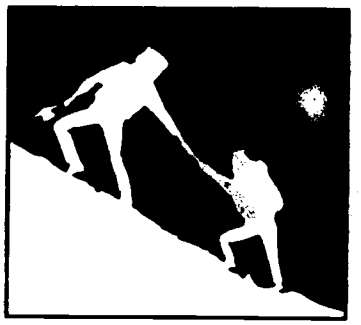
"I don't see why not. They're on a first come, first served basis, and as long as there is space available for all our folks, I think we can do that for your people. By the way, did you ever get any training yourself?"

Joe chuckled. "Oh, yes. At first, I just felt hopelessly inept. Then I realized I couldn't keep up with the training because I was constantly being called back to my office. Finally, I asked one of our technology steering committee members to give me some one-on-one training, and I managed to learn the basics. After a couple of weeks using the computer tutorials, however, I was getting pretty good, and I decided it was fun. Now I'm an expert on spreadsheets."

Mary said, "I'll bet you are. Didn't I say you'd eventually be computer literate? Say, I don't know how to use spreadsheets yet. Maybe you could give me some lessons."

"Mary, I would be delighted. When do you want to start?"

Where Can You Get More Help?



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CHAPTER 7

Knowing How to Support and Maintain Your Technology Solution

OBJECTIVE:

By the time you finish this chapter, you will know how to plan for the ongoing and long-term support and maintenance of your technology solution.

CASE STUDY • Act 1, Scene 1 • The following Saturday

Joe went over to Mary's house to help her figure out how to log onto her network and use the spreadsheet program. Mary had a laptop computer to use at home. "Joe, why do you suppose I can't get logged on to the computer? I have followed all of the directions I received when I got the computer. Surely it's not because there are too many people using the computer. It would be horrible if we already have too many users."

"I don't think that's the problem, Mary. I wish there was someone we could call to ask what we're doing wrong. I guess it wouldn't be very nice to call one of your technology folks at home, would it?"

"I'd rather not," said Mary. "I guess I'll just wait until I get back to the office on Monday."

"Guess what I got last week?" asked Joe. "Some parents brought in used 386 computers for us to add to our system. I think the ones we purchased for our network are Pentiums, and I'm not sure if we can use these with the network. Frankly, I don't know what to do with them, but we'll figure out something."

Mary sympathized. "Surely you can use them somewhere. What did you do with all your older machines that you couldn't use on the network?"

"They're sitting in a warehouse," replied Joe. "Do you need any?"

"I don't think so. I'll check to see what we did with our old machines. I guess there is always something to think about with a new system."

Your new computer technology is up and running. This can often constitute an anti-climax. Is life in your organization perfect now? No. Is it better than it was before? It will be. But first, you need to ensure that the technology is used properly and that it is systematically maintained and supported. This requires providing ongoing training and assistance for all your user groups, and ensuring proper maintenance of the equipment, software and network connections. Once you have instituted these activities, you will see a dramatic difference in the way that your organization operates. If your technology focuses on the provision of instruction to students, you should begin to see some new excitement in the way students approach learning in general, and in the use of

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technology. This chapter will look at specific issues pertaining to the support, maintenance and use of your technology once it is in operation.

When we talk about maintaining the physical aspects of your computer technology throughout its life span (generally 3-7 years for most business applications), what exactly does that entail? We have discussed some of the aspects of ongoing maintenance; however, we haven't discussed the entire process, nor issues that will arise as time passes.

Here is a list of key support and maintenance issues.

1. Providing for ongoing oversight of the technology solution.
2. Providing ongoing user support through help desks, documentation, and training.
3. Reviewing usage measurements.
4. Maintaining technology components.
5. Monitoring system effectiveness.
6. Upgrading software to new releases.
7. Replacing and redeploying equipment.
8. Using volunteers and donations.
9. Finding qualified help.
10. Developing or purchasing new applications.

What Provision Should Be Made for Ongoing Oversight?

A Technology Oversight Committee should be appointed to oversee the usage and make plans to improve the system.

You have had several committees and individuals assisting you along the way. By now, you know who are the people with the most interest, enthusiasm, and knowledge about technology. You also know which people have begun to take an interest both in the system itself as well as the various user applications. These are important people to help you keep the system running efficiently and effectively.

It's time to create a Technology Oversight Committee for maintaining oversight of the technology solution. This should be a mix of users and technical folks who can carry out the activities that follow. You should include at least some of the people who served on the Project Team and the Steering Committee, as well as representatives of your technical staff, training staff, users and potential users. Plan for a rotation of members on a regular basis, such as half or a quarter of the committee annually. There is no perfect schedule for committee turnover; just make sure that you do not find yourself with only unhappy non-users on your committee.

Depending on the nature of your organization, you may have several committees. For instance, if your organization is a school district, you may want to have a committee at each school as well as a district-wide committee that includes school representatives.

Schedule meetings regularly, but don't have the meetings unless you have real work to do. Your committee members, like you, are busy people. Don't expect to keep up interest if you do not have meaningful agendas for your meetings.

Developing and Maintaining an Acceptable Use Policy Statement

One task this group should undertake is the development of an Acceptable Use Policy statement (if one has not already been developed). This statement should include the following areas:

1. Individual rights regarding access to the system and to resources obtained through use of the system.
2. Individual responsibilities with regard to the system, its contents and connections obtained through the system.
3. Rights of the organization relating to the system and access.
4. Organizational responsibilities.

The development of an acceptable use policy is often considered necessary only when students will be using the system; however, it is just as important for all of the users of the system, including administrators, teaching staff, other staff, students, parents, the community and any other persons who will have access to the system and its contents. Protecting the privacy of sensitive information maintained within the system is essential. Security and ethical standards, mentioned in Chapter 3, remain important as long as the system is in operation.

At the end of this chapter, there are sources listed where you can find examples of acceptable use policies.

