Lesson 1: Network Planning

At a Glance



Possibly the most important job of a network administrator is the planning upgrading, or installing of a network. For a network to run efficiently with minimal downtime, it must be well planned. This lesson focuses on the characteristics of a well-planned network.

What You Will Learn

After completing this unit, you will be able to do the following:

- Explain what is involved in planning a network
- Describe project management, the role of a project manager, and explain how they relate to network planning
- List and describe the factors involved in planning a network
- Explain the importance of network management strategies
- List and describe several protocols related to the management of networks



Student Notes:

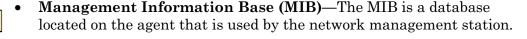


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Tech Talk

- **Agent**—The agent is the software component in a managed hardware device that sends network performance data to the network management station.
- ASN.1—Abstract Syntax Notation One provides a standard for writing clear and uniform definitions for each MIB object. Either a symbolic name or numeric identifier represents each object.
- **Community**—In SNMP, the community name is a password shared by the network management station and the agent.



- Managers—The software component on the network management station that issues requests to the agent. Receives notification of traps from the agent.
- **Network Management Station (NMS)**—The NMS is a workstation that can configure and monitor network devices, and receive network
- Project Manager—Individual who is assigned to oversee the entire project from beginning to end.
- Request for Comment (RFC)—A Request for Comment is a document submitted to the IETF for the purpose of reviewing, revising, and standardizing new Internet protocols. Numbers are assigned to each RFC for identification purposes.
- Simple Network Management Protocol (SNMP)—Protocol used with TCP/IP to control network devices.
- Structure of Management Information—Structure of Management Information defines how to name and organize objects in a MIB. SMI defines the tree structure for MIBs.
- **Trap**—Notification to the manager by the agent of an extraordinary event.
- User Data Protocol (UDP)—UDP is a connectionless transport method used to transmit messages between the NMS and the agent. UDP is a standard member of the TCP/IP protocol suite.

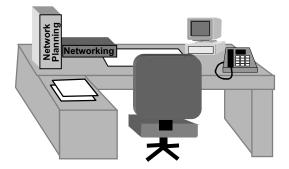


Introduction to Network Planning

The first step toward an efficient network is planning. The first step for any endeavor should be the planning stage. Experience teaches us, however, that many people just "jump in and do" rather than take the time to plan. As exciting as it may be to plunge ahead, it is critical that both time and effort are spent planning.

If you decide to go camping next weekend so you can go hiking, you don't just jump in the car and go. The trip must be planned. This involves making calls and asking questions. You plan where you are going to stay, determine what it costs, and make reservations. Since the purpose of your trip is to go hiking, you select hiking shoes, climbing gear, sleeping bags, and other camping paraphernalia. The equipment you bring fits the purpose of your trip. If the planning didn't take place, you might discover that your trip is a failure because you didn't have all the necessary equipment.

Network Planning





Planning a network is the same, and regardless of how much money a company is willing to spend, a network will only be successful if time and effort are spent during the planning phase of development. There are many factors involved when planning networks. Knowledge of computer software and hardware, networking equipment, protocols, communications media, and topology must be applied. An optimally designed network must meet the business requirements of each individual customer. It is important that you know why you are building a network, for whom you are building it and how it will be used.

Installing or upgrading a network is a major step for any organization. Where individual computers may have existed and files were shared using "sneakernet" a giant leap forward is being considered. When a network is needed, one of the primary concerns is the possibility of downtime and what it will cost in lost revenues. Imagine a network that controls information in an operating room: if you were the person on the operating table, how important would the network be? A well-planned network should run efficiently and have minimal downtime.

The steps in planning a network are much like the steps a scientist uses when solving problems. The first step of the scientific method is to state the problem. A network administrator must also state the problem first. For example, suppose a certain campus has LANs in four separate building, and they are not currently connected together. The problem is that the individuals in these buildings need to communicate with each other frequently. It has been decided that the individual LANs should be connected. A statement of the problem could be "how can I best connect the buildings." This requires gathering data about the campus, assessing the current resources, and determining the current and future needs of the campus.

