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# MODEL NETS GUIDE

*A GUIDE TO IMPLEMENTING  
NETWORKING TECHNOLOGY  
IN K-12 EDUCATION*

Los Alamos National Laboratory

Sponsored by the U.S. Department of Energy



**Los Alamos**  
NATIONAL LABORATORY



# MODEL NETS GUIDE

*A GUIDE TO IMPLEMENTING  
NETWORKING TECHNOLOGY  
IN K-12 EDUCATION*

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*Edited by Denise Tillery*

**Model Nets**  
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# Preface

*Model Nets researchers  
developed a set of  
effective practices.*

The Model Nets Guide to Implementing Networking Technology in K–12 Education is based on research conducted by Los Alamos National Laboratory into the ways computer networks can positively impact teaching and learning in grades kindergarten through 12 (K–12). In particular, Model Nets defines “positive impact” to be the use of a network in support of a discovery-based, student-centered model of learning. In this constructivist model, students explore, discover, create, propose explanations and solutions, and take action on what they have learned.

This Guide will help school districts implement computer networks and use the networks to meet the districts’ educational goals. The Model Nets research project used case studies and teacher surveys to examine the networks in 32 school districts in the United States. Based on this data, Model Nets researchers developed a set of effective practices, reproduced in the Model Nets report as the Guidelines to Implementing Effective Computer Networks (see Appendix A). The effective practices underpin this Guide. As a user of the Guide, you will develop strategies for your district to implement these effective practices in the context of your local needs.

The study was funded by the U.S. Department of Energy.





# Introduction

*The Model Nets Guide provides a framework for the technology planning process within the larger context of overall strategic planning for the district.*

This Guide outlines the steps for a school district to plan and “go on-line” with a computer network that helps students achieve educational goals. It is useful for districts just beginning to think about computer networks and for those who already use networks but need to increase the network’s educational value.

The Guide is intended to support a district technology coordinator or other “network champion” in the schools. It provides a framework for the technology planning process within the larger context of overall strategic planning for the district. The Guide is also intended for use by a technology coordinator to raise teachers’ and others’ awareness about computer networks and how they can be used as an integral part of student learning. Thus, the Guide will help you sort through the details of planning and implementing a district-wide computer network with Internet access.

Of equal importance, it will help you plan to *integrate* that network into the daily learning of your students. It will help you address the critical area of staff training in both the basics of using a network and in integrating networking into the curriculum and classroom. The Guide also contains practical information about network infrastructure and links to resources for the educational use of networks.





# Planning Your Network

## **Why Plan?**

*Going through the planning process helps to identify and eliminate potential problem areas. Failing to plan invites failure.*

This section outlines the steps to create a computer network plan for your district in the context of your local educational goals. To be effective and practical for a school district, technology planning should be thought of as an ongoing process with no termination point. Plan to revisit these steps several times, in any sequence, as part of a process that will continue beyond completion of your plan document.

As you begin thinking about how best to use a computer network in your district, you need to educate yourself on the subject by reading, talking to colleagues in your district and in other districts, searching for information about the topic on the Internet, attending conferences and seminars, and so forth. The Model Nets report (“A National Study of Computer Networking in K–12 Education”) presents research findings and data from a study of effective networking in 32 school districts across the country. Review these findings to get a glimpse of the problems and solutions found by your colleagues in other communities.

The Model Nets report also includes an extensive bibliography of research reports and other documents relating to computer networks and student learning. The report’s Guidelines to Implementing Effective Computer Networks are reproduced in this Guide as Appendix A.

As you proceed through the planning process, you will find it helpful to monitor your progress. The **Master Check List** in Appendix G will help you monitor and record your progress.

*Where are you in the planning process? Review each phase described to the right. Determine what has been completed and where gaps exist in your district’s current technology plan.*

---

## **Preliminary Thinking**

1. Ask questions and inform yourself
2. Determine the climate for supporting technology
3. Form a compelling argument to school board and administration for technology planning

## **Planning Phases**

### **Phase 1: Organize Planning Process**

1. Obtain support from school board and/or district administration to begin the planning process
2. Form planning team
  - Establish criteria for selecting team members
  - Develop team member roles
3. Schedule team meetings

### **Phase 2: Background Review and Research**

1. Collect existing district technology plans and vision statements
2. Review Model Nets effective practices (Appendix A)
3. Become familiar with technology terminology
4. Become familiar with student outcomes
5. Gain understanding of network services

### **Phase 3: Establish Purpose of Networking**

1. Assign team tasks
2. Develop a vision-use statement
3. Determine scope and expectations for the planning project
4. Become familiar with Model Nets effective practices
5. Establish timelines and deliverables
6. Inventory current network uses
7. Inventory current infrastructure
8. Inventory current technology support sources
9. Inventory current technology policies

### **Phase 4: Develop Network Strategies**

1. Determine strategies for integration; i.e., using the network to help students meet outcomes/learning objectives, and to help district meet district strategic goals, administrative needs, and personal productivity needs of staff
2. Determine strategies for technology policies
3. Tie the finalized network strategies to the network services needed to implement them
4. Develop a functional specification that describes the network infrastructure and services you need to achieve your desired future
5. Finalize and select the top network strategies

### **Phase 5: Create Action Plan**

1. Create activities that will help you plan for implementing your strategies, with specific assignments and timelines (see Action Planning Template, pg. 74)
2. Review district context
3. Identify partners and resources
4. Revisit Model Nets effective practices
5. Devise intensive staff development program
6. Develop sources of technical support
7. Compile supporting data
8. Determine budget items
9. Write Action Plan

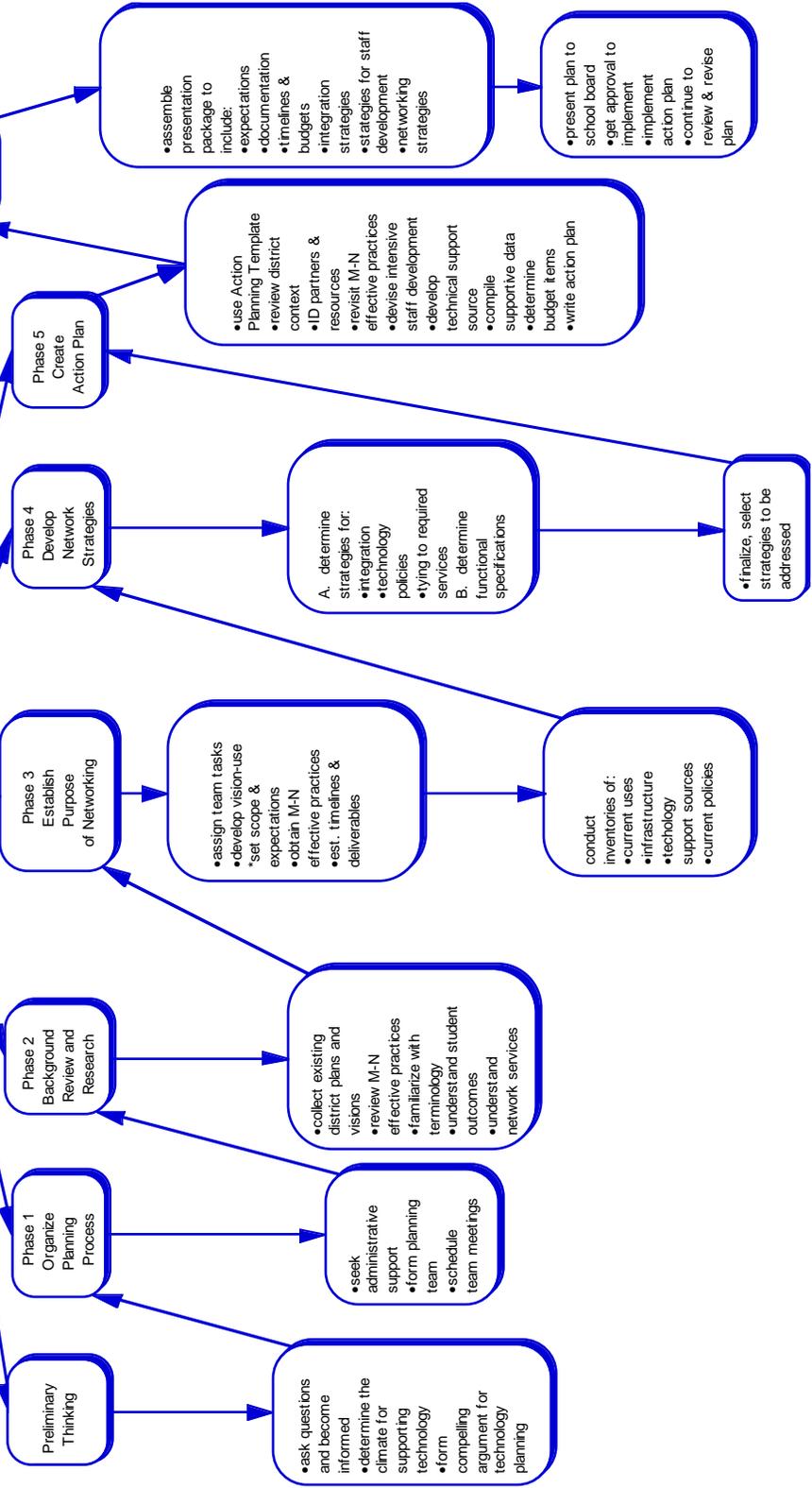
### **Phase 6: Present Action Plan**

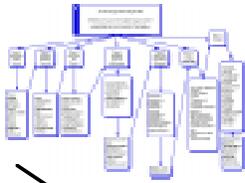
1. Assemble presentation package to include
  - expectations
  - documentation
  - timelines and budgets
  - integration strategies
  - staff development strategies
  - networking strategies
2. Present plan to school board for approval to implement
3. Implement Action Plan



# Technology Planning Guide

Where are you in the planning process?  
What parts have you completed?  
What gaps still exist?



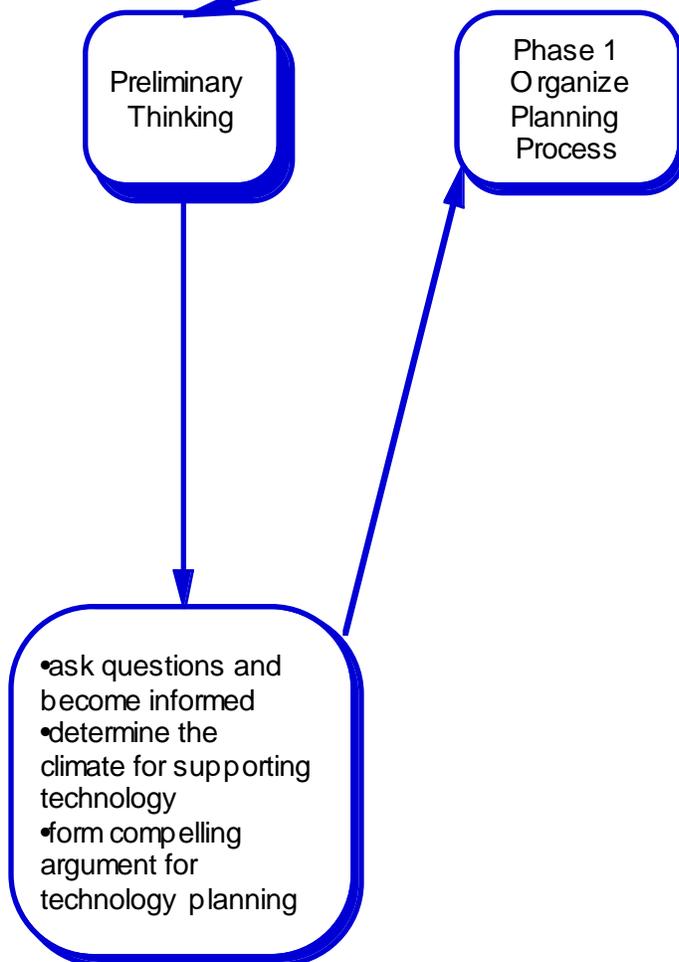


## Preliminary Thinking

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Technology Planning Guide

Where are you in the planning process?  
What parts have you completed?  
What gaps still exist?





# Preliminary Thinking

## ***Why do Preliminary Thinking?***

*You need to develop a solid base from which you will begin the planning process. You will want to get your current thoughts together. You need to answer the question: Why does your district need a computer network?*

*The planning process will require a large investment of time, energy, and resources to make your technology plan a reality.*

If you are thinking about developing your district's networking technology to enhance teaching and learning in your classrooms, you may be at a preliminary stage in the investment of time, energy, and resources to make this process a reality. As you proceed through the phases, consider the following:

- Know who your audience will be for the final presentation of your plan. This will help you when you begin to prepare your final documents for presentation.
- Know who you are expecting to fund this endeavor. You will need to address their concerns when you put together your final presentation.

As a preliminary step to the planning process, you must consider several issues. The first question is "Where are we in the planning process?" Ask yourself, "What parts have we completed? What gaps still exist?" You will ask these questions at each phase of the planning process.

Your next move is to compile any available information about your district's technology needs. If the information already exists, you are probably ready to begin Phase 1.

If you don't know enough about your district's needs to answer questions about technology planning, you may want to examine district plans and objectives, and conduct a very informal needs assessment to help you determine what the climate for supporting technology is. Discuss your ideas with colleagues, district leaders, and decision-makers, and build a compelling argument in favor of developing a technology plan.

Once you are confident that you have support for developing a technology plan, go directly to Phase 1 of this Guide.

## Six Reasons to Use Computer Networks in Schools

Research, trends in the work place, and general societal expectations have established several reasons to use networks in schools:

1. All students need to learn how to use computers. Employment demands that everyone be computer literate
  - Obtain a copy of U.S. Department of Labor report from the Secretary's Commission on Achieving Necessary Skills (see references).
2. Schools are responding to the call from federal, state, and local organizations to establish networks with Internet access. Vice President Gore has challenged the nation to connect all schools to the "information superhighway," that is, the Internet.
  - Obtain copy of the President's national technology plan, *Technology for America's Economic Growth* (see references).
3. Computer networks can be used in the classroom to improve student-centered, inquiry-based learning.

### Uniform Resource Locators (URLs) for Constructivism:

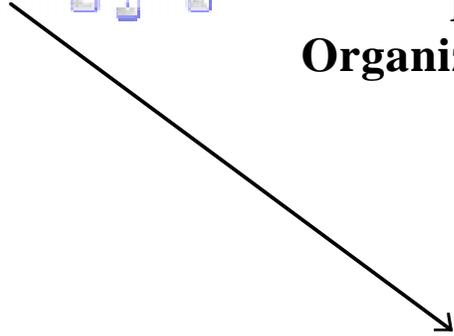
- <http://diogenes.sedl.org/scimath/compass/v01n03/construct.html>
  - <http://diogenes.sedl.org/scimath/compass/v01n03/class.html>
  - <http://diogenes.sedl.org/scimath/compass/v01n03/understand.html>
  - <http://www.inform.umd.edu/8080/UMS+State/UMD-Projects/MCTP/WWW/Essays.html>
  - [gopher://oasis.cudenver.edu/h0/UCD/dept/edu/IT/ryder/itc\\_data/theory.html](gopher://oasis.cudenver.edu/h0/UCD/dept/edu/IT/ryder/itc_data/theory.html)
4. Computer networks streamline many administrative and management tasks. See the following URL:
    - [http://www.yahoo.com/Business\\_and\\_Economics/Companies/Computers/Software/Education/Administrative/](http://www.yahoo.com/Business_and_Economics/Companies/Computers/Software/Education/Administrative/)
  5. Computer networks and the Internet have created a new communication medium with vast potential for overcoming the isolation of classrooms.
    - See Appendices A and C
  6. Your students need to learn on networks. Though it may seem

that computer networks in schools have become a new social imperative, for you, the rationale for planning, designing, and implementing your network should come from your students' needs.

- Obtain copy of Model Nets report



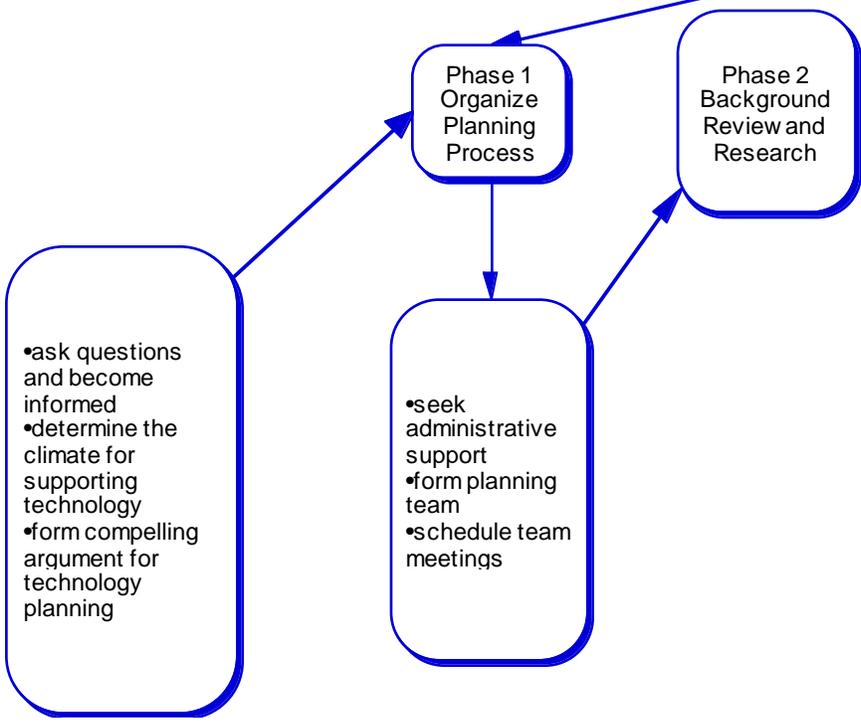
## Phase 1 Organize Planning Process



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**Technology Planning Guide**

Where are you in the planning process?  
What parts have you completed?  
What gaps still exist?





# Phase 1

## Organize the Planning Process

*Why do you need to organize the planning process?*

*You need to be organized to ensure you do not leave any “stones unturned” as you examine your district and its needs. You need to form a competent planning team and select a competent leader to ensure completion of the planning process.*

During this planning phase, you will establish the boundaries and purpose of your network planning project. You will carry out several small administrative tasks to organize the planning process and set it in motion.

---

### To Complete This Phase, You Will Need . . .

- A scheduled opportunity to seek support from your school board and/or administrative team
- Candidates for your planning team

### After Completing This Phase, You Will Have . . .

- Secured endorsements from your school board and any other governing or advisory councils in your district
- Formed a planning team with an identified leader
- Established a schedule for team meetings

*You need to do some administrative work to lay the groundwork for an extended planning effort.*

## Preliminary Steps

In this phase of network planning, you need to do the administrative work to lay the groundwork for an extended planning effort. To get started, carry out the following brief tasks.

- **Obtain Endorsements:** Make sure you have a formal endorsement and support from your local school board, district administration, and any governing or advisory councils functioning at the district or school level. Lack of their full commitment and participation could undermine your plans for a successful network. Before approaching them, review this Guide closely so you understand the process. Then brief key decision makers on the process
- **Obtain Copies of All Applicable Plans:** To complete all the steps of this Guide, you will work with your existing district strategic plan, technology plan, student outcomes (or learning objectives), and any other applicable plans or statements of expectation for student achievement. Get copies of these before you start planning your network.

## Form Your Planning Team

Picking the right individuals for your planning team is critical to the success of networking in your schools. Identify groups in the local community who have a stake in education and in computer networking, so that you can invite representatives of these groups to participate in the planning process.

*As you form your planning team, give careful consideration to its makeup. Having the right people on your team is critical to the success of a networking system in your district.*

Include people from a wide range of perspectives, not only those who strongly advocate computers or who are keenly interested in technology. Encourage teachers, students, parents, administrative staff, school board members, and community members to contribute.

One effective approach is to form two committees: a large advisory committee composed of representatives from all stakeholders, and a smaller “core planning team” of five or six members who do most of the actual work of this Guide. We assume that the core team is carrying out each Guide phase. The Guide indicates appropriate opportunities for engaging the advisory committee in the planning process. The core team should be selected from members of the advisory team, and should include a technology coordinator, an administrator, a few teachers representing different grade levels, and the periodic services of a consultant with network engineering expertise.

