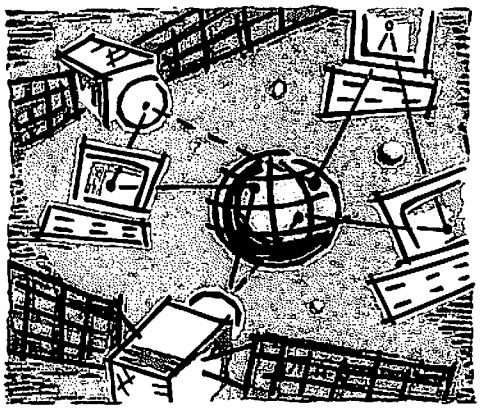
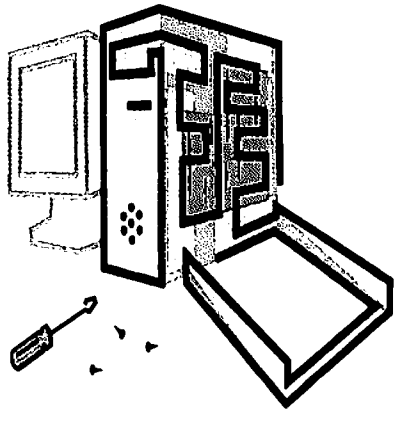
Lewis & Clark Career Center

Curriculum Guide

Computer Maintenance & Networking





Curriculum Guide
For
Computer Maintenance & Networking

Course Rationale, Course Description, Units of Study

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Crosswalk to Show Me Standards

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COMPUTER MAINTENANCE AND NETWORKING

1 year program; 3 units of credit

This program is open to juniors, seniors and post-secondary students who have an interest in computer maintenance as a wage earning occupation.

Students will learn to install, test and repair computer hardware, software and peripheral equipment. Extensive operational theory for computers and networks is incorporated in the course. Students may become a certified PC technician by taking the CompTIA A+ certification exams upon completion of the course.

Students who successfully complete this program will be able to provide technical support for hardware, software and network systems. Graduates may be employed by computer retailers, service companies, consulting firms or businesses that maintain their own systems.

Prior classes in keyboarding or microcomputer applications are beneficial.

LEWIS & CLARK CAREER CENTER

COMPUTER MAINTENANCE AND NETWORKING
UNITS OF STUDY

- Computer Fundamentals
- Types of Software & What They Do
- How Software & Hardware Work Together
- Understanding & Managing Memory
- Motherboards
- Hard Drive Installation & Support
- Troubleshooting Fundamentals
- Supporting I/O Devices
- Multimedia and Optical Drives
- Electricity & Power Supplies
- Supporting Windows 9X
- Supporting Windows 2000 & XP
- Purchasing a PC or Building One
- Communicating Over Phone Lines
- Networking Fundamentals & the Internet
- Printers & Notebook Computers
- Viruses, PC Security, Disaster Recovery & Maintenance Plans
- Customer Relations & Professionalism
- A+ Certification Practice Exams
- Employability Skills
- SkillsUSA
- **Articulated with Linn State Technical College/St. Charles Community College**

LEWIS & CLARK CAREER CENTER

Computer Maintenance Technology

Course Rationale

The Computer Maintenance Technology course is based on the presence of many opportunities for gainful employment in the field of computer repair and networking, to those who complete this course, both secondary and post secondary. The program structure is designed around the Comptia A+ Certification standards and allows an individual to enter the Computer Maintenance Technology course and experience the educational components needed to become a productive member of this exciting and fast moving career field.

The Computer Maintenance Technology program is representative of employer needs as expressed by local business and industry professionals. The combination of theory and hands-on experiences is designed to allow the student to integrate the training into successful employment, leading to the fulfillment of personal, cultural and economic goals.

COMPUTER MAINTENANCE TECHNOLOGY

1 year program; 3 units of credit
Prerequisites: Algebra I, Keyboarding, Microcomputer Applications

This program is open to juniors, seniors and post-secondary students who have an interest in computer maintenance as a wage earning occupation.

Students will learn to install, test and repair computer hardware, software and peripheral equipment. Extensive operational theory for computers and networks is incorporated in the course. Students are expected to become certified PC technicians before completing the program by taking the CompTIA A+ certification exams.

Students who successfully complete this program will be able to provide technical support for hardware, software and network systems. Graduates may be employed by computer retailers, service companies, consulting firms or businesses that maintain their own systems.

Students applying for this program should have completed Keyboarding, Algebra I and have a basic understanding of microcomputer application software.

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COMPUTER MAINTENANCE TECHNOLOGY
UNITS OF STUDY

- Computer Fundamentals
- Types of Software & What They Do
- How Software & Hardware Work Together
- Understanding & Managing Memory
- Floppy Drives
- Hard Drives
- Hard Drive Installation & Support
- Troubleshooting Fundamentals
- Supporting I/O Devices
- Multimedia Technology
- Electricity & Power Supplies
- Supporting Windows 9X
- Supporting Windows 2000 & XP
- Purchasing a PC or Building One
- Communicating Over Phone Lines
- Networking Fundamentals & the Internet
- Printers & Notebook Computers
- Viruses, Disaster Recovery & Maintenance Plans
- Customer Relations & Professionalism
- Instructional Texts
- Employability Skills
- SkillsUSA
- **Articulated with Linn State Technology College**

Lewis & Clark Career Center
Computer Maintenance Technology/A+ Certification
Course Outline & Description

I. Instructional Information

A. Program Objectives in Measurable Terms

Student will be able to:

1. Install and repair computer hardware, software, and peripheral equipment.
2. Confer with staff, users, and management to determine need for system modifications.
3. Develop training materials and procedures, and conduct training sessions for users.
4. Test software, hardware, and peripheral equipment to evaluate performance and effectiveness.
5. Evaluate computer software and hardware operations.
6. Keep records of data transactions, problems, maintenance, and installation activities.
7. Read technical journals and attend seminars to stay current on hardware and software technologies.
8. Configure and install network hardware and software.

B. Course Outline

1. Computer Fundamentals
    a. History & Development
    b. Hardware Used for Input & Output
    c. Temporary & Permanent Storage Devices
    d. System Board Components for Communication
    e. Expansion Cards
    f. The Electrical System
    g. Microprocessor Types & Performance
    h. Safety Procedures

2. Types of Software & What They Do
    a. Operating Systems
        1. DOS
        2. Windows 9X
        3. Windows 2000 Professional
        4. Windows XP
        5. UNIX and LINUX
    b. Applications Software

3. How Software & Hardware Work Together
    a. Boot & Startup Process
    b. How Software Manages Hardware Resources
    c. Protecting Data, Software & Hardware

4. Understanding & Managing Memory
    a. Physical Memory
    b. Managing Memory In DOS & Windows 3X
    c. Managing Memory In Windows 9X
    d. Managing Memory with Windows 2000 Professional
    e. Upgrading Memory

5. Floppy Drives
    a. How Data Is Physically & Logically Stored On A Disk
    b. Formatting Disks
    c. Using Floppy Disks With DOS & Windows

6. Hard Drives
    a. Hard Drive Technology
        1. IDE & EIDE Technology
        2. SCSI Technology
        3. Logical Drives
    b. How Drives Are Organized
    c. Managing & Optimizing Hard Drives
    d. Removable Drives

7. Hard Drive Installation & Support
    a. Installing Hard Drives
    b. Troubleshooting Hard Drives
    c. Data Recovery

8. Troubleshooting Fundamentals
    a. Safety & Protection Methods
    b. Troubleshooting Tools & Test instruments
    c. Isolating Problems
    d. Preventive Measures

