Technology @ Your Fingertips

What is the Purpose of this book?

Technology @ Your Fingertips, Version 2.0 (January 2001) 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.

For questions about the content of this publication, please contact: Gerald_Malitz@ed.gov

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Technology @ Your Fingertips

Acknowledgements

This document was developed to provide assistance to individuals in education organizations who want to learn more about what it takes to develop a technology solution to meet the needs of their organizations. The guidelines and practices included in this document were drawn from the experience of many people who have been involved in the development, implementation, and management of education technology in schools, school districts, state education agencies, institutions of higher education, and libraries. Hopefully this document will provide you with useful advice specific to your education situation and help you to avoid pitfalls as you go through the decision-making process.

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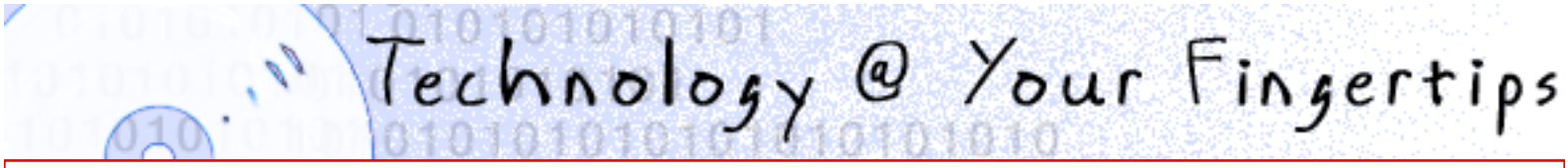

Chapter 1: Knowing What to Do

Case Study- Act 1, Scene 1

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 schools so that all students can enjoy the benefits of technologically sophisticated classrooms that are wired to the National Information Infrastructure and provide learning experiences geared toward developing the skills needed in 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 integrating technology sound easy. But others recognize that acquiring the best technology is very complicated. If you believe that it is difficult to make good 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.

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Technology @ Your Fingertips

Chapter 1: Knowing What to Do

__Technology__ @ __Your Fingertips__ describes steps for making effective decisions about computer and networking technology.

What Is the Purpose of This Book?

Technology* @ *Your Fingertips describes a process for getting the best possible technology solution for your education 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 that the technology you choose will reflect your organization's needs and the context in which you work.

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Chapter 1: Knowing What to Do

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

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, school site technology coordinators, 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.

If you perform 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 information it contains. The writing style is targeted to non-technical individuals, yet it includes the requisite terminology and issues basic to understanding 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 it be a school, school district, state education agency, college, university, library, or another type of education organization.

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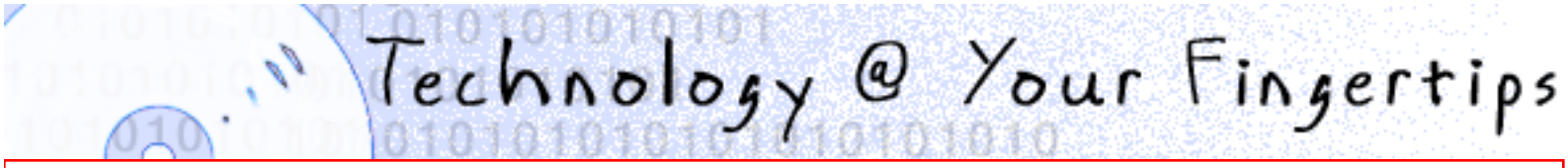

Chapter 1: Knowing What to Do

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

What is Presented in This Book?

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.

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 as a tool for:

- Providing instruction to students (e.g., integrating technology into the curriculum, recording data from experiments, providing computer-based instructional activities, accessing the Internet).
- Managing activities related to instruction (e.g., reporting grades and attendance, designing lessons, accessing information about students).
- Automating and streamlining day-to-day operations (e.g., registering students, maintaining health records, scheduling classes, determining bus routes).

This book does not, however, offer recommendations for specific hardware, software, or networking services. While there are specific examples mentioned, they should not be interpreted as endorsements.

Included at the end of the book are electronic pointers to reference documents and other sources of information. These are meant to serve as examples, not as an exhaustive list of available references. The constant changes in technology make the life of many of these resources fairly brief. There are many resources listed that are available on the Internet because they tend to be most 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, a colleague at 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.

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Chapter 1: Knowing What to Do

Case Study- Act 1, Scene 2

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 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 proven logical process for sound 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 generally contain similar types of elements. This document describes the different steps of the process in a way that will help to meet your specific needs in 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.

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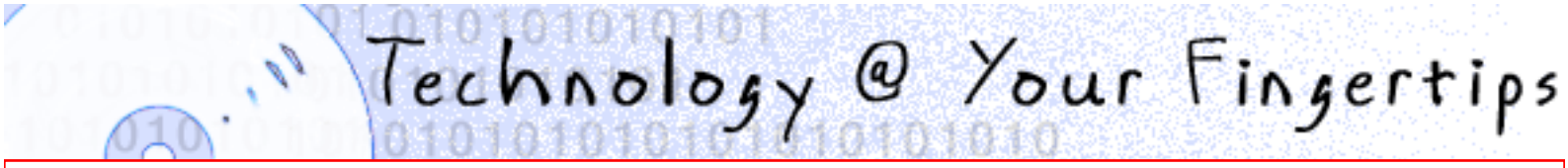

Chapter 2: Knowing What You Need

Case Study- Act 2, Scene 1

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

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, 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 education organization. Still, you must have some ideas about what you want, and chances are there are people who work with you who have additional ideas about what would be valuable. This chapter will help you gather all the possibilities (i.e., perform a needs assessment) and lead you to consider the priorities for your technology solution (i.e., define your technology requirements).

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Chapter 2: Knowing What You Need

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.

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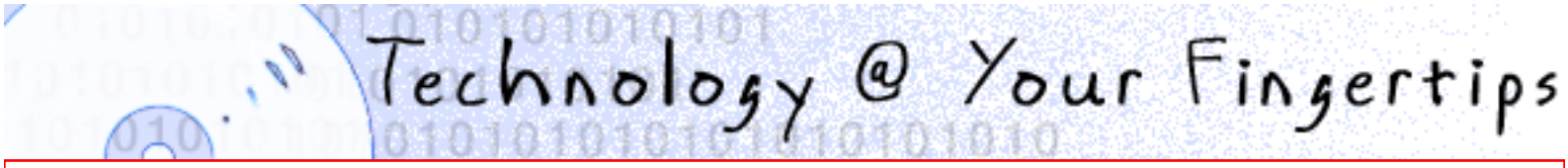

Chapter 2: Knowing What You Need

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

Who Should Do Your Assessment?

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. You may want to bring someone into the organization who is able to explain what is possible. Also, staff may want to visit a "technology rich" site to make some comparisons.

It is important to include as many people as possible in your discussions. After the equipment is installed and the wires connected, you will want to make sure that you have gotten "buy in" from the staff. Otherwise, people might not use the technology. If technology is being discussed at a school, for example, the school technology committee should include representatives from every grade level or department.

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 compete with other potential uses of the organization's scarce resources. Start by requesting a copy of the organization's Technology Plan. (If a Technology Plan has not yet been developed, then it should be!) By doing so, you will know what resources already exist and what is planned for the future.

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.

Mini-Case Study

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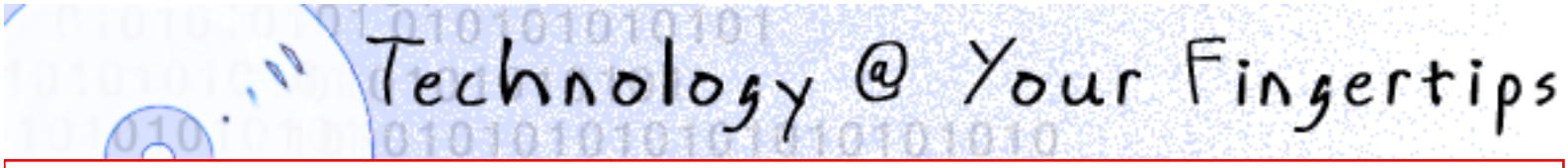

Chapter 2: Knowing What You Need

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

Who Should Participate in the Needs Assessment Process?

Most needs arise from **users**, 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 efficient administrative support. In some cases, "users" might not really be users at all-rather 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.

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 when 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 or multimedia 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.

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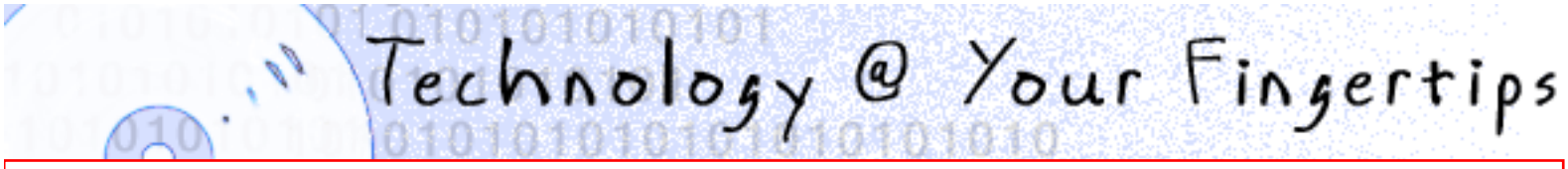

Chapter 2: Knowing What You Need

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.

What are the Steps in the Needs Assessment Process?

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. Although it is really just one component 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 who 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:

- **Information capture** (e.g., student grades and attendance, teacher employment data, new library book titles).
- **Information access** (e.g., previous student course grades, library book availability, instructional software use, World Wide Web surfing).
- **Information processing capability** (e.g., grade point averages, trend lines, finished documents).
- **Information sharing** (e.g., email, video teleconferencing, telephones, TV, electronic transcripts, electronic data interchange).

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:

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 or ignore them, and live with the consequences.

As a management technique, it may be helpful to separate your instructional needs from administrative needs, but keep in mind that there is no magic formula for doing so. Still, keeping the big picture in mind is both helpful and necessary. 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.

Key questions to ask about the organization's needs

Ask
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?

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.

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 is required 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. The following is a description of what is meant by Functional Needs, Technical Requirements, and Security and Ethical Considerations.

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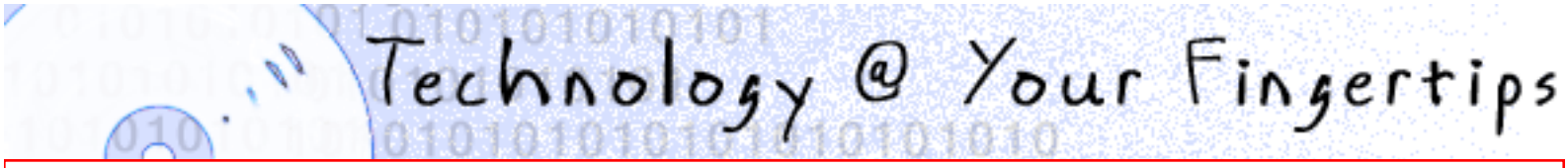

Chapter 2: Knowing What You Need

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.
- Professional development support.
- Word processing.
- Spreadsheet capability.
- Database creation and management.
- Instructional software access.
- Access to the Internet.
- Electronic mail.
- Software appropriate for meeting the instructional needs of students.
- Video access (streaming video and interactive video).
- Telephone access in classrooms.

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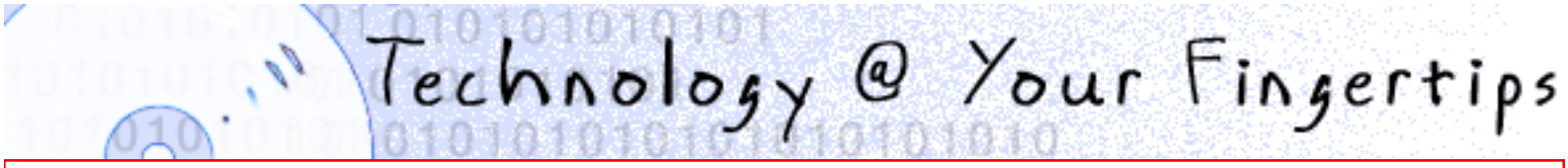

Chapter 2: Knowing What You Need

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

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 (e.g., state, county, city or district) that must be met.
- Federal requirements associated with an E-rate application.
- 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.

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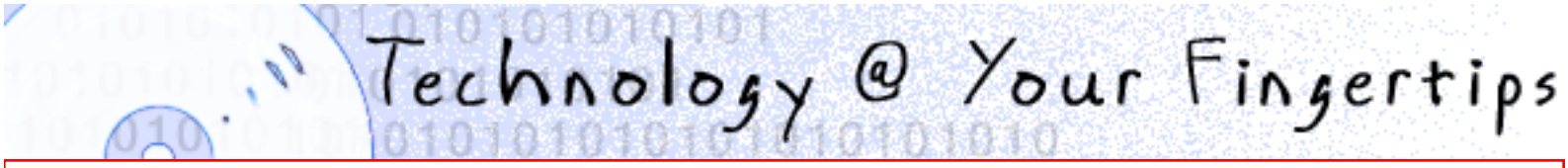

Chapter 2: Knowing What You Need

Security and ethical standards

Everyone in the education community is required to secure the data that are maintained on our computer systems. The level of security might be different for a school district (where information is stored about students who are not adults) than a college or university. The Family Education Rights and Privacy Act (FERPA) is very clear about the regulations that must be considered.