Invite people from all groups who use or otherwise are affected by the network to participate in the advisory committee. Don't forget to include the people you will ask for financial or other support .

These people are suggested for membership on the advisory committee:

- Teachers
- District administrative staff
- External technical consultant (for example, a certified network engineer) with experience planning and implementing networks in K–12 schools
- District and building technology coordinators
- Students
- School board members
- Key partners
- Higher education faculty
- Representatives of teacher unions
- Business people
- Parents
- Community members

## Identify and Empower a Leader

Research shows that strong, visionary leadership is critical to effectively implementing a network. One leader should be in charge of both the advisory and the core planning teams.

Identify a leader. Is it you? Make sure the leader is empowered by the explicit endorsement of key decision makers, such as the school board, administration, or staff council. Note that your leader may be different from your sponsor, or the person or body under whose auspices you undertake the technology planning effort. Your leader and sponsor *can* be one and the same.

## Roles of Core and Advisory Team Members

Inform all members that developing a networking plan is likely to take several months.

Responsibilities can vary among team members, but make sure they are clearly defined for all. You might call on some members to participate in the entire process—a lengthy time commitment—and others to participate in key review phases only. Members of the core team will spend several hours each week on this planning project.

*A successful planning team needs a strong, visionary leader.*

*The core and advisory planning team members must be aware of the time commitment necessary for successfully completing the planning phase.*

You will decide which of the activities on the following pages are best done by the core team and which should be done by the larger advisory committee. Charge someone with creating the plan document, writing responses on the worksheets provided in this Guide, and modifying the district strategic plan to incorporate the networking action plan.

## **Roles of Experts**

Experts will play an important role in your planning and implementation. School districts rarely have staff with the detailed expertise and experience in building a computer network. This field is changing rapidly, and it is very difficult to stay abreast of all of the latest developments.

One of the keys to involving experts is to understand what they know and what they don't know. Understand what their areas of expertise are before you involve an expert with your team. It is important that you get good independent advice in the areas that concern you, and that this advice comes from an individual without any hint of a conflict of interest or other vested interest clouding the input.

Expertise can come from vendors, but this can be a dangerous relationship that is fraught with potential conflict of interest. Remember that a vendor is usually trying to sell you what the vendor has and not necessarily the "best" solution to meet your needs (see Appendix E, Working with Vendors).

# Advisory Team Selection Worksheet

Use this worksheet to identify members for a technology planning team. Some categories have been provided, and there is room to add more items. Remember that team members should be individuals who support the use of technology and who are committed to the planning process.

Category	Name
Administrator:	
Business/Community Members:	
District/Building Technology Coordinator:	
Higher Education Faculty:	
Librarian:	
Parent:	
Partner:	
Representative from Teachers Union:	
School Board Member:	
Student(s):	
Teachers:	
Technical Consultant:	
Vendor:	

# Core Team Selection Worksheet

Use this worksheet to identify members for a core technology planning team. Some categories have been provided, and there is room to add more items. Remember that team members should be individuals who support the use of technology and who are committed to the planning process; all core team members should also be on the advisory team.

**Category**

**Name**

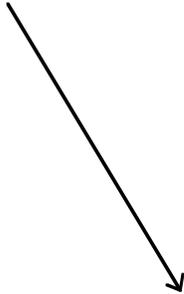
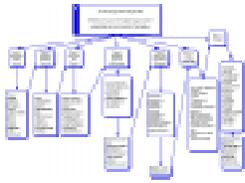
District/Building Technology Coordinator:	
Administrator:	
Teachers:	
Technology Consultant:	

## **In This Phase, Have You . . .**

- Sought and obtained school board endorsement of and participation in network planning activities
- Obtained copies of existing district strategic and technology plans
- Formed a planning team (including core and advisory teams)
- Identified a leader
- Established a schedule for team meetings
- Checked the items completed on the Master Check List

## **Next You Will . . .**

- Familiarize yourself with your district's plans and student outcomes
- Familiarize yourself with the Model Nets effective practices (Appendix A)
- Familiarize yourself with the common network services

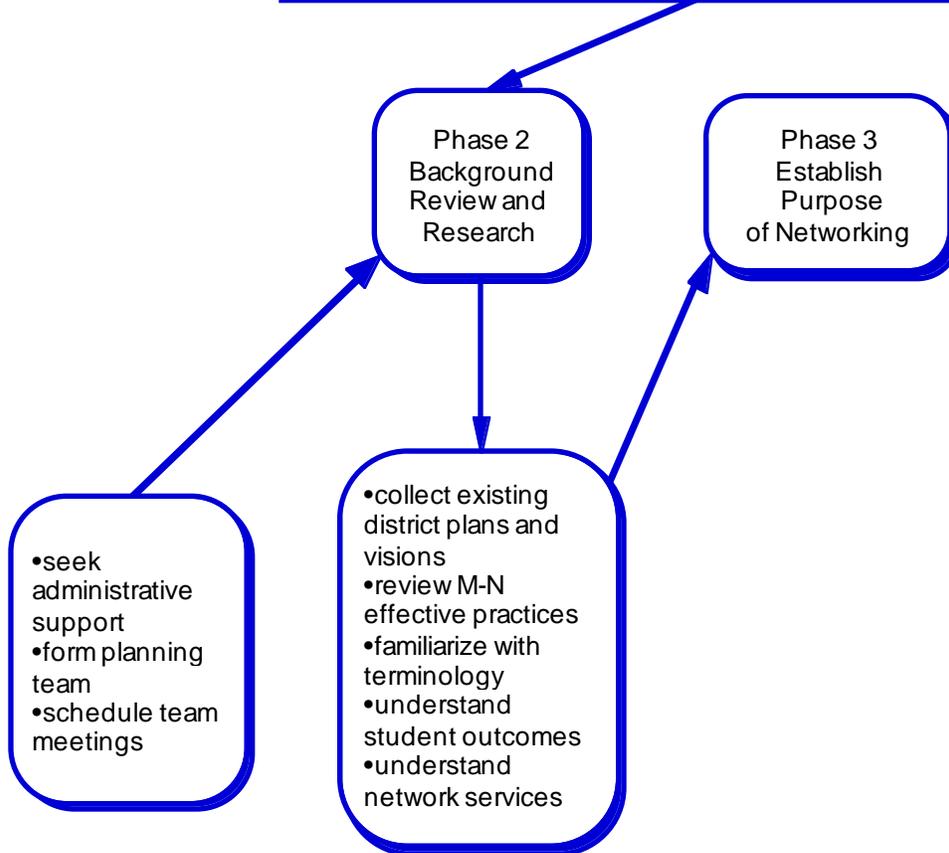


## Phase 2 Background Research and Review

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Technology Planning Guide

Where are you in the planning process?  
What parts have you completed?  
What gaps still exist?





## Phase 2

# Background Research and Review

### ***Why do you need to do a background research and review?***

*You need to learn as much as possible about your district, its vision and mission, its policies and procedures, and its plans for students and staff. This will allow you to address the district's strengths and weaknesses as you proceed through the planning process.*

During this planning phase, you and your core planning team will familiarize yourself with your district's current environment in the areas of strategic planning and computer networking. You will need a working knowledge of these two facets of your district so that you can create strategies for implementing a network that will meet the needs of your students and your district.

---

### **To Complete This Phase, You Will Need . . .**

- An active planning team
- Copies of your district strategic plan, technology plan, district vision statement, and any related plans
- Your student outcomes, or learning objectives
- Copies of the Model Nets effective practices (see Appendix A)

### **After Completing This Phase, You Will Have . . .**

- Learned about the Model Nets effective practices
- Learned about the commonly used network services to support student learning
- Updated your understanding of your student outcomes, learning objectives, or other statements of expectations for student learning used in your district to guide curriculum development and instruction
- Renewed your understanding of your district strategic plan and technology plan, if your district has them

*Effective practices were identified in the areas of **Technical Infrastructure, Policy, and Teaching and Learning.***

## **Effective Practices: What Works?**

The Los Alamos National Laboratory Model Nets research team identified the effective practices (see Appendix A) after studying computer networks in 32 K–12 school districts across the country. These practices are organized under the headings of **Technical Infrastructure, Policy, and Teaching and Learning**. The team defined effective practices to be those uses of computer networks or related policies that support student-centered, hands-on, inquiry-based education—the constructivist model of learning.

Without first knowing what is possible with networking, you cannot use the technology to its fullest. Thus, a thorough knowledge of the effective practices is important. Study them. You will need to know the practices well, so that you can create strategies to implement them.

In Appendix A, you will find the Model Nets effective practices for teaching and learning.

## **Common Network Services: The Enabling Technologies**

Model Nets research found school districts effectively using various network services, each of which the districts can access using several models. The network services compose the “toolkit” you will use to implement the effective practices. Background study of the various network services will give you an advantage as you begin formulating your plan.

*The network services compose the “toolkit” you will use to implement the effective practices.*

Each of these common network services may be provided using several different models. The most historic of these models is the terminal/host model, where a user must log into a host computer system via a terminal to access a service. All of the functions are performed on the host computer. Another common model is peer-to-peer. Each individual computer in a peer-to-peer network is able to access and provide services to every other computer. A more reliable and stable model and one that offers power, flexibility, and scalability is the client/server model. Within this model a robust and reliable server provides a service to client computer systems. A client system processes many functions locally and requests only needed resources from the server. A district using this model may be only a client accessing a remote server run by a university or other institution, or the district may run its own server and act as both client and server.

To access or provide these services effectively, the district must consider a few factors: bandwidth; the demand for service over the network, which is generally proportional to the number of users; and the hardware/software platform that will carry the services. For

a service to be viable at a given bandwidth, system response time must be acceptable to the average user. Some services are possible at a given bandwidth, but the performance would be unacceptable. Detailed considerations about the network platform are dependent upon more variables than we can discuss here, including the particular needs of an individual district.

In this Guide, the commonly used network services are arranged in the categories of communication, resource discovery, security, resource sharing, and providing network services. Appendix D includes a more detailed synopsis of these commonly used network services with some discussion of bandwidth issues.

*See Appendix D for a detailed description of the listed Network Services.*

### **Communication**

- E-mail
- Mailing Lists
- News Groups
- Chats
- Audio/Video Conferencing

### **Resource Discovery**

- World Wide Web (WWW) & Gopher
- File transfer protocol (FTP)
- Bulletin board service (BBS)
- Database access
- Other

### **Security**

- Firewalls
- Routers
- Authentication

### **Resource Sharing**

- File sharing
  - FTP
- Printer sharing
- Terminal access

### **Providing Your Own Network Services**

- Communications
- Resource Discovery
  - WWW and Gopher
  - FTP
  - File Servers
- Domain Name Server (DNS)

## **Using a Computer Network for Effective Communication**

Communication by e-mail is one of the most commonly used network services and one of the most effective uses of computer networks in K–12 schools. It deserves special attention.

*Carefully consider who needs access to networked-based communication on a regular basis in your district*

*Review your district's student expectations and/or standards for areas where computer networks could enhance student achievement.*

To implement an effective network, you need to know who needs access to e-mail or other network-based communications. With whom does your district currently communicate, and how? Likely recipients of district communication are teachers, students, parents, the community at large, teachers and school staff outside the district, institutions of higher education, business partners, and so forth. Carefully consider who needs access to networked-based communication on a regular basis in your district, or who from outside your district needs to communicate with you.

## **Review Your Student Outcomes**

Computer networking allows you to create a powerful learning environment that supports student-centered, inquiry-based learning. However, this learning model can only succeed if other components of your local education system likewise support it.

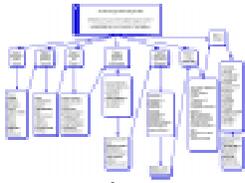
Your district may have defined student outcomes, or expectations of student learning at particular grade levels or upon graduation. They might also be expressed as “standards” for the various content areas of instruction. Review these for areas where computer networks could enhance student achievement. If you have not defined outcomes at the district level, review (1) state-level outcomes or standards and (2) the recommendations for educational standards or outcomes made by national educational organizations.

## **In This Phase, Have You . . .**

- Obtained copies of existing district strategic and technology plans and vision statement
- Familiarized yourself with the technology terminology
- Gained an understanding of network services
- Familiarized yourself with the expected student outcomes

## **Next You Will . . .**

- Assign team tasks
- Develop a district vision-use statement
- Set scope and expectations
- Establish timelines and deliverables
- Conduct a variety of technology inventories

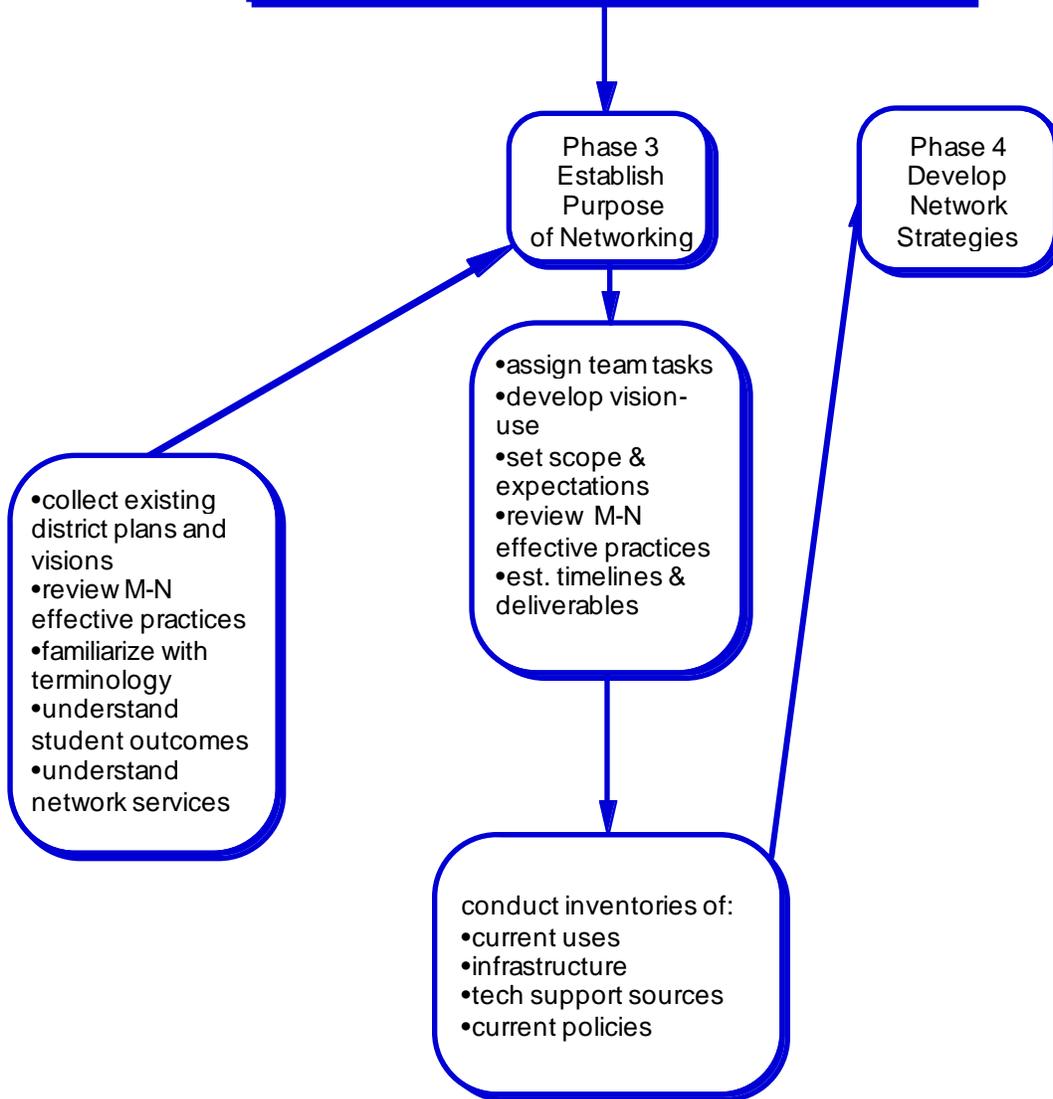


## Phase 3 Establish Purpose of Networking

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Technology Planning Guide

Where are you in the planning process?  
What parts have you completed?  
What gaps still exist?





# Phase 3

## Establish Purpose of Networking

***Why do you need to establish a purpose for your network planning?***

*Without a purpose, your planning will soon begin to drift and become immersed in all of the ever evolving details of computer technology.*

*Establishing a purpose will help to keep you on track. You will discover that you do not need all of the latest technologies to meet most of your district needs, now and in the future.*

During this planning phase, you will establish the boundaries and purpose of your network planning project. You will carry out several small administrative tasks to organize the planning process and set it in motion. Samples of all worksheets provided in this Guide are included in Appendix F.

---

### **To Complete This Phase, You Will Need . . .**

- The Model Nets effective practices (Appendix A)
- The attached networking inventory worksheets

### **After Completing This Phase, You Will Have . . .**

- Set the scope and expectations for your network plan
- Reviewed Model Nets effective practices for planning
- Established timelines and deliverables for the network planning process
- Established a clearly stated purpose for your network
- Inventoried your current network technical infrastructure and technical support
- Inventoried your current network-related policies
- Inventoried the current uses of networking in your district

In this phase of network planning, you need to do administrative work to lay the groundwork for an extended planning effort. To get started, carry out the following brief tasks.

- **Establish Timelines:** Establish deadlines and milestones along the way to keep the planning process on track and moving ahead. Expect it to take several months.
- **Identify Expected Deliverables:** This Guide assumes one key deliverable: a computer networking action plan that you have incorporated into your existing district strategic plan. Your deliverables could vary, depending on the needs and requirements of your district. For instance, if you are developing the network plan concurrently with the district strategic plan or if you are simultaneously writing a proposal for technology funding, your deliverables will reflect these goals. This Guide is intended to support your needs, not force you to comply with a single approach to planning.

*In addition to the educational uses of a computer network, also consider the roles for administrative and business uses as you go through the planning process.*

*Use the effective practices that make sense for your district, given your unique circumstances, barriers, and opportunities.*

*A solid grounding in the unique context of your district helps you design a network that meets your individual district's needs.*

## Setting Scope and Expectations for the Network Plan

What is the scope of this planning project? The Guide helps you sort through issues related to the *educational* uses of a computer network. However, you should consider the roles for administrative and business uses of the network in your planning process. If you want to include other aspects of technology beyond computer networks, you may want to widen the scope and plan for these on your own. You can adapt the basic process presented in this Guide to these and even broader planning efforts, as well.

In Appendix A, you will find the Model Nets effective practices for planning a computer network. You might also think of them as the characteristics of an effective plan.

Effective practices are defined as those characteristics that support a model of learning in which students explore, discover, create, propose explanations and solutions, and take action on what they have learned. (The effective practices are organized under three “domains:” **policy, teaching and learning, and technical infrastructure.**)

The effective practices for planning, a subset of the Policy section, are found in Appendix A. This list of planning practices is also an organizational aid for your own planning effort and to help you decide the scope of your plan. Later, use this section as a checklist when you develop your final networking action plan.

You might decide that you cannot realistically create a plan that addresses all the elements of the practices. That’s just fine. As with all the effective practices presented in this Guide, use the ones that make sense for your district, given your unique circumstances, barriers, and opportunities.

## Review Your District Strategic and Technology Plans

Reviewing your overall district strategic plan and technology plan is an important early step of planning a network. Creating a computer networking plan without first understanding your district’s context could saddle you with schools full of computers, servers, and software that work fine but accomplish little in terms of student success. A solid grounding in the unique context of your district helps you design a network that meets *your* individual district’s needs.

*Reconcile any multiple strategic plans that your district may have developed in the past before proceeding with the planning for a district networking plan.*

To develop an effective computer network plan, you must have a district-wide strategic plan that

- is based on an assessment of student needs
- states specific educational goals
- identifies student outcomes (or learning objectives)

Find any documentation you can that relates to your district's goals, objectives, strategies, and activities for teaching and learning, staff development, technology, facilities, curriculum development, etc.