9. Supporting I/O Devices
    a. Basic Principles of Peripheral Installations
    b. Using Ports & Expansion Slots
    c. SCSI Devices
    d. Keyboards & Pointing Devices
    e. Computer Video
        1. Monitors
        2. Video Cards
        3. Video Memory

10. Multimedia Technology
    a. Multimedia on a PC
        1. Fundamentals Of Multimedia
        2. Multimedia PC Requirements
        3. Choosing Multimedia Hardware
    b. Devices Supporting Multimedia
        1. CD-ROM Drives
        2. CD-R & CD-RW Drives
        3. Sound Cards
        4. Digital Cameras
        5. DVD
    c. Troubleshooting multimedia hardware

11. Supporting Windows
        A. Loading Windows 9X &
        B. Loading Windows Applications
        C. Troubleshooting Windows 9X

12. Supporting Windows 2000 Professional & XP
    a. Windows 2000 vs. Windows 9X
    b. Windows 2000 Environment & Architecture
    c. Windows 2000 Networking
    d. Installing & Customizing Windows 2000 & XP
    e. Installing Software & Hardware
    f. Windows Diagnostic Tools

13. Purchasing A PC or Building One
    a. Selecting a Personal Computer
    b. Building a PC
        1. Selecting parts
        2. Assembly
        3. Hardware Configuration
        4. Installing Operating System
        5. Installing Device Drivers

14. Communicating Over Phone Lines

    a. Modems
    b. Communications Software
    c. Troubleshooting Guidelines
    d. Cable, ISDN, Fiber & Other Networks

15. Networking Fundamentals & The Internet
    a. Overview of Networking
    b. Network Architectures
        1. Ethernet
        2. Token Ring
        3. FDDI
    c. Networking Hardware
        1. Interface Cards
        2. Routers, Bridges, Gateways
    d. Networking Software
        1. Protocols
        2. Services

    e. Networking With Windows 9X , 2000 & XP
        1. Dialup Networking
        2. Direct Cable Connections
        3. Network Servers
            1. Windows 2000 Server
            2. UNIX & Other Servers

f. PC's and the Internet
    1. How the Internet Works
    2. Connecting to the Internet
    3. IP Addresses
    4. Domain Names
g. Network Services
h. Network Troubleshooting

16. Printers & Notebook Computers
    a. Printers & How They Work
    b. Notebook computers
    c. Printer Servicing

17. Viruses, Disaster Recovery & Maintenance Plans
    a. Preventive Maintenance
    b. Viruses & Related Problems
    c. Backups & Fault Tolerance

18. Customer Relations & Professionalism
    a. Customer Expectations
    b. Service Calls
    c. Maintaining Records
    d. Professional Organizations
    e. Copyrights
    f. Professional Certification A+ & MCSE
    g. Professional Ethics
    h. Resume & Job Interviewing Skills

C. Instructional Texts

A+ Guide To Managing & Maintaining Your PC
Jean Andrews, Ph. D.
Course Technology Publishing
Copyright 2000 Revised 2002

MCSE Guide to Windows 2000 Professional
Ed Tittel & James Stewart
Course Technology Publishing
Copyright 2000 Revised 2001

LEWIS AND CLARK CAREER CENTER

COMPUTER MAINTENANCE TECHNOLOGY
COMPETENCY REPORT

STUDENT:

Rating Scale:

3	**Mastered**
2	**Requires Supervision**
1	**Not Mastesed**
N	**Not Covered**

3	2	1	N	A. Careers in Computing Technology
X				1. Identify career opportunities in computing technology
X				2. Identify certifications available in chosen career field
X				3. Develop career plan for future studies

3	2	1	N	B. General Computer Concepts
X				1. Use basic terminology of computing correctly
X				2. Describe briefly the main points of the history of computers
X				3. Demonstrate the ability to use application software
X				4. Identify and describe the function of and relationships between the components of a computer
X				5. Describe the various types of magnetic storage media
X				6. Describe the operation and application of common output devices
X				7. Identify the various types of networks and topologies
X				8. Demonstrate a basic understanding of Internet issues, concepts, and operation
X				9. Describe the purpose and objectives of an operating system
X				10. Develop a knowledge of ethical questions in computer technology
X				11. Describe the capabilities of a data processing system

3	2	1	N	C. Theory of Computer Hardware Operation
X				1. Describe concepts of microprocessor operation
X				2. Describe operational concepts of system motherboards
X				3. Describe concepts of RAM operation
X				4. Describe concepts of disk storage
X				5. Describe concepts of how floppy and hard drives work
X				6. Describe concepts of Input/Output Device operation
X				7. Describe how multimedia (CD-ROM and DVD) work
X				8. Describe how a modem works
X				9. Describe concepts of local area network operation
X				10. Describe concepts of printer hardware operation
X				11. Describe concepts of computer boot up procedure
X				12. List the different types of expansion slots and describe their characteristics
X				13. Describe how plug and play systems work
X				14. Describe concepts of operating system controls

3	2	1	N	D. Computer Maintenance and Upgrading
X				1. Describe proper safety procedures for working on electronic devices
X				2. List and describe the different computer problem classifications.
X				3. List and describe the steps in troubleshooting a problem.

X				4. Create a boot disk for repair purposes.
X				5. Define a circuit and list its primary parts.
X				6. Identify the basic electronic components and their schematic symbols
X				7. Describe the characteristics of the basic electronic components
X				8. List the common tools needed to effectively troubleshoot and repair a PC
X				9. Identify standard PC components
X				10. Demonstrate proper ESD procedures when handling PC components
X				11. Disassemble the PC to its basic components and reassemble it
X				12. Install and run a software diagnostic package
X				13. Install and remove a microprocessor
X				14. Install heat sink and fan on microprocessor
X				15. Compare and differentiate DRAM and SRAM
X				16. Compare and differentiate DIPP, SIPP, SIMM, and DIMM
X				17. Install and remove RAM from a system
X				18. List and describe the symptoms caused by faulty RAM
X				19. Demonstrate isolation of faulty RAM
X				20. Configure motherboards for different processor speeds
X				21. Enter and configure the CMOS setup program
X				22. List and describe the symptoms caused by a faulty motherboard
X				23. Troubleshoot a faulty motherboard
X				24. Configure an expansion card for use in a PC system
X				25. Locate and correct the problem of a failed expansion card within a system
X				26. Properly connect and disconnect the power connectors
X				27. Determine and correct a power-related problem in a PC
X				28. Install and remove a power supply from a PC
X				29. Configure and install an IDE hard drive in a system
X				30. Partition and high-level format a hard drive
X				31. Determine and correct hard drive problems
X				32. Install a floppy disk drive in a system
X				33. Determine and correct floppy drive problems
X				34. Determine and correct a removable media drive problem
X				35. Install an IDE CD-ROM drive
X				36. Identify and correct CD-ROM problems
X				37. Identify and correct disk problems
X				38. Run SCANDISK and DEFRAG programs on a disk volume
X				39. Install an anti-virus software package
X				40. Look for, detect, and remove a virus
			X	41. Install a tape drive and perform a backup
			X	42. Identify and correct a tape drive problem
X				43. Install, and configure a video card
X				44. Test a keyboard port
X				45. Clean a keyboard
X				46. Determine and correct keyboard problems
X				47. Install and configure a pointing device and load appropriate drivers
X				48. Determine and correct pointing device problems
X				49. Install and configure a joystick
X				50. Install, configure, and connect a sound card
X				51. Determine and correct problems with sound
X				52. Install and configure a serial port