How Do You Plan for Providing Ongoing User Support?

It is critical to determine the type of support and training that your organization will need. Trial and error can be a frustrating, costly and dangerous way to learn how to use computer applications initially, or to refresh users' memory (human memory, not computer memory) after their initial training. That's why it is essential to have planned activities to help and support users when new technology is implemented.

Your organization should have a long term plan for providing timely and useful help to users.

Support services, training, and certification must be ongoing to ensure successful post-implementation use of technology. As time passes, personnel change, organizations' needs change, and the ways in which the technology is being used may change as well. Any and all of these changes must be taken into account at all times.

For successful implementation and operation of computer technology, there must be full support and encouragement at all levels of the organization. Help and support services provide users with ongoing technical assistance. This includes both technical questions and application questions. The organization must have a plan for providing timely and useful help to the users either with available staff or through arrangements with vendors or consultants.

E-mail from a user:
"CanYouFixTheSpaceBarOnMyKeyboard?"

Staffing a Help Desk and Offering Ongoing User Support

The most common means of providing user support is to create and staff a bank of telephones (or at least one) with people who are willing and capable of answering users' questions patiently and constructively. Today, most Help Desks in networked organizations offer assistance using electronic mail, fax and telephones. In large organizations, such as universities, Help Desks may be available 24 hours a day. For most education organizations, however, it should be sufficient to have someone running the Help Desk for only part of the day, with the number of hours depending on how many users there are and how many questions are being asked. It may be sufficient to have someone check voice mail or e-mail twice a day to answer questions.

When staffing a Help Desk, keep in mind that the person or people who work at a Help Desk must be able to demonstrate extreme empathy and patience, and they must be very detail oriented. Each caller's problem must be treated diligently, even if it's the hundredth instance of the same question or problem being reported. Some schools use students to run the Help Desk. If you decide to use students, you should have a staff member to train, supervise and evaluate the service provided by the students.

In addition to solving users' problems on a day-to-day basis, a Help Desk's value is in documenting trends and patterns concerning the use of an application or equipment. It is important to track Help calls and responses, preferably using a software package from which it is easy to generate reports such as most frequent queries, distribution of callers with a certain problem, etc. This information can be used for tailoring training to users' needs and for developing new training materials. Many users will find it helpful if frequently asked questions (FAQs) and their answers are printed in a newsletter or made available via your network.

You know you're an E-mail Junkie if ...

✔

You laugh at people with 9600-baud modems.

✔

You start using smileys in your snail mail ;-)

✔

You find yourself typing "com" after every period when using a word processor.com

✔

You start introducing yourself at "JohnDoe at AOL dot com."

✔

All of your friends have an "@" in their names.

✔

You tell the cab driver you live at "http://1000.edison.garden/house/brick.html."

✔

You decide to keep taking college classes just for the free Internet access.

✔

You start tilting your head sideways to smile.

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Providing Ongoing Training

After the initial training has been delivered on your computer technology, the issue of ongoing training for new users and refresher training for experienced users arises. As mentioned before, many organizations fail to budget adequately for training after the initial implementation phase. In addition to the cost of providing the training, organizations must plan to:

- ✔ Define expected outcomes from training.
- ✔ Allow for appropriate time for the users to undergo training.
- ✔ Document when training has occurred.
- ✔ Measure user performance against the learning goals.

Chapter 6 has suggestions for meeting the ongoing training needs of your users.

How Should You Monitor Regular Usage of the System?

Another key aspect of the monitoring of computer technology is simply keeping track of how, how much and by whom the technology is being used. For instance, if you have a goal to increase technology use in the classroom, it will be important to review the amount of time students are using the technology and what applications they are using, as well as your teachers' usage patterns. You will also want to assess the effects of technology use on reducing paperwork and making administrative tasks more efficient.

Regular tracking of how, how much and by whom the technology is used can provide input into training, system maintenance and long-term planning.

Every computer system should have someone reviewing the reports. This person should either generate or receive reports on a regular cycle (typically monthly). Most commercial software packages and well-designed custom computer systems have built-in utility programs to collect information and turn out "canned" reports on usage patterns and volume. The general indicators of usage to watch for include:

- ✔ Volume of transactions processed.
- ✔ Number and average duration of user sessions.
- ✔ Data base size (if relevant).
- ✔ Volume of reports generated.
- ✔ Downtime.

In addition to these routine indicators, *exception* reports should provide information on unusual usage patterns and/or any problems that occur (e.g., disk space constraints, database corruption, interface problems with other systems). The more serious of these should not wait until the regular cycle to be reported; they should be reported and addressed immediately so that no information is lost or damaged.

"One of the most feared expressions in modern times is 'The computer is down.'"

Norman Augustine

What Kind of Ongoing Technology Maintenance Will Be Needed?

Your computer system should have an overall maintenance program established as soon as it is implemented. There are several components of this program that will play a role in the system's efficient and effective operation.

Keeping Hardware Working

Car manufacturers always recommend having your car tuned and the oil changed regularly to keep it running as efficiently as possible. Similar maintenance is required of a computer system. You don't want to wait until there are problems; you want to avoid problems. Often an organization will carry out its own routine, *preventive* maintenance (checking data base size, purging outdated records, deleting user accounts that are no longer in use, etc.). For hardware and network components, maintenance includes periodic cleaning for proper performance.

Routine, preventive maintenance of computer hardware can help ensure proper performance. In addition, software upgrades and other software maintenance help keep the system up-to-date and meeting staff needs.

Despite the best preventive maintenance program, problems do occur. To deal with them, many organizations have a *maintenance agreement* for fix-it-when-it-breaks service with an outside contractor or agency, particularly for hardware. The key parameters of such agreements are response time to a trouble call and the availability and proximity of spare parts. In other words, you want to know how long it will take to get the problems fixed.