Your district's strategic plan should provide information about your district's vision and goals, policies, size, student achievement, student educational needs, student demographics, staff characteristics, instructional program, facilities, community, partnerships, and so forth. (Note: If more than one strategic plan exists — for example, your school board may have developed a strategic plan independent of the administration's plan — reconcile them before proceeding with network planning.)

If you already have a networking or technology plan, think of it as a living document and use this opportunity to improve it. If you already have a network in place—if it's too late for the proverbial clean sheet of paper—you can use the process of this Guide to tailor its fit with your district strategic or technology goals and to evolve, expand, and upgrade the network. Keep in mind that existing infrastructure can be both a constraint and an opportunity.

## **Establish Purpose of Networking**

As you begin to plan your computer network, think about its purpose, or vision. Why build a network?

*The overarching purpose of a computer network ought to be to help students achieve the learning objectives of the district.*

You will come up with many reasons, but they are likely to sort themselves into two general categories: (1) administrative use and (2) teaching and learning. (This Guide is concerned with the latter category, those uses that help students to learn.) The overarching purpose of a computer network ought to be to help students achieve the learning objectives of the district.

The uses of the network should then support the overall educational goals of the district and the action plans designed to accomplish those goals. The effective practices found by Model Nets research in the area of vision are listed below.

## Model Nets Effective Practices: *Vision*

The vision of computer network use is integrated with teaching and learning and includes these components:

- Teachers and students have universal access to the network
- Network is perceived as a tool
- Instruction is improved by use of the network

*The vision is your idealized mental picture of the future when computer networking is used most effectively to support student learning.*

Your district probably has an overall vision statement that includes such concepts as success for all students, academic excellence, the acquisition of learning skills, and so forth. To guide your computer network planning effort, you need a vision for networking. The vision is your idealized mental picture of the future when computer networking is used *most effectively* to support student learning. This future may be five years off, but a clear vision pulls you toward it. Recognition of the gap between your present circumstances and the vision motivates you to strive toward improvement, to plan, and to implement.

As you develop your vision for networking, involve a large group of stakeholders to ensure broad-based commitment and support. Consider these questions as you brainstorm a vision:

- Once your network is fully operational and meeting your highest expectations, what will it “look like” in terms of student and teacher use?
- How will it enable the district to achieve its overall district vision?

Compose succinct answers that will help form your vision for networking, but avoid bogging down in wordsmithing. Perhaps a brainstormed list of ideas is sufficient.

Record your vision on the following worksheet and reproduce it at the beginning of the networking action plan that you will develop during Phase 5 of this Guide (or in your district strategic plan, if appropriate).

## **Vision Worksheet**

Record your vision for networking on this sheet (see previous page). Later you will incorporate it into your action plan.

## Inventory Your Current Network Infrastructure

*You need someone with some computer expertise to help as you conduct an inventory of your district's network infrastructure.*

*Balance your time when conducting the inventories included in this Guide.*

*Consider the level of the equipment and its usefulness to your identified educational needs. You will find that some of your needs can be fulfilled outside of a network with older equipment.*

*Determine the capabilities of your existing equipment and match them to your district's needs. Can the equipment be upgraded inexpensively to meet some of your needs? Can the existing computers be used in a non-networking environment?*

To conduct an inventory, be sure to involve an expert in networks and computers. This person can be an outside consultant or a district staff member with expertise in this technology.

Use the worksheet on the following page to create an inventory list of every piece of equipment that could be used in a computer network, including computers, printers, servers, network cable, telephones and telephone lines, cable television (CATV), modems, old computers, televisions, and so forth. If you have local area networks (LANs) or wide area networks (WANs), document their network operating systems (e.g., Novell, AppleTalk, Token Ring, Windows NT, etc.), topology, bandwidth, and software. Document individual computers by their brand, microprocessor (e.g., Intel 386, 486, Pentium, etc.), and operating system (e.g., Windows, Windows 95, DOS, Macintosh, UNIX, etc.). Document software by type (e.g., word processing, spreadsheets, business/accounting, etc.). Also, describe how you ensure the security of your network.

For more information on these items, see Appendix B, Glossary.

It is a good idea to create a spreadsheet to capture the collected data. You will need this data in later phases to help make sense of your district needs and resources.

# Worksheet

## Inventory of Current Network Infrastructure

Use these worksheets to document your current technical infrastructure. You will use this information later when you develop strategies, create a design specification, and write your action plan.

---

### Identify and describe each of your computer systems.

Location: \_\_\_\_\_ Manufacture/model: \_\_\_\_\_

#### Computer type(s):

- |                                                     |                                           |
|-----------------------------------------------------|-------------------------------------------|
| <input type="checkbox"/> PC (Intel processor based) | <input type="checkbox"/> Macintosh        |
| <input type="checkbox"/> 286 processor              | <input type="checkbox"/> 68K processor    |
| <input type="checkbox"/> 386 processor              | <input type="checkbox"/> PPC processor    |
| <input type="checkbox"/> 486 processor              | <input type="checkbox"/> Apple II         |
| <input type="checkbox"/> Pentium                    | <input type="checkbox"/> UNIX Workstation |
| <input type="checkbox"/> Pentium Pro                | <input type="checkbox"/> Other            |

#### Memory Size

- |                                           |                                |
|-------------------------------------------|--------------------------------|
| <input type="checkbox"/> 4 megabytes (MB) | <input type="checkbox"/> 16MB  |
| <input type="checkbox"/> 8MB              | <input type="checkbox"/> 24MB+ |
| <input type="checkbox"/> 12MB             |                                |

#### Operating System(s):

- |                                              |                                             |
|----------------------------------------------|---------------------------------------------|
| <input type="checkbox"/> MSDOS version _____ |                                             |
| <input type="checkbox"/> DOS version _____   |                                             |
| <input type="checkbox"/> Windows:            | <input type="checkbox"/> UNIX:              |
| <input type="checkbox"/> 3.1                 | <input type="checkbox"/> Linux              |
| <input type="checkbox"/> 95                  | <input type="checkbox"/> AUX                |
| <input type="checkbox"/> NT                  | <input type="checkbox"/> AIX                |
| <input type="checkbox"/> Other _____         | <input type="checkbox"/> Sun OS             |
| <input type="checkbox"/> Mac OS:             | <input type="checkbox"/> Solaris            |
| <input type="checkbox"/> 6.x                 | <input type="checkbox"/> Other              |
| <input type="checkbox"/> 7.1                 | <input type="checkbox"/> VMS: version _____ |
| <input type="checkbox"/> 7.5                 | <input type="checkbox"/> Other OS _____     |
| <input type="checkbox"/> Other _____         |                                             |

**Identify and describe each of your Local Area Networks (LANs).**

**Location:** \_\_\_\_\_

**Network Type**

- LAN classroom  LAN building

**Network Topology**

- Ethernet:
- thick (coax)
  - 10base2 (thin coax)
  - 10baseT (twisted pair)
  - 100baseT (twisted pair)
- AppleTalk:
- Phone-net
  - Localtalk
- Token Ring:
- FDDI:

**Network Operating System / Groupware:**

- Novell network: \_\_\_\_\_
- Microsoft: \_\_\_\_\_
- AppleShare: \_\_\_\_\_
- NFS
- Cross-system connectivity software: \_\_\_\_\_
- Other \_\_\_\_\_

**Local Area Network Bandwidth:**

- <100 kilobits per second (Kb/s)
- 100 Kb/s to 500 Kb/s
- 500 Kb/s to 3 megabits per second (Mb/s)
- 3 Mb/s to 10 Mb/s
- >10 Mb/s
- Other \_\_\_\_\_

**Network Services Servers:**

Mail system:

- SMTP/POP3
- Microsoft
- Other \_\_\_\_\_

Security

- Gateway
- Router
- Authentication

File servers

- Appleshare
- Novell
- NFS
- Other \_\_\_\_\_

Print Servers

- Transmission Control Protocol/  
Internet Protocol (TCP/IP)
- ApplePrint
- Novell

**Identify and describe each of your Wide Area Networks (WANs).**

**Connection types:**

- dial-up
- dedicated data lines
- frame relay
- integrated services digital network (ISDN)
- asynchronous transfer mode (ATM)

**Data rates:**

- 9.6 Kb/s
- 56 Kb/s
- 128 Kb/s (ISDN)
- 1.414 Mb/s (T1)
- 44 Mb/s (T3)
- Other \_\_\_\_\_

**Internet access?**

- Yes
- No

**Internet Service Provider** \_\_\_\_\_

**Bandwidth** \_\_\_\_\_

**Connection Type** \_\_\_\_\_

## Inventory Current Sources of Technical Support

As you plan for and implement a new network or upgrade an existing network, you will depend upon technical support for the planning phase and for daily operations once the network is up.

*It is a good idea to locate and inventory potential and existing sources of technical support. You will need continual technical support once your network is up and running.*

On the following worksheet, make a list of current sources of technical support, including vendors, district staff, teachers, students, volunteer parents, consultants under contract, business partners, and others with expertise in the following areas:

- Computer networking
- Using computer software
- Computer operating systems
- Hardware maintenance and troubleshooting
- Training computer users

Draft a letter or form requesting community volunteers. Seek information about expertise that may exist in your community.

Other ways to collect needed data include setting up calling circles, eliciting help from your local newspaper, parent/teacher organizations (PTOs), etc. The idea is to locate and inventory potential and existing sources of technical support.

# Worksheet

## Inventory Current Sources of Technical Support

You will use this information to identify who can provide support or leadership for implementing specific tasks of the action plan. If they are not already members, consider adding one or two of these support people to your planning team.

---

Sources of Support	Type of Support
Teachers	
Students	
Consultants	
Vendors	
Others	

*Policies created by your local school board, or by administrators within the district, can support or thwart effective network implementation even if they don't explicitly deal with computer networks or technology.*

*Because acceptable use is a new policy area for most school districts, you may need to spend some time researching acceptable use policies.*

## **Inventory Your Current Network-related Policies**

Your district policies will be critical to the successful use of computer networks for student learning. Policies created by your local school board, or by administrators within the district, can support or thwart effective network implementation even if they don't explicitly deal with computer networks or technology. Similarly, policies or funding guidelines set by local, state, or federal governmental agencies can also help or hinder networking. Thus, you need to identify those "internal" or "external" policies that form barriers to implementing your computer network.

With the Model Nets list of effective policies (see Appendix A) in mind, review applicable local, state, and federal policies. On the worksheet on page 43, identify those policies that are barriers to effective networking. If you participate in any education-related programs that fall outside the established policy environment of your state — for example, reform initiatives of national foundations, federal agencies, or other private or public agencies— you need to review their requirements for participation. These requirements might constitute de facto policies with which you must comply to continue receiving funding or assistance.

As you review your district, state, and national policies, keep in mind that policies of a general nature differ from those that deal with specific situations. Your district may have policies in place that deal with student or teacher access to telephone service. These specific policies may be interpreted as a barrier for students and teachers to have computer access to the Internet via telephone lines. As you develop your district technology plans, you must consider how existing policies will impact your plans and what you may have to introduce in the way of policy modification or creation to ensure that your action plan is implemented.

Keep in mind the difference between policies and regulations. Policies are created to guide action, while regulations are written to outline the actions to be taken to ensure policy is implemented. By identifying the different policies and regulations that exist in your district, you will be ready to make decisions on how to include them in the planning process.

## **Research Network Policies**

Computer networking has inspired a new category of policies in schools, called acceptable use policies. These govern activities on computers and on networks, and generally are intended to prevent downloading pornography, infringing on copyrights, using networks for illegal activities, and so forth. Because acceptable use is a new policy area for most school districts, you may need to spend some time researching them. Many WWW sites provide information on acceptable use policies (see Appendix C).

*When it is time to make changes to district policies, you are likely to be most persuasive if you discuss the reforms in terms of enabling effective computer networking in the service of student learning.*

## **Changing Your Policies**

After conducting the policy audit and researching acceptable use policies, you may find that you want to change your policies not only to eliminate barriers, but also to enable effective networking. Keep in mind that policy is created at several levels by organizations.

Your influence is probably greatest with your school administrators and local school board, considerably less at the state level, and minuscule at the federal level. Concentrate your efforts where you can achieve the most results. Be sure to involve local policy makers — especially local school board members — in this policy inventory task and in drafting any proposed changes to policy for submission to the local board. You are likely to be most persuasive if you discuss the reforms in terms of enabling effective computer networking in the service of student learning.

# Worksheet

## Inventory of Current Network-related Policies

Identify current district policies that are either productive or counter-productive to effective networking. You will use this information to identify areas of policy that need to be addressed by implementation strategies.

---

**Planning**

---

**Leadership**

---

**Acceptable use**

---

**Funding**

---

**Evaluation**

---

**Access to facilities**

---

**Barriers**

---

**Community involvement**

---

**Resources**

## Inventory Current Uses of Networks and Computers

Chances are good that your district already has some computers, maybe even a LAN or two. But how are they being used to support goals of student learning?

Consider these questions about your district as you write descriptions of current uses on the worksheet on page 46:

*You should determine how computers are currently being used in your district. Are they being used to support your district's educational goals?*

- How are computer networks and computers currently used in your district, especially by teachers and students?
- Do they support particular student outcomes (learning objectives)? Which ones?
- Do they support particular district goals? Which ones?
- What common network services have you used? What network services do you currently use? What services are you providing to your users?
- How do you assess your current uses for effectiveness?
- How has networking changed your district? Consider curriculum, school organization, teacher preparation, student performance, etc.
- How are teachers trained in network and computer use?
- Who has access to networked computers? How do they access them?
- Are some teachers using individual, non-networked computers in their classrooms?
- Do some schools have LANs or WANs within a computer lab or connecting classrooms?
- Have particular networking-based projects been successful? Could you expand them through networking to include other classes or buildings?
- What has your experience with computers and networks taught you?
- Are the people involved with computers and networks also involved in developing this networking plan? Should they be involved?
- Do you use networks for administrative purposes? What are they?
- Do you use networks for personal productivity purposes, such as word processing, desk-top publishing, creating databases, organizing information on spreadsheets, creating electronic planning calendars, etc.?

- What barriers do you encounter in using networked computers?
- What opportunities exist for using networked computers?

# Worksheet

## Inventory of Current Network Uses

Document the current uses of networks in your district. You will use this information as you develop strategies for implementing the network. Your current uses may already support effective practices. Be sure to include descriptions of how the common network services are currently used.

---

**Network Services Used**

**Descriptions of Current Uses**

## **In This Phase, Have You . . .**

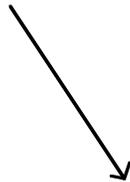
- Set the scope and expectations for your network plan
- Reviewed and become familiar with the Model Nets effective practices for planning
- Established timelines and deliverables for the network planning process
- Established a clearly stated purpose for your network
- Acquainted or reacquainted yourself with your district strategic plan, technology plan, and student outcomes
- Learned about the commonly used network services to support student learning
- Inventoried your existing technical infrastructure, policies, uses, and support for computer networking

## **Next You Will . . .**

- Develop strategies for networking in your district
- Create a functional specification for your network



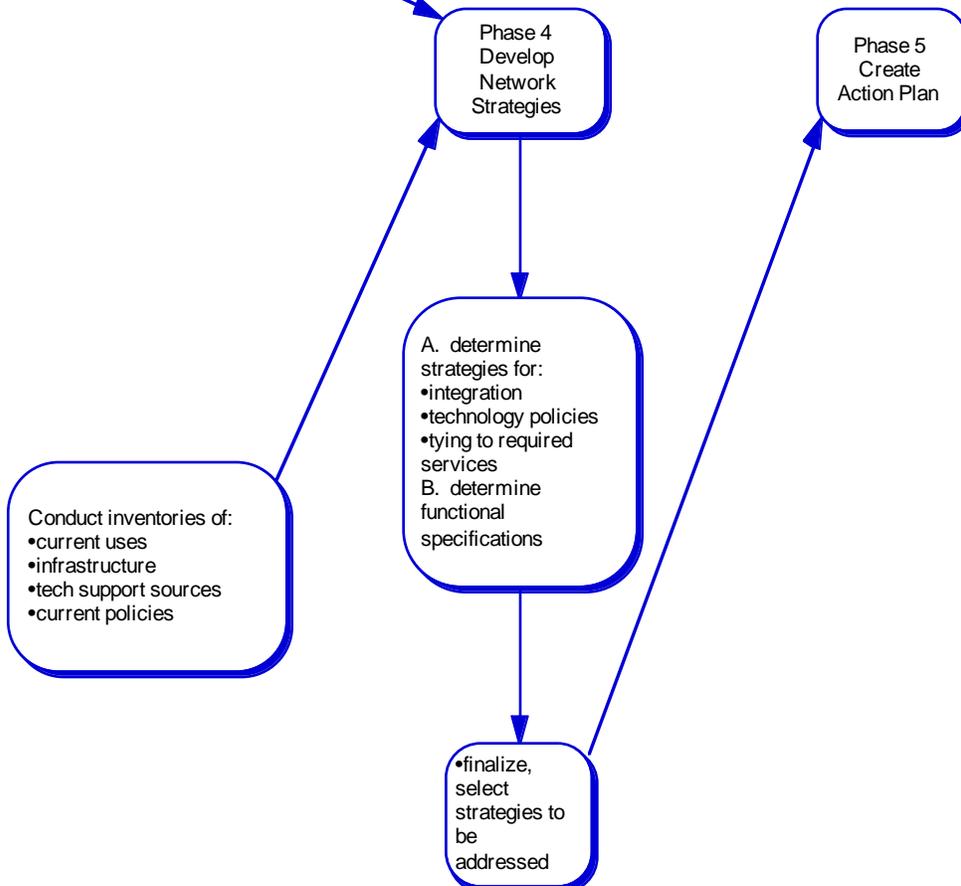
## Phase 4 Develop Networking Strategies and a Functional Specification



✓

Technology Planning Guide

Where are you in the planning process?  
What parts have you completed?  
What gaps still exist?





# Phase 4

## Develop Networking Strategies and a Functional Specification

### *Why do we need to develop networking strategies?*

*You will find that the information you have collected to date will be overwhelming if you do not compile it into meaningful documents.*

*As you develop strategies to meet your district goals, the organized information will prove invaluable for justifying and making sense of your needs.*

*Though the worksheets require a significant amount of “homework,” they are an important tool for organizing and documenting your ideas for use in later steps.*

An effective computer network is a means to achieve educational goals, never an end in itself. It is a tool: make it serve you.

During this phase, you will brainstorm general strategies for your network. You will then finalize the strategies, link them to network services, and use them to derive a functional specification for the network. This functional specification will describe the educational functions your district wants to achieve with the network, and will also include a detailed technical design of your network that is based on your educational functions. Use the worksheets that are provided on the following pages for brainstorming and finalizing your strategies for the network, then tying those strategies to the services that a network can provide.

Though the worksheets require a significant amount of “homework,” they are an important tool for organizing and documenting your ideas for use in later steps of this Guide. In the next phase, you will use the functional specification and worksheets to develop the action plan for implementing the network in three key areas: teaching and learning, policy, and technical infrastructure.

---

### **To Complete This Phase, You Will Need . . .**

- Your district strategic plan and technology plan
- Your student outcomes
- Inventories of your current networking infrastructure, policies, and uses
- The Model Nets effective practices (Appendix A)
- A networking consultant

### **After Completing This Phase, You Will Have. . .**

- Brainstormed and finalized your strategies and selected the most pressing ones to be addressed in your networking plan

- Linked the strategies to required network services
- Created a “functional specification” describing the educational goals and technical requirements for your infrastructure

## Brainstorm Networking Strategies

*These strategies will guide your staff development agenda, the integration of the network into your curriculum, the development of administrative network uses, the adoption of policy, and the technical details of your network infrastructure.*

In this section, you and your core team will brainstorm major strategies for using the network to support student learning in your district. It is a good idea to ask a trained facilitator to lead your planning team through this brainstorming process. Also, be sure to involve the networking consultant on your core planning team.