Statistics must be gathered that:

- Describe the various daily activities
- List the number and type of computers
- Indicate the number of servers and clients
- Specify the number and type of networking devices
- Spell out predicted organizational expansion figures
- Indicate who on the network will be connected to the Internet
- Spell out the needs of remote users, if any
- Indicate the expected growth of the network

Records and documentation are a must at all stages of planning. Network administrators should keep a record of everything, including why they selected the topology, why they used one type of cable over another, why they chose the naming conventions, and why they chose the hardware and software. Warrantees and licenses for all purchases should be saved in one place.

Project Management

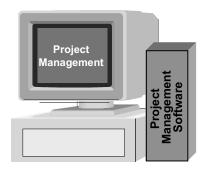
Before the actual planning begins, a networking project manager should be assigned to the job. A project manager is the individual who oversees the entire task. To manage a project, a manager must consider the timeline, costs, labor requirements, physical limitations, ultimate goal, equipment needs, training and education needs, testing schedule, and software requirements. The ability to assess all of these factors is a skill that a successful manager must have.

In addition to the above-mentioned factors, a project manager must be able to predict or estimate. Predictions are not guarantees, but rather educated guesses. The manager must predict how much the network will cost and how long it will take to complete. The best project managers are those who can do a good job at estimating and are able to deliver projects on time and at the expected cost.



The way to predict as accurately as possible is to build in as much realistic additional time and cost into the project as possible. This is not lying, but realistic planning that allows for unforeseen circumstances. If you calculate that network cable can be installed in three days by two cable installers, and the cable arrives two days late, you are behind schedule through no fault of your own. People do not want to hear that the cable company is at fault. They expect the job to be completed in the allotted three days, and you failed to meet the goal. Allowing five days for the cable installation provides extra time on the schedule for potential problems. If all goes well, you will be able to complete the installation in less than five days. Both the client and your supervisor will be pleased.

Project Management Software



There are many software programs that help you manage projects. These programs have tools that allow you to enter data about holidays, vacation days, and other times when technicians will not be on the project. You can schedule tasks and sub-tasks. Tasks or groups of tasks may be made dependent upon each other. For example, you have to run the cable before installing the wall jacks: to do so in the reverse order actually means installing the jacks twice. In a project plan, the task "install jacks" can be made dependent on the task "install cable." If the cable installation gets delayed, the dates for the jack installation would automatically be delayed, too, showing the new projections.

Project management software is helpful, but it cannot plan your project for you. The purpose of the software is to help you to plan and to provide a way of measuring progress. With this software, you can also print periodic status reports. When you pass the president of the company in the hallway and he or she asks you for the status of the network installation, a simple "we're on schedule" may not be enough. It would be much better to be able to say, "I'll get a copy of the current status to you later today."

Factors Involved when Planning a Network

The project manager and his/her team must consider several factors when planning a network. They include:

- Budget
- Physical Media
- Network Users
- Network Purpose
- Physical Limitations
- Management Strategies

Budgetary Considerations

When planning a network, several factors should be considered. They include:

- 1. You may be given a set budget and definite network requirements that must be met within that budget. You must design the network to meet the requirements within the specified budget.
- 2. You may be given a network design with all of the specifications and requirements already decided and asked to propose a budget that will enable the network to be implemented.
- 3. You may be asked to both propose the design and the budget.



Choice number three is preferable since it gives you control over both the network design and budget. Having no control over the budget limits you to whatever you can provide for that price. Having to set a budget for a network that you did not design is difficult because you don't know all the factors that went into the network design. This puts you in the position of having to guess what the network will be used for and by whom.

Budgets Take Time to Prepare



Preparing a budget takes hours and hours of research. For example, determining costs for access to the physical media provided by a telephone company varies from region to region. Labor costs in different areas of the world also fluctuate. It is therefore imperative that you make inquiries regarding local costs that may change from location to location. Hardware and software costs as well as training costs must be considered. Who will install the network? What do they charge? Will you need to engage the local telephone company for work? Will special equipment be needed? What about legacy equipment: will the printers and other computer devices already in place be sufficient for network needs or will they need to be upgraded?