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.

A review of the NCES publication *Safeguarding Your Technology* will be helpful when determining your organization's security needs and strategies.

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. You will also want to know what will happen if equipment is stolen or lost. Does your organization have insurance or are you self insured? Are there local regulations that are in place for the protection of 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 (both information and equipment) at risk. This is not a risk worth taking.

Mini-Case Study

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Technology @ Your Fingertips

Chapter 2: Knowing What You Need

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. The document should be written by the technology committee. The more people participate in these discussions and the development of these plans, the more they will 'buy-in" to the new technologies, and "buy-in" is critical.

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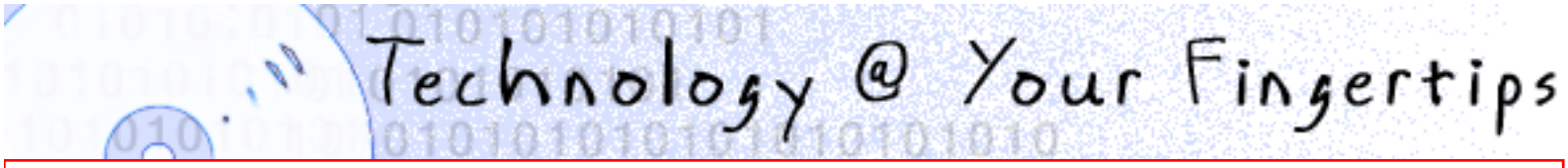

Chapter 2: Knowing What You Need

Case Study- Act 2, Scene 2

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

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, thus far, has focused on a "technology solution," rather than a computer system, that will meet your needs.

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 an upgraded (or new) 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. Your investment must be able to:

- Carry your family of four (and perhaps occasionally a 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.
- Be easily serviced.
- 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.

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, and how many users need to use the system. 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.

Section 2 - System Contents

This section could include a description of the types and amount of information the system is expected to maintain. 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 a central repository of information resources such as encyclopedias and dictionaries.

Section 4 - Access and Capacity

This section contains some of the specifics that must be considered when 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. It is at this point that the technology committee should meet with the people in the organization who are already providing these services. Whether it is the college registrar's office or the school district, county, or state department of education, many of these questions might already have been answered. Remember the Wheel! It does not need to be reinvented?

Section 5 - Interfaces

This section should specify, to the extent possible, which other networks 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 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.

For Further Information about the content of
Technology @ Your Fingertips
please contact Gerald_Malitz@ed.gov.

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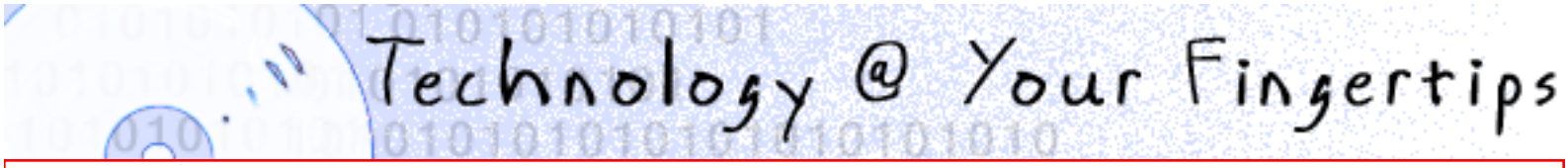

Chapter 3: Knowing What You Have

Case Study- Act 3, Scene 1

Objective:

- *Understand basic features of computer and networking technology.*
- *Describe your current technology environment.*
- *Ascertain which hardware and peripherals you will 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.*

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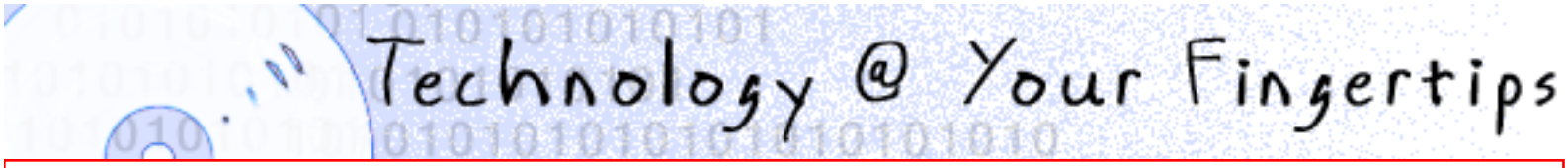

Chapter 3: Knowing What You Have

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

What Technology Resources Do You Have Available?

Computers can be found in nearly all schools, universities, and libraries; some were purchased, some were leased, others were donated. All of them consist of hardware and software, and many 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.
- Peripherals, such as scanners and printers.
- 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.

To a technology novice, distinguishing between computers, operating systems, memory requirements, processing speeds, peripherals, networks and other technical issues can be daunting. When you are talking about management systems, save yourself time, aggravation, and intimidation and find someone who is knowledgeable about computers to help you document the technology resources that currently exist in your organization. Almost all schools, districts and states maintain some kind of technology inventory. That would be the first place to look to see if any of the information you need has already been collected.

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.

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Technology @ Your Fingertips

Chapter 3: Knowing What You Have

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

What Hardware Do You Have in Your Organization?

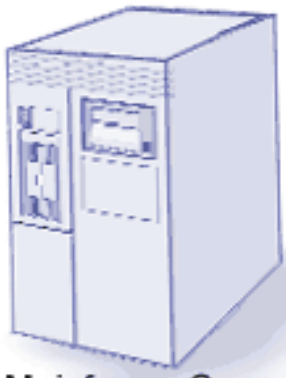
Computer hardware is the equipment used to do the work (i.e., operate software programs). It consists of the items you can touch, such as the computer case and the peripherals (e.g., monitor, keyboard, mouse) that are attached to the computer. The following descriptions will help you prepare to document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

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

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 used by many school districts, state education agencies, and universities because they support so many users and have the storage and computing capacity needed for large data sets.



Mainframe Computer System

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 their speed, power, and capacity have increased, yet 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 (e.g., Windows™, Linux operating systems, etc.) computers fit into this category. Making things more complicated, however, is the server, which oftentimes is little more than a PC equipped with large amounts of storage for "serving" software on demand to other networked 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.

Microcomputer System

Becoming Familiar With Microcomputer (PC) Manufacturers and Models

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

There are many different manufacturers of microcomputers, and many people who create custom computers by putting together the independent parts. There are many computers in use that are no longer made. Computer manufacturing companies and retail businesses are anxious to sell many kinds of computers to schools, districts, colleges and universities. The needs assessment and/or technology plan will help you decide what *you* need (as opposed to what they sell). Then, when you are contacted by a vendor, you will have the necessary information for framing your response to their inquiries.

Understanding Computer Characteristics

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

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 at which it works. The higher the number, the greater number of megahertz and the faster the machine runs.

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 in size to a novel of average length. Software applications often drive the need for RAM; for example, a graphical arts package might not even work on a machine with less than 128 MB of RAM. Thus, when purchasing a computer it is important to anticipate the growing RAM needs of the software you expect to use.

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 more than 4 gigabytes (i.e., 4,000 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.

Some commonly used operating systems include:

Windows (95, 98, 2000 or NT)
Macintosh OS
UNIX (of many kinds)
OS/2
Linux
MVS
VMS

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 will run on multi-platforms, which means that it can run, for example, on computers using either Windows or a Macintosh operating system.

Identifying Peripherals

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


Monitor

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.


Keyboard


Mouse

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 on paper in black and white or color. Printer types include dot matrix, ink jet, laser, impact, fax,

and pen and ink devices.

Cables. Cables used to be collections of wires twined together to connect peripherals to the system unit. Other cables now being used include "fiber-optic" cables, which move larger amounts of information over the network at a faster speed.

Modem (a short form of "modulator / demodulator"). The modem connects a 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. Faster modems accomplish more work per unit time (e.g., per second or minute). Before purchasing a high speed modem, however, be sure to verify that the phone lines can handle the speed advertised on the modem box! There are also cable television modems and DSL modems available in some areas that allow even greater transfer speeds. But, when examining the needs assessment or technology plan, it will probably become clear that for a school, it is more efficient to set up a network rather than rely solely upon modems.

Scanner. This is an input device that takes in an optical image and digitises it into an electronic image represented as binary data. Scanners are used to create computerised versions of a photo or illustration.

Switch. In the olden days (i.e., two years ago) a little box called a "hub" was the point at which computers were connected to the local area network. Today, we use smart hubs, called "switches."

Router. As the name implies, this small computer sits between the outside world and the computers in a local area network and distributes ("routes") information coming in and going out. For example, when a message comes from the Internet into a school, the router sends the information to the computer that is supposed to receive it. The router is like the police officer giving directions at an intersection, sending data to the computer that requests the information.

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 (i.e., designed for utility *and* comfort) and receptive to security (e.g., wires, bolts, etc.).

Developing an Inventory

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

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 redeployed (i.e., given a new purpose within the organization).

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 size of hard disk).
- Peripherals and capabilities they support.
- Intended uses (e.g., classroom instruction, correspondence, record keeping, accounting, graphics).
- Networking capability.
- Location - building/room.

See Table 3.1 for a sample inventory.

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

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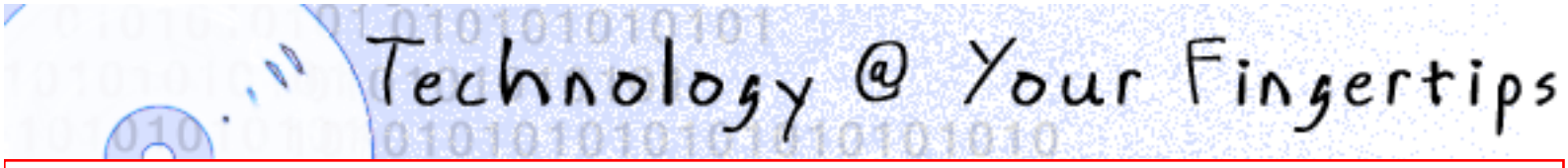

Chapter 3: Knowing What You Have

What Application Software is Available?

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

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, producing a presentation, or creating a simulation for a classroom lesson. We have already spoken about Operating System software; now we need to discuss application software.

Understanding the Different Types of Application 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.

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. Commonly used e-mail packages include cc:Mail, Outlook, Pegasus, Eudora, etc. **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. **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 or links to school, district, or state agency resources.

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. Instructional software can also be used to supplement curriculum that does not use technology. These programs allow teachers and students to demonstrate concepts, perform simulations, and record and analyze data. Sometimes data base programs and spreadsheets are used within the instructional context to help analyze and present information. Additionally, World Wide Web browsers (e.g., Netscape and Internet Explorer) provide access through the Internet to a wealth of software tools that might be used in the instructional program.

Working With Applications Software


Diskette

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, perhaps more likely, on *CD-ROM* (compact disc-read only memory) or DVDs (digital video disks). Diskettes are thin, plastic flexible disks on which information can be stored magnetically. The thin disk is placed in a harder plastic case that is inserted into a slot that contains a *disk drive*. The disk drive is used to read the information stored on the disk. Note that there can be different disk formats for different operating systems and that floppy disks may be used repeatedly.


CD-Rom

Information is also stored and read using CD-ROM or DVD disks. Because of their massive storage capacity, CD-ROMs and DVDs are also useful for storing large collections of data, such as complete encyclopedias. Software programs often come on CD-ROM or DVDs. CD-ROMs are now available in "read/write" form, meaning that they not only can store information that is to be "read" by the computer, but can also save information that is "written" by the computer. DVDs are quickly becoming the standard for viewing large amounts of graphical information, including movies.

Other popular storage devices are *Zip*™ *disks* and *Super Disks*™. These are removable cartridges or diskettes that are able to store between 100 MB and 250 MB of data (compared to the standard diskette that hold 1.44 MB of data). While these types of disks are portable, just like 1.44 MB diskettes, their use requires the installation of a special disk drives.

Knowing the Currency of Your Software

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

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 quite likely 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 for administrative software (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.

Software in the Classroom

To determine the software that is needed in a classroom, ask yourself (or others if they know the answers better than you do) the following questions:

What do you need the software to do?
Do you have the appropriate hardware to make the program work?
Where do you store the software? On each workstation or on the server?
What is the staff development necessary for teachers to be able to use the program or system?

Sometimes, staff will want the latest, best, flashiest and newest version of a program. You must always keep the purpose of the software in mind. If the existing software meets the needs of the instructional program, it is not necessary to upgrade to the newest version. As the instructional needs change, the software can change as well.

Developing an Inventory of Software

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

An inventory of software in use at all organizational levels should be kept. At the district and school levels, it is very important to remind staff that a license is required to use software. This is especially true in classrooms. When developing a software inventory, 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
- Location of software (server or PC)

Each piece of application software should come with documentation describing the following information that is also 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.

See Table 3.2 for a sample software inventory.

Mini-Case Study

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Chapter 3: Knowing What You Have

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

What Networking Capabilities Do You Have?

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

Only a few years ago, if you mentioned the word "network," it's likely that only the three major television networks would come to mind. Today, a network has a whole new meaning, especially for computer users. Yet, there similarities between a TV network and a computer network in that both are comprised of affiliates (users) who share information over a common infrastructure. Moreso, both types of networks have the goal of ensuring that information is transmitted and shared as quickly and efficiently as possible and among as many people as needed.