In previous sections, you studied your district strategic goals and student outcomes. You studied the Model Nets effective practices for teaching and learning, along with examples illustrating their application in school districts. You reviewed the common network services. You inventoried your current network infrastructure, policies, and uses. With all this information in mind (and readily at hand!), you will now develop a few strategies for using the network in your district. The emphasis is on developing a *few*. These strategies will guide your staff development agenda, the integration of the network into your curriculum, the development of administrative network uses, the adoption of policy, and the technical details of your network infrastructure.

*As you revisit the planning process each year or so, you may add and delete strategies to suit your changing needs.*

In subsequent steps, you will eliminate duplicate strategies and prioritize the remaining strategies, selecting the top three or so that you wish to include in your network action plan for the next couple of years. In the action plan, you will identify costs and needed resources, assign responsibility for completing the strategies and associated tasks, and set timelines.

During this later stage, you may find that you cannot realistically plan to implement all the strategies that you have identified. Concentrate on what you *can* get done in the next few years. Save the other strategies for later. As you revisit the planning process each year or so, you may add and delete strategies to suit your changing needs.

*Be sure that your networking strategies are aligned with your overall strategic goals and serve the same purpose: helping students learn.*

You might also find that you can add your networking strategies to existing strategic goals or technology goals. Or you might want to modify those goals based on your new networking strategies. In any case, be sure that your networking strategies are aligned with your overall strategic goals and serve the same purpose: helping students learn.

In this Guide, you will create action steps to support strategies. This Guide begins its focus at the strategy level because it is assumed that you have higher-level goals in a district strategic plan. You can fit the strategies you create for networking under these

goals or create new ones in your strategic plan.

As you brainstorm each strategy, keep these criteria in mind:

- Does the strategy support your *student outcomes*?
- Does the strategy support *administrative* and *personal productivity* goals?
- Does the strategy state *who* will use the network, such as students, teachers, administrative staff, and parents?
- Does the strategy state which *network services* will be required, and for whom?
- Can the strategy be adapted and applied to *every grade level* K–12? (If not, do you have strategies that taken together reach all students K–12? Or do you have a good reason for targeting a particular segment of your student or staff population?)
- Does the strategy support *constructivist* learning?
- Does the strategy address a *gap* between the effective practices and your current state, as revealed by your inventories?
- Is the strategy *flexible* enough that individual teachers can adapt it to their teaching styles?

If you don't have a clear idea of how you would like to use the network, go back to the Model Nets effective practices for teaching and learning (Appendix A). Which of these could be adapted to your district? Could you state them more specifically, meeting the above criteria?

As you think about the effective practices, keep in mind that you are not expected to implement *every* effective practice. You might also find that you can address several practices with one strategy, and you might want to address additional practices not suggested by Model Nets. It is *your* plan; make sure it addresses *your* needs.

Here are two sample strategies:

- *Students in all grades use e-mail and World Wide Web pages to collaborate on problem-centered learning projects.*
- *Teachers address student deficiencies in reading and writing in all grades through the use of network-based collaborative writing projects, such as engaging students in “keypals” writing exchanges, and using e-mail to allow older students to tutor their younger schoolmates.*

*Your teachers will do with their students what they learn during professional development workshops.*

## **Integrating the Network into the Curriculum**

To integrate the network into your curriculum, you must use it as a tool to achieve student outcomes. This integration happens at the level of the individual teacher. A wide variety of teaching strategies based on networking can support student learning: e-mail-based collaborative group projects; tele-apprenticeships with remote professional mentors; publishing WWW pages; retrieving, qualifying, sorting, and reporting information using electronic bulletin boards; etc. Your staff will try those strategies that they are comfortable with — in practical terms, this means that your teachers will do with their students what they learn during professional development workshops. The Model Nets research project identified many different examples of effective integration of computer networks with the curriculum. The examples below are intended to give you an idea of the wide range of curriculum applications of networking technology.

### **Examples of Integrating Networks with Curriculum**

- One school has a strong-student run entrepreneurial program consisting of eight discrete businesses. About half of them are using the network for both internal and external communications. Students are marketing their services through e-mail and the Internet. A student group that serves as a link between schools and the community to work on network-based projects goes out into the community and helps non-profit organizations create WWW home pages.
- At one school, an earth science teacher assigned students to use the World Wide Web browser Netscape to look up and read primary documents about and by the people affected by the Kobe (Japan) earthquake. She found the students quickly became comfortable with the mechanics of using the browser. She assessed their work by requiring a written description of their experience.
- The network at one site allows students to access files from any location. A student can start an article in the computer lab and continue on it from any other machine, for example, in a classroom or media center. Informal assessments show that students are writing more than they did before using the network.
- The JASON project, sponsored by the JASON Foundation for Education, uses communications technology such as the Internet to involve students and teachers in actual, real-time research in such exotic places as the ocean floor or the rain forests of Central America. In many ways, the project is continually

pushing the envelope not only of educational technology, but of innovations in the ways we will all be able to travel through “cyberspace” to experience the world in new ways. In one Jason project, students were able to remotely control a miniature submarine to collect marine samples on the other side of the world, and view their progress with images beamed to satellites from underwater video cameras. Communications between students and teachers involved in these projects is also a powerful way to make science come alive in the classroom, and has led to ongoing collaborations around the world. (See <http://www.jasonproject.org/> for further information.)

## Evaluation

The evaluation of your networking technology should focus on how the network helps you accomplish your educational goals. Asking the following types of questions helps you think about how to optimize the use of the technology before you start creating action steps. These are some examples of the kinds of questions you might wish to ask:

*Evaluate your success in achieving each outcome.*

- How are you using the technology to enhance your educational objectives?
- How will you measure success?
- Can success be stated in terms of student achievement?
- What impact will the use of the technology have on students?

Think about these questions as you develop the evaluation measures. You might also consider gathering operational data about network use, such as the following:

- number of active users
- volume of e-mail messages
- number of “hits” on a World Wide Web page, etc.

If you are trying to motivate teachers and students to use technology, you might use surveys to probe student and teacher attitudes toward the network.

If your goal is to integrate technology in your curricula, then focus your evaluation on the extent to which you are successful with that integration.

# Worksheet

## Brainstorm Networking Strategies

On this sheet, record your brainstormed strategies for your use of a computer network. As you develop these strategies, keep in mind:

---

- **your student outcomes**
- **the goals and strategies of your network strategic plan and technology plan**
- **the Model Nets effective practices**
- **your inventories**
- **other research you have done into effective computer networking in schools**

## Worksheet

# Tie Strategies to Network Services

Now, you will identify the network services you need to implement your strategies. This is the first step in developing the functional specification for your network. Be sure to involve a network consultant in this activity. You will need in-depth expertise to sort through the complex technical issues underpinning each network service.

Describe in detail how each of the network services listed on the next page will be used to carry out each of your networking strategies. (Copy the worksheet for each strategy.) Record such information as who will need access to the service and how often; what kind of data the service will handle (text, multimedia, real-time video, or real-time voice); locations where the service must be available; and minimum desktop system requirements for users accessing the service. Skip any services not applicable to a strategy.

---

**Strategy #X:** (write your strategy here)

---

### **Communication**

- E-mail
- Mailing Lists
- News Groups
- Chats
- Video Conferencing

### **Resource Discovery**

- WWW & Gopher
- FTP
- BBS
- Database access
- other

### **Resource Sharing**

- File sharing
- Printer sharing
- Terminal access

### **Providing your own network services**

- Communication
- Resource Discovery
  - FTP
  - WWW or Gopher server(s)
  - File Servers
- Domain Name Server (DNS)

### **Security**

- Firewall
- Router
- Authentication

## Finalize and Select Top Networking Strategies

*By recording strategies of lesser priority, you will begin to lay out a framework for networking implementation for the next several years, even though you won't develop action steps for lower-priority strategies.*

At this point, you have brainstormed networking strategies on the preceding worksheet. Take some time to review them and (1) examine and compare them to eliminate duplication, and (2) validate them for suitability in meeting your district's needs. For this second step, again look over your district strategic plan, student outcomes, inventories, and the common network services. Did you miss anything that should be addressed by a strategy? Also at this time, you might rewrite some strategies, combine some, delete others, and so on. This is a good time to seek input and counsel from your large advisory committee.

Now it is time to prioritize your strategies so that you can select a few to implement in the next two or three years. Several strategies are probably plenty to keep you busy, since for each you will develop supporting action steps in the areas of teaching and learning, policy, and technical infrastructure. However, by recording strategies of lesser priority, you will begin to lay out a framework for networking implementation for the next several years, even though you won't develop action steps for lower-priority strategies. Now consider how to incorporate your networking strategies into your district strategic plan.

On the following worksheet, record your top several strategies, and indicate the ones that you will implement in the near future.

## **Worksheet**

# **Finalize and Select Top Strategies**

On this sheet, record your finalized networking strategies and indicate the top few that you will implement through your action plan over the next couple years, then those that you will implement in later years. You will develop action steps only for the next year or two.

As you brainstorm each strategy, these criteria in mind.

---

**Strategy supports student outcomes**

**Strategy supports administrative and personal productivity goals**

**Who will use the network?**

**Which network services are required? For whom?**

**Can the strategy be adapted and applied to every grade level K–12? (If not, is there a good reason for targeting a particular segment of your student or staff population?)**

**Strategy supports constructivist learning**

**Strategy addresses gaps between effective practice and current state**

**Strategy is flexible for individual instructional uses**

## Develop a Functional Specification for Your Network

*You need to produce a “blueprint” of your proposed network. This is a technical document describing the design specifications you have determined are necessary for your district.*

In the last step, you identified the network services you would need to implement each strategy. Now you will use this information to derive the functional and technical requirements for your network, working closely with your networking consultant and technical staff. This is a technical document that will provide the framework for the actual network design functional specification, which is the “blueprint” for the network.

The functional specification and technical design documents are highly technical and unique to your district. Thus, they fall outside the scope of this Guide. However, you will need to have them completed before you can create an action plan, since you must know what categories of activity, or *functions*, your technical infrastructure will support before you can create a specific action plan for the use of the network in your district.

## **In This Phase, Have You . . .**

- Brainstormed general strategies for implementing the effective practices
- Finalized and selected the most pressing strategies to be addressed in your networking plan
- Linked the strategies to common network services
- Created a “functional specification” describing the educational functions and technical requirements for your infrastructure

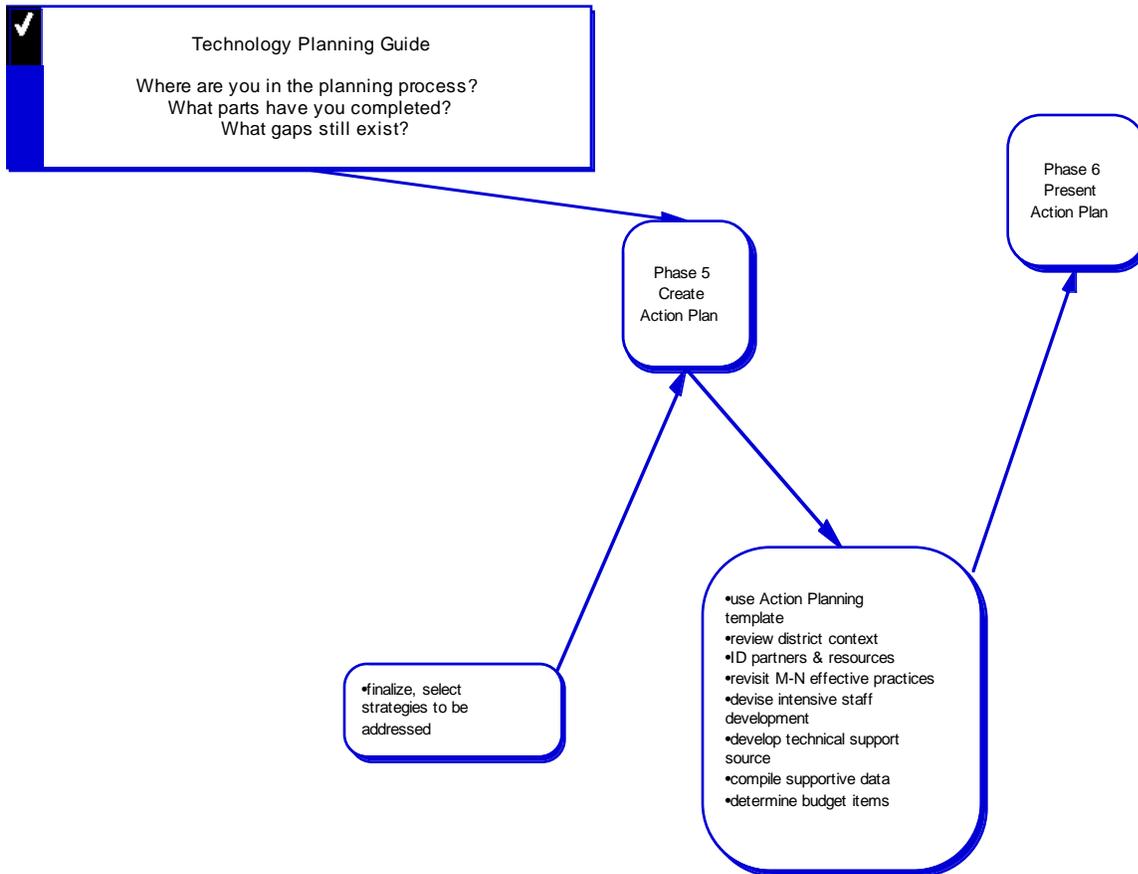
## **Next You Will . . .**

- Create an action plan with concrete tasks to allow you to implement the network





## Phase 5 Create Action Plan





# Phase 5

## Create Action Plan

### *Why do we need to create an action plan?*

*You will need to present a coherent plan to your school board or funding agency if you want to implement your network successfully. The action plan will reflect your district's student outcomes, strategic plan, and many other factors that are unique to your schools and community. The action plan will clarify what you plan to do, when you plan to do it, and why.*

*You will compile all the information you have collected and create your district's networking plan. You will create action steps for each strategy you identified during the previous phases.*

In this section, you will pull together all the information you have collected and ideas you have developed and create your networking plan. The plan will address how to implement your strategies in three key areas: teaching and learning (including staff development), policy, and technical infrastructure. The action plan will reflect your district's student outcomes, strategic plan, and other factors unique to your schools. For each of your strategies, you will create action steps and identify the responsible party, deadline or completion date, costs, and resources available to support that step. The Action Planning Template on page 74 gives you a structure for planning. Use it or create one that suits your needs.

---

### To Complete This Phase, You Will Need

- Final networking strategies (see Phase 4)
- Functional specification of network (see Phase 4)
- Action planning template (provided in this section)
- Copies of district strategic plan and technology plan (see Phase 2)
- Student outcomes, or learning objectives (see Phase 2)

### After Completing This Phase, You Will Have . . .

- Created an action plan to implement your networking strategies, with specific tasks addressing the key areas of teaching and learning, policy, and technical infrastructure

*You will now move from general statements of what you want to accomplish with a network to specific activities. Limit your work to within a two-year time frame.*

*By looking at the current inventory of teaching and learning uses, for instance, and comparing it to the strategies, you might get a clear idea of what steps you need to take to reach your desired future.*

## Creating Activities to Implement Your Strategies

During this step of planning, you are moving from general statements of what you want to accomplish with a network — the strategies — to specific activities (or tasks) that have a definite scope, a time span, and a person or people *doing something*. You might want to brainstorm with your larger advisory committee to develop these activities, then refine them with the smaller core team. Limit the time frame of the plan to about two years. This gives you enough time to accomplish significant tasks, but isn't so long that you will later feel "locked in" to ideas that become obsolete in the face of changing technologies or evolving district needs. Be sure to include a planning step that involves going through this planning process again, the next time with your evaluation results as an additional data point about your current situation.

## Using the Action Planning Template

The template includes subheadings where you can create action steps in the three Model Nets domains:

- teaching and learning
- policy
- technical infrastructure

These headings are intended to prompt you to create activities that will support the strategy in each of these key areas. Because you conducted your inventories in relation to these domains, the headings will help you review your current networking environment as you develop activities for the future. By looking at the current inventory of teaching and learning uses, for instance, and comparing it to the strategies, you might get a clear idea of what steps you need to take to reach your desired future. The same goes for technical infrastructure. In the realm of policy, the current inventory will help you spot either barriers or gaps in policy that you need to address to enable your activities to succeed. In some cases, you might not need to create any activities in a particular domain. That's fine, too.

## Reflecting Your District's Context

As you begin to plan your activities, continually review your district plan, student outcomes, and inventories. This information gives you the context within which you will implement the network.

## Using the District Strategic Plan and Technology Plan

*Areas needing special attention are staff development and curriculum development or reform. These two areas require close coordination with your networking plan so that you don't either duplicate or nullify efforts.*

Keep your district strategic plan handy — *very* handy — as you develop activities for your networking strategies. Your district plan may already have goals or objectives that are closely related to your networking strategies. Consider combining them (we recommend that you do so). For instance, the district strategic plan may contain activities onto which you can “piggyback” networking activities. Areas needing special attention are staff development and curriculum development or reform. These two areas require close coordination with your networking plan so that you don't either duplicate or nullify efforts.

The strategic plan should also report on student needs in your district. Reviewing these as you develop activities will help you implement a network that meets those needs. For instance, if very few of your students (or their families, or even teachers) have computers at home, you might not give high priority to dial-up access to your network from home. In another example, student deficiencies in particular areas of learning may influence how best to use the network to improve student achievement.

## Using Student Outcomes

*Ask how each activity in the action plan will ultimately result in more students reaching your learning objectives.*

Developing activities with student outcomes in mind will help you focus on those tasks — particularly in staff development and curriculum integration — that enable students to achieve your learning expectations. In fact, asking how each activity in the action plan will ultimately result in more students reaching your learning objectives is a good way to test the validity of the activity.

## Using the Inventories

*The gap between your current state and desired future state stakes out the territory that you will cross by planning.*

The inventories you completed earlier in the process outlined in this Guide give you a picture of your current state relative to networking. The strategies and the technical design and functional specification provide the desired future state. The gap between your current state and desired future state stakes out the territory that you will cross by planning. Develop activities to bridge the gap.

Using the previous worksheets (see Phase 4),

- Compare your existing uses to your strategies. Can you incorporate existing uses into activities that support your strategies? For instance, suppose one teacher currently participates in an Internet-based weather project that involves students from around the world in a collaborative experiment. Could such an activity be expanded to the several classes across the entire district?

- Compare your policy inventory to your strategies. Do you need activities related to changing or creating policy in order to support any strategies? For instance, has your district created acceptable use policies governing network users?
- Compare your current infrastructure to your strategies and your technical design specification. What steps do you need to take to enhance your current network to carry out your strategies? For instance, does your district have a LAN that can easily be expanded to a WAN with Internet connections? This might sway your decision about curriculum use of networking at certain school sites.

## Partnerships and Resources

Identifying contributing partners is an important part of the action plan. A list of partners and the resources or services they can provide will help you decide which tasks to undertake in what order. This information might also help you spot opportunities for leveraging or coordinating resources more effectively. Consider the following questions as you create your action plan:

*A list of partners and the resources or services they can provide will help you decide which tasks to undertake in what order.*

- Who are your partners?
- Have you invited them to participate in planning the network?
- What do they provide?
- What do you provide in return?
- Do they support or use networking?
- Who are potential partners or sources of financial or in-kind support? Consider business, colleges and universities, federal grants, foundations, your own students, etc.
- What networking-related resources are either available to you or potentially available? For example, these resources might include access to the Internet through a university, gifts of equipment, donation of networking support services, etc.

*Your plan can form the foundation for proposals to funding agencies.*

Also, keep in mind that once completed, your plan can form the foundation for proposals to funding agencies. You might want to include steps in your plan for seeking funding, forming partnerships, and otherwise securing resources.

## A Word About Vendors

Dealing with vendors is a very important part of the planning and implementation of your network. Make sure that you have a fairly complete plan in place before you look at selecting vendors. A good vendor relationship can enhance your implementation, while a poor relationship can destroy your good planning. Many school districts have indicated that they struggle with this process. We have included more information on strategies, processes, conflict of interest, and some tools to help you with the process of selecting and working with vendors in Appendix E.