Once all costs are determined, it is not unusual to add 10 to 20 percent extra to the proposed budget. This allows for unforeseen expenses or time delays that always seem to be part of any project. It is always better to finish a project under budget than to be looking for additional funding, or cutting corners, toward the end of a project

Interoperability and Connectivity Issues

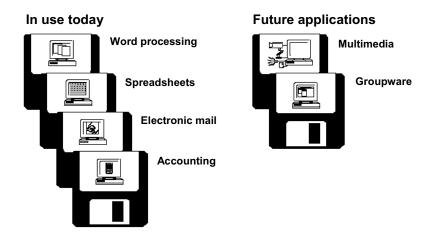
Also required as part of the planning phase is research into interoperability and connectivity issues. Interoperability is important because it affects the entire network. Software that won't work with the selected hardware is clearly not an example of a well-planned network. Technology built today is obsolete within a few short years. You need to research all equipment you plan to use as part of the network to assure that it is both backward and forward compatible and can accommodate both existing equipment and future expansion. Does the manufacturer adhere to Request for Comment (RFC) standards? How about IETF and TCP/IP standards? Is the media you selected IEEE and EIA/TIA compliant? You must keep up with any changes in networking standards in order to be sure the equipment you use is standards compliant. Is the existing equipment or the equipment you plan to install proprietary? All of these areas need to be researched.

Network Users

Perhaps the most important consideration when planning a network involves the needs of the people using the network. A network for a financial department is not likely to be the same as a network for a creative department that produces graphics and artwork. Determining user needs will help you decide whether the network should be peer-to-peer or client/server. For example, a small office with sophisticated computer users, where security is not an issue and there is no need of centralized administration, is well suited for a peer-to-peer network. A larger organization that needs data centrally controlled might be better served with a client/server network.



User Needs Dictate Network Design



Here are some questions that can be asked to help you design the right network for the network users.

- What are the kinds of software you plan to use?
- Are there periodic deadlines when you all work longer hours than usual?
- Will you need to log onto the system from remote locations? If so, what kinds of access will you need (e-mail, files, active applications)?
- What kinds of printing will you need to do? How many documents per day, week, month?
- Will you need Internet access from your desktop? Are there times when access to the Internet will need to be restricted?
- Do you use desktop computers or laptops?
- Are there any special needs such as high-resolution monitors, voice recognition software, and ergonomic keyboards?

There are many more questions that can be asked, and some of them are for the individual users while others are for supervisors. For example, a supervisor needs to let you know about the level of security he or she feels is necessary for company data. Financial information and payroll data are very sensitive information, while archived periodicals are not. Be aware again that budgetary considerations will help to dictate the level of security and that many people, including most department heads, will consider their data to be very important and needing the top level of security.

Questions about network segmenting and creating virtual private networks to enhance performance need to be researched. You should also be aware of planning account management policies. Examples of account management policies include the need to plan account naming conventions, lockout, and password procedures. Planning should also consider how network activity would be tracked. This is called auditing and it assists in identifying and solving problems using records that track past activities.

Physical health issues of the network users should also be considered when planning. For example, wrist rests for mouse pads to relieve the stress of using a mouse can be a planned expense for the network. Incorporating health strategies into a network design helps cut down on employee absenteeism by eliminating health problems caused by computer use.



Network Purpose

A critical question that needs to be addressed is the purpose of the network. Why is the network needed? Reasons for installing a network might be to improve communications, to speed report production, to install e-mail, to provide Internet access to everyone, and to provide file sharing. The kind of network you design depends very much on the ways in which it will be used and the purpose of the network.

Building a network is somewhat like buying a car. You don't just go out and buy any car, you sit down and think about what you want or need the car for. You might want a car that can get you around town but also go on the back dirt roads. You might also want a roof rack for boats and skis. Your needs will be met with a 4-wheel drive car, not a suburban minivan.

Networks must be designed and tailored to the specific needs and purposes of the people who will be using it. For example, the art department does a lot of graphics, and may need to have Macintoshes in a peer-to-peer environment, a high-resolution color printer, and high-resolution monitors. Their bandwidth needs will be greater, too, since graphical files consume more space than text files. If the network you are designing requires a LAN that connects a variety of departments physically located on several different floors of a building, you will want to plan a network that is segmented in a logical fashion. That will help ensure efficient communication within departments the various departments.