Maintaining Software

If your organization's computer system includes a commercial software package, you will probably have a maintenance agreement with the vendor. Product maintenance agreements should be negotiated at the time of initial purchase or at the time the software application is being developed. Such agreements usually begin either when you purchase the software or when your system is initiated, as long as you pay the vendor the stipulated monthly or yearly maintenance fee. In return for this fee, the client organization (i.e., you) typically receives solutions for errors in the application, changes, additions, and further documentation. Maintenance agreements can also provide for copies of new releases (upgrades) at no or at reduced costs.

Providing Internal Maintenance Support

As an alternative to a maintenance agreement with an external provider, an organization can weigh the risks and benefits of in-house maintenance, assuming the expertise is available. Especially with hardware, paying for time and materials as repairs are needed — as opposed to a monthly fee — may save money over time.

Establishing External Maintenance Agreements

Maintenance agreements are like insurance policies. You must weigh the relative and absolute risks to your organization. Honestly assess your in-house capability to deal with any potential problems, and make your decisions accordingly. Some useful questions to ask are:

Key questions about in-house system maintenance

ASK:	RESPONSE:
Who is available in-house who can maintain the system?	
If the key in-house contact were to leave the organization, who else would be able to maintain the system?	
If a situation were to occur that could not be handled in-house, what would the cost be to the organization?	
What are the benefits to maintaining the system in-house?	
What are the disadvantages to maintaining the system in-house?	

Key questions about external system maintenance agreements

ASK:	RESPONSE:
What does the vendor provide as part of its standard maintenance contract?	
Will the vendor make modifications as part of an overall upgrade or new release of the software application?	
Are additional services available, and, if so, at what price?	
What do time and materials cost? Is this a viable alternative for maintenance?	
How long can your organization wait for service in the event of a problem?	

How Do You Monitor Your System's Users' Needs?

It may take a while before your new computer system is up and running at its maximum effectiveness. A key maintenance function that you can begin right away is setting up a mechanism to collect user complaints and suggestions for improvement. Having a process in place for collecting this type of information provides a measure of control for your organization. It allows the organization to learn more about and document users' problems and concerns with current systems, and help to decide what the priorities should be for new investments. This is a simple internal procedure that is identified and treated as a separate issue only because of the trouble caused by its absence. Without such a process, requests for change can build up without administrators realizing that problems are occurring.

Establish a process for receiving and reviewing complaints and suggestions from users.

To help set up a process for determining needed changes, consider using the following procedures.

- ✔ Develop forms for documenting requests and select a central point for gathering the requests. These can be paper documents or e-mail formats.
- ✔ Have your Technology Coordinator (or someone else) document and research the requests and develop a list of possible solutions.
- ✔ Maintain a log that shows the date of the request, source, cost and time estimates, who needs to respond, date(s) of response, priority and disposition.
- ✔ Have the Technology Oversight Committee review the requests and possible solutions in keeping with your organization's system architecture, technology goals and long range plans. The Committee should then prioritize desired changes or purchases and make recommendations to you or your organization's final decision maker.
- ✔ Have someone send a reply about what will be done to the originator of the request (unless it is an anonymous request).

Make sure that all users understand this process and that they feel free to use it. Where suggested changes are involved, the user bears responsibility to distinguish important changes from 'nice to have' requests. Where new purchases are requested, the user making the request must provide documentation to assist in the decision making process.

What Do You Need to Do About Upgrades to Software?

Decisions about upgrading software should depend upon the goals and plans of the organization and the risks of getting too close to the "bleeding edge" of technology.

When dealing with commercial software packages, the vendor typically offers a stream of new releases of their product on a semi-regular cycle. As previously mentioned, new releases are more recent versions of a software application that the developer has published, either to enhance features and functions or to correct problems in an earlier release.

If your organization has been keeping up its maintenance payments, it has the right to upgrade to new releases when they become available. However, this does not necessarily mean that you must, or that you should upgrade to new releases. Weighing whether it is worthwhile can be a tricky process that requires considering several factors. One thing to keep in mind is that upgrades should be assessed in relation to the organization's system architecture, network architecture, and other relevant guidelines. An upgrade should be consistent with established standards and contribute to progress toward the overall vision for technology.

If an upgrade does pass the first test in that it meets established standards, you still need to approach upgrades to a new release of a software application with caution. Too often, the definition of an upgrade is: take old bugs out, put new ones in. New releases are often distributed before all the problems are resolved. When that is the case, those using a new release become participants in the debugging process.

Another consideration to take into account is whether the new release of application software requires changes to other elements of your organization's technology environment, such as the operating system, hardware, or network software. If major changes are included, the new release may be published as a new "version" or edition, which may require a purchase beyond your organization's current maintenance payments.

Some organizations follow a rule of thumb never to be the first to install a new version of a software application. Others tend to stay one release back of the "leading (or bleeding) edge" to avoid the risks. Generally, such rules lower risks but may delay the benefits from a useful upgrade.

To decide whether or not to upgrade, you and your Technology Oversight Committee need to evaluate whether the changes in the software provide benefits beyond the potential risks. Benefits should be assessed based on:

- ✔ Impact on user productivity.
- ✔ Ongoing costs.
- ✔ Addition of useful functions.
- ✔ Addition of recent content.

Risks and costs should be based on:

- ✔ Costs for potential temporary loss of productivity.
- ✔ Costs for retraining.
- ✔ New hardware, operating systems, or networks required by the upgrades.

What Do You Do About Replacement and Redeployment of Equipment?

The previous section addressed application software upgrades. Upgrading the hardware platforms on which the applications run is also a key part of system maintenance. Computer hardware follows a life cycle that is perhaps best described as "rapid, planned obsolescence." This refers to the fact that hardware will be overtaken within three years by new models that are better, faster, and (adding insult to injury) cheaper than what you paid for existing models. This is especially true of desktop microcomputers, although it applies to printers, servers, modems, and other peripherals as well.