Many schools, districts, institutions, libraries, and education agencies have established in-house connections between computers. Some have provided mechanisms by which persons working in an organization can connect with computers outside of the organization. Often individuals establish their own linkages to networks such as the *Internet* by purchasing software and using a *commercial service* (i.e., a company that will connect you to a network so that your computer can exchange information with other computers). More frequently, in the education environment, a school will connect through a district, county or state service. A college or university department might connect through a central entity within the organization as well.

Understanding How Networking Works

A *network* is the complete set of hardware, software, and wiring (or, in the case of 'wireless networks', no wiring) used to connect computers together to share information and peripherals, such as printers, scanners, and modems. Networks allow information to be exchanged directly between numerous computers without having to be transcribed by hand.

The smallest networks are *Local Area Networks (LANs)* in which 2 to 500 or more computers are connected within a small geographic area, often a single building or classroom. Larger networks called *Wide Area Networks (WANs)* connect the LANs together. They may use telephone lines, dedicated cables, radio waves or other media to link computers that can be thousands of miles apart.

See Figure 3.1 to view a sample district network design.

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

- In *peer-to-peer networks*, users store their files on their own computers so that anyone else on the network can access the files (and the user, in turn, can access files stored on the other networked computers as well).
- In *client/server networks*, users store their files on a central computer from which files are accessed directly. In the client/server network, the *server* is the central computer that stores the information, and the *client* is the computer (and user) that accesses the information from that central computer. Many people think that 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 *hubs* or *switches*, where all the cables linking client computers to the server come together. The switch (a switch is just an "intelligent" 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 Service Provider (ISP) and, then, to the Internet.

A Note About the Internet

Perhaps the ultimate WAN is the Internet, which is a matrix of networks. The Internet connects quite literally millions of supercomputers, mainframes, workstations, personal computers, laptops and more.

The most popular application available via the Internet is the *World Wide Web (WWW)*. It is the primary navigation tool for using the Internet. More often than not, when people say they are "*on-line*" they mean that they are connected to the Internet. Education organizations can connect to the Internet via one computer or many. A single computer might use a regular telephone line to connect to the Internet through an *Internet Service Provider (ISP)* (such as America On Line, Earthlink, etc.). A school or office might connect numerous computers together into a LAN, as described above, and then connect those computers to a hub/switch and on to the router, which in turn is connected to the wire (or cable, or satellite) that is connected to the ISP.

It is not very efficient for an organization to have numerous computers using modems to connect to the Internet over telephone lines. Rather, it is preferable to connect to the Internet over a "digital" line that is dedicated to organizational use. A digital line allows more than one computer to access the Internet at any time. The number of computers that can access the Internet at one time is limited only by the size of the wire connecting the site to the ISP. In terms of installing digital lines in a K-12 education environment, the Federal government currently provides funds through the E-rate discount program (discussed later) which is intended to defray up to 90% of associated costs.

Developing an Inventory of Networking Capabilities

The inventory of the LAN or WAN should be maintained by the office responsible for the network. If the school is responsible for making sure that the network is operational, then the school should maintain the inventory. However, if the district, county or state maintains the network, then the inventory should be retained at that level. An accurate inventory is required if the network is to be maintained adequately. You should develop an inventory of the equipment and software specifically allocated to the network and note where they are located (see Table 3.3 as an example).

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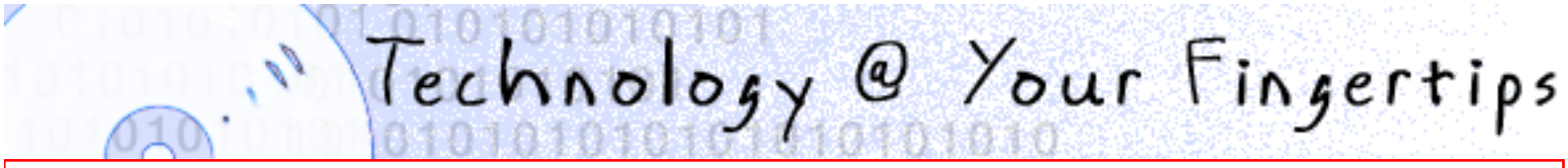

Chapter 3: Knowing What You Have

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 of those people may even have knowledge of the mechanics of computer operation. Even if you don't have any computers, many people in the field of education have used computers elsewhere. Some might be quite sophisticated when it comes to putting together computer systems and developing user-friendly applications. Identify these people, as they could become invaluable to your development efforts!

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.

Determining the hardware, software and network topology within an organization may seem like a huge task. It is! But it is manageable if persons who actually have the responsibility for developing the technology solutions and providing support are also responsible for handling the purchase of new technology equipment.

If you are the person responsible for making the technology decisions at your school, ask the district, county or state offices the following questions:

- Who has developed the topology for the networks in my organization?
- Do hardware standards exist?
- Is there a suite of software that is recommended?

If there are no answers to these questions, ask for recommendations about hiring a consultant from outside the organization to find the answers. Even though there might be a teacher, or an Internet guru, within your group who is knowledgeable about all of these issues, it is still advisable to hire an objective person from outside who will be able to guide your staff through the development of a Needs Assessment or Technology Plan. Many times your "guru" will have the solutions in mind before consulting with the staff who will actually work with the computers and the network. This approach does not allow your other users to "buy into" the move toward the technology age.

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Technology @ Your Fingertips

Chapter 3: Knowing What You Have

Case Study- Act 3, Scene 2

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

What Financial Resources Are Available?

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 on a cooperative basis 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. If you are part of a K-12 educational organization, or a public library, you may take advantage of the E-Rate program. The E-Rate is a federal program that permits discounts up to 90% on telecommunication services, Internet access, network wiring within school and library buildings, and other associated costs as described by program regulations. The discount rate is based on the number of students eligible for the Free and Reduced Lunch Program. The goal of the E-rate program is to get all classrooms connected to the Internet. Currently, $2.25 billion is available each year (paid for through the Universal Service Fund collected on all of our telephone bills). The E-Rate program is quite complex, but can be well worth your time and effort. Be certain to involve your purchasing and contracting personnel as you plan to participate. At the end of this book, links are provided for more information.

For Further Information about the content of
Technology @ Your Fingertips
please contact Gerald_Malitz@ed.gov.

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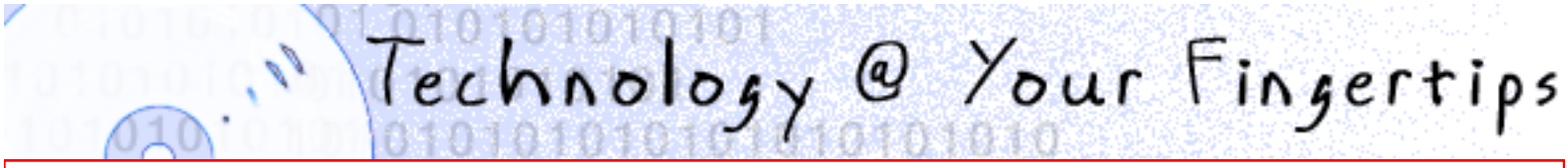

Chapter 4: Knowing What to Get

Case Study- Act 4, Scene 1

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

- *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.*

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 (or a technology plan) 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.

This is the time you may encounter the dreaded "whisky (or whiscy) syndrome" among users and managers. This refers to the impatience that occurs while 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.

If you are a district superintendent or a school principal, you are being asked the same kinds of questions. Teachers want to know when they can get on the Internet and principals are ready to use online applications to send reports to the central office. In any case, it's natural that people want to know that *plans* are turning into *results*, whether you're starting from ground zero or just upgrading the system.

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 the money and effort that you've spent thus 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 steps.

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.

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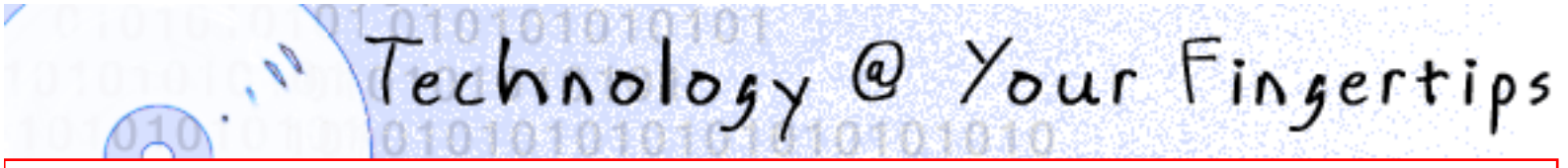

Chapter 4: Knowing What to Get

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

What kinds of things should you consider?

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:

- What do you want to do with the technology?
- What is the best approach to meeting your requirements (i.e., filling the identified gap)?
- How much is this solution going to cost?
- 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? Do we upgrade or start over from scratch? 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. 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. Another approach, depending on the size of the organization, might be to bring in an outside consultant to more objectively facilitate this process. Sometimes the people involved in the planning process have preconceived ideas about the solutions. It may be necessary to have someone from the outside make certain that all voices

are heard.

Considering Your Software Options (In the Office)

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, SmartSuite, 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 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 commercially available products, 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 the book. Finally, with respect to software and software development, you will want to make certain that all applications are "web enabled." That is, the applications should run over the Internet and be viewable over the World Wide Web. While this raises security issues, they can be solved. And with web enabled software, you won't have to worry about the computers or the operating systems that are in use at your remote sites. (Translation: If a school system can't decide on a single operating system, web enabled applications will run on Macs, Windows or, even, Linux machines.)

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.

Key questions to ask before looking at software products

ASK:
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 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 staffing needs for modifying it to accommodate your 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 will still be provided even after you have modified the product.

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 fundamental aspects of the product's code (i.e., formulas for operation) that can be changed only with great difficulty and by persons with a thorough knowledge 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 to address some additional questions about hardware. 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 when networking different computer platforms, although it is possible if the equipment is not too outdated and there is software available for use 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:
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?

Software for Classrooms

School districts should decide on specific sets of software that each classroom will have. Then, using an economy of scale, the districts can negotiate "site licenses" with the software vendors in order to reduce costs. Selecting the software to purchase could be difficult if different schools (or even different teachers) want different software packages. Some things, however, should be standardized. Microsoft Office Suite or Corel Office Suite are just two applications that can run on different platforms. (Remember the Mac vs. Windows war!) Beyond that, ask your teachers what they need.

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 for handling 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 your 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.
- Staff 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. When discussing the support and maintenance of your technology, be very specific about your expectations. For example, can a district afford to have a payroll system down for 24 hours? Can a classroom teacher afford to have a school network down for 24 hours? And what will the penalty be if the vendor is unable to repair the computer, provide a substitute, or fix the system in the allotted time.

When your staff is evaluating the resources needed to implement and support hardware or software, be certain that they consider the classroom environment. Since the most important activity of our "business" is the education of students, we must concern ourselves with what happens when a prepared lesson cannot be implemented because the system will not do what is expected of it. Is there staff at the school that can help the teacher? Can the vendor respond immediately?

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Technology @ Your Fingertips

Chapter 4: Knowing What to Get

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

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 since the product's vendor will have to respond to an RFP anyway. Thus, you can save time by simply defining the category of vendors/developers you want to have bid, and *then* concentrate on writing the 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 4.3 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 subsequently give you a bid on implementing their design. 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 not only helps to identify sources of assistance from outside the organization, but also serves as an important step in arranging for your solution to be implemented. There are two ways you could use the RFI at this stage:

- Use the RFI to enable you to select a specific desired vendor of a product or services.
- 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.

Reviewing 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, feedback from these users can inform your organization's decision making. 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 certain questions you should ask to help you compare the usage to your own situation. If you choose to work with a vendor that is unfamiliar to you, you will want to ask the same questions of several of the vendor's references .

Key questions to ask of references

ASK:
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?

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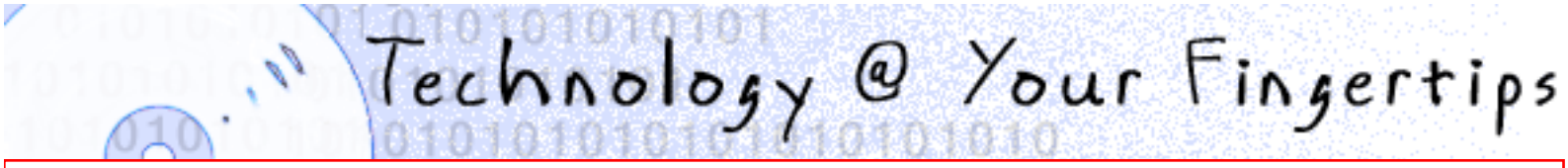

Chapter 4: Knowing What to Get

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 relates 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.

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.

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

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.

Education institutions have also leased equipment. With this arrangement, maintenance can be built into the contract. Also, the cost of the equipment can be spread over the life of the lease. Some vendors offer classroom computers on a three-year lease, with a one dollar ($1) purchase option at the end of the lease. An additional advantage of leasing at local education

and post-secondary institutions is that when the organization has to commit to a three-year lease (for example), such an ongoing line-item in the budget might more easily be extended upon completion of the lease so that hardware and software resources can be continuously replaced as they age.

Comparing Costs to Benefits

Once costs are known, the next step is to compare 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 always be easily measured in dollars and cents since 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 because a standard methodology for determining benefits often is simply not available.