Physical Limitations

Unless you are planning a network for a brand-new installation, you will have to make compromises with the physical environment. Newer buildings are generally easier to wire than older buildings since walls tend to be hollow and cable can be "snaked" through them more easily than through plaster. Older buildings usually lack the utility closets (containing phone wires, pipes, etc.) that newer ones have, so wires must be attached to ceiling molding or hidden in conduits. Suspended ceilings are often a good place to run cable. You may need to research safety considerations such as fire codes that require plenum cable in certain areas of a building. You need to check for any other specific local codes to see if inspections and/or permits are necessary.

Other considerations might be the connections to the building—are they secure? Are servers, routers, switches physically secured? Can you be disconnected from your other buildings by a wayward car? Are the communications cables away from sources of EMI? What about potential water damage to components of your network? What about fire hazards?

Consider neighboring business facilities. If the first floor of the building in which you are planning to install a network contains a restaurant, you might want to be sure that the computer wiring closet or main computer room is located on the opposite side of the building away from the kitchen. A kitchen fire is more likely to cause damage to adjacent areas.



Basic Guidelines

Networks planned today are best if they are designed with the following characteristics:

- A physical star or bus topology with a logical star topology allows for ease of management when expanding and troubleshooting a network.
- Cabling should be at least category 5, fiber-optic if affordable or if security is a major concern. Fiber is also the cable of choice for backbone and between buildings. Again, this will allow for expansion to faster speeds. Always add additional cable lines for future expansion. It is less expensive to install them when building a network than to add them after a network is built.
- Fiber optic is also a good choice when EMI is a problem. If this is not affordable, use STP category 5 cable since it offers more insulation. Follow building codes for cable. For example, use plenum grade for fire protection.
- In large networks use bridges, switches, and hubs to segment network traffic. This helps reduce bottlenecks.
- Be sure you build redundancy into your network plan.
- Take into account network management requirements.

Check Your Understanding

Directions: The Check Your Understanding questions below require you to recall information from previous NetKnowledge lessons. You may need to use your portfolio to assist when answering these questions.

- Which type of network would you suggest for a very small company that probably will not experience any expansion in the next few years? Explain why you made your choice?
- ♦ How might you expand an Ethernet 10Base2 network
- If you were planning to build a network for 20 users who frequently access databases and require strong security measures, would you use a peer-to-peer design? Explain your answer.
- ♦ Which type of Internet service should you obtain if you have a budget of under \$1000 and fewer than 10 users? Explain your answer.



- ♦ Which network operating systems are typical for peer-to-peer networking?
- ♦ Why might you select more expensive category 5 cable for a 10 Mbps network?
- ◆ Suppose you work for a company whose network is peer-to-peer and recent expansion has resulted in a total of 25 employees connected to the network. How would you convince your supervisor that a change should be made to a client/server network?

Planning Management Strategies

When planning, designing, upgrading, or maintaining a network, management strategies for baselining and monitoring the network must be set in place. How is the management information system (MIS or IS) team going to maintain the network once it is implemented? Which protocols will they use? Cost, efficiency, and security issues must be taken into account when defining the appropriate management strategies. Which tools are needed to ensure optimal network functioning? Many factors must be weighed. Since the needs of different networks vary, the weight given to the various features will change with each new job.

Some management areas to consider when planning which network management tools are appropriate include:

- Growth (Scalability)
- Quality (Performance and Availability)
- Maintenance (Manageability and Security
- Cost

When considering network growth, Information Systems (IS) employees discuss such things as managing the movement or addition of offices and devices. Quality management refers to the tools needed to monitor, detect, trace, and solve problems before they affect the users. Maintenance management includes the day-to-day issues that arise when configuring devices or downloading net software. Cost is also a management concern. Tools that consider, account for, and justify network use and requests for upgrades must be part of network planning strategies.

Management Information and Transport Protocols

One design factor network administrators must consider when planning the network is which transport agent should be used for management information. Should it be Simple Network Management Protocol (SNMP), SNMPv2, SNMPv3, or the Hypertext Transport Protocol (HTTP)?