*Before selecting a vendor, you should have a fairly complete plan on hand.*

## **Revisiting the Effective Practices**

Once again, review the Model Nets effective practices, this time for ideas about what action steps to take for implementing your network.

## The Importance of Staff Development

*For most teachers, using a network sparks a radical shift in teaching methods toward the constructivist model of problem-centered learning.*

*Effective use of a network is not a substitution for a textbook; it involves restructuring the classroom.*

*Identify what training you need to offer, and also identify potential trainers within your district.*

Effectively integrating a computer network into the curriculum in your district will only happen through intensive staff development. Teachers must learn about possibilities that networks enable, and must be given the chance to *practice* various strategies for using networks. For most teachers, using a network sparks a radical shift in teaching methods toward the constructivist model of problem-centered learning.

Effective use of a network is not a substitution for a textbook; it involves restructuring the classroom in terms of time management, student groupings, even the very content of a unit. Pulling network cable and delivering four personal computers into a classroom alone won't cause these fundamental shifts. Carefully planned staff development can. Guidelines for staff development are provided in the Model Nets teaching and learning effective practices.

Successful network implementation and timelines will depend directly on the knowledge and abilities of your staff in two key areas: 1) computer networking literacy and 2) instructional strategies for implementing networks in the student-centered classroom. Assess your staff's needs and capabilities in these areas. This information will help you identify what you need to offer in training and also identify potential trainers within your district. Remember: fellow teachers are just as effective as paid consultants in training on network skills. Find out who on your staff has expertise or experience in the following areas and involve them in your implementation activities (use provided worksheet):

- Integrating computers or networked computers into the curriculum
- Hands-on, student-centered, discovery-based learning
- Computer networking
- Using computer software
- Computer operating systems
- Hardware maintenance and troubleshooting
- Training computer users

Don't overlook students as a source of technical support, especially at the secondary level. A key finding of Model Nets research was that students were as effective as outside consultants in providing support to teachers!

## Worksheet Staff Capabilities

Identify staff members who have expertise or experience in the following areas:

	Name	Experience
Integrating computers or networked computers into the curriculum		
Hands-on, student-centered, discovery-based learning		
Computer networking		
Using computer software		
Computer operating systems		
Hardware maintenance and troubleshooting		
Training computer users		

## **Examples of Effective Staff Development**

- As an incentive for staff to learn technology, one district provided selected teachers with a computer, printer, and modem to take home for their own use as long as they were employed by the district. Teachers were required to enroll in computer training classes.
- A second school district provided stipends for teachers to attend workshops. The instructional method of the workshops combined lectures, demonstrations, and hands-on skill building. Teachers worked in pairs, were provided with resources and materials, and had an opportunity to use the Internet via easy-to-use menus. Teachers were encouraged to think about how they would integrate the networking technology with their curriculum projects. During the summer, the teachers were loaned computers to work on the integration of technology with their curriculum and were supported with home visits by the district's education project staff.
- In another example, a group of teachers were provided personal Internet accounts. The teachers were expected to learn and understand how an Internet connection could be used in their classrooms. They were provided support in identifying and locating relevant sources of information, and they learned how to incorporate this information into their teaching. A one-day training session was provided to teach participants how to activate accounts and to provide minimal guidance on how to use the tools. Support was provided by the project leader who maintained regular contact with each teacher.
- Another district offered workshops for school teams to learn how to use the Internet. Participants were also given an Internet user manual that they could refer to after the workshop. A monthly newsletter was sent to each member of the group which highlighted interesting projects, discoveries and so on.
- In still another example of staff development, teams of teachers were challenged to use learning technologies to explore an essential question over a period of several weeks. The goal was to create adult learning experiences which engaged staff in solving a curricula-related problem in a manner which is very much like the learning offered to students.

- Questions to be explored were generated by teachers. They were adaptable to a variety of grade levels to increase the degree of transferability. A variety of Internet resources were used and all projects published so that teachers could learn from each other and so that a collection of relevant local resources became available.

## Action Planning Template

Reproduce the following form for all your networking strategies. Take as much space as you need to describe the evaluation, tasks, responsible party, available resources, etc. Customize this template to suit your needs. Remember, it's *your* plan!

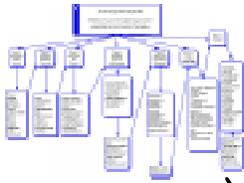
<b>Networking Strategy:</b>				
<b>Evaluation:</b> (measurable outcomes)				
<b><i>Teaching &amp; Learning</i> Action Steps</b>	<b>Responsible Party</b>	<b>Completion Date</b>	<b>Cost</b>	<b>Available Resources</b>
1.				
2.				
3.				
4.				
<b><i>Policy</i> Action Steps</b>	<b>Responsible Party</b>	<b>Completion Date</b>	<b>Cost</b>	<b>Available Resources</b>
1.				
2.				
3.				
4.				
<b><i>Technical Infrastructure</i> Action Steps</b>	<b>Responsible Party</b>	<b>Completion Date</b>	<b>Cost</b>	<b>Available Resources</b>
1.				
2.				
3.				
4.				
<b><i>Staff Development</i> Action Steps</b>	<b>Responsible Party</b>	<b>Completion Date</b>	<b>Cost</b>	<b>Available Resources</b>
1.				
2.				
3.				
4.				

## **In This Phase, Have You . . .**

- Created an action plan to implement an effective computer network

## **Next You Will . . .**

- Present your action plan to the school board to get approval to implement
- Implement the network by carrying out the tasks and action steps of your plan
- Continue to review and revise the plan

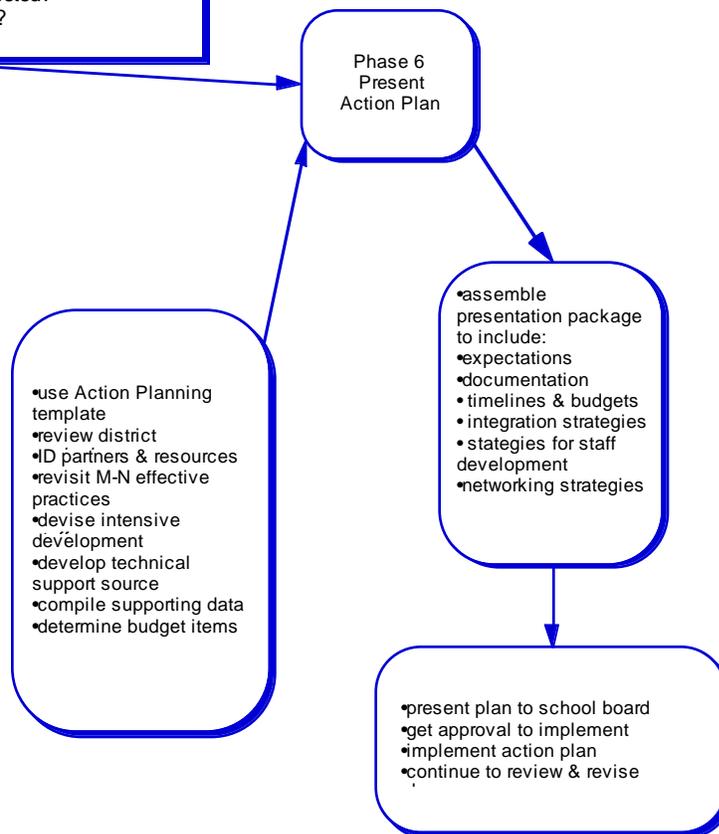


## Phase 6 Present Action Plan

✓

Technology Planning Guide

Where are you in the planning process?  
What parts have you completed?  
What gaps still exist?





# Phase 6

## Present Action Plan

*Why do we need to present our action plan to the school board? Didn't we already receive their approval to proceed with the planning process?*

*Although you received permission to plan the network for your district, your school board must decide whether or not the district can afford to put the network in place. They may see areas of concern that are obvious to them, but not to you. They have the final decision and you must convince them that your plan is sound and will meet the district's vision and educational goals.*

In this section, you will seek approval to implement your action plan. You will demonstrate to your school board the need to set up the network and the steps needed to train the district staff in the appropriate use of the network to use its full potential for enhancing the educational process. You will demonstrate the strategies that need to be addressed in the areas of technical infrastructure, the district policies, and especially in the areas of teaching and learning.

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### To Complete This Phase, You Will Need . . .

- Your completed action plan
- Approval from your school board and administration to implement your action plan
- Appropriate funding and/or funding strategies

### After Completing This Phase, You Will Have . . .

- Received the appropriate commitment from your school board to implement the action plan
- Begun the process of creating an effective computer network in your school and/or district by implementing your action plan

## Preparing to Present Your Action Plan

You should prepare an outline to follow as you develop the presentation to be delivered to your school board. You should include the following:

- Core and advisory planning team members
- Statement of Purpose (include the three domains identified in the Model Nets effective practices)
- Description of your approach toward the planning effort
- District educational goals addressed by the project
- Current state of computer networking in the district
- Outcomes for the year
- Strategies to be addressed by the action plan
- Documentation to back up the identified strategies
- Timelines, milestones, and people responsible for specific actions
- Strategies for staff development
- Benefits to the district
- Funding requirements
- Follow-up strategies

*Making an outline of what you want to present will ensure that you include everything that is necessary to get your point across. Once you have an outline, you will be able to create the proper documents you will need to persuade your school board to approve the action plan.*

## Preparing the Presentation

Since you are trying to sell a technology-oriented action plan, plan to use technology in your presentation. This will help emphasize the usefulness of computers to your audience. If your district doesn't have computer projection devices, use an overhead projector. The projector will suffice, but make sure to produce quality viewgraphs using computer software. There are some excellent presentation software packages available at a minimal cost. By producing computer-generated viewgraphs, you emphasize how computer technology can be used in an educational setting.

As you design your presentation, create a storyboard to visualize the presentation. Create your viewgraphs on paper and tape them to a wall. Step back and see how things fit together. Does any part of the presentation look out of place? If so, move it within the storyboard until its position makes sense. When you have completed the presentation, practice your delivery. What points are you trying to get across? Where do you want to place emphasis? Practice, practice, practice until you are confident that you will be able to deliver the action plan persuasively.

*A storyboard provides an effective way to prepare a persuasive presentation.*

## Implement the Approved Action Plan or Review and Revise

*Planning and implementing a workable network is time consuming. You understand its importance to the educational process. It is up to you and your committee to persuade the school board.*

Now that you have presented the action plan to your school board, your next step is determined by whether or not the plan was approved. If the plan was approved, you need to begin implementation as soon as possible. As you implement the plan, continually evaluate its effectiveness. Record any shortcomings. Technology changes rapidly, and you will discover that you will need to make changes to the plan.

If your action plan was not approved, ask yourself what points the school board disagreed with. How will you address these points and modify the plan so it will be accepted the next time you present it to the school board? You have put in a lot of time and effort, and you should not let it go to waste. Implementing a computer network is an important task and should be continually pursued. Maybe the timing is not right for your district, or maybe the school board and district staff are reluctant to implement the plan because they are unfamiliar with the technology. You need to identify why the plan was not accepted, make the necessary corrections, and present it to the school board again.

Planning and implementing a workable network is time consuming. You understand its importance to the educational process. It is up to you and your committee to persuade the school board.

## **In This Phase, Have You . . .**

- Presented your action plan
- Received the appropriate commitment from your school board to implement the action plan
- Begun to implement your action plan

## **Next You Will . . .**

- Continue to review and revise the plan

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# MODEL NETS GUIDE

## *Appendices*

- A. Guidelines for Implementing Effective Computer Networks
- B. Glossary
- C. Links
- D. Network Services
- E. Working With Vendors
- F. Worksheets
- G. Master Check List





# Appendix A

## GUIDELINES FOR IMPLEMENTING EFFECTIVE COMPUTER NETWORKS

This section presents the Model Nets effective practices organized by the three domains of **technical infrastructure, policy, and teaching and learning.**

---

We have created the guidelines for implementing effective computer networks on the following pages to assist federal agencies as they develop criteria for awarding funds to school districts implementing networks. The guidelines are also intended to help school districts to plan and implement computer networks. We derived these guidelines, or characteristics of effective computer networking, based on our case studies of school districts, on teacher surveys, and on the expertise of a group of subject-matter specialists who reviewed the research results.

For the purposes of the guidelines, “effective practices” are defined as those characteristics of computer network implementation that support a model of learning in which students explore, discover, create, propose explanations and solutions, and take action on what they have learned. The guidelines are not intended as an all-inclusive or rigid set of requirements. We do not expect even an exemplary school district to demonstrate every effective practice in the guidelines. We also recognize that many districts that were not included in the Model Nets research have developed other effective practices not mentioned here.

We have organized the effective practices under the three domains of our study:

- technical infrastructure
- policy
- teaching and learning

---

## Technical Infrastructure Characteristics and Practices

### Infrastructure

1. District provides convenient access to all users.
2. In a given school building, a single LAN supports video, voice, and data for both instructional use in all classrooms and administrative use.
3. In a given district, a single district-wide WAN supports video, voice, and data for both instructional and administrative uses.
4. District WAN has multiple connections to Internet.

5. District provides users with dial-up access from home through external Internet service providers.

## **Security**

1. Configuration-control software prevents users from “hacking” individual computers and thus rendering them incompatible with the network.
2. Proxy servers and firewall technology limit access to sensitive information, as appropriate.

## **Services**

1. All students, teachers, staff, and administrators have e-mail and share a common, district-wide e-mail system, which may include bridges between subsystems.
2. A shared, standardized network infrastructure serves all facets of education, including administrative and teaching functions.
3. The network supports a wide range of functions, including e-mail, file sharing, printer sharing, conferencing, access to productivity software (e.g., databases of student information), news groups, terminal connections, access to library databases and CD ROM databases, access to the Internet and World Wide Web, security and climate-control systems, etc. (See Appendix E, Technical Infrastructure Requirements for Network Services.)

## **Support**

1. A key server system provides centralized software distribution and configuration management.
2. Use of configuration control software (At Ease, FoolProof, etc.) helps support staff to maintain the network.
3. The district establishes baseline standards for hardware and software across the network to ensure compatibility and performance.
4. The district provides support in layers (for example, local or site level, district level over the network or by phone, and local visits).
  - District builds a cadre of internal (school and district) experts
  - District provides on-site network managers at building level
  - Students at high school provide “help desk” support to users and get vocational credit

---

# **Policy**

## **Characteristics and Practices**

### **Vision, Leadership, and Decision Making**

1. The vision of computer network use is integrated with teaching and learning and includes these components:
  - Universal access to the network by teachers and students
  - Network perceived as a tool
  - Improvement of instruction

2. Strong administrative support contributes to survival of vision as funding decisions are made.
3. One person championing the cause helps a network to succeed, but the champion need not be a manager or in position of authority. Important functions include lobbying for support, fundraising, and identifying resources.
4. Decision-makers support the vision.
5. Decision-making is shared between district and schools. Some decisions are best made centrally at district level to ensure compatibility among schools. However, schools are best able to determine their individual needs.
6. Districts maintain consistency and integrity of vision and plan. Funding or other opportunities are pursued only if they help the district accomplish their overall educational goals and objectives.

## **Planning**

1. Plan integrates computer networking with district's overall strategic plan and with individual school plans. The computer networking plan links a set of achievable, long-term and short-term goals to the vision. It also provides the basis for proposals for funding.
2. Plan provides all schools with a step-by-step guide book documenting how to implement a computer network at the site level and how to gracefully expand and upgrade the network.
3. The plan is multifaceted and includes the following considerations:
  - Addresses educational goals and integration with curriculum.
  - Addresses technical support for users, including training on software and hardware.
  - Addresses professional development, with incentives to participate.
  - Addresses access for students.
  - Provides time for teachers to plan instructional use, train on networking, and explore network capabilities.
  - Is informed by needs assessment.
  - Provides for a sustainable network, with adequate budget; staffing; and provisions for the development, maintenance, and trouble-shooting of technical infrastructure.
  - Addresses selection of infrastructure components based on reliability and performance of network, in addition to cost considerations.
  - Identifies strategies to communicate the plan.
  - Defines roles and responsibilities of staff and students.
  - Involves stakeholders, including parents and community members, in planning process, so that they will understand the impact of computer networks, help define the use of networks for their district, and agree upon networking goals and objectives.
  - Involves computer network experts and technology coordinators from schools and district in planning process.
  - Establishes integration of network with curriculum.
  - Links use of computer networking to district-defined goals for student achievement.
  - Addresses articulation across grades and across disciplines.
  - Provides benchmark through evaluation plan for measuring progress and effectiveness of network implementation in relation to student learning.

## **Operational Policies and Implementation**

1. Acceptable use policies govern activities of students and staff on the network.
  2. Teachers receive written procedures related to such network issues as use, misuse, technical support, etc.
  3. District provides network access to teachers, students, other school staff, parents, and community members.
  4. District provides network access to students during nonclass hours (lunch, free period, before and after school, etc.).
  5. Students are encouraged to use the network outside of school for noneducational purposes.
- 

## **Teaching and Learning Characteristics and Practices**

### **Administrative Uses**

1. Teachers use network capabilities for timely, efficient, and improved communication among students, teachers, parents, administration, and others and to overcome isolation.
2. Teachers use network for submitting grades, recording attendance, sending correspondence, etc., to increase efficiency of operations.
3. Teachers use network capabilities to assess student performance, for example, by creating on-line student portfolios.

### **Instructional Uses**

1. Teachers use network capability to obtain curricula and lessons, to collaborate, to exchange materials, and to share ideas.
2. Teachers use network capabilities to engage students more directly in all aspects of their learning, for example, creating databases, collaborating, making presentations, and accessing a wide variety of resources.
3. Teachers use network capabilities to involve students in tasks and projects that are meaningful and relevant to the students' life and world.
4. Teachers use a wide variety of network capabilities and resources to build classroom activities to complement instruction and to address the diversity of interests and learning styles of their students. In such an environment, students help set their own path through the learning process.
5. Through presentations, multimedia, World Wide Web pages, etc., students reach audiences beyond the school boundaries for feedback from the community, business, parents, etc.
6. Students use networks to collaborate on projects.
7. Students use network-based projects to enhance problem-solving skills.
8. Students use networks to explore careers, training, and job opportunities.
9. Students use networks to develop specific job skills.

### **Professional Development**

1. District maintains an on-going plan for staff development.

2. District provides professional development to all staff, including teachers, aides, substitutes, and administrators.
3. Professional development is tailored to individual needs of teachers and staff.
4. District training complements site-based training.
5. Teachers take hands-on courses on how to integrate network resources into the curriculum and instruction.
6. Teachers take hands-on courses on how to use the network infrastructure, network skills, and tools, e.g., Internet, Web browser, file transfer, etc.
7. Training can be applied by staff immediately upon returning to their sites.
8. Activities are sensitive to the nonuser perspective.
9. Incentives are provided for participating in training.
10. Network capabilities are used to expand teachers' content knowledge.
11. Sources of training include building-level technology coordinators, colleagues, colleges/universities, students, self-instruction, consultants, conferences/workshops, on-line courses, parents, and community members.
12. Programs encourage staff to obtain personal computers at home.
  - District allows loans of personal computers for staff development at home.
  - District arranges low-cost financing and educational pricing.



# Appendix B

## GLOSSARY

This section defines key terms related to networks and computers. Refer to your technical expert for further clarification of these technical terms.