X				53. Determine and correct a serial port problem
X				54. Install and configure a modem
X				55. Determine and correct a modem problem
X				56. Install and configure a parallel port
X				57. Determine and correct parallel port problems
X				58. Install and configure a printer
X				59. Perform preventative maintenance on a printer
X				60. Determine and correct printer problems
X				61. Configure printer settings in all Windows operating systems
X				62. Determine and correct a boot-up problem
X				63. Create a CONFIG.SYS file
X				65. Create a typical AUTOEXEC.BAT file
X				64. Configure system startup options to load an operating system
X				65. Install and configure Windows 2000 Professional
X				66. Install applications under Windows 2000 Professional
X				67. Troubleshoot applications and hardware in Windows 2000 Professional
X				68. Perform administrative tasks with Windows 2000 Professional
X				69. Use REGEDIT to make changes to the Registry
X				70. Install and configure Windows 95/98
X				71. Determine and correct problems in Windows 95/98
X				72. Install and configure Windows NT Workstation
X				73. Install and configure a network card
X				74. Install client software on a computer
X				75. Install software to connect to the Internet
X				76. Configure a web browser for lan or modem operation
X				77. Install and configure Windows Millennium
X				78. Install driver software for Windows Millennium
X				79. Install service packs and upgrades for Windows Millennium
X				80. Troubleshoot applications and hardware in Windows Millennium

3	2	1	N	**E. Networking Essentials**
X				1. Define common networking terms
X				2. Identify the hardware components of a network
X				3. Describe the advantages and disadvantages of various cable types
X				4. Define broadband and baseband communications
X				5. Compare a client-server network with a peer-to-peer network
X				6. Describe gateways and their use in modern networks
X				7. Identify the characteristics of star, bus, mesh, and ring topologies
X				8. Identify the characteristics of segments and backbones
X				9. Identify the characteristics of 10Base2, 10Base5, 10BaseT, and other network types
X				10. Describe and explain the OSI model and networking services within each layer
X				11. Describe how two systems communicate through the OSI model
X				12. Describe the structure and purpose of data frames
X				11. Select the appropriate network and transport protocol for various networks
X				13. Select the appropriate connectivity devices for various networks
X				14. List the characteristics, requirements, and appropriate situations for WAN connection services
X				15. Choose an administrative plan to meet specified needs
X				16. Choose a disaster recovery plan
X				17. Install, configure, and resolve hardware conflicts for multiple adapters in networks

X				18. Configure IP and DHCP based networking
X				19. Select the appropriate hardware and software tools to monitor trends in the network
X				20. Identify common errors associated with components required for communications
X				21. Diagnose and resolve common connectivity problems with cards, cables, and related hardware
X				22. Configure a Local area network for Internet access
X				23. Identify and resolve network performance problems

3	2	1	N	F. Leadership Competencies and Employment Preparation
X				1. Demonstrate an understanding of VICA, its structure and activities
X				2. Demonstrate an understanding of one's personal values
X				3. Perform tasks related to effective personal management skills
X				4. Demonstrate interpersonal skills
X				5. Demonstrate etiquette and courtesy
X				6. Demonstrate effectiveness in oral and written communication
X				7. Develop and maintain a code of professional ethics
X				8. Maintain a good professional appearance
X				9. Perform basic tasks related to securing and terminating employment

A+ Core Hardware Service Technician Examination Objectives

6/20/02

Introduction

For A+ Certification, the examinee must pass both this examination and the A+ Operating System Technologies examination. The Core Hardware examination measures essential competencies for a desktop computer hardware service technician with six months of on-the-job experience. The examinee must demonstrate basic knowledge of installing, configuring, upgrading, troubleshooting, and repairing desktop computer systems at the standard defined by this test specification.

The skills and knowledge measured by this examination are derived from an industry-wide and worldwide job task analysis which was validated through a survey of almost 2,000 A+ certified professionals. The results of the survey are used in weighting the domains and ensuring that the weighting is representative of the relative importance of that content to the job requirements of a service technician with six months on-the-job experience. The intent is to certify individuals in a body of knowledge that is identified and accepted as the baseline or foundation of any entry-level PC technician.

The results of the job task analysis and survey can be found in the following report: CompTIA A+ Certification Core Hardware and OS Technologies examinations Job Task Analysis. This report is available for distribution.

The exam is in adaptive format, therefore, will be presented with 20-30 questions. You will have 30 minutes to complete the exam. Please be aware that a score determination could be made before the maximum number of questions is presented. Once a score determination is made, the exam will shut off. The exam is translated in the following languages: Japanese, French, Spanish and German.

NOTE: This examination blueprint for the A+ Core Hardware examination includes the weighting, test objectives, and example content. Example topics and concepts are included to clarify the test objectives and should not be construed as a comprehensive listing of all the content of this examination.

The table below lists the domains measured by this examination and the extent to which they are represented in the examination.

Domain	% Of Examination
1.0 Installation, Configuration and Upgrading	30%
2.0 Diagnosing and Troubleshooting	30%
3.0 Preventive Maintenance	5%
4.0 Motherboard/Processors/Memory	15%
5.0 Printers	10%
6.0 Basic Networking	10%
Total	100.00%

Response Limits

The examinee selects, from four (4) or more response options and the option(s) that best completes the statement or answers the question. Distracters or wrong answers are response options that examinees with incomplete knowledge or skill would likely choose, but are generally plausible responses fitting into the content area. Test item formats used in this examination are:

Multiple-choice: The examinee selects one option that best answers the question or completes a statement. The option can be embedded in a graphic where the examinee "points and clicks" on their selection choice to complete the test item.

Multiple-response: The examinee selects more then one option that best answers the question or completes a statement.

Sample Directions:
Read the statement or question and from the response options, select only the option(s) that represent the most correct or best answer(s).

A+ Core Hardware Service Technician Examination Objectives

6/20/02

Domain 1.0 Installation, Configuration, and Upgrading

This domain requires the knowledge and skills to identify, install, configure, and upgrade desktop computer modules and peripherals, following established basic procedures for system assembly and disassembly of field replaceable modules. Elements included are listed below with each test objective.

Content Limits

1.1 Identify basic terms, concepts, and functions of system modules, including how each module should work during normal operation and during the boot process.

Examples of concepts and modules are:

- System board
- Power supply
- Processor /CPU
- Memory
- Storage devices
- Monitor
- Modem
- Firmware
- BIOS
- CMOS
- LCD (portable systems)
- Ports
- PDA (Personal Digital Assistant)

1.2 Identify basic procedures for adding and removing field replaceable modules for both desktop and portable systems.

Examples of modules:

- System board
- Storage device
- Power supply
- Processor /CPU
- Memory
- Input devices
- Hard drive
- Keyboard
- Video board
- Mouse
- Network Interface Card (NIC)

Portable system components

- AC adapter
- Digital Camera
- DC controller
- LCD panel
- PC Card
- Pointing Devices

1.3 Identify available IRQs, DMAs, and I/O addresses and procedures for device installation and configuation.

Content may include the following:
- Standard IRQ settings
- Modems
- Floppy drive controllers
- Hard drive controllers
- USB ports
- Infrared ports
- Hexidecimal/Addresses

1.4 Identify common peripheral ports, associated cabling, and their connectors.

Content may include the following:
- Cable types
- Cable orientation
- Serial versus parallel
- Pin connections

Examples of types of connectors:
- DB-9
- DB-25
- RJ-11
- RJ-45
- BNC
- PS2/MINI-DIN
- USB
- IEEE 1394

1.5 Identify proper procedures for installing and configuring IDE/EIDE devices.

Content may include the following:
- Master/Slave
- Devices per channel
- Primary/Secondary

1.6 Identify proper procedures for installing and configuring SCSI devices.

Content may include the following:
- Address/Termination conflicts
- Cabling
- Types (example: regular, wide, ultra-wide)
- Internal versus external
- Expansion slots, EISA, ISA, PCI
- Jumper block settings (binary equivalents)

1.7 Identify proper procedures for installing and configuring peripheral devices.

Content may include the following:
- Monitor/Video Card
- Modem
- USB peripherals and hubs
- IEEE 1284
- IEEE 1394
- External storage

Portables
- Docking stations
- PC cards
- Port replicators
- Infrared devices

1.8 Identify hardware methods of upgrading system performance, procedures for replacing basic subsystem components, unique components and when to use them.