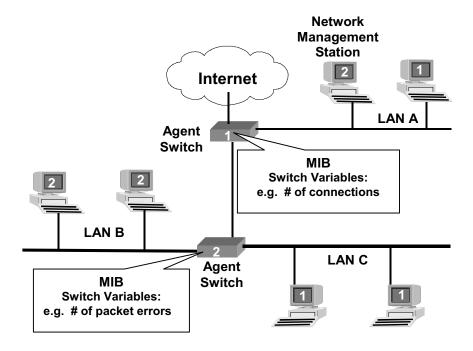
SNMP is a relatively simple management protocol, requiring little overhead. It allows IS employees to monitor, inspect, and alter networking functions from a remote management station. SNMPv2 and SNMPv3 are the result of the evolution of SNMP, although the versions are not compatible and their differences must be taken into account if they are to coexist in the same network.



SNMP uses the UDP protocol from the TCP/IP protocol suite. The four main components to SNMP include:

- **The agent**—Devices being monitored and managed.
- The management information base (MIB)—The database of network performance information.
- **The community**—The devices that are organized into distinct groups for management purposes.
- The network management station—The workstation that is used to configure and monitor the agents in each of the communities.

SNMP Managed Network With Two Communities



HTTP is the Internet Web Browser protocol. With the recent popularity of the Web and web browsers, network managers are now using web browsers that are customized to act as remote management tools.

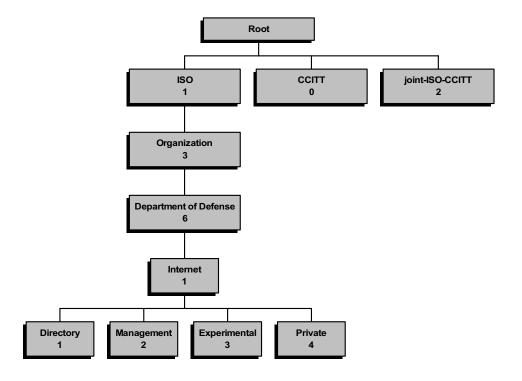
SMI (RFC 1155) and ASN.1

Planning networks also involves understanding how management information is structured. Structured Management Information (SMI) RFC 1155 describes how management is structured using Abstract Syntax Notation One (ASN.1). These are the two standards that define how an MIB is written. SMI describes the following:

- How to assign names to the managed objects
- How to structure and identify management information
- The data types that describe the managed objects
- How to define the managed objects
- How SNMP accesses the defined objects
- How new objects can be added to the Internet-standard MI.

Every MIB has a branching structure starting with a root that branches out and connects to a number of labeled object groups. Each group may again branch out to another sublayer of objects.

Management Information Base Structure





A network manager must plan which threshold values to use for events and traps used by the SNMP agent. He or she wants to be notified about networking problems without causing excessive congestion the network. He or she also must plan which events to monitor. In addition to SNMP MIBs, there are MIBs for interfaces, address translation group objects, IP group objects, TCP groups, UDP groups, and more.

RMON MIB

Network administrators, as part of their planning, must determine if the network should have Remote Network Monitoring (RMON) probes. RMON probes are specialized devices that gather and control network management information. RFC 1757 describes the Internet RMON standard. Probes perform the following tasks:

- Polls and examines Ethernet statistics, historical statistics, thresholds and alarms, host statistics, and statistics for conversations between two network addresses
- Provides for packet filtering and capturing
- Sets up control parameters for data collection operations

Check Your Understanding

- ♦ What are some of the areas to consider when planning network management strategies? Explain each of these factors.
- Describe the four main components of SNMP.
- What are some of the tasks performed by RMOM probes?
- What is the purpose of maintaining records and documenting networking activity? Give an example.



Try It Out

Materials Needed:

None



Pre-Site Information Gathering

Planning, designing, or redesigning a network requires a significant amount of knowledge about the requirements and objectives for the network. This process takes time. Many issues need to be researched, discussed, and decided upon. In this activity, you will prepare a typical pre-site questionnaire that a network architect might want to ask before designing the ideal network for a company.