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<b>10base2</b>	10-Mbps baseband Ethernet specification, also known as <i>thin-Ethernet</i> or <i>Thinnet</i> , using 50-ohm thin coaxial cable. 10base2 has a distance limitation of 185 meters per segment. (A segment is the length of wire that can be run before requiring supporting electronics to process the signals being sent along the wire.)
<b>10base5</b>	10-Mbps baseband Ethernet specification, also known as <i>thick-Ethernet</i> , using standard 50-ohm thick baseband coaxial cable. 10base5 has a distance limitation of 500 meters per segment.
<b>10baseT</b>	10-Mbps baseband Ethernet specification using two pairs of unshielded twisted-pair cabling (Category 3, 4, or 5), one pair for transmitting data and the other for receiving data. 10baseT has a distance limitation of approximately 100 meters per segment. However, the cable is much thinner and more flexible, and can be used for phone lines as well as network support.
<b>100baseT</b>	100-Mbps baseband Ethernet specification using unshielded twisted-pair cabling (Category 3, 4, or 5). 100baseT has a distance limitation of approximately 100 meters per segment.
<b>286/386/486</b>	Different generations of processors from Intel that are used in IBM PC-compatible systems.
<b>Apple II</b>	Early model of computer from Apple.
<b>ApplePrint</b>	The protocol used to access printers using the AppleTalk protocols.
<b>AppleShare</b>	The product that provides a robust file server using AppleTalk protocols.
<b>AppleTalk</b>	A collection of protocols developed by Apple Computer for file and printing sharing over networks. This protocol can work on a variety of LAN implementations. Current implementations exist for LocalTalk, a 235 Kbps LAN, and EtherTalk, a 10 Mbps Ethernet LAN.
<b>ARA</b>	AppleTalk Remote Access. Protocol that provides Macintosh users direct access to information and resources at a remote AppleTalk site.
<b>ATM</b>	Asynchronous Transfer Mode. ATM is a 25- or 125-Mbps access protocol for local and wide-area networks.

<b>Authentication</b>	The verification of the identity of a person or process. In a communication system, authentication verifies that messages really come from their stated source, like the signature on a paper letter.
<b>AIX</b>	A version of the UNIX operating system developed and used by IBM.
<b>AUX</b>	A version of the UNIX operating system developed and used by Apple.
<b>bandwidth</b>	The amount of data expressed in bits per second (bps) that can be transmitted over a given data transmission medium. Contemporary usage in the computing field refers to bandwidth as the “rate” or “speed” of a network communications line.
<b>bridge</b>	A device that connects networks of the same type, allowing equipment on one LAN to communicate with devices on another.
<b>BBS</b>	Bulletin board services. A collection of information that is stored in a computer system and can be accessed by either a specified group of people or the general public. (See newsgroups.)
<b>CAD</b>	Computer-aided design. A software program (and, often, a computer workstation) that allows the user to design a three-dimensional object. The term is usually applied to programs and workstations that are used to design engineering, architectural, and scientific models of physical objects.
<b>CATV</b>	Cable television. A few cable television systems are beginning to offer data networking service in addition to the standard cable television service. CATV offers the promise of low-cost, high-bandwidth connection for WANs and especially the Internet.
<b>chats</b>	On-line conversations among multiple users.
<b>CU-SeeMe</b>	A free video conferencing program for use on Macintosh or Windows platforms and over the Internet. CU-SeeMe allows users to video conference between any Internet sites. Cornell University and its collaborators hold copyright to the software.
<b>database access</b>	The authority of an individual to use a clearly defined collection of data.
<b>dial-up</b>	To connect to a computer by calling it up using a modem connected to the telephone. Often, <i>dial-up</i> only refers to the kind of connection you make when using a terminal emulator and a regular modem.
<b>domain name server</b>	An Internet site, or file server, identified by a unique name. The domain name constitutes the Internet address of a computer.
<b>domain name system (DNS)</b>	A distributed database system that translates computer names into numeric Internet addresses and vice-versa for ease of use.
<b>DOS</b>	Disk Operating System. Another common name for MS-DOS, the operating system developed by Microsoft for use on computers using the Intel processor.

<b>e-mail</b>	Electronic mail. E-mail systems allow users to exchange electronic memos (often including text, data, and graphics files as attachments) over a computer network. E-mail may operate on a LAN, a WAN, or the Internet.
<b>Ethernet</b>	A form of LAN that implements the IEEE 802.3/ISO 8802-3 CSMA/CD standard. Computers, printers, and other devices on an Ethernet may be attached using a common transmission facility, such as coaxial or twisted pair cable.
<b>FDDI</b>	Fiber Distributed Data Interface is a form of LAN in which systems are connected to one another using point-to-point fiber-optic cable segments to form a ring topology (i.e., the ends of the cable connect to each other and form a ring with no terminal points). FDDI supports a data rate of 100 Mbps.
<b>file server</b>	The central repository of shared files and applications in a computer network.
<b>file sharing</b>	The common use, by two or more users, of data and program files, usually located in a file server, but also located on an individual computer desktop or drive.
<b>firewall</b>	A router or access server designated as a buffer between any connected public networks and a private network to protect any networked server from damage (intentional or otherwise) by those who log in to it. This could be a dedicated computer equipped with security measures such as a dial-back feature, or it could be software-based protection called defensive coding.
<b>Frame-Relay</b>	An industry standard, switched data link level protocol that handles multiple virtual circuits between connecting systems. It is typically used by telecommunication providers to connect to an ISP. Frame-Relay connections can run at several different data rates. The most common are 56 Kbps and T1.
<b>FTP</b>	File transfer protocol. A login method that allows users to send or retrieve files over the Internet. Many Internet sites allow the public to retrieve files using the “anonymous” account name. These sites are called anonymous FTP servers.
<b>Gopher</b>	A client/server program that makes available menus of information on the Internet. Gopher sites, or servers, allow users, or clients, to access information. Gopher is quickly being supplanted by WWW home pages.
<b>HTML</b>	Hypertext markup language. A set of programming codes embedded in text or graphics on a computer that provide links to other text, graphics, or sounds. HTML is the standard for creating hypertext documents on the World Wide Web. (See WWW)
<b>IRC</b>	Internet Relay Chat. A medium for worldwide “party line” networks that allow one to converse with others in real time.

<b>ISDN</b>	Integrated services digital network. A worldwide standard for digital telephone service.
<b>ISP</b>	Internet Service Provider. A company that provides access to the Internet.
<b>Internet</b>	International computer network based on a set of protocol standards for communication and data exchange. The Internet allows users to exchange e-mail and various kinds of electronic files (text, graphics, data, video, etc.), search databases around the world, access remote files, participate in “newsgroups” on subjects of common interest, and otherwise communicate, share, and retrieve information. When written without the initial capital—that is, <i>internet</i> —the term refers to the particular set of protocols that are used over the Internet or other connected networks.
<b>LAN</b>	Local area network. A LAN is a computer communications network used by a single entity (for example, a school) over a limited distance, which permits users to share information and resources. LANs are partly defined by their reliance on cabling (for example, twisted pair or fiber optic). If a segment of the network uses the phone system (even dedicated lines) or a satellite uplink, for example, it is considered a WAN (see WAN).
<b>Linux</b>	An implementation of UNIX originally written from scratch with no proprietary code. It runs on Intel and Alpha hardware in the general release, with SPARC, PowerPC, MIPS, ARM, Amiga, Atari, and SGI in active development.
<b>Listserv</b>	An automatic mailing list server which processes electronic mail requests for addition to or deletion from mailing lists.  Listserv and Majordomo are specific products (or implementations) that run automatic mailing list servers.
<b>LocalTalk</b>	The low-level network transport protocol developed by Apple for the Macintosh using two twisted pair cables. It has a data rate of approximately 235 Kbps.
<b>Macintosh</b>	A popular type of computer system developed by Apple Computers.
<b>MacOS</b>	The operating system for the Apple Macintosh family of computers.
<b>mail</b>	See e-mail.
<b>mailing list</b>	An e-mail address that is an alias which is expanded by a mail exploder to yield many other e-mail addresses. Some mailing lists are simple “reflectors,” redirecting mail sent to them to the list of recipients. Others are filtered by humans or programs of varying degrees of sophistication; lists filtered by humans are said to be “moderated.”  Also, the people who receive your e-mail when you send it to such an address. (See also Majordomo and Listserv.)
<b>Majordomo</b>	A specific product (or implementation) that runs automatic mailing list servers. Majordomo is a freeware system.

<b>MIME</b>	Multipurpose Internet Mail Extensions. A standard for multipart, multimedia electronic mail messages and World Wide Web hypertext documents on the Internet. MIME provides the ability to transfer non-textual data, such as graphics, audio, and fax.
<b>MS-DOS</b>	Microsoft Disk Operating System. MS-DOS is a single user operating system that runs one program at a time and is limited to working with one megabyte of memory, 640 kilobytes of which are usable for the application program. Special add-on EMS memory boards allow EMS-compliant software to exceed the 1-Mbyte limit. Add-ons to DOS, such as Microsoft Windows, take advantage of EMS and allow the user to have multiple applications loaded at once and to switch between them.
<b>multimedia</b>	Computer applications or files that comprise video, voice, graphics, and text data in some combination.
<b>MUD</b>	Multiple-user dungeons or multi-user dimensions. A virtual environment in cyberspace where people “meet” to interact, often in a text-based role playing or adventure game. MUDs often provide “rooms” where people interact through real-time communications.
<b>MUSE</b>	Multi-user shared experience.
<b>newsgroups</b>	Worldwide bulletin boards, organized more or less stringently around a topic.
<b>NFS</b>	Network file system. A set of protocols that allows users to access files on physically remote network computers as if the files were local. Thus, rather than using FTP to transfer a file to a local computer, the user can read it, write it, or edit it on the remote computer using the same commands that would be used locally. NFS was originally developed by Sun Microsystems, Inc. and is currently in widespread use.
<b>Novell NetWare</b>	A popular networking product that provides LAN services to a variety of computer systems. It is mainly used to network IBM-compatible PC systems, and is Novell, Inc.’s proprietary networking operating system for the IBM PC. NetWare uses the IPX/SPX, NetBEUI or TCP/IP network protocols. It supports MS-DOS, Microsoft Windows, OS/2, Macintosh, and UNIX clients. NetWare for UNIX lets users access UNIX hosts.
<b>Pentium/ Pentium Pro</b>	The latest versions of the Intel x86 family of processors.
<b>PhoneNet</b>	A variety of the Apple LocalTalk protocol that uses a different connector and standard telephone wiring.
<b>POP</b>	Post Office Protocol. POP is used by e-mail applications to retrieve from an e-mail server. It works with a SLIP/PPP connection.

<b>PPP</b>	Point-to-Point Protocol. A communications protocol that enables a computer to connect to a network over a regular telephone line. Supports a TCP/IP connection over a modem, thus enabling full Internet access (see SLIP).
<b>printer sharing</b>	A technique for a local area network that allows a printer to be shared among all users connected to the network.
<b>protocol</b>	Procedures that enable devices within a computer network to exchange information. Also known as communication protocol.
<b>router</b>	A device that connects networks of the same type, allowing equipment on one LAN to communicate with devices on another.
<b>SLIP</b>	Serial Line Internet Protocol. A protocol that allows a computer to connect to the Internet by a modem. SLIP is gradually being supplanted by PPP.
<b>SMTP</b>	Standard Mail Transfer Protocol. The standard protocol used for transferring e-mail messages on the Internet.
<b>Solaris</b>	A version of the UNIX operating system developed and used by Sun Microsystems. Solaris is available on a wide variety of workstation platforms.
<b>SunOS</b>	A version of the UNIX operating system developed and used by Sun Microsystems.
<b>T1</b>	A digital WAN leased-line service standard that is provided by your local telephone service provider and available throughout most of the world. T1 has a data rate of 1.544 Mbps.
<b>T3</b>	A digital WAN leased-line service standard that is provided by your local telephone service provider and available throughout most of the world. T3 has a data rate of 44.736 Mbps.
<b>TCP/IP</b>	Transmission Control Protocol/Internet Protocol. A suite of protocols accepted as the standard for all Internet activity.
<b>terminal access</b>	Generally, to obtain data through a device used to input programs and data into a computer and to receive output from the computer.
<b>token ring</b>	The name of a proprietary IBM network architecture. It also describes a class of networks that share a similar ring shaped topology. In token ring networks, the cable literally forms a ring connecting the client devices. FDDI uses a token ring topology.
<b>transmission medium</b>	The cable or other physical circuit that interconnects systems in a network.
<b>transparent file access</b>	A term describing a process that is not visible to the user. For example, the details of how a file is stored on tracts and sectors are transparent to the user.

<b>UNIX</b>	A popular operating system that was very important in the development of the Internet and led the way in creating an “open” system environment (i.e., the specifications for creating interfaces and software to use on the UNIX system are publicly available). There are various varieties of UNIX. Two common ones are BSD and System V. Most computer companies have their own variety of the UNIX operating system.
<b>URL</b>	Uniform Resource Locator (previously “Universal”). A draft standard for specifying an object on the Internet, such as a file or newsgroup. URLs are used extensively on the World Wide Web. They are used in HTML documents to specify the target of a hyperlink.
<b>video</b>	As defined for the Model Nets study, video is real-time, full-motion video transmission.
<b>video conferencing</b>	The ability to connect several sites together with image and voice transmission.
<b>VMS</b>	The operating system developed by Digital for the VAX family of computers.
<b>voice</b>	As defined for the Model Nets study, voice is real-time telephone transmission.
<b>WAIS</b>	Wide area information server. A powerful system for looking up information in databases (or libraries) across the Internet.
<b>WAN</b>	Wide area network. A WAN is a computer communications network used by multiple entities (for example, the schools within a school district) at geographically separate locations (and over longer distances than a LAN), which permits users to share information and resources. For the purposes of the Model Nets study, WAN was further defined as a network that was owned or managed entirely by a school district or site, thus distinguishing it from a LAN with Internet access (see Internet, LAN).
<b>Windows</b>	A window system and user interface software released by Microsoft in 1985 that provides a point-and-click graphical user interface on top of the MS-DOS operating system.
<b>WWW</b>	World Wide Web. An international, Internet-based network of hypertext documents, which are often called “home pages” or “Web sites.” Home pages can include text, graphics, sound, video, and other multimedia objects. Home pages provide links to other home pages or other information sources, such as e-mail, FTP, gopher, or telnet. WWW also comprises a set of protocols (including HTML) and Internet services supporting the exchange of data. WWW home pages can be created and used on a single workstation, a LAN, or a WAN, in addition to the Internet (see HTML, Internet).
<b>Workstation</b>	A general-purpose computer designed to be used by one person at a time and offering higher performance than normally found in a personal computer, especially with respect to graphics, processing power, and the ability to carry out several tasks at the same time.



# Appendix C

## LINKS

This section provides links and addresses to Internet sites with further information about planning, curriculum integration of computer networks, and education. Each site is listed by a brief title phrase and followed with the URL (Uniform Resource Locator).

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### SITES FOR ACCEPTABLE USE POLICIES

Acceptable Use Policies: <<http://riceinfo.rice.edu/armadillo/acceptable.html>>  
Controlling Access to the Internet: <<http://dis.strath.ac.uk/people/paul/Control.html>>  
FAIR USE GUIDELINES FOR EDUCATIONAL MULTIMEDIA:  
<<http://www.lib.virginia.edu/dmmc/Copyright/fairuse.html>>  
Global SchoolNet Articles: <<http://www.gsn.org/gsn/articles/index.html>>  
Guidelines for Developing Acceptable Use Policies:  
<<http://www.gsn.org/web/tutorial/issues/aupguide.htm#begin>>  
Guidelines for Educational Uses of Networks:  
<<http://www.ed.uiuc.edu/Guidelines/guidelines.html>>  
ICLU - Your Rights in Cyberspace: <<http://www.law.indiana.edu/law/iclu.html>>  
INTELLECTUAL FREEDOM AND CENSORSHIP OF THE INTERNET:  
<<http://www.freenet.tlh.fl.us/infreedom.html>>  
Internet Parental Control FAQ: <<http://www.vtw.org/ipcfaq>>  
K-12 Acceptable Use Policies: <<http://www.erhwon.com/k12aup/>>  
NetPolitics  
<<http://pathfinder.com/@@8PI9JAYAmU3u81rd/technology/netdecency/index.html>>  
Parental Control of the Internet:  
<<http://www.worldvillage.com/wv/school/html/control.htm>>  
Sample Acceptable Use Policies:  
<<http://www.gsn.org/web/tutorial/issues/aupsampl.htm#begin>>  
Society & Culture: Censorship and the Net: Communications Decency Act:  
<[http://www.yahoo.com/Society\\_and\\_Culture/Civil\\_Rights/Censorship/Censorship\\_and\\_the\\_Net/Communications\\_Decency\\_Act/](http://www.yahoo.com/Society_and_Culture/Civil_Rights/Censorship/Censorship_and_the_Net/Communications_Decency_Act/)>  
TRC's Teacher Toolbox: Acceptable Use Policies: <<http://www.trc.org/aup.htm>>

### SITES FOR EDUCATIONAL ARTICLES

10/2/96 - Technology Summit Makes School-College Connection:  
<<http://www.edweek.org/ew/vol-16/05tech.h16>>  
10/23/96 - On-Line Access Appears To Benefit Student Projects, Study Finds:  
<<http://www.edweek.org/ew/vol-16/08online.h16>>  
10/23/96 - Technology Update: A Host of Challenging Web Sites Combine Surfing With Learning:  
<<http://www.edweek.org/ew/vol-16/08tech.h16>>  
10/9/96 - Techno-Reformers and Classroom Teachers:  
<<http://www.edweek.org/ew/vol-16/06cuban.h16>>  
5/10/95 - Connecting Technology: <<http://www.edweek.org/ew/vol-14/33connec.h14>>

9/25/96 - New Web Site Seeks To Help Parents Make the Home-School Connection:  
 <<http://www.edweek.org/ew/vol-16/04tech.h16>>  
 9/25/96 - Universal Truths: Technology in Education:  
 <<http://www.edweek.org/ew/vol-16/04marsh.h16>>  
 9/25/96 - Working The Web: <<http://www.edweek.org/ew/vol-16/04online.h16>>  
 Access Is Not Enough, The American Prospect: <<http://epn.org/prospect/27/27resn.html>>  
 Education Summit: Briefing Book:  
 <<http://www.summit96.ibm.com/brief/papers/transit.html>>  
 Education Week Issues Page: The Internet:  
 <<http://www.edweek.org/context/topics/internet.htm>>  
 EW's Best of the Web: Educational Technology:  
 <<http://www.edweek.org/context/hotlist/edtech.htm>>  
 Paul Starr, Computing Our Way to Educational Reform, The American Prospect:  
 <<http://epn.org/prospect/27/27star.html>>  
 Global SchoolNet Articles: <<http://www.gsn.org/gsn/articles/index.html>>  
 Global SchoolNet Foundation Alphabetical Index:  
 <<http://www.gsn.org/gsn/alpha.index.html>>  
 Newsweek's Parent's Guide to Children's Software:  
 <<http://www.NewsweekParentsGuide.com/>>  
 THE ROAD AHEAD IN AMERICA'S SCHOOLS: <<http://www.nfie.org/rasites.htm>>  
 Electronic School: <<http://www.access.digex.net/~nsbamags/e-school.html>>  
 Electronic School archive - Elec Magazine:  
 <<http://www.access.digex.net/~nsbamags/archive.html>>

## **SITES FOR ASSOCIATIONS AND ORGANIZATIONS**

The ASCD Web: <<http://www.ascd.org/index.html>>  
 U.S. Department of Education: <<http://www.ed.gov/>>

## **SITES FOR EDUCATIONAL TECHNOLOGY**

A SIMPLE MAIL AND NEWS SERVER: <<http://www.gsn.org/ednet/intacs2.html>>  
 About ISTE: <<http://isteonline.uoregon.edu/>>  
 ACOT Reports: <<http://www.atg.apple.com/acot/index.html>>  
 Apple Education Servers and Networks Homepage: <<http://www.ednet.apple.com/>>  
 ATIIN Home: <<http://www.atiin.com/>>  
 Charm Net Personal IP Page - Connectivity: <<http://www.charm.net/pip.html>>  
 Computer Curriculum Corporation: <<http://www.cccnet.com/>>  
 CoSN Home Page: <<http://www.cosn.org/>>  
 December, 1995: <<http://www.pacificrim.net/~mckenzie/fnodec95.html>>  
 Did anybody Learn?: <<http://www.pacificrim.net/~mckenzie/dec95/simpletext.html>>  
 Education Applications of the NII: <<http://nii.nist.gov/educ.html>>  
 Educational Internet Resources: <<http://www.hub.terc.edu/edresources.html>>  
 Educational Technology: <<http://www.fwl.org/edtech/welcome.html>>  
 Edutech's Education Servers List: <<http://www.cc.gatech.edu/cogsci/edutech/sites.html>>  
 EdWebEd-Tech Reform Info: <<http://k12.cnidr.org:90/>>  
 Excite Reviews: Computing FAQs:  
 <<http://www.excite.com/Reviews/Computing/FAQs/index.html?CCt>>  
 Global SchoolNet Foundation Home Page: <<http://www.gsn.org/>>  
 hercoir.htm: <<http://www.cts.com/~netsales/herc/hercoir.htm>>  
 Home Education Resources Center (HERC): <<http://www.cts.com/~netsales/herc/>>  
 Apple Internet Server Solution for the World Wide Web:  
 <<http://www.solutions.apple.com/aiss-faq/>>  
 InterKnowledge Index: <<http://www.interknowledge.com/index.html>>