Content may include the following:
- Memory
- Hard Drives
- CPU
- Upgrading BIOS
- When to upgrade BIOS

Portable Systems
- Battery
- Hard Drive
- Types I, II, III cards
- Memory

GOAL 1

Students in Missouri public schools will acquire the knowledge and skills to gather, analyze and apply information and ideas.

Student will demonstrate within and integrate across all content areas the ability to:

1. Develop questions and ideas to initiate and refine research
2. Conduct research to answer questions and evaluate information and ideas
3. Design and conduct field and laboratory investigations to study nature and society
4. Use technological tools and other resources to locate, select and organize information
5. Comprehend and evaluate written, visual and oral presentations and works
6. Discover and evaluate patterns and relationships in information, ideas and structures
7. Evaluate the accuracy of information and the reliability of its sources
8. Organize data, information and ideas into useful forms (including charts, graphs, outlines) for analysis or presentation
9. Identify, analyze and compare the institutions, traditions and art forms of past and present societies
10. Apply acquired information, ideas and skills to different contexts as students, workers, citizens and consumers

GOAL 2

Students in Missouri public schools will acquire the knowledge and skills to communicate effectively within and beyond the classroom.

Student will demonstrate within and integrate across all content areas the ability to:

1. Plan and make written, oral and visual presentations for a variety of purposes and audiences
2. Review and revise communications to improve accuracy and clarity
3. Exchange information, questions and ideas while recognizing the perspectives of others
4. Present perceptions and ideas regarding works of the arts, humanities and sciences
5. Perform or produce works in the fine and practical arts
6. Apply communication techniques to the job search and to the workplace
7. Use technological tools to exchange information and ideas

GOAL 3

Students in Missouri public schools will acquire the knowledge and skills to recognize and solve problems.

Student will demonstrate within and integrate across all content areas the ability to:

1. Identify problems and define their scope and elements
2. Develop and apply strategies based on ways others have prevented or solved problems
3. Develop and apply strategies based on one's own experience in preventing or solving problems
4. Evaluate the processes used in recognizing and solving problems
5. Reason inductively from a set of specific facts and deductively from general premises
6. Examine problems and proposed solutions from multiple perspectives
7. Evaluate the extent to which a strategy addresses the problem
8. Assess costs, benefits and other consequences of proposed solutions

GOAL 4

Students in Missouri public schools will acquire the knowledge and skills to make decisions and act as responsible members of society.

Student will demonstrate within and integrate across all content areas the ability to:

1. Explain reasoning and identify information used to support decisions
2. Understand and apply the rights and responsibilities of citizenship in Missouri and the United States
3. Analyze the duties and responsibilities of individuals in societies
4. Recognize and practice honesty and integrity in academic work and in the workplace
5. Develop, monitor and revise plans of action to meet deadlines and accomplish goals
6. Identify tasks that require a coordinated effort and work with others to complete those tasks
7. Identify and apply practices that preserve and enhance the safety and health of self and others
8. Explore, prepare for and seek educational and job opportunities

Domain 2.0 Diagnosing and Troubleshooting

This domain requires the ability to apply knowledge relating to diagnosing and troubleshooting common module problems and system malfunctions. This includes knowledge of the symptoms relating to common problems.

Content Limits

2.1 Identify common symptoms and problems associated with each module and how to troubleshoot and isolate the problems.

Content may include the following:

- Processor/Memory symptoms
- Mouse
- Floppy drive
- Parallel ports
- Hard Drives
- CD-ROM
- DVD
- Sound Card/Audio
- Monitor/Video
- Motherboards
- Modems
- BIOS
- USB
- NIC
- CMOS
- Power supply
- Slot covers
- POST audible/visual error codes
- Troubleshooting tools, e.g., multimeter
- Large LBA, LBA
- Cables
- Keyboard
- Peripherals

2.2 Identify basic troubleshooting procedures and how to elicit problem symptoms from customers.

Content may include the following:

- Troubleshooting/isolation/problem determination procedures
- Determine whether hardware or software problem
- Gather information from user regarding, e.g.,
    - Customer Environment
    - Symptoms/Error Codes
    - Situation when the problem occurred

A+ Core Hardware Service Technician Examination Objectives

6/20/02

Domain 3.0 Preventive Maintenance

This domain requires the knowledge of safety and preventive maintenance. With regard to safety, it includes the potential hazards to personnel and equipment when working with lasers, high voltage equipment, ESD, and items that require special disposal procedures that comply with environmental guidelines. With regard to preventive maintenance, this includes knowledge of preventive maintenance products, procedures, environmental hazards, and precautions when working on desktop computer systems.

Content Limits

3.1 Identify the purpose of various types of preventive maintenance products and procedures and when to use them.

Content may include the following:

- Liquid cleaning compounds
- Types of materials to clean contacts and connections
- Non-static vacuums (chasis, powersupplies, fans)

3.2 Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace.

Content may include the following:

- UPS (Uninterruptible Power Supply) and suppressors
- Determining the signs of power issues
- Proper methods of storage of components for future use

Potential hazards and proper safety procedures relating Lasers

- High-voltage equipment
- Power supply
- CRT

Special disposal procedures that comply with environmental guidelines.

- Batteries
- CRTs
- Toner kits/cartridges
- Chemical solvents and cans
- MSDS (Material Safety Data Sheet)

ESD (Electrostatic Discharge) precautions and procedures

- What ESD can do, how it may be apparent, or hidden
- Common ESD protection devices
- Situations that could present a danger or hazard

A+ Core Hardware Service Technician
Examination Objectives

6/20/02

Domain 4.0 Motherboard/Processors/Memory

This domain requires knowledge of specific terminology, facts, ways and means of dealing with classifications, categories and principles of motherboards, processors, and memory in desktop computer systems.

Content Limits

4.1 Distinguish between the popular CPU chips in terms of their basic characteristics.

Content may include the following:

- Popular CPU chips (Intel, AMD, Cyrix)
- Characteristics
- Physical size
- Voltage
- Speeds
- On board cache or not
- Sockets
- SEC (Single Edge Contact)

4.2 Identify the categories of RAM (Random Access Memory) terminology, their locations, and physical characteristics.

Content may include the following:

- Terminology:
- EDO RAM (Extended Data Output RAM)
- DRAM (Dynamic Random Access Memory)
- SRAM (Static RAM)
- RIMM (Rambus Inline Memory Module 184 Pin)
- VRAM (Video RAM)
- SDRAM (Synchronous Dynamic RAM)
- WRAM (Windows Accelerator Card RAM)
- Locations and physical characteristics:
- Memory bank
- Memory chips (8-bit, 16-bit, and 32-bit)
- SIMMS (Single In-line Memory Module)
- DIMMS (Dual In-line Memory Module)
- Parity chips versus non-parity chips

4.3 Identify the most popular type of motherboards, their components, and their architecture (bus structures and power supplies).