- Work with two or three other students and prepare a written questionnaire to send a perspective client, prior to an on-site visit. For this assignment, assume that you are redesigning a current network for WAN connectivity of three or four major sites, several smaller locations, and several hundred remote users.
- 2. Prepare a written questionnaire of at least 10-15 questions you might want answered at a pre-site visit.
- 3. Compare questionnaires with those of other groups in your class.
- 4. Discuss and critique all of the questionnaires.
- 5. If possible, have a networking design or business person critique your questionnaire.
- 6. Revise and finalize the questionnaire. The final questionnaire must be professional quality similar to what a network designer might use.
- 7. Submit a copy to your instructor and include a copy in your portfolio.

Rubric: Suggested Evaluation Criteria and Weightings:

Criteria	%	Your Score
Rough draft of questionnaire shows an understanding of the type of information gathering that should take place prior to an onsite visit	25	
Participation in class discussion and critique of questionnaires	25	
Professional quality final questionnaire	35	
Questionnaire incorporated into portfolio	15	
Other		
TOTAL	100	



Stretch Yourself

Materials Needed:

- Classroom Network
- Optivity software



MIB Browser

In this lab, you will use Optivity to learn to search for and retrieve MIBs, set a MIB value, and become familiar with MIB access rights.

- 1. MIB Browser
 - a. Select your probe from the Summary or Map View.
 - b. On the Main Menu bar, select Tools > MIB Browser.
 - c. To search for a MIB variable such as etherstats, replace iso.org.dod... with ether and from the pull down menu, select MIB Search or use the Tool Bar icon.
 - d. To search for the Next Occurrence, select MIB Search for Next, or use the Tool Bar icon.
 - e. There are three ways to retrieve a MIB value. You can replace iso.org.dod... with IP and press Enter. The MIB values are displayed in the lower Frame. You can click on the interfaces group (blue box) so that it is selected, and from the pull—down menu select MIB, Get MIB or use the Tool Bar icon, and finally you can drag and Drop the system group (blue box) into the lower frame.

2. Understanding MIB access rights

a.	Retrieve the MIB variable System and double-click on the
	sysContact.0. Enter your_first_and_last_name as the value and
	click on the send. Were you successful or did you get an error?

b.	Now try the same procedure on the sysUpTime.0. Were you successful or did you get an error?	
	What is the difference?	

c. Return to the upper left frame and open System by clicking on it then and click on the sysUpTime and then on sysContact. Notice the different access values.

Suggested Evaluation Criteria and Weighting

Criteria	%	Your Score
Successful completion of activity	15	
Accurately follows directions	15	
Complete, accurate responses to lab activity questions	15	
Complete summary of experiences and an insightful analysis of how a network manager might use this software to help improve network performance.	20	
Summary included in portfolio	15	
Participation and cooperative teamwork during activity	20	
Other		
TOTAL	100	



Network Wizards

Materials Needed:

Information Systems Department Proposed Annual Budget

Budgetary Considerations



Work in groups of three or four and plan a network budget. Your instructor will give you the necessary information such as number of routers and cable lengths for the network that you are planning.

Prepare a budget for one fiscal year using the budget below as a guide. This is an actual budget submitted by a network manager for approval. Since this organization did not have a networking department prior to 1995, the costs for FY93 and FY94 are not itemized and were calculated retroactively.

Prepare a cover letter for the budget that defends your requests.

Prepare a report that compares the shift in costs for network expenses in 1995 vs. this year. Indicate which prices have increased and which have decreased. As part of this report, discuss the reasons your group feels that these changes have taken place.