Mini-Case Study

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 previously spent on unproductive tasks (a value that can be estimated) 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 overestimated) by allowing staff to do what they were trained to do (e.g., teaching students or analyzing information, rather than transcribing information or verifying data on forms).

Another benefit to acquiring a new technology system is that maintenance costs are often lower than those 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 not only reduced their annual phone bills, but also received more capacity and expanded capabilities (such as putting a telephone in each teacher's room). When technology to perform a service, such as registration, replaces a service that is currently being outsourced or done manually, the ROI may also be reached in a much short time.

Thus, when we now look at the phrase "Comparing Costs to Benefits", we know to ask whether the software we purchased has affected the teachers and students in our school. For example, have there been any changes in the instructional program? In test scores? In other areas? It is likely that the answer to such questions might very well be a resounding 'yes'!

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Technology @ Your Fingertips

Chapter 4: Knowing What to Get

Case Study- Act 4, Scene 2

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, you may be missing a key element.

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

See Figure 4.4, Business Case Suggested Table of Contents

For Further Information about the content of
Technology @ Your Fingertips
please contact Gerald_Malitz@ed.gov.

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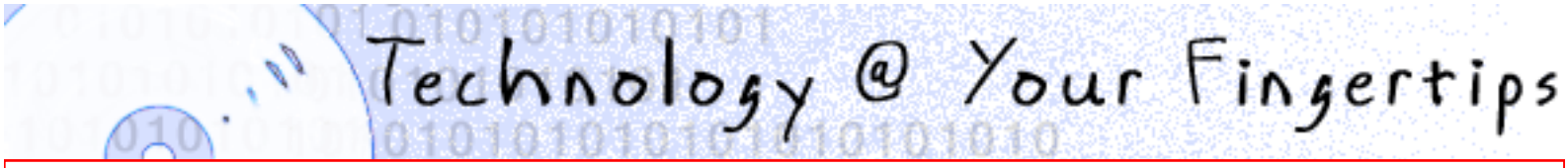

Chapter 5: Knowing How to Implement Your Solution

Case Study- Act 5, Scene 1

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.

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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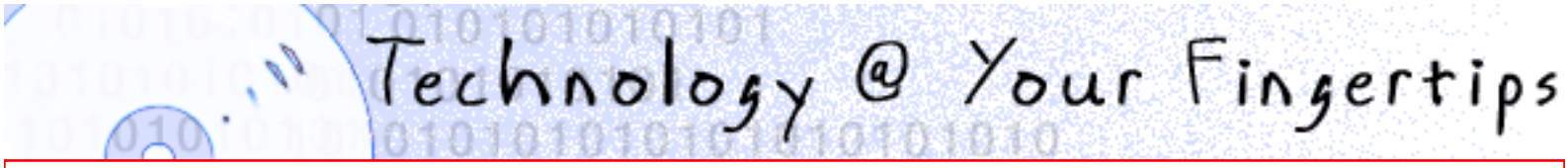

Chapter 5: Knowing How to Implement Your Solution

How Do You Implement the Solution?

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, depend to a great extent on the choices you have made with regard to computer hardware, software packages, instructional applications, custom products and network linkages, as discussed in Chapters 3 and 4. 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 one 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.

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Chapter 5: Knowing How to Implement Your Solution

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

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. It is also 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.

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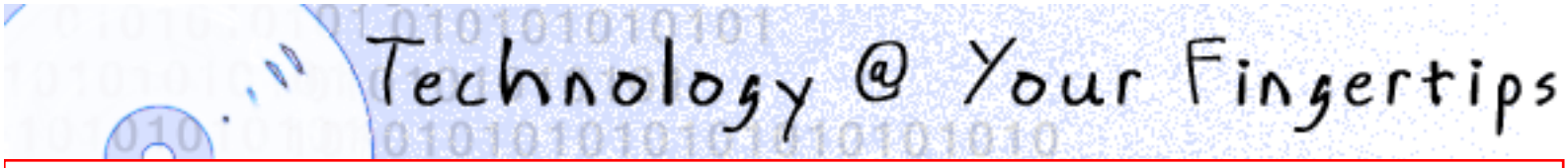

Chapter 5: Knowing How to Implement Your Solution

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

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 throughout 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. Instead, it should focus primarily on what is to be done, when, and by whom. As the project progresses, the plan should also reflect what has already been done, when and by whom.

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 expect to use for this purpose. The initial effort required to enter the data into PM software generally pays off many times as the work unfolds. If project team and steering committee members are connected on a network, PM software also makes it easier for them to view, comment on, and participate in the project on-line.

Establishing a Schedule

The schedule is an important part of any project plan. It tells you when you'll arrive at 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 create schedules by estimating the amount of time they think it will take to do the job, and then doubling it. Such a strategy may not apply to your situation, but it underscores the point that selecting and implementing technology can be a very complicated process.

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 the schedule development process. 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*. Any payment to outside consultants or contractors should be based on the submission of specific deliverable items according to an agreed upon schedule. It might also be wise to include a "liquidated damages" clause in all contracts with outside organizations. Such a clause requires the contractor to pay a fee whenever work actually performed fails to meet contracted obligations. The following are some additional suggestions.

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 without a phasing-in process.
- Outside pressures that result in unrealistic schedules that are doomed to failure.
- Developers turning over the project to those who are responsible for implementation without having first trained them adequately.

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.

Handling Schedule Slippage

A key issue that often comes up during 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.

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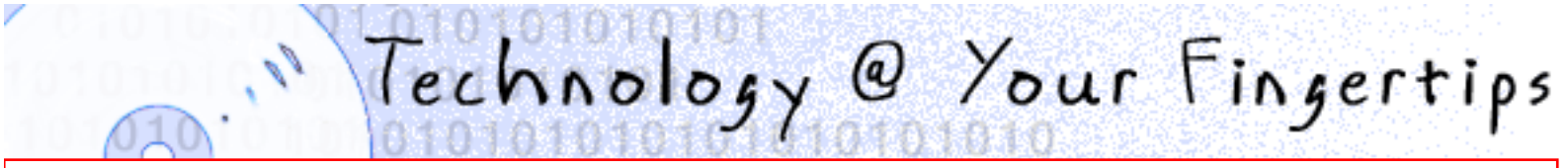

Chapter 5: Knowing How to Implement Your Solution

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

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 the preparatory work on the location of equipment, electric power, ventilation, etc. The locations selected must accommodate both the equipment and the people who will use it. Prerequisites include good ventilation and breathable air, comfortable temperature ranges, usable lighting, easy access, safe passage around wiring and equipment, etc. You will note that this example assumes that the "technology solution" refers to the placement of hardware. Thus, there are different issues depending on the solution being applied. For instance, if you are going to place network cabling in a school, how would that be accomplished without disrupting the instructional program? A well considered process, as exemplified below, is the key.

Knowing the Characteristics of a Good Site

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

- 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.

Please review these Helpful Hints in site selection and preparation.

Key questions about installing equipment
ASK:
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?

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Chapter 5: Knowing How to Implement Your Solution

How Do You Make Sure Your System Works?

Now, suppose your implementation process is well underway. The software is coming together, classroom applications 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.

Please see these Hints for successful performance testing

Testing the System

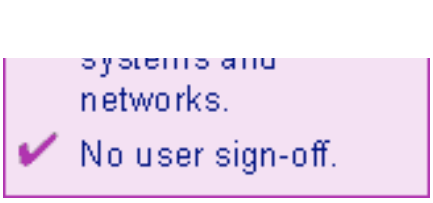
There are three important steps to conduct when your system is in place. The opinion "It works well enough" is not sufficient.

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 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

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



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 in order 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 (e.g., the network, desktop workstations, and printers) can carry the load. Be careful not to confuse user approval with system functionality.

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.

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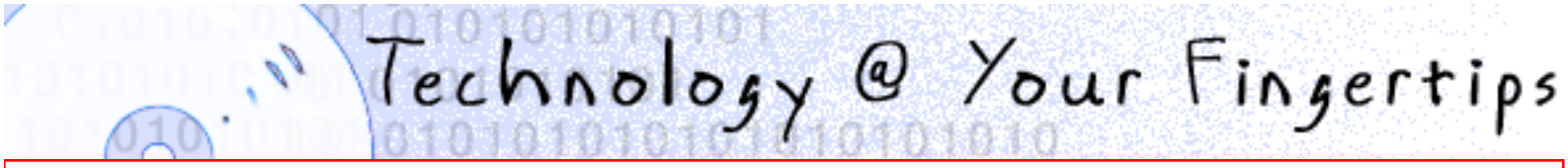

Chapter 5: Knowing How to Implement Your Solution

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.

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).

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.

Please see these Hints for converting your data.

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.
- Insufficient controls or audit trails.
- Absence of a fall back plan.

Fore warned is fore armed.

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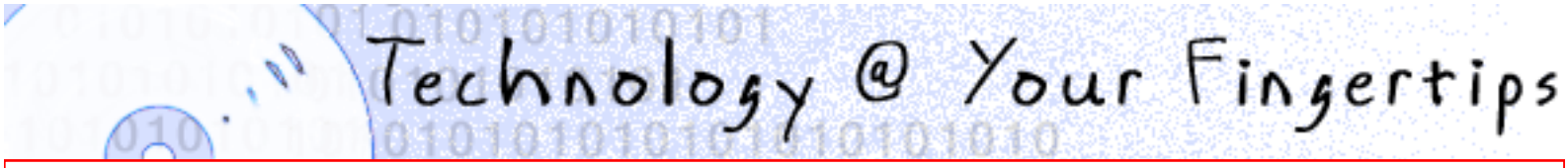

Chapter 5: Knowing How to Implement Your Solution

How Do You Implement the Changeover of Information Systems

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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Chapter 5: Knowing How to Implement Your Solution

Case Study- Act 5, Scene 2

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 verify 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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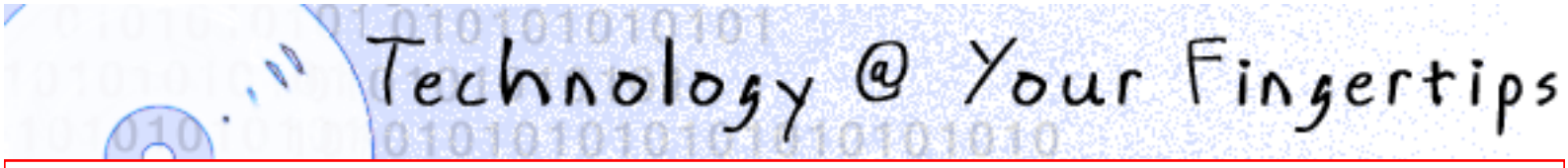

Chapter 6: Knowing How to Train Users

Case Study- Act 6, Scene 1

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.

Organizations installing new or upgraded technology should establish a training program for the technology support staff and for each category of user in order 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.

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Technology @ Your Fingertips

Chapter 6: Knowing How to Train Users

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

Who should receive training?

Everyone within your organization who will have access to your computer system and hold 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 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 personnel who enter information about registering students.
- 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 are 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), standard office applications that can be used individually as well as in the classroom (e.g., word processing, spreadsheets), and instructional

software specifically designed for integration into classroom lessons. This training would include the use of the Internet and its applicability in the classroom.

- Students who will be using the system both in and outside 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. While this publication does not deal directly with the types of staff training (i.e., professional development) necessary to help a teacher develop a "technology-enhanced curriculum", it recognizes that the technology infrastructure as described here has as a major objective the effective and efficient delivery of a more advanced curriculum-from kindergarten through post-graduate. This topic will be discussed in more detail in the National Forum on Education Statistics' publication, *Technology in Schools*, which is scheduled to be available in the first-half of 2001.

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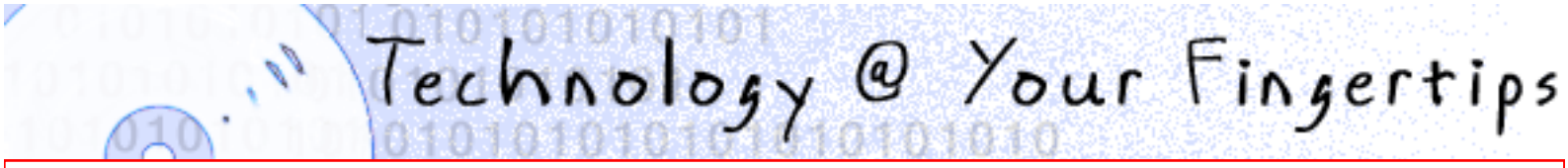

Chapter 6: Knowing How to Train Users

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

When should initial training be provided?

You should plan for initial training to be provided before the system is fully implemented. The equipment installation phase is a good time to begin training efforts so that people will be ready to use the system as soon as the technology becomes available. 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 in order 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.

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Chapter 6: Knowing How to Train Users

Case Study- Act 6, Scene 2

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 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 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 when they have questions after the training. 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 you use these published manuals in your training or not, you may want to purchase a few copies to have around as references.

Planning Basic Training for All Users

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

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 number as the first character). 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 understanding 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. They 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 could at some point 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 teachers need to learn how to use a computer system and the applications that are available, they also need to receive training on the use of available instructional software and how to access other technology resources. In fact, there are now nationally recognized standards for teacher technology proficiency. To meet these goals, training for teachers (after addressing the most fundamental of technology issues) should be based primarily on their curricular needs and demands with a secondary emphasis on their administrative responsibilities. The focus of the training must be on the curriculum, not on technology for its own sake. If this is not the case, it will be difficult for the teachers being trained to understand why they should include technology in their lesson planning. 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, more specifically, how network use 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 student use in the classroom. This training should also be based on the curricular needs of the teachers. One example of integrating technology into the curriculum might be the use of a spreadsheet as a tool for manipulating

U.S. Census results and thereby studying local, regional, and national demographics. If such an activity were to be modeled during training, teachers would leave the training session with ideas and lessons that could immediately be translated into student learning in a "technology-enriched classroom."