Content may include the following:

- Types of motherboards:
  - AT (Full and Baby)
  - ATX
  - Components:
  - Communication ports
  - SIMM and DIMM
  - Processor sockets
  - External cache memory (Level 2)
  - Bus Architecture
  - ISA
  - PCI
  - AGP
  - USB (Universal Serial Bus)
  - VESA local bus (VL-Bus)
  - Basic compatibility guidelines
  - IDE (ATA, ATAPI, ULTRA-DMA, EIDE)
  - SCSI (Wide, Fast, Ultra, LVD(Low Voltage Differential))

4.4 Identify the purpose of CMOS (Complementary Metal-Oxide Semiconductor), what it contains and how to change its basic parameters.

Example Basic CMOS Settings:

- Printer parallel port—Uni., bi-directional, disable/enable, ECP, EPP
- COM/serial port—memory address, interrupt request, disable
- Floppy drive—enable/disable drive or boot, speed, density
- Hard drive—size and drive type
- Memory—parity, non-parity
- Boot sequence
- Date/Time
- Passwords
- Plug & Play BIOS

Domain 5.0 Printers

This domain requires knowledge of basic types of printers, basic concepts, and printer components, how they work, how they print onto a page, paper path, care and service techniques, and common problems.

Content Limits

5.1 Identify basic concepts, printer operations and printer components.

Content may include the following:

Paper feeder mechanisms

Types of Printers

- Laser
- Inkjet
- Dot Matrix

Types of printer connections and configurations

- Parallel
- Network
- USB
- Infrared
- Serial

5.2 Identify care and service techniques and common problems with primary printer types.

Content may include the following:

- Feed and output
- Errors (printed or displayed)
- Paper jam
- Print quality
- Safety precautions
- Preventive maintenance

Domain 6.0 Basic Networking

This domain requires knowledge of basic network concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring network interface cards, and knowledge of the ramifications of repairs when a computer is networked. The scope of this topic is specific to hardware issues on the desktop and connecting it to a network.

Content Limits

6.1 Identify basic networking concepts, including how a network works and the ramifications of repairs on the network.

Content may include the following:

- Installing and configuring network cards
- Network access
- Full-duplex, half-duplex
- Cabling—Twisted Pair, Coaxial, Fiber Optic, RS-232
- Ways to network a PC
- Physical Network topographies
- Increasing bandwidth
- Loss of data
- Network slowdown
- Infrared
- Hardware protocols

A+ Operating System Technologies
Examination Objectives

6/20/02

Introduction

For A+ Certification, the examinee must pass both this examination and the A+ Core Hardware examination. This examination measures essential operating system competencies for desktop computer hardware service technician with six months of on-the-job experience. The examinee must demonstrate basic knowledge of Command Line Prompt, Windows 9x and Windows 2000 for installing, configuring, upgrading, troubleshooting, and repairing desktop computer systems.

The skills and knowledge measured by this examination are derived from an industry-level and worldwide job task analysis which was validated through a survey of almost 2,000 A+ certified professionals. The results of the survey are used in weighting the domains and ensuring that the weighting is representative of the relative importance of that content to the job requirements of a service technician with six months on-the-job experience. The intent is to certify individuals in a body of knowledge that is identified and accepted as the baseline or foundation of an entry-level PC technician. It is not intended to measure 'cutting edge' technologies.

The results of the job task analysis and survey can be found in the following report: CompTIA A+ Certification Core Hardware and OS Technologies examinations Job Task Analysis Report. This report is available for distribution.

The exam is in adaptive format, therefore, will be presented with 20-30 questions. You will have 30 minutes to complete the exam. Please be aware that a score determination could be made before the maximum number of questions is presented. Once a score determination is made, the exam will shut off. The exam is translated in the following languages: Japanese, French, Spanish and German.

NOTE: This examination blueprint for the A+ Operating System Technologies examination includes the weighting, test objectives, and example content. Example topics and concepts are included to clarify the test objectives and should not be construed as a comprehensive listing of all the content of this examination.

The table below lists the domains measured by this examination and the extent to which they are represented.

Domain	% Of Examination
1.0 OS Fundamentals	30%
2.0 Installation, Configuration and Upgrading	15%
3.0 Diagnosing and Troubleshooting	40%
4.0 Networks	15%
Total	100.00%

Response Limits

The examinee selects, from four (4) or more response options and the option(s) that best completes the statement or answers the question. Distracters or wrong answers are response options that examinees with incomplete knowledge or skill would likely choose, but are generally plausible responses fitting into the content area. Test item formats used in this examination are:

Multiple-choice: The examinee selects one option that best answers the question or completes a statement. The option can be embedded in a graphic where the examinee "points and clicks" on their selection choice to complete the test item.

Multiple-response: The examinee selects more then one option that best answers the question or completes a statement.

Sample Directions:
Read the statement or question and from the response options, select only the option(s) that represent the most correct or best answer(s).

A+ Operating System Technologies
Examination Objectives

6/20/02

Domain 1.0 Operating System Fundamentals

This domain requires knowledge of underlying DOS (Command prompt functions) in Windows 9x, Windows 2000 operating systems in terms of its functions and structure, for managing files and directories, and running programs. It also includes navigating through the operating system from command line prompts and Windows procedures for accessing and retrieving information.

Content Limits

1.1 Identify the operating system's functions, structure, and major system files to navigate the operating system and how to get to needed technical information.

Content may include the following:

- Major Operating System functions
  - Create folders
  - Checking OS Version
- Major Operating System components
  - Explorer
  - My Computer
  - Control Panel
- Contrasts between Windows 9X and Windows 2000
- Major system files: what they are, where they are located, how they are used and what they contain:

  System, Configuration, and User Interface files
  - IO.SYS
  - BOOT.INI
  - WIN.COM
  - MSDOS.SYS
  - AUTOEXEC.BAT
  - CONFIG.SYS
  - COMMAND LINE PROMPT

  Memory management
  - Conventional
  - Extended/upper memory
  - High memory
  - Virtual memory
  - HIMEM.SYS
  - EMM386.exe

Windows 9x

- IO.SYS
- WIN.INI
- USER.DAT
- SYSEDIT
- SYSTEM.INI
- SETVER.EXE
- SMARTDRV.EXE
- MSCONFIG (98)
- COMMAND.COM
- DOSSTART.BAT
- REGEDIT.EXE
- SYSTEM.DAT
- RUN COMMAND
- DriveSpace

Windows 2000

- Computer Management
- BOOT.INI
- REGEDT32
- REGEDIT
- RUN CMD
- NTLDR
- NTDETECT.COM
- NTBOOTDD.SYS

Command Prompt Procedures (Command syntax)

- DIR
- ATTRIB
- VER
- MEM
- SCANDISK
- DEFRAG
- EDIT
- XCOPY
- COPY
- FORMAT
- FDISK
- MSCDEX
- SETVER
- SCANREG

1.2 Identify basic concepts and procedures for creating, viewing and managing files, directories and disks. This includes procedures for changing file attributes and the ramifications of those changes (for example, security issues).

Content may include the following:

- File attributes - Read Only, Hidden, System, and Archive attributes
- File naming conventions (Most common extensions)
- Windows 2000 COMPRESS, ENCRYPT
- IDE/SCSI
- Internal/External
- Backup/Restore
- Partitioning/Formatting/File System
  - FAT
  - FAT16
  - FAT32
  - NTFS4
  - NTFS5
  - HPFS
- Windows-based utilities
  - ScanDisk
  - Device manager
  - System Manager
  - Computer Manager
  - MSCONFIG.EXE
  - REGEDIT.EXE (View information/Backup registry)
  - REGEDT32.EXE
  - ATTRIB.EXE
  - EXTRACT.EXE
  - DEFRAG.EXE
  - EDIT.COM
  - FDISK.EXE
  - SYSEDIT.EXE
  - SCANREG
  - WSCRIPT.EXE
  - HWINFO.EXE
  - ASD.EXE (Automatic Skip Driver)
  - Cvt1.EXE (Drive Converter FAT16 to FAT32)

A+ Operating System Technologies
Examination Objectives
6/20/02

Domain 2.0 Installation, Configuration and Upgrading

This domain requires knowledge of installing, configuring and upgrading Windows 9x, and Windows 2000. This includes knowledge of system boot sequences and minimum hardware requirements.