Sample Budget

Position

Information Services Manager Tech. Client Services Manager IT Support Specialist IT Support Specialist Web AA Technical Assistance

Preliminary	/ IS 1998 B	udget v1.0	(12/3/97)	<u> Item Cost</u>
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Base Level/Maintenance/Supplies

Internet connection	\$30,000
Network maintenance contracts	\$3,500
Network software upgrades	\$4,000
Network room equipment &	\$3,000
supplies	
UNIX maintenance consulting	\$2,000
Printer supplies/toner	\$6,000
Printer service contracts	\$3,500
Phone/voicemail modifications	\$2,500
Apple Developer membership	\$1,500
Site license software upgrades	\$4,000
Other software	\$1,500
Audio/video repair/replacement	\$2,000

Cables, parts, miscel. IS supplies	\$1,500
Core Initiatives	
Education & Training	
Staff training	\$12,000
Staff education	\$4,000
IS staff training/conferences	\$23,000
Books & publications	\$3,000
Collaborative Tools	
Notes consulting	\$15,000
Servers	\$8,000
Infrastructure Improvement	
Bullet-proof network/7x24 support	\$8,850
PC & network server backup	\$8,000
RAID array for main NT server	\$6,000
Support Improvement	
NT consulting	\$4,000
Software	\$1,500
Enterprise Integration	
Internal web server projects	\$2,500
Telecollaboration	
Virtual Private Network	\$8,000
IS Strategic Planning	
Consulting	\$3,500
Priority Initiatives	\$3,500
_	\$3,500
Priority Initiatives	\$3,500 \$12,000
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration	
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology	
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation	\$12,000
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement	\$12,000 \$8,000
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network	\$12,000
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination	\$12,000 \$8,000 \$1,000
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies	\$12,000 \$8,000
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies Infrastructure Improvement	\$12,000 \$8,000 \$1,000 \$500
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Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies Infrastructure Improvement Network security monitoring	\$12,000 \$8,000 \$1,000 \$500
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies Infrastructure Improvement Network security monitoring (Basic) TOTAL (non-labor)	\$12,000 \$8,000 \$1,000 \$500 \$6,000 \$199,850
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies Infrastructure Improvement Network security monitoring (Basic) TOTAL (non-labor) Wish List	\$12,000 \$8,000 \$1,000 \$500 \$6,000
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies Infrastructure Improvement Network security monitoring (Basic) TOTAL (non-labor) Wish List Infrastructure Improvement	\$12,000 \$8,000 \$1,000 \$500 \$6,000 \$199,850 Item Cost
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies Infrastructure Improvement Network security monitoring (Basic) TOTAL (non-labor) Wish List Infrastructure Improvement Network room sprinkler system	\$12,000 \$8,000 \$1,000 \$500 \$6,000 \$199,850 Item Cost \$20,000
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies Infrastructure Improvement Network security monitoring (Basic) TOTAL (non-labor) Wish List Infrastructure Improvement Network room sprinkler system CDROM tower	\$12,000 \$8,000 \$1,000 \$500 \$6,000 \$199,850 Item Cost \$20,000 \$5,000
Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies Infrastructure Improvement Network security monitoring (Basic) TOTAL (non-labor) Wish List Infrastructure Improvement Network room sprinkler system CDROM tower Spare server	\$12,000 \$8,000 \$1,000 \$500 \$6,000 \$199,850 Item Cost \$20,000
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Priority Initiatives Telecollaboration Tinker Demo/Heisenberg Exploration Emerging technology experimentation Support Improvement Microsoft Technical Network Electronic Dissemination Supplies Infrastructure Improvement Network security monitoring (Basic) TOTAL (non-labor) Wish List Infrastructure Improvement Network room sprinkler system CDROM tower Spare server	\$12,000 \$8,000 \$1,000 \$500 \$6,000 \$199,850 Item Cost \$20,000 \$5,000



Presentation Tools
Large format color printer

\$10,000

Wish List TOTAL

\$57,000

Rubric: Suggested Evaluation Criteria and Weightings:

Criteria	%	Your Score
Participation and ability to work in a professional manner within the group	25	
Cover letter of professional quality	25	
Professional quality budget that accurately reflects current networking costs	25	
Comparison/reflection report that indicates understanding of budgets	25	
Other		
TOTAL	100	

Unit 4 Summary

Summary

Lesson 1: Network Planning

In this unit, you learned to:

- Explain what is involved in planning a network
- Describe project management, the role of a project manager and explain how they relate to network planning
- List and describe the factors involved when planning a network
- Explain the importance of network management strategies
- List and describe several protocols related to the management of networks



Review Questions

Lesson 1: Network Planning

Multiple Choice: Select the best answer.