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 be able to 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 while 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.

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

ASK:
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?

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Technology @ Your Fingertips

Chapter 6: Knowing How to Train Users

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

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. This is particularly the case now that the E-Rate program enables K-12 schools to develop networks capable of carrying a great deal of information.

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 staff development. However, if your system or software has been customized for your organization's use, then beware that these consultants may not be able to provide specific training on your system or adapted software.

With respect to instructional software, the district or state can also encourage training. For example, a funding agency could state that when software is purchased, a staff development plan must be in place as a condition of the purchase. It should also be clear that professional development should be based on integrating technology into the application of any applicable curriculum standards.

Key questions about who should deliver the training
ASK:
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. Remember that all training, when delivered to teachers, should be based on the curriculum rather than on the technology. Similarly, make sure you select trainers who have the ability to convey technical knowledge in ways that novices can understand.

Be certain to have an evaluation component for all training. This "feedback" will ensure that staff are receiving the training that you expect and, in turn, provides recipients an opportunity to tell trainers whether the training is meeting their needs and expectations.

Using Software Application Training Materials

If you are using off-the-shelf software, such as word processing software (e.g., Microsoft Word and WordPerfect) or spreadsheets (e.g., Excel and 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 tutorials developed by the software publishers, there may be tutorials, manuals or other training materials developed by consultants that would be useful to purchase as well.

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Chapter 6: Knowing How to Train Users

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

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.

Key questions about where training should be held
ASK:
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?

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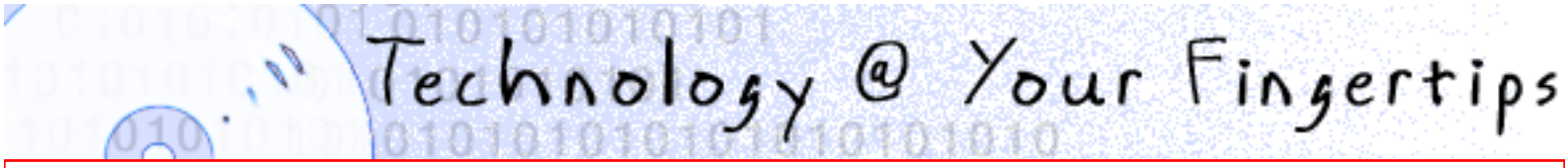

Chapter 6: Knowing How to Train Users

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

What should be the training outcomes?

Just as it is important to define goals and measure expected outcomes for 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 the efficient operation of your organization and the provision of continuing professional development for staff members. You will want to come up with specific indicators that your goals have been met, and monitor your progress toward accomplishing these goals.

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. 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 that the trainee has demonstrated proficiency.

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), which are applicable to inservice training requirements or other conditions required for re-licensure or continued employment. Whoever is planning the training of instructional personnel should keep

these requirements in mind and ensure that training is neither redundant nor inappropriate for instructional staff. As stated above, professional development must be directed at specific curricular areas, with a focus on integrating technology into that curriculum.

Common shortcomings of training programs are the failure to document that the training actually occurred and failure to properly evaluate the effectiveness of the training. It's a good idea to keep a record of participants in all training and professional development classes 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 the content of the courses to ensure that the users' needs are being met and to help improve the overall quality of the training program.

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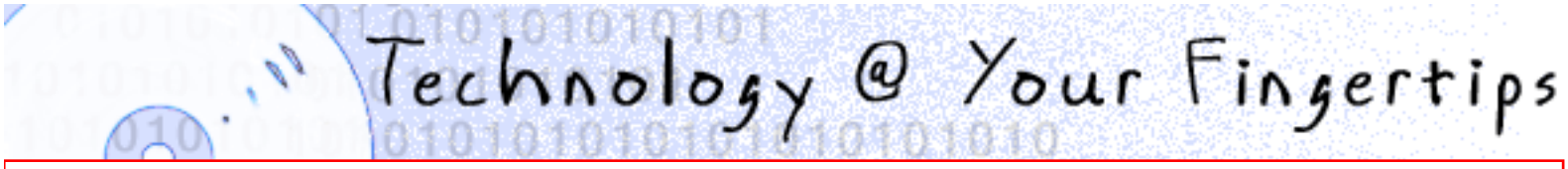

Chapter 6: Knowing How to Train Users

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

When is additional 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 ongoing 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, new curriculum and other resources available on the Internet.

There are various times and ways to offer ongoing 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 even 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:
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?

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Chapter 6: Knowing How to Train Users

Case Study- Act 6, Scene 3

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

What about training students?

When your new technology is in place, you will need to plan training for those activities you expect students to do using the system. This training should not "stand alone," but should be part of (or, at least, build toward) the use of technology in the instructional program. 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.

Ideally, training should occur in the classroom, with students receiving credit for the coursework. Various vendors have developed training packages for students, but care must be taken to provide "vendor neutral" training. While a school, district, or college/university might use a specific type or brand of equipment, the student will presumably be leaving school someday, and you will want them to have a broader knowledge of the types of software and/or hardware they might eventually be asked to use.

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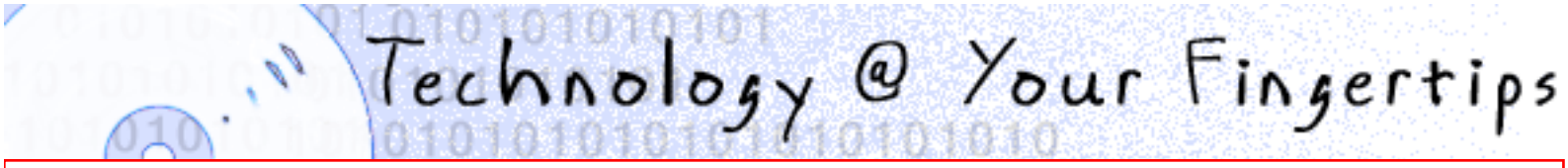

Chapter 7: Knowing How to Support and Maintain Your Technology Solution

Case Study- Act 7, Scene 1

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.

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 technology in particular. 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 3-5 years for many applications), we must think seriously about what maintenance requirements actually entail. We have previously mentioned some aspects of ongoing maintenance, but haven't discussed the entire process, or other issues that will surely arise as time passes. For example, the following is a list of key ongoing support and maintenance issues:

- Providing for ongoing oversight of the technology solution.
- Providing ongoing user support through help desks, documentation, and training.
- Reviewing usage measurements.
- Maintaining technology components.
- Monitoring system effectiveness.
- Upgrading software to new releases.
- Replacing and redeploying equipment.
- Using volunteers and donations.
- Finding qualified help.
- Developing or purchasing new applications.

Thus, there are many issues to consider when thinking about the support and maintenance of your technology solution. If one looks at computers in the classroom, for example, one option to think about is leasing your computers with maintenance service built directly into the contract; an alternative is to purchase a separate maintenance agreement. But before making your decision, you should probably ask yourself, "How long can we

tolerate a classroom teacher being without a computer if he or she has planned on using the technology in a lesson?" Such a question clearly underscores the importance of planning in advance for ongoing maintenance and timely support.

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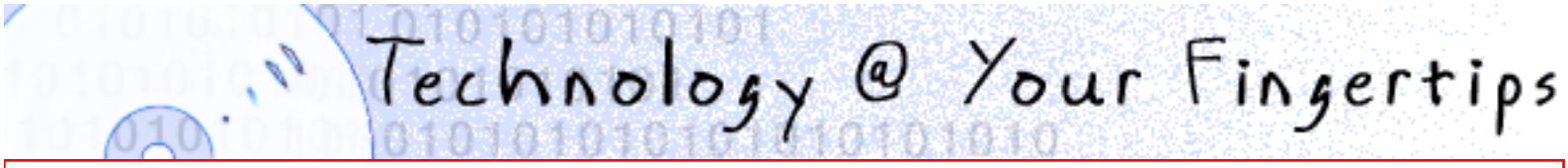

Chapter 7: Knowing How to Support and Maintain Your Technology Solution

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

What provisions should be made for ongoing oversight?

You have had several committees and individuals assisting you along the way. By now, you know 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 and 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 (an Instructional Technology Committee) as well as a district-wide committee that includes representatives from schools.

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

Developing and Maintaining an Acceptable Use Policy Statement

The development of an Acceptable Use Policy (AUP) is a critical component of technology planning. Once developed, the AUP should periodically, but consistently, be reviewed by the Instructional Technology Committee or other appropriate oversight body. The AUP should address the following areas:

- Individual rights regarding access to the system and to resources obtained through use of the system.
- Individual responsibilities with regard to the system, its contents, and connections obtained through the system.
- Organizational rights relating to system oversight and monitoring.
- Organizational responsibilities with regard to the system, its contents, and connections obtained through the system.

The development of an acceptable use policy is often considered

necessary only when students will be using the system. This is shortsighted and incorrect-an AUP is just as important for other system users as well, 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. Ask both your legal and technical staffs to review the acceptable use policy to ensure that appropriate protections are in place. Examples of acceptable use policies can be found in this document's Additional Online Resources.

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Chapter 7: Knowing How to Support and Maintain Your Technology Solution

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

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.

Support services, training, and certification must be ongoing to ensure successful post-implementation use of technology. As time passes, personnel change, organizational 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 when planning for ongoing system support.

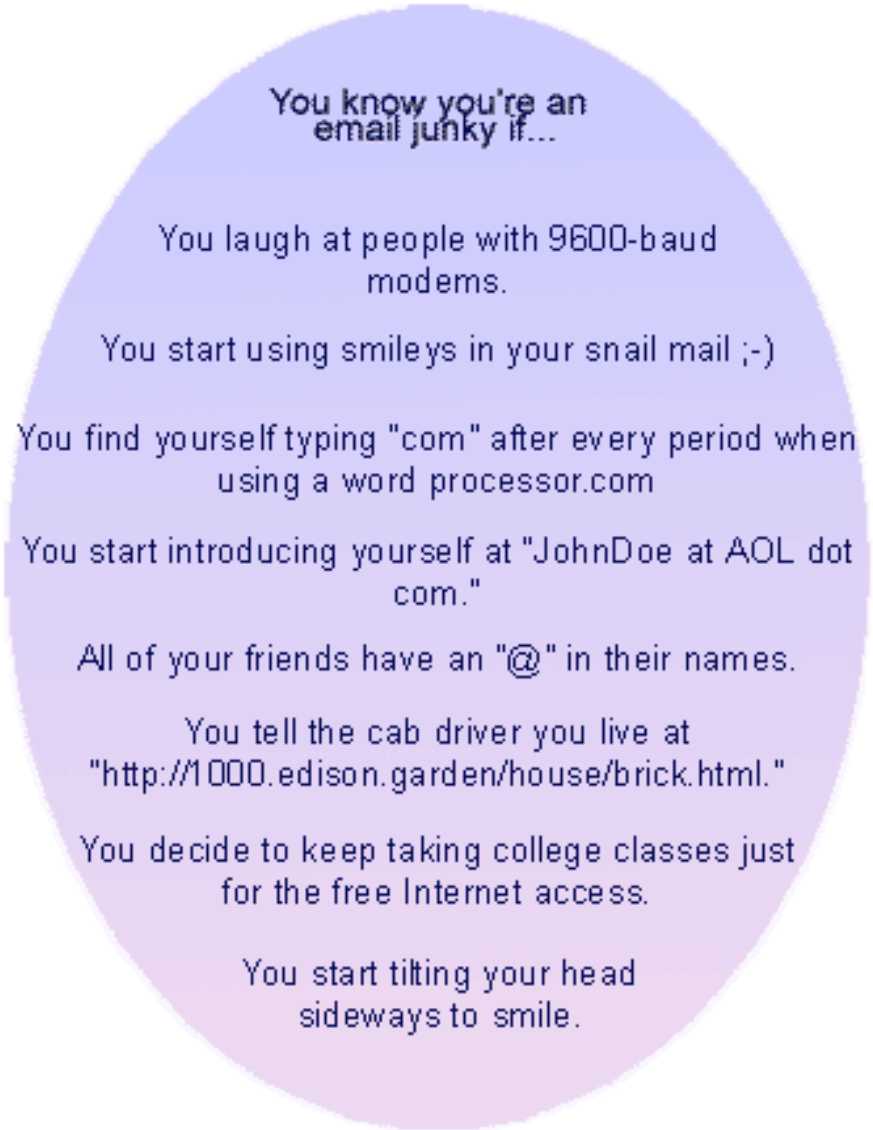
For successful implementation and operation of computer technology, there must be full support and encouragement at all levels of the organization. Help and support services provide users with ongoing technical assistance. This includes both technical questions and application questions. The organization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

The most common means of providing user support is to create and staff a bank of telephones (or at least one phone) with people who are willing and capable of patiently and constructively answering users' questions. Today, most Help Desks in networked organizations also 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. Likewise, it may be sufficient simply to have someone check voice mail or e-mail twice a day to see if any questions have been forwarded.