Content Limits

2.1 Identify the procedures for installing Windows 9x, and Windows 2000 for bringing the software to a basic operational level.

Content may include the following:
- Start Up
- Partition
- Format drive
- Loading drivers
- Run appropriate set up utility

2.2 Identify steps to perform an operating system upgrade.

Content may include the following:
- Upgrading Windows 95 to Windows 98
- Upgrading from Windows NT Workstation 4.0 to Windows 2000
- Replacing Windows 9x with Windows 2000
- Dual boot Windows 9x/Windows NT 4.0/2000

2.3 Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed for Windows 9x, Windows NT, and Windows 2000.

Content may include the following:
- Startup disk
- Safe Mode
- MS-DOS mode
- NTLDR (NT Loader), BOOT.INI
- Files required to boot
- Creating emergency repair disk (ERD)
-

2.4 Identify procedures for loading/adding and configuring application device drivers, and the necessary software for certain devices.

Content may include the following:
- Windows 9x Plug and Play and Windows 2000
- Identify the procedures for installing and launching typical Windows and non-Windows applications. (Note: there is no content related to Windows 3.1)

- Procedures for set up and configuring Windows printing subsystem.
  - Setting Default printer
  - Installing/Spool setting
  - Network printing (with help of LAN admin)

A+ Operating System Technologies
Examination Objectives

6/20/02

Domain 3.0 Diagnosing and Troubleshooting

This domain requires the ability to apply knowledge to diagnose and troubleshoot common problems relating to Windows 9x and Windows 2000. This includes understanding normal operation and symptoms relating to common problems.

Content Limits

3.1 Recognize and interpret the meaning of common error codes and startup messages from the boot sequence, and identify steps to correct the problems.

Content may include the following:

- Safe Mode
- No operating system found
- Error in CONFIG.SYS line XX
- Bad or missing COMMAND.COM
- HIMEM.SYS not loaded
- Missing or corrupt HIMEM.SYS
- SCSI
- Swap file
- NT boot issues
- Dr. Watson
- Failure to start GUI
- Windows Protection Error
- Event Viewer – Event log is full
- A device referenced in SYSTEM.INI, WIN.INI, Registry is not found

3.2 Recognize common problems and determine how to resolve them.

Content may include the following:

- Eliciting problem symptoms from customers
- Having customer reproduce error as part of the diagnostic process
- Identifying recent changes to the computer environment from the user
- Troubleshooting Windows-specific printing problems
  - Print spool is stalled
  - Incorrect/incompatible driver for print
  - Incorrect parameter
- Other Common problems
  - General Protection Faults
  - Illegal operation
  - Invalid working directory
  - System lock up
  - Option (Sound card, modem, input device) or will not function
  - Application will not start or load
  - Cannot log on to network (option – NIC not functioning)
  - TSR (Terminate Stay Resident) programs and virus
  - Applications don't install
  - Network connection
  - Viruses and virus types
    - What they are
    - Sources (floppy, emails, etc.)
    - How to determine presence

A+ Operating System Technologies
Examination Objectives

6/20/02

Domain 4.0 Networks

This domain requires knowledge of network capabilities of Windows and how to connect to networks on the client side, including what the Internet is about, its capabilities, basic concepts relating to Internet access and generic procedures for system setup. The scope of this topic is only what is needed on the desktop side to connect to a network.

Content Limits

4.1 Identify the networking capabilities of Windows including procedures for connecting to the network.

Content may include the following:

- Protocols
- IPCONFIG.EXE
- WINIPCFG.EXE
- Sharing disk drives
- Sharing print and file services
- Network type and network card
- Installing and Configuring browsers
- Configure OS for network connection

4.2 Identify concepts and capabilities relating to the Internet and basic procedures for setting up a system for Internet access.

Content may include the following:

Concepts and terminology

- ISP
- TCP/IP
- IPX/SPX
- NetBEUI
- E-mail
- PING.EXE
- HTML
- HTTP://
- FTP
- Domain Names (Web sites)
- Dial-up networking
- TRACERT.EXE
- NSLOOKUP.EXE

CompTIA.
A+® Certification Program

A+ Core Hardware Exam
Score Report
220-221

Candidate: David Selph
Candidate ID: ID Pending
Registration Number: 206728480
Exam: A+ Core Hardware Exam

Date: 17-May-2003
Site Number: 46104

Passing score: 596
Candidate score: 647
Pass/Fail: Pass

The A+ Core Hardware Exam has a scaled score between 0 and 1300. The A+ Core Hardware Exam is an adaptive exam. Each question on the adaptive exam has a known difficulty level. The Candidate's exam score is based on the difficulty level of questions answered correctly. Answering all questions correctly would give a candidate a very high score, but not necessarily a 1300.

Even though the adaptive version of the exam is shorter than the non-adaptive version, the ability required to pass the adaptive exam is the same as that required to pass the longer non – adaptive version. For more information, please visit www.CompTIA.org.

You missed one or more questions in the following objective areas:

- 2.1 Identify common symptoms and problems associated with each module and how to troubleshoot and isolate the problems.
- 3.2 Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace.
- 4.3 Identify the most popular type of motherboards, their components, and their architecture (bus structures and power supplies).
- 5.1 Identify basic concepts, printer operations and printer components.
- 1.8 Identify hardware methods of upgrading system performance, procedures for replacing basic subsystem components, unique components and when to use them.
- 1.4 Identify common peripheral ports, associated cabling, and their connectors.
- 4.4 Identify the purpose of CMOS (Complementary Metal-Oxide Semiconductor), what it contains and how to change its basic parameters.
- 6.1 Identify basic networking concepts, including how a network works and the ramifications of repairs on the network.
- 3.1 Identify the purpose of various types of preventive maintenance products and procedures and when to use them.

For a complete listing of A+ Certification objectives, please visit www.CompTIA.org.

Receiving your certificate: Your certificate will be mailed to you within four to six weeks after you pass both A+ Certification exams, the A+ Core Hardware Exam and the A+ OS Technologies Exam covering the 2001 objectives.

A+ OS Technologies Exam
Score Report
220-222

Candidate: Douglas L Engelhardt
Candidate ID: COMP001000916039
Registration Number: 206613460
Exam: A+ OS Technologies Exam

Date: 08-May-2003
Site Number: 46104

Passing score: 600
Candidate score: 767
Pass/Fail: Pass

The A+ OS Technologies Exam has a scaled score between 0 and 1300. The A+ OS Technologies Exam is an adaptive exam. Each question on the adaptive exam has a known difficulty level. The Candidate's exam score is based on the difficulty level of questions answered correctly. Answering all questions correctly would give a candidate a very high score, but not necessarily a 1300.

Even though the adaptive version of the exam is shorter than the non-adaptive version, the ability required to pass the adaptive exam is the same as that required to pass the longer non – adaptive version. For more information, please visit www.CompTIA.org.

You missed one or more questions in the following objective areas:

- 4.1 Identify the networking capabilities of Windows including procedures for connecting to the network.
- 3.2 Recognize common problems and determine how to resolve them.
- 3.1 Recognize and interpret the meaning of common error codes and startup messages from the boot sequence, and identify steps to correct the problems.