Establishing a plan for purchasing and replacing equipment can help you decide how and when to dispose of old equipment and make new purchases.

There is no way to buck this trend. You simply have to appreciate it and allow for it in your long-term technology plans. Ideally, you have developed a system architecture (the design and contents of your computer system). This can help you determine when equipment should be upgraded or replaced and what type of new equipment or modifications to existing equipment will be needed.

A reasonable rule of thumb is to budget to upgrade or replace one third of your computers each year, so that nothing more than three years old remains on site in your organization. It may be painful to see "perfectly good machines" withdrawn from use after such a short period of time, but the pace of change in the computer field is so rapid that three year-old machines might not do their jobs effectively.

Once a decision is made to replace a group of machines, the next decision is what to do with the old machines. Education organizations are typically multi-faceted, and there may be several potential homes for "once-removed" machines within your organization. A typical example is moving machines from a student lab to an administrative office or vice versa.

Internal redeployment, however, is not as simple as it sounds. What do you do with the older machines that are being replaced in the administrative office? You may be able to find another spot for them in your

organization, but do you really want to maintain three generations of computer equipment? You have to draw the line somewhere. The disruption caused by "trickle down" internal redeployment might exceed the cost of external replacement with new machines. Some organizations establish clear policies that — while somewhat arbitrary — provide rules for equipment disposal. For instance, one university has decided that it will move equipment only once internally. The old equipment is then permanently disposed of, by selling it to staff or students or by donating it to other organizations.

Key questions to ask about redeploying equipment

ASK:	RESPONSE:
What equipment needs to be upgraded to run new or upgraded software?	
What equipment is going to be replaced?	
Where will the equipment that is being replaced go?	
Will there be any equipment that will need to be disposed of? If so, is there any place else where it might be used?	
Is there any benefit to storing old equipment?	

Should You Accept Donations?

When companies are replacing their computer systems, they often offer the equipment and/or software to education organizations. While this may seem like a boon to the organization initially, it may end up that this equipment is more trouble than it's worth. If your organization is confronted with this situation you will need to weigh the benefits and consequences. You can benefit best from donated equipment when it fits with your long term plan for purchasing and replacing equipment.

When your organization is offered donations, there needs to be an established protocol that dictates whether or not it can be accepted.

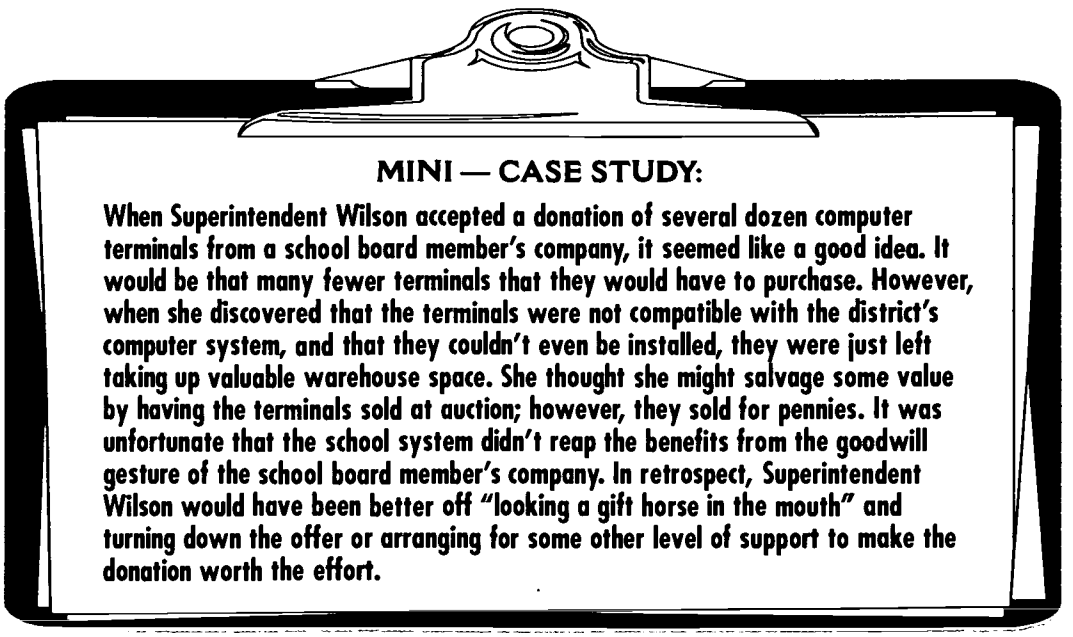
- ✔ First of all, all of the standards established in the organization's system architecture should be followed. For that reason, donors should have access to the organization's published system architecture and any other standards established for technology projects.
- ✔ Staff should screen potential donations to ensure compliance with adopted standards. Donations can be useful to supplement available funds and equipment. However, to avoid invalidating warranties and creating increased future expenses for maintenance and support, all donations should comply with the same standards that would have been followed if these goods and services had been purchased by the institution.
- ✔ Just as with purchases, donations come with associated costs for installation, training, maintenance, power supplies, facilities, associated

hardware or software, human resources, etc. In cases where donations are not in compliance with established standards, the donor could be asked to underwrite the additional maintenance and support that the donation will require.

It's always tempting to say "yes" to someone who is offering something "free." On the other hand, a rule one might live by is: "Don't accept a gift you have to feed."

Key questions to ask when considering accepting donations

ASK:	RESPONSE:
Does the hardware, software, or networking resource being donated comply with the organization's standards?	
Will the hardware, software, or networking resource being donated be covered by the organization's existing maintenance and warranty agreements?	
What provision is the donor making for ongoing maintenance and support?	
What are the costs to the organization for accepting the donation?	
Will matching resources be required?	
What will the organization be required to provide in order for the donation to be used?	
Will the donor make any adjustments or modifications in order to comply with established standards?	