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 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. One effective way of doing so is by using a software package that generates reports like 'most frequent queries' or 'call distributions' (i.e., the distribution of callers who have the same problem). This information can be used when tailoring training to users' needs and 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.



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.

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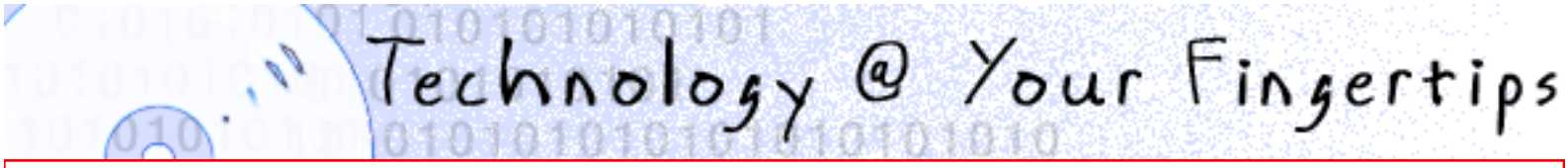

Chapter 7: Knowing How to Support and Maintain Your Technology Solution

How should you monitor regular usage of your system?

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

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.

Most commercial software packages and well-designed custom computer systems have built-in utility programs to collect usage information and turn out 'canned' reports on use patterns and volume. Every computer system should have a staff member assigned to review these reports on a regular basis. Some commonly accepted 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.

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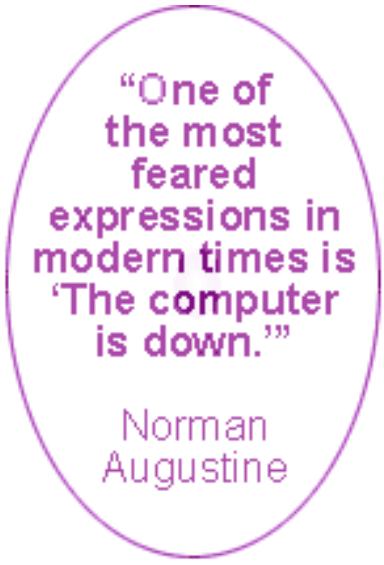
Chapter 7: Knowing How to Support and Maintain Your Technology Solution

Routine, preventative 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.

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. The basic components are similar for all types of education organizations, be they schools, districts, or other agencies.

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. 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.

Maintenance 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 cost.

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 that the expertise is available. Paying for time and materials only as repairs are needed - as opposed to a monthly fee - can, under some circumstances, save money. In other cases, the staff time necessary to complete repairs may make the in-house solution much more expensive than it first appears. Losing access to critical systems can be even more "expensive" in non-financial terms. It is obvious that a payroll system cannot be down for long. It's also obvious that a lost server at a school site can be disruptive to the educational program and demoralizing to teachers learning to use a technology-enhanced classroom. Thus, it is imperative that you perform a cost-benefit analysis before deciding whether to pay a vendor to provide maintenance service.

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:
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 systems maintenance agreements
ASK:
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?

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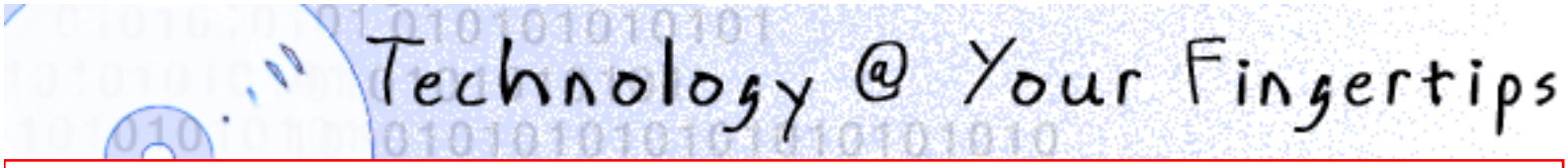

Chapter 7: Knowing How to Support and Maintain Your Technology Solution

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

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 address immediately, however, is the development of a mechanism for collecting user complaints about the system 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 identify and document users' problems and concerns with the current system, and helps with decisions about priorities for future investments. It is a simple internal procedure that is treated as a separate issue only because of the trouble caused in its absence. Without such a process, requests for change can build up without administrators realizing that problems are occurring.

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, the source of the request, projected cost and time estimates, who needs to respond to the request, the date(s) of all responses, their 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 the feedback 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.

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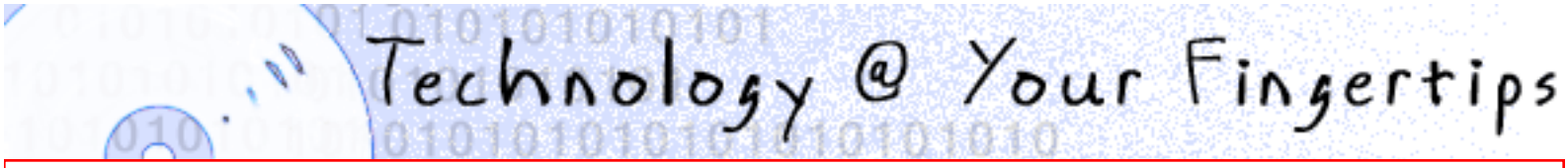

Chapter 7: Knowing How to Support and Maintain Your Technology Solution

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.

What do you need to do about upgrades to software?

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 in your organization's technology environment, such as the operating system, hardware, or network software. Also, 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 adopt a philosophy that they will never be the first to install a new version of a software application. Others tend to stay one release behind the "leading (or bleeding) edge" to avoid the risks. Generally, such rules lower risk but may delay the benefits of 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/savings.

- 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.

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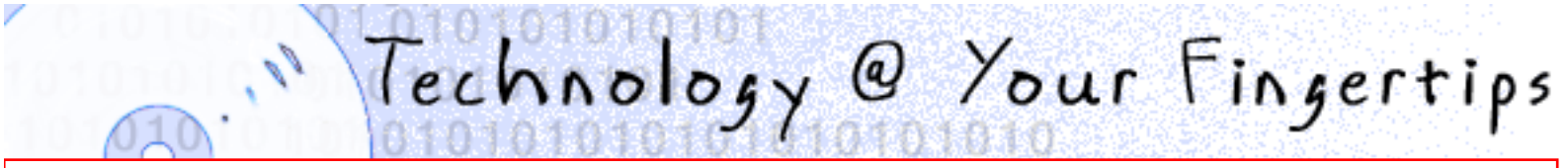

Chapter 7: Knowing How to Support and Maintain Your Technology Solution

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

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.

There is no way to buck this trend. You simply have to recognize it and account 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 set a 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 are unlikely to be doing their jobs efficiently. Another solution is to lease the computers for three years. At the end of that time, either return the computers or lease new ones - in either case the organization is never paying for old machines.

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 common strategy is to move 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 recycled 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 actually 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.

Regardless of the plan for discarding old computers (be it internal redeployment, external redeployment, storage, or even disposal), all files from old machines must be deleted. To be confident of effective file removal, each hard disk should be erased completely, a processed referred to as 'degaussing' by your technical staff. In any case, saving time by not fully erasing files is never worth the risk of accidentally passing along information that shouldn't be shared. After all, think of the possible repercussions should you mistakenly divulge individual student data, sensitive financial records, or other private files.

Key questions to ask about redeploying equipment
ASK:
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?

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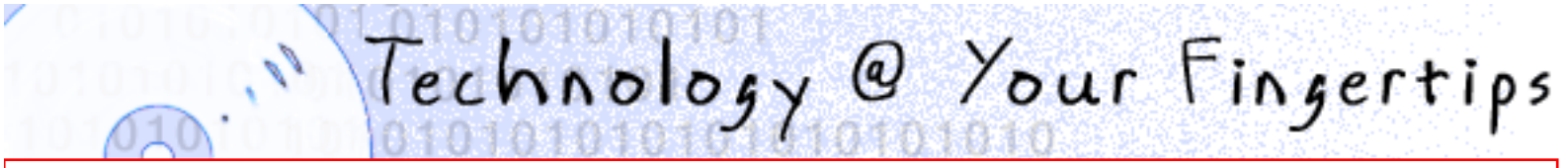

Chapter 7: Knowing How to Support and Maintain Your Technology Solution

Should you accept donations?

When companies replace their computer systems, they often offer the equipment and/or software to education organizations. While this may seem like a boon to your 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 both the potential benefits and consequences. Obviously, you can benefit best from donated equipment when it fits with your long term plan for purchasing and replacing equipment.

Thus, when your organization is offered donations, you should be able to refer to an established protocol that dictates whether or not they should 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. (For example, most donations come without an operating system, which leads to the question of who will purchase the Windows or Mac OS?) In cases where donations are not in compliance with established standards, the donor might even be asked to underwrite the additional maintenance and support that the donation will require.

We all know that it's tempting to say "yes" to anyone who is offering something for "free." On the other hand, a rule one might want to live by is: "Don't accept a gift you have to feed."

Key questions to ask when considering accepting donations
ASK:
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

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

When should you use volunteers?

Since the E-Rate program enables schools and districts to "wire" buildings at greatly reduced cost to the organization, reliance upon volunteer efforts to wire schools may have become less necessary than it once was. Nonetheless, and regardless of who performs the task, all work must adhere to relevant building codes. Additionally, non-trivial issues such as asbestos and lead paint must also be considered. Thus, while it may be difficult to say "no" to the American traditional of barn raising, onsite work can be a very difficult issue that could even create physical danger to students, volunteers, and others. It must be handled with considerable forethought.

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

Key questions to ask when considering including volunteers
ASK:
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?

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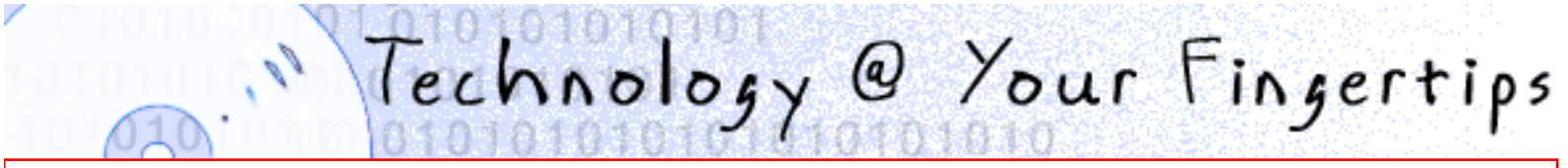

Chapter 7: Knowing How to Support and Maintain Your Technology Solution

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

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. There are numerous 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 informed 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:
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?

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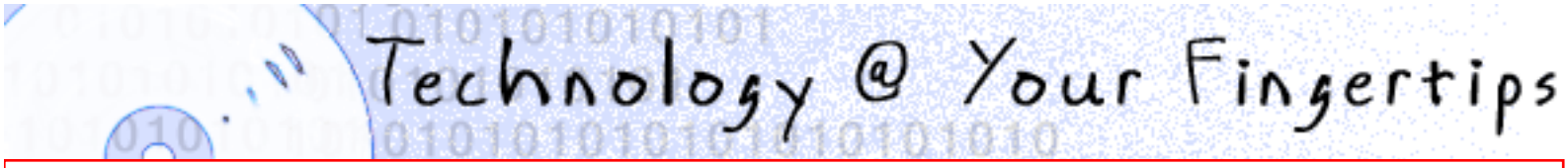

Chapter 7: Knowing How to Support and Maintain Your Technology Solution

Case Study- Act 7, Scene 2

Is that all there is to it?

The intended purpose of this book is to provide a focus on the fundamentals and tools needed to make sensible decisions about technology now and in the future. By investing time up front in developing a plan of action, you will be able to create 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.

This brings us to the end of this book and the beginning of your adventure with technology. Hopefully you are now aware that the world of technology is moving so rapidly and so dramatically that there is no such thing as a single beginning and end point - it's just one rapid technology adventure. Have fun, be efficient and, most of all, be effective!

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Case Study

Case Study - Act 1, Scene 1

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 information about students out of an antiquated system that didn't have much in it and wouldn't do much with what was there. She said that there had to be a better way to compile statistics for state reports and keep up with students as they moved in and out of the district. She was tired of having to pull out paper file folders in order to update information not handled by her computer. She mentioned that District 32 (the district next door) had purchased a new software package that contained all the information they needed about students and let them create any kind of report they needed. Furthermore, they had all of their computers networked so that more than one person could work with the information at the same time.

Joe seemed to remember that his friend Mary had done something with computer upgrades at her college the previous year and had even networked a few computers in her office. He thought, "I'll give her a call sometime this week to find out what she did, and how it's 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 was unhappy that their Internet access was limited by 'slow' dialup modems. They wanted faster access to the Information Superhighway, and requested the expansion of the college's network to cover the entire campus. They also wanted their library to provide access to catalogs from other colleges and online subscriptions to research journals. Mary remembered that her friend Joe had talked about connecting his high school's library to a database with hundreds of magazines in it. 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 better electronic resources in our library. What can you tell me about your library's Internet magazine subscriptions?"

"Wow, Mary, we must have a psychic connection. I was just thinking about calling you. My teachers love what the library connections have done for our students, although they are concerned that it's pretty easy for students to copy and paste directly from the articles. We have to watch more closely for plagiarism, but in balance, the computers have done a lot to help students. Now our teachers are complaining because they can't get access directly from their classrooms. They want to network the whole school. In fact, that's why I was going to call you. My secretary has also been asking

about upgrading our student information system and networking the system. I remembered something about a network in your office and thought you might be able to help me."