International Schools CyberFair 96: Index: <<http://gsn.org/gsn/alpha.html>>  
 Internet Links: <<http://ladb.unm.edu/www/retanet/links.html>>  
 ITS - Integrating Technology Schools: <<http://www.unm.edu/~jeffryes/its1.html>>  
 Kickstart home page: <<http://www.benton.org/KickStart/>>  
 LabNet Home Page: <<http://labnet.terc.edu/labnet/labnet.html>>  
 MAIN PAGE: Harnessing the Power of the Web:  
 <<http://www.gsn.org/web/tutorial/index.htm>>  
 McKinsey Report: <<http://cavern.uark.edu/mckinsey/>>  
 National Center for Technology Planning:  
 <<http://www2.msstate.edu/~lsa1/nctp/index.html>>  
 NETSCHOOL: <<http://www.netschool.com/>>  
 Network How-To: <<http://www.access.digex.net/~nsbamags/0396f3.html>>  
 New Tools for Teaching: J.J. O'Donnell:  
 <<http://ccat.sas.upenn.edu/jod/teachdemo/teachdemo.html>>  
 OPEN LEARNING TECHNOLOGY CORPORATION LIMITED:  
 <<http://www.oltc.edu.au/>>  
 Related Topics & Sites: <<http://www.fwl.org/edtech/edtech.html>>  
 Retanet Home Page: <<http://ladb.unm.edu/www/retanet/>>  
 Sherry Turkle: <<http://www.mit.edu:8001/people/sturkle/Turkle-HomePage.html>>  
 SyllabusWeb: <<http://www.syllabus.com/>>  
 Table Of Contents: <<http://www.cvu.cssd.k12.vt.us/k12tech/toc.htm>>  
 Teaching with Electronic Technology: <<http://www.wam.umd.edu/~mlhall/teaching.html>>  
 Tech Corps -- New Mexico: <[http://www.nm.org/techcorps\\_nm/tc.html](http://www.nm.org/techcorps_nm/tc.html)>  
 Tech Corps home page: <<http://www.ustc.org/>>  
 Technology Curriculum and Projects:  
 <<http://hub.terc.edu:70/1/hub/technology/curriculum>>  
 Technology Planning: <<http://www.fwl.org/edtech/techplan.html>>  
 Technology Planning Institute:  
 <<http://www.etc.bc.ca/provdocs/disttech/institute.html#p01>>  
 Technology Related Articles, Papers and Reports:  
 <<http://hub.terc.edu:70/1/hub/technology/articles>>  
 Telecommunications for Reflective Discourse:  
 <<http://hub.terc.edu/terc/LabNet/Articles/Reflective/reflective.html>>  
 TERC: <<http://hub.terc.edu:70/hub/owner/TERC>>  
 The Costs and Effectiveness of Educational Technology:  
 <<http://www.ed.gov/Technology/Plan/RAND/Costs/>>  
 The Hub: <<http://hub.terc.edu/>>  
 The Internet Educational Resources Guide:  
 <[http://www.dcs.aber.ac.uk/~jjw0/index\\_ht.html](http://www.dcs.aber.ac.uk/~jjw0/index_ht.html)>  
 The Kids on the Web: <<http://www.zen.org/~brendan/kids.html>>  
 Turn of the Century: <<http://www.valdosta.peachnet.edu/~markswif/rsch.html>>  
 US Department of Education Technology Initiatives: <<http://www.ed.gov/Technology/>>  
 Virtual High: <<http://bc-education.botany.ubc.ca/VH/WT.html>>  
 Welcome to Education Station!: <<http://www.sqc.net/>>  
 Welcome to the BC Ministry of Education, Skills and Training:  
 <<http://www.stl.gov.bc.ca/>>  
 Welcome to the Software Publishers Association:  
 <<http://www.spa.org/>>  
 zine.html: <<http://www.fwl.org/edtech/zine.html>>

## **SITES FOR EDUCATION LINKS**

SSEN: THE MAD SCIENTIST NETWORK: <<http://128.252.223.239/~yssp/MSN/>>  
 Maryland Virtual High School Main Page: <<http://mvhs1.mbhs.edu/mvhs.html>>

EDInfo Archive by date: <<http://www.ed.gov/MailingLists/EDInfo/index.html#179>>  
EdLinks from a principal: <<http://webpages.marshall.edu/~jmullens/edlinks.html>>  
Education Hot Links: <<http://www.nsba.org/itte/hotlinks.html>>  
I\*EARN: <<http://www.igc.apc.org/iearn/>>  
JASON Project: <<http://www.jasonproject.org/>>  
Natl Academy of Science page: <<http://www.nas.edu/>>  
New Jersey Online's Yucky Site: Worm World: <<http://www.nj.com/yucky/worm/>>  
Remote Educational WWWeb Sites: <<http://www.gsn.org/gsn/gsn/k12links.html>>  
21st Century Teachers: <<http://www.21ct.org/>>  
David Bower's Educational Marketplace Home Page:  
<<http://www.io.org/~dbower/phpl.cgi?Home.html>>  
Eisenhower National Clearinghouse: <<http://www.enc.org/>>  
Internet for Minnesota Schools: <<http://informns.k12.mn.us/>>  
K-12 Sources - Curriculum - Lesson Plans: <<http://execpc.com/~dboals/k-12.html>>  
TEACHERS HELPING TEACHERS: <<http://www.pacificnet.net/~mandel/>>  
Teachnet-ToolsforTeachers-Online: <<http://www.teachnet.com/>>  
TEAMS Distance Learning... for K12 Educators: <<http://teams.lacoe.edu/>>  
The FAMILY MATH Home Page: <<http://theory.lcs.mit.edu/~emjordan/famMath.html>>  
The Learning Resource Server: <<http://www.ed.uiuc.edu/>>  
TRC's Educational Bookmarks: <<http://www.trc.org/bookmark.htm>>

## **SITES FOR GRANTS INFO**

GrantsWeb WWW HomePage: <<http://infoserv.rttonet.psu.edu/gweb.htm>>  
TRC's Teacher Tool Box: Grants & Grant Writing: <<http://www.trc.org/grants.htm>>  
Yahoo! - Education:Grants: <<http://www.yahoo.com/Education/Grants>>

## **SCHOOL WEB PAGES**

Albuquerque Public Schools Home Page: <<http://www.aps.edu/aps/INDEX.HTML>>  
Hillside Elementary School: <<http://hillside.coled.umn.edu/>>  
Los Alamos Middle School: <<http://lams.losalamos.k12.nm.us/>>  
Santa Fe Community College: <<http://www.santafe.cc.fl.us/>>  
Schools on the Web: <<http://lams.lams.losalamos.k12.nm.us/school.html>>  
The University of New Mexico Home Page: <<http://www.unm.edu/>>  
Web66: International WWW School Registry: <<http://web66.coled.umn.edu/schools.html>>

## **MATH AND SCIENCE ED SITES**

Los Alamos National Laboratory Science Education Resources:  
<<http://education.lanl.gov/resources/>>  
Critical Issues Forum project: <<http://education.lanl.gov/resources/cif>>  
AIMS Education Foundation: <<http://204.161.33.100/>>  
SCIENCE FAIR RESEARCH: <<http://spacelink.msfc.nasa.gov/html/scifairt.html>>  
AAAS Home Page: <<http://www.aaas.org/>>  
AAAS Project 2061: <<http://www.aaas.org/project2061/2061main.htm>>  
Famous Physicists and Astronomers: <<http://www.phy.hr/~dpaar/fizicari/allindex.html>>  
CELLS alive!: <<http://www.comet.net/quill/>>  
Exploratorium Home Page: <<http://www.exploratorium.edu/>>  
Habitat Ecology Home Page: <<http://biome.bio.dfo.ca/>>  
History of Astronomy: <[http://fits.cv.nrao.edu/www/yp\\_history.html](http://fits.cv.nrao.edu/www/yp_history.html)>  
Journey North: <<http://www.ties.k12.mn.us/~jnorth/>>  
NSTA Home Page: <<http://www.nsta.org/>>  
Physics for Poets: <<http://www.voicenet.com/~broderic/write/physics.html>>

Possibilities in Science: <<http://kendaco.telebyte.com:80/billband/Possibilities.html>>  
Welcome to ERIC National Clearinghouse: <<http://gopher.ericse.ohio-state.edu/>>

### **STAFF DEVELOPMENT SITES**

Issues Page: Professional Development:

<<http://www.edweek.org/context/topics/profdev.htm>>

RAND Report: Teacher Training:

<<http://www.ed.gov/Technology/Plan/RAND/Teacher.html>>



# Appendix D

## NETWORK SERVICES

During the Model Nets study, we found districts effectively using various network services. In this appendix, we describe network services that districts in our study find have found useful, and that should be considered when a district plans its technical infrastructure. The districts can either access these services as a “client” or provide them as a “server.” To access or provide these services effectively, the district must consider a few factors: bandwidth; the demand for service over the network, which is generally proportional to the number of users; and the hardware and software platforms that will carry the services. For a service to be viable at a given bandwidth, system response time must be acceptable to the average user. Some services are possible at a given bandwidth, but the performance would be unacceptable. Detailed considerations about the network platform are dependent upon more variables than we can discuss here, such as the particular needs of an individual district. We strongly encourage you to consult and actively involve an expert as you plan your network.

---

The following services are discussed:

### **Communication**

- E-mail
- Mailing Lists
- Network News Groups
- Chats
- Audio/Video Conferencing

### **Resource Discovery**

- WWW & Gopher
- FTP
- BBS
- Database access
- Other

### **Security**

- Firewalls
- Routers
- Authentication

### **Resource Sharing**

- File sharing
  - FTP
- Transparent File access
  - NFS
  - AppleShareAppleshare
- Printer sharing
- Terminal access

### **Providing Your Own Services**

- Communications
- Resource Discovery
  - WWW and Gopher
  - FTP
  - File Servers
- Domain Name Server (DNS)

For definitions of these services, see Appendix B.

# Analyzing Your Network Requirements

The following principles will help you analyze your requirements for technical infrastructure and bandwidth:

- Network performance is a function of the level of demand for service and bandwidth. The more data a network transfers, the more bandwidth is required to provide adequate service.
- Serving multiple users requires more bandwidth than serving a single user; the required bandwidth generally increases as the demand on services increases.
- Demand for network services is proportional to the number of network users.
- Transferring multimedia data requires greater bandwidth than transferring simple text data.
- Clients perform one function with one server at a time, while servers (that is, providers) perform many functions simultaneously for multiple clients.

## Communication

The Model Nets Study found that the most common use of the network is for communication, and the most commonly used communication service is e-mail. You will need to consider communication services carefully as you plan for your network services. E-mail is the most basic and essential service, with mailing lists, network news groups, chats, and audio and video conferencing as the next steps. Each service offers more capabilities, as well as more potential problems.

### E-mail

E-mail is one of the most widespread services that we found on networks in Model Nets districts. Currently, the most effective e-mail systems are those that allow people to exchange e-mail with others who are on either the same or different e-mail systems. Because e-mail is generally simple text, it can be used even over low bandwidth connections. More sophisticated e-mail systems allow multimedia data or other files to be attached to the message, thus increasing the minimum bandwidth required for acceptable service. E-mail tends to be most successful when a large community of users relies on it for communication.

The basic service is the e-mail system itself. Effective e-mail systems will allow the exchange of e-mail with different e-mail systems using international industry standards. The basic electronic mail protocol for the Internet is the simple mail transfer protocol (SMTP). This allows for the exchange of e-mail between Internet mail servers. One extension to the basic e-mail service between networks is a post office protocol (POP) server. A POP server allows someone on a personal computer to obtain mail from an SMTP mail server easily. POP servers do not require the computer to be constantly available to receive e-mail. POP also supports friendlier user interfaces on personal computers for reading e-mail.

Multipurpose Internet Mail Extension (MIME) is another extension to the basic Internet e-mail service. MIME is a standard for multimedia e-mail over the Internet and allows the user to include or attach multimedia data to an e-mail message.

## **Mailing Lists**

Mailing lists are used to communicate with a large number of users quickly and easily. A mailing list allows you to specify one e-mail address for the members of a group, rather than having to specify a large number of individual e-mail addresses. The one address that you specify is called a mail alias; most e-mail systems can provide this alias capability. Maintaining e-mail aliases can be a major task for the system administrator.

When the number of mailing lists grows, then you need to use a mailing list management program. These programs allow you to create lists that can be managed by individuals other than the system administrator. These lists allow users to add or delete themselves from the list without involving a system administrator, reducing the system administrator's workload tremendously.

One of the most common uses of mailing lists is to bring together a group of people with a common interest. This allows information to be shared with the group, and individuals can participate on their own schedules.

ListServ and Majordomo are widely used mailing list processing programs.

## **Network News Groups**

Network news groups also let people with shared interests communicate about a particular subject area. News group services are powerful tools for districts and their local communities to use to discuss topics of interest. The news group mechanism differs from an e-mail mailing list in that people must query the news group server for the specific group each time they want to receive information from that group. The information shared through news groups and e-mail mailing lists is usually simple text, making news groups useable over low-bandwidth connections. News groups allow users to participate on their own schedule and, because the messages are sent to and retrieved from a central repository, the messages do not overburden the electronic mailboxes of users. The most effective use of a news group is determined by the size and interests of the group.

## **Chats**

Chats allow people to type messages to each other in real time over the network. They can be used by two people on the network, or by a group of people who enter a "chat room." Chat rooms are very popular with users of many of the on-line services.

Problems can arise when chat rooms are used in the education environment. You must be sure that you know the persons that are participating in the chat. Much negative news coverage related to the Internet involves individuals who use chat rooms to lure children into inappropriate conversations and activities.

## **Audio/Video Conferencing**

Audio and video conferencing takes the concept of real-time communication another step. Individuals or groups can participate in on-line conferences over the network. These on-line conferences are similar to the typical telephone or video conference call. Computer networks can provide conference services ranging from multi-user, text-based systems to very demanding video teleconferencing systems with features that allow collaboration among people over long distances. The system determines the bandwidth requirements; servers, in general, require significantly more bandwidth than clients. Common conferencing applications include IRCs, MUDs, and CU-SeeMe (see Appendix B).

# Resource Discovery

Probably the fastest growth in the use of the Internet is resource discovery using public information servers such as the World Wide Web. Others include Gopher, anonymous FTP, and WAIS. Bandwidth requirements for these services are functions of the type of service and also the role (i.e., whether client or server). Services that provide multimedia data will require more bandwidth than those that provide only simple text. In general, servers require more bandwidth than clients require because servers handle multiple simultaneous requests.

## WWW & Gopher

The World Wide Web (WWW) has fueled the rapid growth of the Internet over the past few years. The WWW is an integrated multimedia information-sharing mechanism that provides access to vast amounts of information across the world using a common protocol called the Hypertext Transfer Protocol (HTTP). You do not need an account to browse WWW information; you need only establish a connection to a remote system for the time it takes to transfer the data.

Gopher is a older system, similar to the WWW but primarily text-based. Gopher systems are rapidly being replaced by WWW servers.

## FTP

One of the very first network services available in the early days of the Internet was file transfer between different computers. This file transfer was called FTP (file transfer protocol) and is still one of the most heavily used services on the network. FTP requires you to have an account on both systems before you can transfer files. Because it was not practical to give everyone on the Internet an account on any private system, organizations began the practice of creating an “anonymous” user. This is called “anonymous FTP” service. With anonymous FTP, users log into the remote system with the user name “anonymous” and give their e-mail address as their password. This allows the general Internet user to access files on one particular system without having an account on that system. You must take care to restrict access of the anonymous user to only those files that you want to be available.

## BBS

Bulletin Board Servers (BBS) are another way to share information among a group of people. Users must log into the BBS system to participate. BBS systems may provide e-mail and other information services similar to a network newsgroup.

## Database Access

Collecting and organizing data using a database system is an effective way to manage large amounts of information. Most database systems now allow for access to the database over the network. In many cases, you must have an account, and you log onto the database server to access information. Access to the database through a WWW interface is becoming common. You must be aware of the security of the information stored and who has access to that information.

## New Services

New resource discovery tools and techniques are rapidly becoming available over the Internet or your local LAN. Each new service is trying to fill a niche in the constant demand for information.

# Security

The Model Nets Study found that the educational organizations were often less concerned about the security of their systems and data than they should be. School districts were just becoming aware of the many problems that can be introduced by access to the Internet and networks in general. As more students become dependent on the Internet for gathering information, security will become increasingly important. You should carefully consider your security needs during the planning process to make the process of securing your data and systems easier. We discuss several tools for making your network more secure. Again, this is an area that requires detailed technical knowledge; therefore, we highly recommend using an expert in computer network security.

## Firewalls

Firewall servers can control access to your WAN from the Internet. They can isolate any user's access to only certain systems on your network. They can also deny access to portions of the Internet that you deem inappropriate to access. The configuration of a firewall is a highly technical task, and you should involve an expert in this process.

## Routers

Routers are an integral part of any network. They provide some isolation of pieces of the network (subnets) from one another. They also route messages to other network pieces or to the Internet. Breaking your WAN into pieces can help prevent problems from one piece of the network from causing trouble across the entire network. Again, the configuration of a router is a highly technical task, and you should involve an expert in this process.

## Authentication

Knowing your users is extremely important in maintaining a secure network. Each system and service must maintain a list of authorized users. As the number of different systems and services grows, this can become a very large job. Authentication also distributes the security concern to each system that maintains a list of authorized users. Maintaining a central authentication server can help to reduce the size of this task and allow you to focus your efforts on the security of the authentication system.

# Resource Sharing

One of the principle reasons for using a network is to share resources. Printers, files, and computing resources are the most common services that you will share. This allows an organization to use its resources to their full potential.

## File Sharing

File sharing is one of the most common services among network computer users. This service falls into two broad categories: simple explicit file transfers, and the more demanding full access of a file system over the network. Each type of service is a set of protocols that will run on top of a number of different network media and will place its own set of requirements on the network.

The basic file service allows users to transfer files between networked computers. This type of service began with the earliest connections of computers over modems. Kermit, Xmodem, and

other file transfer schemes provided a method for simple file transfers. The best example of this type of service over a real network is FTP. FTP allows a registered user with accounts on two networked computer systems to transfer files between those systems. The public can access files on a system by using the special user name “anonymous.” This service, called anonymous FTP, is fraught with many potential security problems and must be configured carefully to avoid a security breaches. The bandwidth requirements for an FTP client or server may be quite low if the transfers are few and the files are small.

The more sophisticated file services allow a network computer to mount a remote file system on a local computer. Once mounted, the files in the remote file system may be accessed in the same way as a local file on the local computer. The bandwidth required for this type of file service is usually higher than that required for a simple file transfer using FTP, and is a function of the demand for service. For these connections to be viable, they must be responsive to file requests. These types of file servers provide mechanisms for accessing only a portion of a file, thereby reducing the amount of data transferred. NFS, AppleShare, Novell, and Windows for Workgroups are examples of products that provide this type of network file service.

### **Printer Sharing**

A printer is probably the easiest resource to share on a network. Many new printers come with a network option that allows the printer to be shared across the many different computing platforms on your network. This is a case where you can provide more capability and higher quality by using a network printing solution than by buying individual printers for each system. A typical computer lab usually requires only one or two printers.

### **Terminal Access**

Terminal connections allow the user to connect a terminal over a network to a remote computer. The basic Internet terminal connection is telnet. Using telnet, the user of a terminal on a local system can connect to another system across the network and appear to have a direct terminal connection.