MINI — CASE STUDY:

When Superintendent Wilson accepted a donation of several dozen computer terminals from a school board member's company, it seemed like a good idea. It would be that many fewer terminals that they would have to purchase. However, when she discovered that the terminals were not compatible with the district's computer system, and that they couldn't even be installed, they were just left taking up valuable warehouse space. She thought she might salvage some value by having the terminals sold at auction; however, they sold for pennies. It was unfortunate that the school system didn't reap the benefits from the goodwill gesture of the school board member's company. In retrospect, Superintendent Wilson would have been better off "looking a gift horse in the mouth" and turning down the offer or arranging for some other level of support to make the donation worth the effort.

When Should You Use Volunteers?

Volunteers can provide valuable services to organizations if they have relevant experience and the willingness to work with the organization's plans.

The recent focus on getting schools wired has resulted in the volunteered assistance of many parents and others wanting to help with technology. When an organization accepts a volunteer's offer to help install or maintain technology, this is generally less problematic than accepting donations of equipment. However, volunteers too should be assessed with some care before being accepted.

In order to use the volunteer's assistance wisely, you need to know if the volunteer has training and experience in the activity for which he or she is volunteering. Once you have determined your needs and the volunteer's expertise, you should provide the volunteer with information about your technology plans and the system architecture to ensure that voluntary work meets the requirements of your long-range plans and the standards for your system.

Another thing you should consider is the timing of the offer. If you do not have staff to work with the volunteer at the time the volunteer is available, you may have to consider changing staffing arrangements or postponing the assistance. Usually volunteers will understand if you do not have staff to work with them at the time they come forward. However, you may consider that a "bird in the hand" is worth some inconvenience on your part.

Before you make arrangements for the volunteer to work, you should check with your organization's insurance provider and any other supervisory group (e.g., the school district office) to determine if there are limitations to what the volunteer can be allowed to do.

Key questions to ask when considering including volunteers

ASK:	RESPONSE:
How knowledgeable (computer literate) is the volunteer?	
Will your staff have to spend time and effort orienting the volunteers?	
Will this effort and associated cost exceed the value of the volunteer contribution?	
Will your organization incur liabilities by having non-employees working with technical equipment — either in terms of risk of injury, or risk of invalidating product warranties?	

How Do You Find Qualified Help When You Need It?

Throughout this book, we've discussed the importance of finding the right people with the necessary expertise to help you, the decision maker, make the right decisions. We've also discussed the necessity of having experts who help install, implement, monitor and evaluate the system, and the importance of providing ongoing technical support and training for staff so that everyone is up-to-date. We have not discussed how to find these experts, however. Knowing where to find technical support and advice is critical for informed, successful decision making.

Finding help is best done through similar organizations and groups in whom you have confidence.

There are many sources of qualified help available, many of whom are willing to come to you to help. Some sources you may want look into include:

- ✔ Professional organizations that provide appropriate member services.
- ✔ Private or not-for-profit consulting organizations or individuals.
- ✔ Governmental agencies chartered to provide assistance.
- ✔ Technical and professional publications.
- ✔ Training programs.
- ✔ University faculty or centers.
- ✔ Vendors who are willing to describe their solutions.

You should also look for sources of help among other organizations similar to yours. These are often the best source of useful assistance, as they may have already faced the same challenges as you. Talk to their decision makers. Ask about the consultants they used. Use the feedback you receive to make educated choices for your own organization.

When dealing with consultants and organizations that have products to sell or who represent specific products, make sure that they disclose those relationships up front to avoid possible conflicts of interest. Your organization should determine in advance whether vendors, organizations, and individuals who represent products would be appropriate sources of help. If a product recommendation is not a part of the help needed, or if an open and public bidding process will follow, vendors representing specific products may be able to provide current and appropriate expertise.

Key questions to ask about locating sources of assistance

ASK:	RESPONSE:
What other organizations have recently gone through the changes that my organization is undergoing?	
What professional organizations might be able to provide my organization with advice and contacts?	
Of the organizations that I know have gone through something similar, which do I feel are most successful and why?	
What publications are available that might help with the transition, and that might offer further sources of assistance?	

CASE STUDY - Act 1, Scene 2 - The following Friday

Late in the day, Joe called Mary. "Mary, did you get the materials I faxed you last Wednesday? I found them to be really useful. My technology steering group has purchased some software to provide us with reports on usage, and they have set up an e-mail address to handle user questions."

"Yes, thanks a bunch for sending them, Joe, but I think it's time you started using e-mail rather than fax machines." replied Mary.

"I guess you're right," said Joe. "I'll try to remember next time."

Mary continued. "Our technical staff advertised on campus for students who would be willing to work on a new HELP desk a few hours a week. After screening the students, they found twenty students who seemed pretty knowledgeable, and they will begin training them next week. They also bought a software package to get usage reports. Did you ever decide what to do with those donated computers?"

"I think so. I talked with a couple of my friends in other districts, and they said they had been able to use 386 computers for word processing classes. If we get any 486 machines donated, we can use them on the network. We took all the other old computers we had to the Salvation Army. Maybe they can give them away."

"I checked with Bob to see what we did with our old computers," said Mary. "He said he placed an ad in the paper, and gave them away to whoever wanted them. He said if a donated machine doesn't fit our system architecture, we turn it down. It's too hard to get the equipment fixed and we can't use our software on the machines anyway."

"Mary, I didn't really call to talk about our computer systems. I wanted to see if you would like to join me for dinner and a movie tomorrow night."

"I was wondering if you would ever get around to asking me out. I was afraid you were turning into a computer guru, Joe."

"No, Mary. I hired someone to be the computer guru, so now I finally have some time to pursue other interests."

Is That All There Is To It?

This brings us to the end of this book and the beginning of your adventure with technology. Let us make something abundantly clear: in many respects parts of this are book are already out of date. It would be so even if we finished it on the same date that you read it. The world of technology is moving so rapidly and so dramatically that that there is no such thing as a beginning and end point; it's just one rapid adventure.