"We have a few local area networks like the one in my office and one for the Registrar. But we haven't tied them together. Actually, our faculty seems to have some of the same concerns as yours. There is a lot of talk about developing a network for the whole campus. Maybe we should research this together. What do you think?"

"I agree, Mary. Oh, yeah. I was also wondering if you have a student information system you are happy with. My secretary is really frustrated with ours and wants something that handles more information."

"Our registrar's office has some pretty good software, but I expect that it is aimed at our postsecondary needs and might be different from what you would want. Still, I think that the general principles are the same from one data system to another. I bet that we could help you figure out which features would be most useful to you."

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

"Fun!!!!! Are you serious?" Mary asked incredulously. "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 took that next step into the information age," Joe opined.

"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."

Back to Chapter 1.

Case Study - Act 1, Scene 2 - Two days later

Joe called Mary two days later. "Mary, guess what? I went to an administrators association 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. Maybe they will help us build our case. What have you found out?"

"I've done some asking around," Mary answered, "and discovered that there are a lot of options for networking now, and that some of them don't cost a fortune. Some of our staff members have a lot of experience with computer networks. When I told them about the faculty senate's request,

they said that they would be happy to help the college get networked. We've got a meeting set up next Wednesday to talk about getting started. Do you know if the state education agency has any information that can help?"

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

"Thanks Joe. By the way, would you like to sit in on our committee meeting? You might get some ideas from our more experienced folks. You could bring the technology reports with you."

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

Back to Chapter 1.

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 this information before your meeting. I glanced through it when it arrived 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. "You're right, Joe. This report seems to recommend a lot of steps. I didn't realize there were so many ways you could use a computer network. I wonder what we are going to need to get the job going?"

"I was reading about a school in a magazine last night," Joe replied. "The network they set up gives the teachers access to student records and instructional programs right in the classroom. It also gives them extremely fast access to the Internet. They can see what books are in their library, which ones have been checked out, and even get direct access to thousands of current full text magazine articles and government documents. That seems to be just what your faculty was talking about. They even enter their class records and import standardized test data over the network. Their principals can track budget information at the building level too. It's really impressive how many things the network can do. I can see where that would be helpful to teachers and students, not to mention the administration. I certainly could have used those things when I was a teacher."

"Egad!" Mary responded. "If we had a system like that, some smart-aleck students would probably break into the computer and change their grades. I've heard that hacking is a major problem."

Joe nodded. "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 need to establish. But there must be many more. Did you say that your faculty wants to give students regular access to the network, too?"

"I guess we'll hear more about that and the 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 and tools to make instructional management easier for the faculty. And I just know that the students will love all the possibilities such a system would offer them. I hope you are prepared to help me take notes at the meeting this afternoon. In fact, maybe we should tape the meeting to be safe. Shall we get the check and get rolling?"

Back to Chapter 2.

Case Study - Act 2, Scene 2 - Later that afternoon

Mary and Joe collapsed 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."

Joe agreed. "And 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 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. 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 would share their questionnaire with our group?" 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."

"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!"

Back to Chapter 2.

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?"

Mary 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, and then sent it out. They are planning to begin interviews and

focus groups at our next staff development meeting. Most everyone seems to be pretty excited, although a few people are still suspicious. I talked with those two school board members who work for a computer company, and they were pleased with our plan. They 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, indicating that we will need faster computers with more memory and storage just to run today's most basic programs. 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, but I'll bet you aren't the only district with those types of computers."

Back to Chapter 3.

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 on the technology project. 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!"

Joe began, "We have really learned a lot over the last couple of weeks. It seems that our situation is just like yours. We have lots of stuff, but much of it is incompatible, and most of it is as 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 they, quite literally, are worthless. The good thing I found out is that there are a lot of teachers who use newer computers at home. Most of them 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 the program. 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 then 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."

Back to Chapter 3.

Case Study - Act 4, Scene 1 - A couple of weeks after New Year's Day

Joe called 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 most 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 an excellent 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 looked 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 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 budgeting for the system. I don't want us to be in the position of paying over the long run for equipment that will become obsolete in a few years and can't be upgraded easily, as happened with our Apples."

Back to Chapter 4.

Case Study - Act 4, Scene 2 - A month later

Joe called Mary, thoroughly excited after a meeting with his school board. He asked her 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 would want if we couldn't get permission from the board to purchase the whole laundry list, 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 Big State University people convinced us that we need to get some consulting help to select our system components. We also realized that we need to hire some technical people to help us with setup and then provide ongoing support. We heard some real horror stories about schools that tried to do it on their own and ended up with expensive systems that crash all the time. We also talked with a number of vendors, and found that there are management information systems available that will fit our needs with little or no modification. The one we chose has adopted the data elements used by our state education agency and can send student transcripts electronically via electronic data interchange (EDI). That vendor is also working to make its software compatible with other programs so that we can get basic data for our school lunch program out of the student information system and use the same source to generate transportation routes. This should save us all kinds of time and headaches by cutting down on errors from rekeying the same information more than once. 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 handle all of our administrative needs, as well as provide 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 agreed that the library needs to be computerized and that our priority should be on getting faculty members onto the system as soon as possible, especially in our Education Department. It seems that our faculty is especially excited about the possibility of training prospective teachers to use instructional applications in elementary and secondary classrooms. Luckily we can use much of our existing administrative software since it is compatible with or upgradable to the computers and network we are planning to use. We have decided to consolidate the various technology support offices on campus into a single office and hire additional staff with network expertise. 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. Best of all, even if we can't get all of the needed funding immediately, the network can be designed to be scalable so that it can grow with our available resources and needs without slowing down or becoming obsolete." 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.

Back to Chapter 4.

Case Study - Act 5, Scene 1 - Mid-August, six months later

[Accepting that this is a fictitious story and these are small organizations, we'll assume that both Joe's and Mary's funding has been received, that they have selected the computer and networking systems they want, and that they are ready to proceed.]

Mary and Joe decided to meet for coffee one Saturday morning before their schools were scheduled to open for a new academic year. Both were carrying their planner notebooks. 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 the whole time I was there. Were you able to get away this summer?"

Joe laughed. "Are you kidding? I spent the summer buried in paperwork-most of it concerning the new 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 concerning the fact that 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'm delusional?"

"Perhaps," Joe laughed. "Do you have all your new technical staff hired? Is the equipment purchased, and everything else?"

"I think so, but I'm not sure where or how to start," said Mary. "It seems that I'll 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?"

Back to Chapter 5.

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 á 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 in the schools for the equipment."

"Well, we're not online yet, but we're making real progress. We have the library set up, which has our faculty ecstatic. Would you believe that through the databases and high speed internet connections, our faculty and students have access to all the resources you used to find only in the largest research libraries? The equipment is in place in all of the buildings, although the network isn't fully operational. The consultants are bringing everything online one piece at a time so that they can troubleshoot more easily and then fix any problems before they activate the next node. We hope to 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 our Director of Technology."

Back to Chapter 5.

Case Study - Act 6, Scene 1 - Same evening

As Joe was driving Mary home, he gave her an update on his progress. "I spent some time during the winter break trying to learn how to log on and use our network. I still haven't figured out very much, 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. We have a few people who were already comfortable around computers, but I don't know what we are going to do to get the rest of our people trained. Have you thought about how to get your faculty and staff trained?"

"At first I assumed that our technical staff would do all the training," Mary admitted, "but I discovered that knowing everything about the inside of the computer doesn't necessarily prepare one to teach other people how to use them in their jobs. I'm not even sure how much training the faculty will need."

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

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

Back to Chapter 6.

Case Study - Act 6, Scene 2 - The following Monday

Joe walked into his office and immediately reached for the telephone.

"Hello, Mary?" he said, "I'm so glad you're there. I am terribly frustrated and need to talk with someone who might appreciate my concern. You see, I've just gotten back from a professional development program where the speaker spent almost two hours talking about the various ways a teacher could use technology to deliver the curriculum to students."

"OK, so what is frustrating you? I don't understand." Mary responded sincerely.

Joe explained. "Well, now I understand that in addition to the computers in the main office and those in the library, I have to worry about putting computers in classrooms. And our staff will need to know how to use the computers, projectors, scanners, and printers. The students will need to know how to use this technology too."

Mary interrupted him, "But Joe, we already knew all that, didn't we?"

Joe thought for a moment, "Well, yeah, I guess we did. But you know it will be difficult for some of our staff to accept all this. Some of them may have never before used a computer. And many of those folks have been such an important part of our past that we can't just leave them out of our future."

"I agree completely," Mary affirmed, "so we'll have to put a lot of thought into how we prepare them for these changes."

Joe was finally seeing the picture more clearly. "Okay, I think we might have to reconsider how we offer our staff development program. We'll have to ensure that our teachers are able to integrate this technology into the curriculum. I had better get a group together to see what types of professional development programs are available and, more importantly, which of those programs reflect our local and state curriculum standards."

Mary paused, "You know, Joe, the reality of this project is that we had better have a comprehensive technology plan and a reliable process for implementation. You're right. There is a lot of work to do, but think of how this will affect learning in our schools."

Back to Chapter 6.

Case Study - Act 6, Scene 3 - 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 over the past two months has not hampered our efforts to get our staff trained."

"It's nice to see the trees budding," Joe responded. "It's getting to be that time of the year when it's hard to keep folks inside after school. I'm glad that we got our initial training completed over the winter as well. So how did you end up doing your training?"

"Well, we'd made sure that our technical staff had solid training in computer maintenance and network operation before we hired them. Still, we found it necessary to keep them up-to-date with professional development because everything changes so fast. But since we knew they were well prepared, we were able to have them do the initial introduction on using the network and other basics for the rest of the staff. Then we brought in the various vendors to provide on-sight training on their specific software applications

for both the technical staff and everyone else. We were lucky to have had the training center set up in the library. The library folks also received specialized training on their own software and in general computer usage so that they could help 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?"

"Well," Joe began, "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 the consulting firm. Then, because we don't have much of a training or technology maintenance budget, we had our technical staff train three of our most enthusiastic and able teachers in each building to serve as 'Tech Leaders'. They can help students and other staff members who are having problems and 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, but to be honest, I think that 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 on the computer right now, but 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 serve basis, and as long as there is space available for all of our folks who sign up, your people would be welcome. 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?"

Back to Chapter 6.

Case Study - Act 7, 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've followed all of the directions. Surely it's not because there

are too many people using the network, is it? It would be horrible if we already had too many users."

"No, I don't think that's the problem, Mary. I just wish there were 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?"

"No, I'd rather not," Mary said gloomily. "I guess I'll just wait until I get back to the office on Monday."

"Hey, guess what I got last week?" Joe asked, trying to change the subject. "Some parents brought in their old computers for us to use as stand alone units. The machines wouldn't be able to work on our network, but they can still run basic applications like spreadsheets and word processors. They have really helped to cut down the wait for students who want to use a computer at school for writing term papers and doing homework. Unfortunately, we also got some old computers that still run, but can't even handle the most basic software we now use."

Mary sympathized. "Surely you can use them somewhere. What are you doing with them now?"

"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."

Back to Chapter 7.

Case Study - Act 7, 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."

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

Mary continued. "Our technical staff has advertised on campus for students who would be willing to work at a new HELP desk a few hours a week. After screening the students, they found twenty people who seemed pretty knowledgeable. We 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 were still using the older machines and software in their word processing classes. We also created a loan program for some of our students who don't have computers at home, and took the rest of them 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 that 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."

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Technology @ Your Fingertips

Glossary

Select a letter:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

Acceptable use policy (AUP) - a policy designed to limit the ways in which a computer or network can be used. Acceptable Use Policies usually include explicit statements about the required procedures, rights, and responsibilities of a technology user. Users are expected to acknowledge and agree to all AUP stipulations as a condition of system use, as should be certified on the AUP by the user's signature.

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.

Anti-virus software - computer programs designed to detect the presence or occurrence of a computer virus. The software subsequently signals an alert of such a detection via any of a variety of mechanisms and, in many commercial products, can then be used to delete the virus.

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.

ATM (Asynchronous Transfer Mode) - this high speed network protocol is composed of 53 byte "cells" having 5 byte headers and 48 byte payloads. Because of its short packet length, it is especially good for real time voice and video.

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B

Backup - (verb) to make a copy of a file or program for the purpose of restoring the data if the masters were to be lost, damaged, or otherwise unavailable for use. 2. (noun) a copy of a master file or program. To be most effective from a security standpoint, backup files are frequently stored at off-site locations.

Bandwidth - the amount of data that can be moved through a particular interface in a given period of time.

Bit - the smallest unit of computer memory, eight of which constitute a byte. The value of each bit, as limited by the "binary" code read by computers, is either 0 or 1.

Bookmark - a shortcut to an Internet site that is stored and accessed via a Web browser (also called "favorite").

Browser - see Web browser.

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.

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C

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

Cache - an area of disk space which stores the text and graphics of a viewed Web page. When the Web page is revisited, the Web browser will retrieve the data from the cache instead of downloading it again to save time.

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 - an electronic device that stores, retrieves, and processes data, and can be programmed with instructions. A computer is composed of hardware and software, and can exist in a variety of sizes and configurations.

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.

Cookie - a string of text relating to your activity at a particular World Wide Web site that is downloaded to your hard disk and accessed by that site the next time you visit.