- 1. What is involved in network planning?
 - a. Knowing the number and types of computers
 - b. Knowing the requirements of remote users
 - c. Knowing if the network is going to be connected to the Internet
 - d. Knowing organizational expansion figures
 - e. All of the aboveWhat is one of the primary concerns when planning a network?
 - a. The number of computers
 - b. Budgetary considerations
 - c. Visiting the site
 - d. The possibility of downtime
- 3. What is the name for the first stage of the five-step methodology for designing a network?
 - a. Budgetary considerations
 - b. Statement of topology
 - c. Statement of work
 - d. Determining logical topology
- 4. During the first phase of network planning, what do you need to know?
 - a. The current resources of the organization
 - b. The name of the individual making the presentation
 - c. What the company did 10 years ago
 - d. Who will be working on the project
- 5. What does MIB stand for?
 - a. Management Information BIOS
 - b. Monitoring Information Base

Unit 4 Review Questions

- c. Management Information Base
- d. Monitoring Information BIOS
- 6. Which of the following is the Internet Web browsing protocol?
 - a. SNMP
 - b. ASN.1
 - c. HTTP
 - d. RMON
- 7. What does RFC 1757 define?
 - a. SNMP
 - b. ASN.1
 - c. HTTP
 - d. RMON
- 8. Which of the following is not one of the four main components of SNMP?
 - a. RMON
 - b. Agent
 - c. Community
 - d. MIB



- 9. When using SNMP, what are the devices being monitored called?
 - a. Community
 - b. MIB
 - c. Agent
 - d. RMON
- 10. Which of the following is a standard that defines how a MIB is written?
 - a. ASN.1
 - b. SNMP
 - c. HTTP
 - d. MIBv2
- 1. List five statistics that should be obtained during the statement of the work phase of methodology.
- 2. Describe project management and tell how it relates to planning a network.
- 3. What is the role of the project manager when planning a project?

Unit 4 Review Questions

- 4. Why is it important to have a project manager when planning a project?
- 5. List the factors that influence decisions when planning a network.
- 6. Name three ways in which network budgets may be established.
- 7. List the basic guidelines to following when planning a network. Include topology, media requirements, hardware and software options and explain why you would use each of the guidelines.

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Dire fals	ections: Indicate whether each of the following statements is true or se.
1.	The amount of money allotted for a budget does not influence how a network is designed.
2.	A network that uses a lot of graphics would most likely be a 100 Mbps speed rather than a 10 Mbps speed
3.	If you have fewer than 6 employees, you will definitely need a client/server network.
4.	An organization whose users primarily use only word processors would most likely be 100 Mbps.
5.	A network with several hundred users will most likely have several servers and segments.
6.	The size and purpose of an organization have an influence on the network design.
7.	A small organization that deals with highly classified data should be peer-to-peer.
8.	RMON probes are specialized devices that gather and control network management information.
9.	RFC 1757 describes the Structured Management Information standard.
10.	MIBs are only written for SNMP standards.

Unit 4 Scoring

Scoring

Criteria	%	Your Score
Check Your Understanding		
Explain what is involved in planning a network	20	
Describe project management, the role of a project manager and explain how they relate to network planning	20	
List and describe the factors involved when planning a network	20	
Explain the importance of network management strategies	20	
List and describe several protocols related to the management of networks.	20	
TOTAL	100	
Try It Out: Building organizational and interpersonal skills	100	
Stretch Yourself: Network planning issues	100	
Network Wizards: Budget preparation	100	
Review	100	
FINAL TOTAL	500	



Resources:

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Craft, Melissa, Poplar, Mark A., Watts, David V., Willis, Will (1999). *Network* +. The Coriolis Group, LLC, Scottsdale, Arizona.

Groth, David. Bergersen, Ben. Catura-Houser, Tim (1999). Network+ Study Guide. Sybex Inc., Alameda, California.

Hayden, Matt (1998). Sams Teach Yourself Networking in 24 Hours._Sams Publishing, Indianapolis, Indiana.

NortelNetworksTM (June, 1999). *Network Design Essentials for Routers and Switches*, NortelNetworksTM, Billerica, Massachusetts.

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