However, the value this book provides is the focus on the fundamentals and the tools needed to make sensible decisions about technology now and in the future. With any luck, you will develop a technology vision that helps you to select, purchase, and implement a system that provides the foundation for technology usage in your organization for many years to come.

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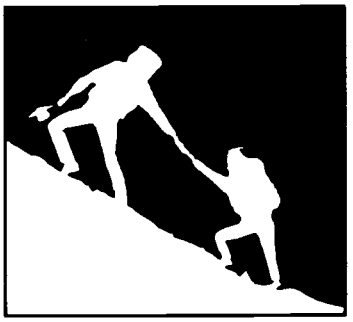
Where Can You Get More Help?

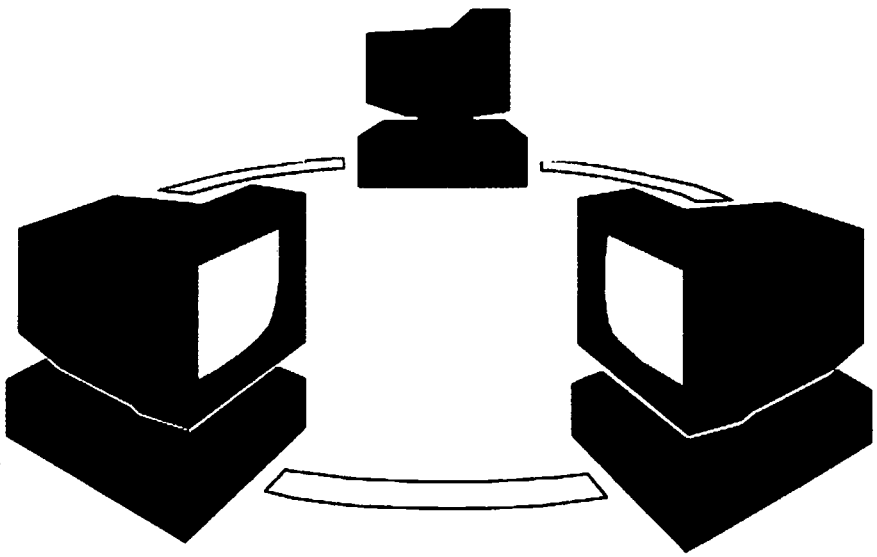


Massachusetts Software Council, Inc., *Switched-On Classroom.* Available http:www.swcouncil.org/switch2.html.

National Center for Supercomputing Applications. *K-12 Networking Infrastructure Guide.* Available http://www.ncsa.uiuc.edu/edu/nie/overview/network/network.html.

National Center for Supercomputing Applications. *A Guide to Networking a K-12 School District.* Available http://www.ncsa.uiuc.edu/edu/nie/overview/handbook/handbook.html.

North Central Regional Educational Laboratory. *Learning Through Technology: A Planning and Implementation Guide.* Available http://www.ncrel.org/tandl.



Glossary

Acceptable use policy - a statement of the procedures, rights and responsibilities of a user of a technology solution and any disciplinary procedures that will be enforced for misuse of the technology.

Administrative software - computer programs that are used to expedite the storage and use of education data for efficient functioning in education settings. Examples are student records systems, personnel records systems, and transportation mapping packages.

Application software - computer programs that are used to accomplish specific tasks not related to the computer itself. Examples are word processors, spreadsheets, and accounting systems.

Browser - software that lets you locate, view, and retrieve information on the World Wide Web using a graphical interface.

Business process re-engineering - the process of solving an organization's needs and problems by changing the organization's policies and procedures.

Bug - a glitch that keeps a software program from being able to perform all of its capabilities or that affects its ability to function.

Build versus buy analysis - a process of considering the needs of the organization and the available options, costs, and staff to determine the most efficient way to obtain the desired technology solution.

Business case - a document providing a description of the desired technology solution and the anticipated costs and benefits.

Byte - the amount of memory space needed to store one number, letter or symbol in a computer.

Cables - the collections of wires twined together to connect peripherals to the computer system unit.

CD-ROM (compact disc-read only memory) - a round silver colored plastic disk that comes with massive amounts of information embedded and ready to be used. Unlike diskettes, CD-ROM disks can be read by any type of computer with a CD-ROM drive.

Central processing unit (CPU) - the brain of the computer that processes instructions and manages the flow of information through a computer system.

Client/server network - a configuration where all people store their files on a central computer, and files are accessed directly from where they are stored on the central computer. The central computer is the server, and the client is the computer that can access the information from the central computer.

Commercial service provider - a company that will connect one computer to other computers for the exchange of information.

Computer case - the unit that contains the components of the computer system that enable data to be processed according to a series of instructions. It is also known as the system unit or console.

Computer type - the classification of a computer according to its storage and computing capacity, the number of users that can be supported, the variety of input and output options, and the physical size. Three major types of computers are mainframe computers, minicomputers, and microcomputers.

Conversion - the task of moving data from an existing computer system or from paper files to a new software application.

Data base software - the computer programs that allow the storage of large amounts of information and give the capacity to search, retrieve, sort, revise, analyze and order data quickly and efficiently. There are two types of data bases, flat file data bases and relational data bases.

Disk - a round plastic magnetic device on which computer programs and data are saved. There are three main types of disks: hard disks (maintained inside the computer), diskettes (a.k.a. floppy disks), and compact disks.

Disk drive - a device that reads the information contained on a disk. The drive may be permanently installed inside the computer (hard disk drive) or contain a slot for entering the disk from outside the computer (floppy disk drive or compact disk drive).

Diskette - a thin, plastic flexible disk on which computer programs and data can be saved outside of the computer. The two types of diskettes are 3.5 inch disks that come in a hard plastic case and 5.25 inch disks that come in thin pliable (floppy) cardboard-like cases.