For a complete listing of A+ Certification objectives, please visit www.CompTIA.org.

Receiving your certificate: Your certificate will be mailed to you within four to six weeks after you pass both A+ Certification exams, the A+ Core Hardware Exam and the A+ OS Technologies Exam covering the 2001 objectives.

Track your exam history on-line: Please visit **http://www.comptia.org/careerID** to access your exam history, update your demographics, and verify certification status. Allow 5 business days for your CompTIA web record to be updated with the A+ OS Technologies Exam results.

CompTIA Retake Policy

In the event you have passed the A+ OS Technologies Exam, you shall be required to wait for a period of twelve (12) calendar months before retaking the A+ OS Technologies Exam, unless CompTIA has changed the test objectives for the exam.

In the event you have failed the A+ OS Technologies Exam, CompTIA does not require any waiting period

LINN STATE
Technical College

And

Lewis & Clark Career Center

Articulated Program

For

Networking Systems Technology

May 2001

CONTENTS OF AGREEMENT:

LINN STATE

Technical College
Networking Systems Technology

Articulation Agreement
Between
Linn State Technical College and Lewis & Clark Career Center

General Understanding:
Linn State Technical College seeks to expand educational opportunities to students through advanced and professional technical education. The program specifics outlined below provide a baseline of courses available for articulated credit. To allow reasonable flexibility for individual secondary school differences, changes in program specifics may be made with the mutual assent of the secondary school and LSTC prior to finalizing/signing the articulation agreement. Contact LSTC should course changes be required. **Refer to LSTC program content, Syllabi and course descriptions (following) for clarification of articulated course learning objectives.**

PROGRAM SPECIFICS:

COURSES WHICH QUALIFY FOR ARTICULATED CREDIT				
COURSE DESCRIPTION	COURSE NO.	CREDIT HOURS	SECONDARY COURSES TITLE/DESCRIPTION	COURSE NO.
See Attached Course Listing Rev. May 1, 2001				
CREDIT EARNED				

SIGNATURES:
LSTC agrees to grant college credit to students based on the "Goals, Guidelines, Procedures and the program specific guidelines/amendments" provided in the agreement.
We have reviewed this agreement and the supporting instruments and agree to the terms of this articulation agreement.

LINN STATE TECHNICAL COLLEGE AND ST. CHARLES R-VI School District

Date: 1-4-02

Vice President of Academic Support, Grants & Contracts

Date: 12/10/01

Secondary Director

Date: 10 DEC 2001

Department Chair, LSTC

Date: 12-11-01

Secondary Instructor

Linn State Technical College

CNT - Networking Technology Program

Articulation Credit Options -- Effective 5/01
Attachment to articulation agreement

A. LSTC graduates are required to complete a minimum of four (4) semesters of CISCO training. These semesters can be: Semesters I-4 (CCNA), Semesters 5-8 (CCNP) **or** any combination of 1-8. Articulating students can receive credit, after passing pre-admission CISCO skills testing, for the following secondary course work:

CISCO Semester	**LSTC Course**	**Credit**
Semester I	CNT 113	3 cr. hr.
Semester II	CNT 120	3 cr. hr.
Semester III	CNT 210	3 cr. hr.
Semester IV	CNT 220	3 cr. hr.

B. An LSTC graduation requirement is attainment of at least one (1) professional certification. Articulating students can receive credit, when they provide verification of certification(s) -- on or before college registration, -- for the following secondary course work:

Certification	**LSTC Course**	**Credit**
Cert. Novell Admin.	CNT 165	3 cr. hr.
Microsoft Office User Specialist	CPP 101	3 cr. hr.
Microsoft Certified Professional		
NT Server	CNT 266	3 cr. hr.
Windows 2000 Server	CNT 266	3 cr. hr.
NT Workstation	CNT 215	3 cr. hr.
Windows 98 Workstation	CNT 115	3 cr. hr.
A+ Certification	CNT 142 **and** CNT 162	Total: 6 cr. hr.
CISCO Cert. Network Admin.	CNT 113, 120, 210 **and** 220	Total: 12 cr. hr.

Effective: May 2001

NETWORKING SYSTEMS TECHNOLOGY

CNT 113 3 (5)

Network Fundamentals. This is the first of four semester courses designed to provide students with classroom and laboratory experience in current and emerging networking technology that will empower them to enter employment and/or further education and training in the computer networking field. A task analysis of current industry standards and occupational analysis was used to develop the content standards. Instruction includes, but is not limited to, safety, networking, network terminology and protocols, network standards, LANs, WANs, OSI models, cabling, cabling tools, routers, router programming, star topology, IP addressing, and network standards. Particular emphasis is given to the use of decision-making and problem-solving techniques in applying science, mathematics, communication and social studies concepts to solve networking problems. In addition, instruction and training are provided in the proper care, maintenance and use of networking software, tools and equipment and all local, state and federal safety, building and environmental codes and regulations.

CNT 115 3 (5)

Operating Platforms I. Course covers popular Operating Systems. (Windows 95,98 and DOS) Use and installation is covered for each operating system.

CNT 120 3 (5)

Network Routing. This is the second of four semester courses designed to provide students with classroom and laboratory experience in current and emerging networking technology that will empower them to enter employment and/or further education and training in the computer networking field. A task analysis of current industry standards and occupational analysis was used to develop the content standards. Instruction includes, but is not limited to, safety, networking, network terminology and protocols, network standards, LANs, WANs, OSI models, Ethernet, Token Ring, Fiber Distributed Data Interface, TCI/IP Addressing Protocol, dynamic routing, routing, and the network administrator's role and function. Particular emphasis is given to the use of decision-making and problem-solving techniques in applying science, mathematics, communication and social studies concepts to solve networking problems. In addition, instruction and training are provided in the proper care, maintenance and use of networking software, tools and equipment and all local, state and federal safety, building and environmental codes and regulations. Prerequisites: CNT 113 Network Fundamentals

CNTI 124 4 (40)

Networking Internship I. The networking internship is comprised of 280 hours of paid work experience in a networking setting requiring the student to perform a variety of tasks. The student will be required to work eight hours per day for seven weeks. A training agreement between the employer and the College is required, as is a weekly summary of activities (tasks performed) prepared by students.

CNTI 125 4 (40)

Networking Internship II. The networking internship is comprised of 280 hours of paid work experience in a networking setting requiring the student to perform a variety of tasks. The student will be required to work eight hours per day for seven weeks. A training agreement between the employer and the College is required, as is a weekly summary of activities (tasks performed) prepared by students.

CNT 142 3 (5)

System Maintenance. This course covers the diagnosis, troubleshooting and maintenance of computer components. Topics include hardware compatibility, system architecture, memory, input devices, video displays, disk drives, modems and printers. Prerequisites: CNT 115 Operating Platforms I.

CNT 165 3 (5)

Network Administration Using Novell. This course focuses on the management of a computer network using the Novell network operating system. Emphasis will be placed on daily administrative tasks performed by a network administrator. Prerequisites: CNT 113 Network Fundamentals and CNT 215 Operating Platforms II.

CNT 166 3 (5)

Network Administration Using Microsoft Windows NT Server. This course focuses on the management of a computer network using the Microsoft Windows NT Server network operating system. Emphasis will be placed on daily administrative tasks performed by a network administrator. Prerequisites: Student should be familiar with the Windows Environment to include: Windows Explorer, starting an application, open, close, minimize, maximize, and move windows. Switch between applications or tasks. Knowledge of basic computer hardware components, including computer memory, hard disks, central processing unit (CPU) and pointing devices. Prerequisites: CNT 215 Operating Platforms II.