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D

Data base software - a computer program that allows the storage of large amounts of information and give the capacity to search, retrieve, sort, revise, analyze and order data quickly and efficiently (e.g., Access). There are two types of data bases, flat file data bases and relational data bases.

Digital certificate - an attachment to an electronic message that allows the recipient to authenticate the identity of the sender via third party verification from an independent certificate authority. Digital certificates are used to identify encryption and decryption codes between message senders and recipients.

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.

Downloading - the process of transferring information from a remote computer to yours.

DSL (Digital Subscriber Lines) - this technology uses existing copper pair wiring that exists in almost every home and office. Special hardware attached to both the user and switch ends of line allows data transmission over the wires at far greater speed than the standard phone wiring.

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."

DVD-ROM (Digital Video Disc-Read Only Memory) - a disc like a CD-ROM that has more storage (4.7 gigabytes) and can provide digital video.

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E

Electronic data interchange (EDI) - a format that prescribes how specific elements of data should be combined and formatted for computer-to-computer exchange.

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

E-mail - electronic messages, typically addressed as person to person correspondence, that are transmitted between computers and across networks.

E-mail address - an identifying address for a user's mailbox; characters identifying the user are followed by the @ symbol and the address of the mailbox's computer.

Encryption - the process of translating a file into an apparently unintelligible format (i.e., to encode it) via the use of mathematic algorithms or other encoding mechanisms. In general terms, the recipient of an encrypted message must

possess a matching key to decrypt and read the message.

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.

Extranet - the part of a company or organization's internal computer network which is available to outside users, for example, information services for customers.

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F

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.

Firewall - an electronic boundary that prevents unauthorized users and/or packets of data or information (e.g., files and programs) from accessing a protected system.

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.

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G

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

Gateway - an electronic device that allows for two different computer or networks to connect (i.e., it "translates" between networks that use different protocols).

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H

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

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

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.

Home page - the introductory page on a Web site that usually contains a table of contents for the site and hot links to other pages.

HTML (Hyper-text markup language) - the formatting language used to create Web pages and specify how a page will appear on screen.

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

Hypertext - text that contains links to other parts of a document, or to documents held on another computer.

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I

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.

Intranet - a localized network of computers that is used to communicate electronically within that specific area.

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

ISP (Internet Service Provider) - an entity that provides commercial access to the Internet. These can range in size from someone operating dial-up access with a 56 kilobit line and several dozens of customers to providers with multiple pops in multiple cities and substantial backbones and thousands or even tens of thousands of customers.

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J

K

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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L

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 connect to a computer or network, usually through the entry of an acceptable user ID and password (i.e., through appropriate authentication).

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M

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 remotecomputer 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 capable of utilizing more than one communication

medium media such as CD-ROM, DVD, speakers, etc.

Multitasking - the concurrent execution of several jobs.

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N

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.

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O

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 (e.g. Windows 95, Windows 98, Windows NT).

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P

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, DVD, 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.

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Q

R

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.

Remote access - the act of accessing a computer or network from a location that is removed from the physical site of the computer or network. Remote access is often accomplished via the use of a modem.

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.

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S

Scanner - an input device that takes in an optical image and digitises it into an electronic image represented as binary data. This can be used to create a computerised version of a photo or illustration.

Screen saver - a computer program that automatically displays a moving image or pattern on a monitor screen after a pre-set period of inactivity.

Search engine - software that searches for specific information or files on the Internet using search criteria that you enter.

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 (e.g. Excel, Lotus) 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 - a group of elements, components, or devices that are assembled to serve a common purpose. In a technological system, this refers to all hardware, software, networks, cables, peripheral equipment, information, data, personnel, and procedures (i.e., all technology resources) that comprise a computer environment.

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.

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T

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).

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U

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.

URL (Uniform resource locator) - a World Wide Web address composed of several parts including the protocol, the server where the resource resides, the path and the file name of the resource such as: http://nces.ed.gov.

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.

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

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V

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.

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W

Web browser - software that allows a user to locate, view, and access information from World Wide Web sitesvia the use of a graphical interface (e.g. Internet Explorer, Netscape).

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 (e.g. Word, Word Perfect).

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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X

Y

Z

For Further Information about the content of
Technology @ Your Fingertips
please contact Gerald_Malitz@ed.gov.

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Technology @ Your Fingertips

Additional Online Resources

California Instructional Technology Clearinghouse
http://clearinghouse.k12.ca.us
An educator's guide to high quality instructional technology resources that support California's curriculum framework and standards.

Classroom Connect's Connected Teacher
http://www.connectedteacher.com/home.asp
Contains World Wide Web FAQ (Frequently Asked Questions), Internet Tools and other technology information.

Computers for Learning
http://www.computers.fed.gov/School/user.asp
Computers for Learning will place hundreds of thousands of computers in our Nation's classrooms and prepare our children to contribute and compete in the 21st century. The program is designed to donate surplus Federal computer equipment to schools and educational nonprofits, giving special consideration to those with the greatest need.

Connecting to the Future: A Guide for Building a Network Infrastructure for Education
http://quest.arc.nasa.gov/handbook/toc.html
Jointly published by the National Aeronautics and Space Administration's Office of Aeronautics and the United States Department of Education's National Center for Education Statistics.

Consortium for School Networking (CoSN)
http://www.cosn.org
CoSN, a non-profit organization, promotes the use of telecommunications in K-12 education to improve learning.

Council of Chief State School Officers: Technology and Telecommunications
http://www.ccsso.org/arthur.html
This site is linked to state education agencies' and other organization home pages that are involved with technology.

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

Early Connections: Technology in Early Childhood Education
http://www.netc.org/earlyconnections
Early Connections provides information on appropriate and effective use of technology for educators and care providers of young children,organzed by the educational settings: childcare providers, preschool staff, primary teachers (K-3), and before/after-school program staff.

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

Education Week's Technology Counts '99
http://www.edweek.org/sreports/tc99/
Education Week's 1999 National Survey of Teachers' Use of Digital Content.

Educational Resources Information Center Clearinghouse on Information and Technology
http://ericir.syr.edu/ithome
This site specializes in educational technology and library and information science, and contains numerous links and references to useful sites. Included is information on lesson plans, choosing software, and technology planning.

Educational Technology Expert Panel
http://www.ed.gov/offices/OERI/ORAD/LTD/panel.html
Established by the Office of Educational Research and Improvement (OERI) and the Office of Educational Technology, this 18-member panel works to identify and recommend to the Secretary of Education promising and exemplary programs in the area of educational technology.

Educause
http://www.educause.edu/
This site is oriented toward higher education.

Eisenhower National Clearinghouse for Mathematics and Science Education.
http://www.enc.org
This site contains resources and activities related to mathematics and science.

Eugene Oregon School District, Internet Services: Appropriate Use Policy
http://www.4j.lane.edu/4jnet/

Federal IT Accessibility Initiative
http://www.section508.gov/
The Federal Information Technology Accessibility Initiative is a Federal government interagency effort to offer information and technical assistance to assist in the successful implementation of Section 508.

Foundation Center
http://fdncenter.org
This center produces materials that help educators seeking grants for computer technology and software.

FREE - Federal Resources for Educational Excellence
http://www.ed.gov/free
More than 30 Federal agencies developed a web site to make hundreds of federally supported education resources available to enrich the Internet as a tool for teaching and learning..

GEM - The Gateway to Educational Materials
http://www.thegateway.org
The key to one-stop, any-stop access to high quality lesson plans,

curriculum units and other education resources on the Internet!.

The Global Schoolhouse
http://www.gsn.org
Provides assistance on planning telecomputing.

High Plains Regional Technology in Education Consortium
http://hprtec.org
Lesson Planning; http://scrtec.org/track/
Resource Library; http://scrtec.org/explorer/
Resources for Establishing a Low-Cost School Intranet;
http://SCRTEC-NE.unl.edu/SCRTECNE/Support/intranet.html
Interactive Web-based Training
http://scrtec-ne.unl.edu/SCRTECNE/TechTopics/online/online.html

Institute for Learning Technologies, Teachers College, Columbia University
http://www.ilt.columbia.edu/
Educators using technologies to advance equity, knowledge and education.

International Society for Technology in Education
http://iste.org

Massachusetts Software Council, Inc., Switched-On Classroom
http://www.swcouncil.org/switch2.stm
The Switched-On Classroom Technology Planning Guide, a 250- page book outlining a 12-step technology planning and implementation process for public schools, is the result of a collaboration between software company executives and five public school systems in Massachusetts.

Mid-Continent Regional Educational Laboratory, Technology Integration
http://www.mcrel.org/resources/technology/index.asp?
These pages provide online resources available to help educators, administrators, and parents answer common questions and solve problems related to the implementation and use of technology in education.

NASA Quest, The Internet in the Classroom
http://quest.arc.nasa.gov/
This site contains educational activities as well as assistance in learning to use the Internet in schools.

National Association of Elementary School Principals
http://www.naesp.org
This site has the National Principal's Center Online and provides services to its members.

National Association for Secondary School Principals
http://www.nassp.org
This site has the Principal Technology Network for members only.

National Center for Supercomputing Applications: Technology Division
http://www.ncsa.uiuc.edu/
This site contains several exhibits designed to demonstrate how computers and computer networking can enhance K12 education. Included are tutorials to help teachers on the World Wide Web and a handbook.

National Center for Technology Planning
http://www.nctp.com
This site contains school district technology plans, sample planning forms, and other timely information.

National Center to Improve Practice
http://www2.edc.org/NCIP/
This site contains information about the use of technology to enhance the educational opportunities of students with disabilities.

National School Boards Association: Education Leadership Tool Kit
http://www.nsba.org/sbot/toolkit

National School Boards Association: Institute for the Transfer of Technology to Education
http://www.nsba.org/itte/index.html
Education Technology Programs Department of NSBA.

National Telecommunications and Information Administration (NTIA)
http://www.ntia.doc.gov/otiahome/top/index.html
NTIA's Office of Telecommunications and Information Applications (OTIA) assists state and local governments, educational and health care entities, libraries, public service agencies, and other groups in effectively using telecommunications and information technologies to better provide public services and advance other national goals. This is accomplished through the administration of the Technology Opportunities Program.

North Central Regional Educational Laboratory
http://www.ncrel.org/ncrel/
This site has various helpful documents on education technology as well as links to many other sites.

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

North Central Regional Educational Laboratory: Pathways to School Improvement
http://www.ncrel.org/ncrel/sdrs/pathwayg.htm

North Central Regional Educational Laboratory: Providing Professional Development for Effective Technology Use
http://www.ncrel.org/ncrel/sdrs/areas/issues/methods/technlgy/te1000.htm

North Central Regional Technology in Education Consortium
http://www.ncrtec.org/capacity/capacity.htm
This site contains resources and external links to information on how to increase the technology capacity of your school in ways that are both cost-effective and beneficial to teachers and students.

Northwest Regional Technology in Education Consortium: Early Commnections: Technology in Early Childhood Education
http://www.netc.org/earlyconnections/index.html
This site makes the connection between technology and the way children learn and develop. It provides resources and information for educators and care providers of young children.

Northwest Regional Technology in Education Consortium: Digital Bridges - Welcome to K-12 Videoconferencing
http://www.netc.org/digitalbridges/
This site provides information about using videoconferencing technology for instruction, communication, and collaboration.

Northwest Regional Technology in Education Consortium: Technology Plans-Resources
http://www.netc.org/tech_plans/
This site looks at technology plans from the Northwest and from across the country. In addition to technology plans, this site provides access to research and thinking about the planning process.

Plugging In: Choosing and Using Educational Technology
http://www.ncrtec.org/capacity/plug/plug.htm
"Plugging In" discusses what is known about effective learning and effective technology, and puts it together in a planning framework for educators and policymakers.

Safeguarding Your Technology
http://pubsearch/pubsinfo.asp?pubid=98297
These guidelines, published by the National Center for Education Statistics, to help educational administrators and staff at the buildings, campus, district, and state levels better understand why and how to effectively secure their organization's sensitive information, critical systems, computer equipment, and network access.

Schools and Libraries Program
http://www.sl.universalservice.org/
This site is where you will find information and applications for the E-Rate program..

TeachTech
http://schools.brunnet.net/district6n8/

Technical Education Research Center (TERC)
http://www.terc.edu/
This non-profit organization is dedicated to improving mathematics and science learning.

United States Advisory Council on the National Information Infrastructure: KickStart Initiative, A Leadership Guide to Getting There
http://www.benton.org/Library/KickStart/kick.leadershipguide.html
This site contains information about galvanizing stakeholders, identifying costs and sources of funding, addressing the needs of users, and security, relating to schools, libraries, and community centers.

United States Department of Education: An Educator's Guide to Evaluating The Use of Technology in Schools and Classrooms
http://www.ed.gov/pubs/EdTechGuide

U.S. Department of Education, Office of Educational Technology
http://www.ed.gov/Technology/index.html
The Office of Educational Technology (OET) encourages and leads education improvement efforts by helping educators, congressional leaders, and administrators utilize available resources to reshape

instruction, teaching, and learning environments.

Web66: A K12 World Wide Web Project
http://Web66.umn.edu
This site contains a comprehensive list and links to schools, as well as useful resources, such as a guide to setting up an Internet server and information on software.

For Further Information about the content of
Technology @ Your Fingertips
please contact Gerald_Malitz@ed.gov.

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