Dumb terminal - a unit that has a monitor and a keyboard and connects to another computer for it's processing power. These are sometimes called "tubes" or "CRTs."

Electronic data interchange (EDI) - a national set of standards that prescribes how specific elements of data should be combined and formatted for exchange.

Electronic mail (e-mail) software - the computer programs that facilitate computer-to-computer communications among users in any location.

E-mail - messages transmitted across networks typically accessible only by the addressee.

Ethical standards - guidelines for the appropriate use of the technology solution and the maintenance of privacy of the contents of the system. These are generally specified in an Acceptable Use Policy, particularly where there is concern about the security of the system or the availability of objectionable materials obtained through the system

File - a block of information stored on a magnetic media such as a floppy or hard disk or a tape. A file may contain a computer program, a document, or a collection of data.

Flat file data base - a data base where information is stored in a single table (e.g., a table in which there is a list of employees, where data about each employee follows the name).

Floppy disk - see Diskette.

Frequently asked questions (FAQs) - a listing of questions typically asked along with the answers to the questions. This list is prepared to help novice users as they begin to use computers or software.

Functional specifications - a document that states in detail what a new (or upgraded) computer system should be expected to do, i.e., what services it delivers to those who will use and maintain it. This listing of a computer system's capabilities can be compared to what can be bought from a commercial vendor or built by developers.

Functions - the tasks or actions that software is intended to perform.

Hard drive (a.k.a., hard disk drive) - a device used to "permanently" store information within a computer, such as programs and data.

Gantt chart - a diagram that shows tasks and deadlines necessary for competing a project.

Handover - the point when an organization accepts that a technology solution is complete and ready for routine usage.

Hardware - the computer equipment used to do the work (i.e., operate software programs). It consists of the items you can touch, such as the computer case and the peripherals (e.g., monitor, keyboard, mouse) that are attached to the computer.

Help desk - a set of procedures for getting speedy assistance to users concerning the use of a computer. Help may be provided by telephone, fax or e-mail, or through summary listings of typical questions and answers.

Hub - a device that links all client computers to the server.

Implementation project manager - the person who directs the installation and implementation of a technology solution.

Instructional management software - the computer programs that serve as tools to be used by teachers to prepare for instruction and maintain records. Some typical instructional management applications include gradebook programs and curriculum builders such as crossword puzzle generators.

Instructional software - the computer programs that allow students to learn new content, practice using content already learned and/or be evaluated on how much they know. These programs allow teachers and students to demonstrate concepts, do simulations and record and analyze data. Often administrative applications like data base programs and spreadsheets are used within the instructional context to help analyze and present information.

Interface - the connection between a computer and the person trying to use it. It can also be the connections required between computer systems so that communication and exchanges of data can take place.

Internet - a world-wide network of computer networks through which people can exchange data and communications.

Internet service provider - a company that provides access to the Internet, such as phone companies and other commercial service providers.

ISDN (Integrated Services Digital Network) - a digital phone line that can transmit data, video and voice.

Keyboard - a device similar to a typewriter that is used to enter information and instructions into the computer. In addition to letter keys, most keyboards have number pads and function keys that make the computer software easier to use.

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Local area network (LAN) - the linkage of computers and/or peripherals (e.g. printer) confined to a limited area that may consist of a room, building or campus that allows users to communicate and share information.

Log on - to initially connect to a computer.

Mainframe computer - a large computer that supports many users and has the storage and computing capacity needed for large data sets. It generally stores data on large reel-to-reel magnetic tapes that require extensive physical storage space. Users of mainframes use dumb terminals or "tubes" that have screens and keyboards to connect to the mainframe.

Maintenance agreement - a contract with an outside service or agency to fix a computer system (or its components) when it breaks, or assist with upgrades to the system.

Megabyte (MB) - the amount of computer memory needed to store 1,048,576 characters, which is approximately equal to one novel. Megabytes are used to describe the amount of memory on a hard disk or in random access memory.

Megahertz (MHz) - a measure of the clock speed of a central processing unit expressed in millions of cycles per second.

Microcomputer, a.k.a. Personal Computer or PC - a small computer that is desktop size and uses a microprocessor chip (the brains of the unit) to run the computer. It is generally used by only one person at a time, but it can be networked to provide communication with other PCs, mainframes and minicomputers. Both Macintosh and IBM-compatible computers are considered a part of this category of computers.

Minicomputer - a computer that is between a mainframe and a microcomputer in size and capacity. It generally can serve between 10 and 100 users simultaneously.

Modem - short for "modulator/demodulator." This device connects the computer to a telephone line for communication with another remote computer or information network. Modems may be internal or external to the computer case. Modems are classified according to the speed with which they send and receive information.

Monitor - a device similar to a television screen that receives video signals from the computer and displays the information for the user.

Mouse - a hard-held pointing device (used on top of a desk) that gives directions to the computer and moves information around on a monitor screen.

Multimedia - a computer with a mixture of media such as CD-Rom, speakers, etc.

Needs assessment - an evaluation of the functions you want your computer and networking technology to have or the needs you hope this technology will meet.

Needs statement - a description of the functional needs, technical requirements and security and ethical standards that need to be met by a technology solution.

Network - a group of computers connected to each other to share computer software, data, communications and peripherals. Also, the hardware and software needed to connect the computers together.

On-line - the status of being connected to a computer or having information available through the use of a computer.

Operating system software - the electronic instructions that control the computer and run the programs. This software is generally specific to a type of computer.

Password - a secret sequence of letters and numbers that will enable users to log on to a computer and prevent unauthorized use. Passwords may be established by a system administrator or by the individual user.

Peer-to-peer network - a configuration where people store their files on their own computers, and anyone on the network can access the files stored on the other networked computers.

Peripheral - a device that is attached to a computer, such as a monitor, keyboard, mouse, modem, CD-ROM, printer, scanner, and speakers.