Often, the terminal is actually a personal computer running software that emulates a particular type of terminal with a direct connection. On the server side, providing terminal services simplifies the method of connection between a terminal, emulated or real, and the system.

Terminal connections are most often used for connections to bulletin boards, servers, and so-called legacy systems, which typically run on large mainframe computers and require a terminal connection. These terminal connections are all text-based and support graphics only if they emulate a now-antiquated graphics terminal. They do not support multimedia data, except as simple file transfers from the mainframe server to the client system over the terminal connection. Because of the text-based nature of the connection, the bandwidth requirement is low for both the client and the server. The bandwidth demand will increase on the server side if a large number of simultaneous connections are being supported.

## **Providing Your Own Services**

Each of the services outlined previously can be provided by your Internet Service Provider (ISP), or your district can provide them locally. The level of effort and expertise required to provide many of these services is proportional to the number of users and systems that will rely on the service. The advantage of local servers is that you have local control and access to that service.

Before you start to provide your own services, you must ensure that you have the necessary support and expertise in place. Once you start providing these network services, you will find that many will become indispensable and must be kept running at all times. Support will be required immediately when problems occur.

## **Communication**

E-mail server systems are fairly common and are a good place to start to provide your own services. Mailing list processing services are a little more complicated, but can reap huge benefits if you have to manage a large number of mailing lists. Chat servers and video/audio teleconferencing servers are also available and fairly easy to set up.

## **Resource Discovery**

WWW, Gopher, and FTP servers are fairly easy to set up. WWW and FTP are very useful services to provide if you have information that you want to share. Security is not a large potential problem with these services unless the servers also contain sensitive data that you do not want to be accessed. These cases will require the careful analysis of the security threats and defense mechanisms to ensure the integrity of your data.

## **Domain Name Services**

A name service is critical to every network and must always be available. The domain name system (DNS) is the name service for the Internet. Every computer on the Internet (or using Internet protocols) has a unique address consisting of a dotted octet (xxx.xxx.xxx.xxx) IP address. Every computer should also have a unique name. These names are of the form systemname.domain, where there may be several qualifying domains (e.g., lahs.losalamos.k12.nm.us). In fact, it is possible to have several names for each address. The mapping between names and addresses is a function provided by the Internet's DNS.

As a client, every Internet computer accesses a DNS server to perform this translation between names and addresses. The bandwidth requirement for these small requests is low, yet the service is critical to the proper function of the network. In many cases, the DNS system is provided by the Internet service provider. Running a DNS service locally provides more control over the allocation of addresses and the naming (and renaming) of those addresses within your domain. This is especially useful if systems are being moved, added, or removed from the network and rapid updates to the DNS are required. The bandwidth requirement for a given server is driven by the number of requests and the need to query other servers for names and addresses not contained on the server.



# Appendix E

## WORKING WITH VENDORS

The Microsoft slogan,

*"Where do you want to go today?"*

translated into Japanese means:

*"If you do not know where you want to go, we will make sure you get taken."*

Sometimes it seems that the translated version of this famous slogan is the reality when you work with vendors. It is important to remember that vendors want to sell you what they have, NOT necessarily what will be best for you or even what will work. Not all vendors have such a callous attitude, and you should value those vendors who look out for your best interests and help you identify services you need. But please beware that you must always be on your guard.

Working with technology means that you will have to work with vendors to cover your many different needs. These needs can range from a purchase of a simple cable to very large and complex projects like contracting to build a WAN or LAN. For every project, no matter how large or how small, you must take the appropriate steps to ensure you purchase the appropriate equipment and services at the best price.

We have identified some simple steps that can help you navigate the process of making purchases from vendors. Reviewing these steps will help you focus on the critical issues and provide some strategies for getting what you need from your vendors. Please note that you may need to go through several of these steps a number of times before you can proceed to a following step.

- Step 1: Know what you want to do
- Step 2: Document your needs
- Step 3: Seek advice
- Step 4: Understand your buying process
- Step 5: Qualify your sources and vendors

and

The Purchase Process

## **Step 1: Know what you want to do**

The key to working with technology is to know your requirements and to be able describe them fully. You need to specify what services are absolutely necessary, what services are beneficial but not crucial, and what services are definitely not necessary or desirable. Keep an open mind for new options and opportunities, so you can do your best to keep up with new developments as they occur.

Some people feel quite strongly about certain technology issues. For example, devoted Macintosh users are often extremely reluctant to learn to use a PC (and vice versa), and people are often loyal to the software program that they know the best, to the exclusion of all others. Keep in mind that people have certain prejudices, but don't allow unreasonable prejudices to cloud your decisions.

## **Step 2: Document your needs**

The process of documentation will begin informally as you are gathering information and clarifying your needs. The functional specification of Phase 4 will be important to this step. Include as much detail as you can to ensure clear communication between you and the vendor.

As you get closer to a formal bidding process, the documentation must also become more formal. This document will become the "request for proposal," and later, the document will detail the important deliverables in the contract for the work.

Many school districts or states provide standard formats or templates for documents such as requests for proposals. Use these templates as a starting point, because they will include most of the standard requirements and will be fairly complete. You will need to specify your requirements and any specific changes to the terms and conditions for the activity.

You must prioritize your needs and use those priorities to build a scoring matrix for the responses that you expect to receive. Make sure that you identify the following items:

- 1) Those items that you absolutely require.
- 2) Those items that would add benefit.
- 3) Those items that may be ignored.
- 4) Those items that you absolutely do not want.

To build a scoring matrix, prioritize the items described above and place a weight or score for each item in the list. You will rank the response from each vendor using this matrix. It is important to anticipate possible responses as you create the matrix. This process helps to focus on the real issues and eliminate issues that are not important to the network that you envision.

## **Step 3: Seek advice**

Educate yourself on what tools and techniques will help you meet your requirements. Identify resources available to you. These might include some of the following:

- 1) Company product information on the WWW
- 2) Technical experts
- 3) Others who have similar requirements
- 4) Vendors with potential products to meet your requirements

As you work with these resources, be aware of any interests these individuals have that may conflict with your district's needs. For example, vendors are interested in selling you the product that they have. Technical experts, on the other hand, may be more familiar with a certain product and may not encourage you to explore other options. Get as many opinions as you can, being sure to gather different and independent sources. At this point, you need to be establishing good, long-term working relationships with these sources.

#### **Step 4: Understand your buying process**

Every organization has its own set of policies and procedures for buying equipment and services. You need to understand the options available to you. Some of the questions that you need to answer include the following:

- 1) Do you have to bid the equipment formally?
- 2) Are you restricted to only certain suppliers?
- 3) Do you qualify for education discounts?
- 4) Must you buy with General Services Administration pricing?
- 5) What are the dollar limits for certain purchases?
- 6) Can you lease or lease-to-purchase the item?

#### **Step 5: Qualify your sources and vendors**

This is an important step in the process. If your source of information is a vendor, then seek references from other customers of that vendor. Try to find customers via independent means; don't just talk to those referred to you by the vendor. Talk with these customers about their experiences, both good and bad. If appropriate, ask to come and see the quality of the work performed. This is especially important if you intend to have the vendor do similar work for you.

Find out how experienced the vendor is in the type of work you require. Ask the following questions:

- 1) What are the skills and expertise of this vendor?
- 2) Is this vendor new to this field?
- 3) Has the vendor worked with schools before?
- 4) Does the vendor understand your environment?

Make sure that the vendor has the appropriate permits and licenses to do the job.

### **The Purchase Process**

Now that you have done your homework, you are ready to place your purchase. For most items, this is simply placing your order with the vendor that you have chosen. With larger efforts, depending on your purchase process, you may choose to bid the order with several vendors. This can be a big effort and take a great deal of time, but if you have carefully done your homework and documented the process then it will be much easier. Remember: stay objective and document your steps and reasons for selecting a particular vendor.



# Appendix F

# WORKSHEETS



# Advisory Team Selection Worksheet

Use this worksheet to identify members for a technology planning team. Some categories have been provided, and there is room to add more items. Remember that team members should be individuals who support the use of technology and who are committed to the planning process.

Category	Name
Administrator:	
Business/Community Members:	
District/Building Technology Coordinator:	
Higher Education Faculty:	
Librarian:	
Parent:	
Partner:	
Representative from Teachers Union:	
School Board Member:	
Student(s):	
Teachers:	
Technical Consultant:	
Vendor:	

# Core Team Selection Worksheet

Use this worksheet to identify members for a core technology planning team. Some categories have been provided, and there is room to add more items. Remember that team members should be individuals who support the use of technology and who are committed to the planning process; all core team members should also be on the advisory team.

**Category**

**Name**

District/Building Technology Coordinator:	
Administrator:	
Teachers:	
Technology Consultant:	

# Vision Worksheet

Record your vision for networking on this sheet. Later you will incorporate it into your action plan.



# Worksheet

## Inventory of Current Network Infrastructure

Use these worksheets to document your current technical infrastructure. You will use this information later when you develop strategies, create a design specification, and write your action plan.

**Identify and describe each of your computer systems.**

**Location:** \_\_\_\_\_ **Manufacture/model:** \_\_\_\_\_

### Computer type(s):

- |                                                     |                                           |
|-----------------------------------------------------|-------------------------------------------|
| <input type="checkbox"/> PC (Intel processor based) | <input type="checkbox"/> Macintosh        |
| <input type="checkbox"/> 286 processor              | <input type="checkbox"/> 68K processor    |
| <input type="checkbox"/> 386 processor              | <input type="checkbox"/> PPC processor    |
| <input type="checkbox"/> 486 processor              | <input type="checkbox"/> Apple II         |
| <input type="checkbox"/> Pentium                    | <input type="checkbox"/> UNIX Workstation |
| <input type="checkbox"/> Pentium Pro                | <input type="checkbox"/> Other            |

### Memory Size

- |                                           |                                |
|-------------------------------------------|--------------------------------|
| <input type="checkbox"/> 4 megabytes (MB) | <input type="checkbox"/> 16MB  |
| <input type="checkbox"/> 8MB              | <input type="checkbox"/> 24MB+ |
| <input type="checkbox"/> 12MB             |                                |

### Operating System(s):

- |                                              |                                             |
|----------------------------------------------|---------------------------------------------|
| <input type="checkbox"/> MSDOS version _____ |                                             |
| <input type="checkbox"/> DOS version _____   |                                             |
| <input type="checkbox"/> Windows:            | <input type="checkbox"/> UNIX:              |
| <input type="checkbox"/> 3.1                 | <input type="checkbox"/> Linux              |
| <input type="checkbox"/> 95                  | <input type="checkbox"/> AUX                |
| <input type="checkbox"/> NT                  | <input type="checkbox"/> AIX                |
| <input type="checkbox"/> Other _____         | <input type="checkbox"/> Sun OS             |
| <input type="checkbox"/> Mac OS:             | <input type="checkbox"/> Solaris            |
| <input type="checkbox"/> 6.x                 | <input type="checkbox"/> Other              |
| <input type="checkbox"/> 7.1                 | <input type="checkbox"/> VMS: version _____ |
| <input type="checkbox"/> 7.5                 | <input type="checkbox"/> Other OS _____     |
| <input type="checkbox"/> Other _____         |                                             |

**Identify and describe each of your Local Area Networks (LANs).**

**Location:** \_\_\_\_\_

**Network Type**

- LAN classroom  LAN building

**Network Topology**

- Ethernet:
- thick (coax)
  - 10base2 (thin coax)
  - 10baseT (twisted pair)
  - 100baseT (twisted pair)
- AppleTalk:
- Phone-net
  - Localtalk
- Token Ring:
- FDDI:

**Network Operating System / Groupware:**

- Novell network: \_\_\_\_\_
- Microsoft: \_\_\_\_\_
- AppleShare: \_\_\_\_\_
- NFS
- Cross-system connectivity software: \_\_\_\_\_
- Other \_\_\_\_\_

**Local Area Network Bandwidth:**

- <100 kilobits per second (Kb/s)
- 100 Kb/s to 500 Kb/s
- 500 Kb/s to 3 megabits per second (Mb/s)
- 3 Mb/s to 10 Mb/s
- >10 Mb/s
- Other \_\_\_\_\_

**Network Services Servers:**

Mail system:

- SMTP/POP3
- Microsoft
- Other \_\_\_\_\_

Security

- Gateway
- Router
- Authentication

File servers

- Appleshare
- Novell
- NFS
- Other \_\_\_\_\_

Print Servers

- Transmission Control Protocol/Internet Protocol (TCP/IP)
- ApplePrint
- Novell

**Identify and describe each of your Wide Area Networks (WANs).**

**Connection types:**

- dial-up
- dedicated data lines
- frame relay
- integrated services digital network (ISDN)
- asynchronous transfer mode (ATM)

**Data rates:**

- 9.6 Kb/s
- 56 Kb/s
- 128 Kb/s (ISDN)
- 1.414 Mb/s (T1)
- 44 Mb/s (T3)
- Other \_\_\_\_\_

**Internet access?**

- Yes
- No

**Internet Service Provider** \_\_\_\_\_

**Bandwidth** \_\_\_\_\_

**Connection Type** \_\_\_\_\_



# Worksheet

## Inventory Current Sources of Technical Support

You will use this information to identify who can provide support or leadership for implementing specific tasks of the action plan. If they are not already members, consider adding one or two of these support people to your planning team.

Sources of Support	Type of Support
Teachers	
Students	
Consultants	
Vendors	
Others	



# Worksheet

## Inventory of Current Network-related Policies

Identify current district policies that are either productive or counter-productive to effective networking. You will use this information to identify areas of policy that need to be addressed by implementation strategies.

### Planning

---

#### Leadership

---

#### Acceptable use

---

#### Funding

---

#### Evaluation

---

#### Access to facilities

---

#### Barriers

---

#### Community involvement

---

#### Resources



# Worksheet

## Inventory of Current Network Uses

Document the current uses of networks in your district. You will use this information as you develop strategies for implementing the network. Your current uses may already support effective practices. Be sure to include descriptions of how the common network services are currently used.

**Network Services Used**

**Descriptions of Current Uses**



# **Worksheet**

## **Brainstorm Networking Strategies**

On this sheet, record your brainstormed strategies for your use of a computer network. As you develop these strategies, keep in mind:

- **your student outcomes**
- **the goals and strategies of your network strategic plan and technology plan**
- **the Model Nets guidelines for effective computer networks**
- **your inventories**
- **other research you have done into effective computer networking in schools.**



# Worksheet

## Tie Strategies to Network Services

Now, you will identify the network services you need to implement your strategies. This is the first step in developing the functional specification for your network. Be sure to involve a network consultant in this activity. You will need in-depth expertise to sort through the complex technical issues underpinning each network service.

Describe in detail how each of the following network services will be used to carry out each of your networking strategies. (Copy the worksheet for each strategy.) Record such information as who will need access to the service and how often; what kind of data the service will handle (text, multimedia, real-time video, or real-time voice); locations where the service must be available; and minimum desktop system requirements for users accessing the service. Skip any services not applicable to a strategy.

**Strategy #X:** (write your strategy here)

### Communication

- E-mail
- Mailing Lists
- News Groups
- Chats
- Video Conferencing

### Resource Discovery

- WWW & Gopher
- FTP
- BBS
- Database access
- other

### Resource Sharing

- File sharing
- Printer sharing
- Terminal access

### Providing your own network services

- Communication
- Resource Discovery
  - FTP server(s)
  - WWW or Gopher server(s)
  - Domain Name Servers (DNS)

### Security

- Firewall
- Router
- Authentication



## **Worksheet**

### **Finalize and Select Top Strategies**

On this sheet, record your finalized networking strategies and indicate the top few that you will implement through your action plan over the next couple years, then those that you will implement in later years. You will develop action steps only for the next year or two.

As you brainstorm each strategy, keep these criteria in mind.

---

**Strategy supports student outcomes**

**Strategy supports administrative and personal productivity goals**

**Who will use the network?**

**Which network services are required? For whom?**

**Can the strategy be adapted and applied to every grade level K–12? (If not, is there a good reason for targeting a particular segment of your student or staff population?)**

**Strategy supports constructivist learning**

**Strategy addresses gaps between effective practices and current state**

**Strategy is flexible for individual instructional uses**



## Staff Capabilities Worksheet

Identify staff members who have expertise or experience in the following areas:

	Name	Experience
Integrating computers or networked computers into the curriculum		
Hands-on, student-centered, discovery-based learning		
Computer networking		
Using computer software		
Computer operating systems		
Hardware maintenance and troubleshooting		
Training computer users		



## Action Planning Template

Reproduce the following form for all your networking strategies. Take as much space as you need to describe the evaluation, tasks, responsible party, available resources, etc. Customize this template to suit your needs. Remember, it's *your* plan!

<b>Networking Strategy:</b>				
<b>Evaluation:</b> (measurable outcomes)				
<b><i>Teaching &amp; Learning</i> Action Steps</b>	<b>Responsible Party</b>	<b>Completion Date</b>	<b>Cost</b>	<b>Available Resources</b>
1.				
2.				
3.				
4.				
<b><i>Policy</i> Action Steps</b>	<b>Responsible Party</b>	<b>Completion Date</b>	<b>Cost</b>	<b>Available Resources</b>
1.				
2.				
3.				
4.				
<b><i>Technical Infrastructure</i> Action Steps</b>	<b>Responsible Party</b>	<b>Completion Date</b>	<b>Cost</b>	<b>Available Resources</b>
1.				
2.				
3.				
4.				
<b><i>Staff Development</i> Action Steps</b>	<b>Responsible Party</b>	<b>Completion Date</b>	<b>Cost</b>	<b>Available Resources</b>
1.				
2.				
3.				



# Appendix G

## MASTER CHECK LIST

The following check list is provided to enable you to keep track of where you are in the planning process. As you begin each step, determine an approximate completion date. This will give you a target to shoot for as you and your planning team move through the planning process. As you complete each step, record the date completed and any notes that might be helpful as you begin to revisit and revise the plan.

## Master Check List

Task	Projected Completion Date	Date Completed
<b>Preliminary Thinking</b>		
1. Ask questions and inform yourself		
2. Determine the climate for supporting technology		
3. Form a compelling argument for technology planning		
<b>Planning Phases</b>		
<b>Phase 1: Organize the Planning Process</b>		
1. Obtain support from school board and/or district administration to begin the planning process		
2. Form planning team		
<ul style="list-style-type: none"> <li>• Establish criteria for selecting team members</li> <li>• Develop team member roles</li> </ul>		
3. Schedule team meetings		
<b>Phase 2: Background Review and Research</b>		
1. Collect existing district technology plans and vision statements		
2. Review Model Nets effective practices		
3. Become familiar with technology terminology		
4. Gain understanding of student outcomes		
5. Gain understanding of network services		
<b>Phase 3: Establish Purpose of Networking</b>		
1. Assign team tasks		
2. Develop a vision-use statement		
3. Determine scope and expectations for the planning project		
4. Become familiar with Model Nets effective practices		
5. Establish timelines and deliverables		
6. Inventory current uses		
7. Inventory current infrastructure		
8. Inventory current technology support sources		
9. Inventory current technology policies		

<b>Phase 4: Develop Network Strategies</b>	
1. Determine strategies for integration	
2. Determine strategies for technology policies	
3. Tie the finalized network strategies to the network services needed to implement them	
4. Develop a functional specification that describes the network infrastructure and services you need to achieve your desired future	
5. Finalize and select the top network strategies	

<b>Phase 5: Create Action Plan</b>	
1. Create activities that will allow you to implement your strategies, with specific assignments and timelines (see Action Planning Template, page 78)	
2. Review district context	
3. Identify partners and resources	
4. Revisit Model Nets effective practices	
5. Devise intensive staff development program	
6. Develop sources of technical support	
7. Compile supporting data	
8. Determine budget items	
9. Write Action Plan	

<b>Phase 6: Present Action Plan</b>	
1. Assemble presentation package to include the following:	
• expectations	
• documentation	
• timelines and budgets	
• integration strategies	
• staff development strategies	
• networking strategies	
2. Present plan to school board for approval	
3. Implement Action Plan	



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