Physical security - measures that must be taken to prevent theft, vandalism, and other types of harm to the technology equipment.

Platform - the computer hardware and operating system software that runs application software.

Printer - a device that translates signals from a computer into words and images onto paper in black and white or color. Printer types include dot matrix, ink jet, laser, impact, fax, and pen and ink devices.

Project management software - software programs that provide tools to help manage projects, such as integrated calendars, report generators, scheduling, charting, tracking, prioritizing, etc.

Project team - the group of persons responsible for carrying out the successful implementation of the technology solution.

Protocols - the set of standards and rules that let networked computers communicate or share information, such as Ethernet or token ring.

Random access memory (RAM) - the space in the computer on which information is temporarily stored while the computer is on.

Redeployment - the assignment of a computer to a new task or office once it has been replaced by a newer computer.

Relational data base - a data base where data are stored in more than one table, each one containing different types of data. The different tables can be linked so that information from the separate files can be used together.

Release - an edition of a software program released when minor changes or bug-fixes have been made. Releases are usually shown by a whole number (denoting the version) followed by a decimal number indicating the release number.

Resolution - the clarity of the images produced on a monitor screen.

Router - a device that regulates network traffic as its enters another network, and makes sure that messages go to the correct network site.

Security - protection from threats to the equipment, functioning and contents of a technology solution.

Software - the computer programs that tell the computer what to do. Software can be divided into two groups, operating system software and application software.

Software features - the capabilities offered by software that make it easy and effective to use.

Spreadsheet software - computer programs that have efficient and accurate methods of working with numbers. They are used to perform a wide variety of simple to complex calculations, and offer charting and graphing capabilities.

Steering committee - a group of persons who meet periodically to evaluate the progress and success of the implementation of the technology solution.

Suite - a collection of software programs that are sold together and are supposed to work together efficiently and use similar commands.

Surfing - exploring locations and scanning the contents of WWW sites on the Internet.

System architecture - a description of the design and contents of a computer system. If documented, it may include information such as a detailed inventory of current hardware, software and networking capabilities; a description of long-range plans and priorities for future purchases, and a plan for upgrading and/or replacing dated equipment and software.

System functions - a list of the specific capabilities a system should be able to do or staff should be able to do using the system, such as system storage and retrieval capabilities, calculation and processing capabilities, reporting and output capabilities, and telecommunications capabilities.

Technical requirements - simple statements of parameters for a technology solution addressing topics such as the number of people who will use the system and where they are located, the numbers and types of transactions that will need to be processed, and the types of technology components that need to interact.

Technical support staff - the persons who support and maintain the technology solution once it is implemented.

Technology resources - the hardware, software, networks and networking capability, staff, dollars and context which together can be used in the implementation of a technology solution.

Termination point - the point where a communication line enters into a building.

Topology - the geometric configuration of a computer network, or how the network is physically laid out. Common topologies are star (centralized), bus (decentralized), and ring (decentralized).

Upgrade - to install a higher version or release of software on a computer system, or to add memory or newer types of equipment to a computer system.

Users - the people who use technology as a tool to do their jobs. Typically users include instructional staff who provide instruction or do instructional management tasks using technology, and administrative staff who use technology to do the routine and non-routine administrative activities of the organization as efficiently as possible. Students, parents, and community members can also be users. In some cases, "users" are not really users at all; they are staff who wish they had technology to use.

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Utility software - computer programs that help to manage, recover, and back up files.

Version - a major edition of a software program. The version number changes when a software developer makes major alterations to the software such as adding new features. The version number is a whole number following the name of the software.

Wide area network (WAN) - a data communications linkage (e.g. dedicated line, radio waves) designed to connect computers over distances greater than the distance transmitted by local area networks (e.g. building to building, city to city, across the country, internationally) that allows users to communicate and share information, such as the Internet, America Online, etc.

Word processing software - computer programs that allow documents to be typed, revised, formatted and printed quickly and efficiently.

World Wide Web (WWW) - a system that allows access to information sites all over the world using a standard, common interface to organize and search for information. The WWW simplifies the location and retrieval of various forms of information including text, audio and video files.

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Additional Resources On Line

American Association of School Administrators (http://www.aasa.org). This site has acceptable use policies, technology plans, and other technology planning resources.

Association for Supervision and Curriculum Development (http://www.ascd.org)

This site has documents and other resources free for members.

Association of Research Libraries (http://arl.cni.org/access.html) Assists member libraries to exploit technology in the fulfillment of their missions.

Classroom Connect for K12 Teachers and Students. (http://www.classroom.net/classroom/edulinks.html) Contains World Wide Web FAQ (Frequently Asked Questions), Internet Tools.

Classroom Connect on the Net [http://wentworth.com/classroom/default.html]

In addition to lesson plans, science projects, etc., it has links to business sites and a list of nonprofit organizations' Web sites.

Consortium for School Networking [http://www.cosn.org]

Council of Chief State School Officers (http://www.ccsso.org) This site is linked to state education agencies' home pages. In addition, there are publications and other information about technology projects in states.

Council of Great City Schools (http://www.cgcs.org) This site contains information about technology activities in large school districts.

Education Commission of the States [http://www.ecs.org/ecs.235a.htm]. At this site, you can find information about state technology actions.

Education Technology Resources [http://www.camosun.bc.ca] This site contains educational resources identified by Canadian colleges and institutes.

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Education Week (http://www.edweek.org) This site lists deadlines for grant applications and discusses effective sites on the Web.

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HotList of K-12 Internet School Sites [http://rmet.com/~gleason/k12.html] This site contains links to schools with Home Pages.

Institute for Learning Technologies [http://www.ilt.columbia.edu/k12/livetext/topics/index.html] There are many topics of interest under the Resource Section I, such as school technology planning guides and examples, technology skills, and needs assessments.

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