CNT 210 3 (5)

Network Design and Implementation. This is the third in four courses designed to introduce new content and extend previously learned networking skills which will empower the student to enter the workforce and/or further education and training in the computer networking field. A task analysis of current industry standards and occupational analysis was used to develop the content standards. Instruction introduces and extends the student's knowledge and practical experience with switches, LAWs and LVANs design, configuration and maintenance. Students develop practical experience in skills related to configuring LANs, WANs, Novell networks, Internetwork Packet Exchange (IPX) routing and Interior Gateway Routing Protocol (IGRP) protocols and network troubleshooting. Prerequisites: CNT 113 Network Fundamentals, CNT 120 Network Routing.

CNT 215 3 (5)

Operating Platforms II. Course covers popular Networking Operating Systems. (Windows NT Workstation, Linux, Novell) Use and installation is covered for each operating system.

CNT 220 3 (5)

Wide Area Networking. This is the fourth course in four courses designed to introduce new content and extend previously learned networking skills which will empower the student to enter the workforce and/or further their education and training in the computer networking field. A task analysis of current industry standards and occupational analysis was used in the development of content standards. Instruction introduces and extends the student's knowledge and practical experience with Wide Area Networks (WANs), Integrated Services Data Networks (ISDN) and Point-to-Point Protocols (PPP) and Frame Relay design, configuration and maintenance. Students develop practical experience in skills related to configuring WANs, ISDN, PPP and Frame Relay protocols and network troubleshooting. Prerequisites: CNT 113 Network Fundamentals, CNT 120 Network Routing, CNT 210 Network Design and Implementation.

CNT 254 3 (7)

Project Management. This course covers Information Technology Project Management, which builds a foundation for tomorrows creators and managers. Students gain understanding through project analysis, which includes both successful and failed examples.

CNT 266 3 (5)

Advanced Network Administration Using Microsoft Windows NT Server. This course is a continuation of Network Administration Using Microsoft Windows NT Server. Emphasis is placed on installation, configuration and implementation of a functional NT Server. Prerequisites: CNT 166 Network Administration Using Microsoft Windows NT Server.

NETWORKING SYSTEMS TECHNOLOGY
11.0501
(Two-year Associate of Applied Science Degree)

The Linn State Technical College Networking Systems Technology program focuses on networking with elective options in programming and telecommunications. The program will require students take one certification test. Current certification options are CISCO Certified Network Assistant (CCNA) or Network +.

The world is operating in the age of information technology. To keep competitive in the global worldwide market, businesses and industries must rely on computer networks to process information, produce information, transmit information, exchange information and store information.

The use of computer networking systems is widespread. Businesses and industries are installing and utilizing computer network systems. Companies are also connecting to the Internet and the Worldwide Web.

The trend toward greater use of networking systems results in the need for personnel who possess a solid foundation in networking systems emphasizing design, installation and administration. A successful network technician must have the technical versatility to effectively communicate with all the types of information technology professionals and the professional user.

		Credit Hours	Hours Per Wk.
	SEMESTER 1		
COM 111*	Oral Communications	3	3
CNT 113	Network Fundamentals	3	5
CPP 112	Computer Concepts	3	5
CNT 115	Operating Platforms I	3	5
CPP 101*	Introduction to Microcomputer Usage	3	5
	Semester Total	**15**	**23**
	SEMESTER 2		
CNT 215	Operating Platforms II	3	5
COM 101*	English Composition	3	3
MAT 113*	Intermediate Algebra w/lab	3	5
CNT 142	System Maintenance	3	5
SEM 005	Resume Seminar	NC	
CNT 120	Network Routing	3	5
	Semester Total	**15**	**23**
	SEMESTER 3		
CNTI 124	Networking Internship I (Seven weeks)	4	40
CNTI 125	Networking Internship II (Seven weeks)	4	40
	Semester Total	**8**	**40**
	SEMESTER 4		
PSC 101*	American Government	3	3
CNT 166	Network Administration Using Microsoft Windows NT Server	3	5
CNT 165	Network Administration using Novell	3	5
CNT 210	Network Design and Implementation	3	5
COM 211	Technical Writing	3	3
	General Elective	3	5
	Semester Total	**18**	**23**

SEMESTER 5

CNT	254	Project Management	3	5
CNT	220	Wide Area Networking	3	5
CNT	266	Advanced Network Administration Using Microsoft Windows NT Server	3	5
PHY	101*	College Physics	4	5
		Programming Elective	3	5
		Semester Total	**16**	**28**
		Program Totals	**72**	

* General education course

Linn State Technical College

CNT - Networking Technology Program

Articulation Credit Options -- Effective 5/01
Attachment to articulation agreement

A. LSTC graduates are required to complete a minimum of four (4) semesters of CISCO training. These semesters can be: Semesters I-4 (CCNA), Semesters 5-8 (CCNP) **or** any combination of 1-8. Articulating students can receive credit, after passing pre-admission CISCO skills testing, for the following secondary course work:

CISCO Semester	**LSTC Course**	**Credit**
Semester I	CNT 113	3 cr. hr.
Semester II	CNT 120	3 cr. hr.
Semester III	CNT 210	3 cr. hr.
Semester IV	CNT 220	3 cr. hr.

B. An LSTC graduation requirement is attainment of at least one (1) professional certification. Articulating students can receive credit, when they provide verification of certification(s) -- on or before college registration, -- for the following secondary course work:

Certification	**LSTC Course**	**Credit**
Cert. Novell Admin.	CNT 165	3 cr. hr.
Microsoft Office User Specialist	CPP 101	3 cr. hr.
Microsoft Certified Professional		
NT Server	CNT 266	3 cr. hr.
Windows 2000 Server	CNT 266	3 cr. hr.
NT Workstation	CNT 215	3 cr. hr.
Windows 98 Workstation	CNT 115	3 cr. hr.
A+ Certification	CNT 142 **and** CNT 162	Total: 6 cr. hr.
CISCO Cert. Network Associate.	CNT 113, 120, 210 **and** 220	Total: 12 cr. hr.

Rev. May 1, 2001

Networking Systems Technology

Program Goal:
The Network Systems Technology Program has established goals, which relate to the needs of the student and employers. These goals include:

- To provide a quality education regardless of age, color, disability, gender, national origin, race and/or religion.
- To provide each student with skills, knowledge and attributes to support the Networking industry.
- To prepare students for profitable employment or further education.
- To provide each student with an assessment of the quality of training.
- To keep the programs faculty and staff current with industry training.
- To maintain a professional working classroom and laboratory.
- To maintain existing and develop new partnerships with business, industry, labor, the state, and the state's educational institutions for the purpose of developing curriculum and modifying the program annually.

Completion Outcome:
Graduates of this program will obtain the basic training needed to be successful in the field of Network Technologies. The program offers training in the areas of network technology as well as general education courses required for the successful completion of a two-year degree. The guidelines for this program are set with the assistance our advisory council. Training will consist of instruction in areas relative to the development, use, and maintenance of a network in a business setting.

General Performance Requirements:
Students will demonstrate good work habits through reliability, personal appearance, personality, cooperation, and attitude toward work. Students will utilize school computer equipment and will demonstrate care and safety of equipment.

Essential Functions:
In order to successfully function on a job and succeed in this program, students must be able to:

- Maintain at least a 2.0 grade point average in program specific courses in order to obtain an AAS degree.
- Maintain at least a 2.0 grade point average overall in order to obtain an AAS degree.
- Lift 50 pounds.
- Demonstrate accurate vision reception from monitors and other instructional media.

SCANS Competencies Addressed:
Three Part Foundation:

Basic Skills – reads, writes, performs arithmetic and mathematical operations, listens, and speaks.

- General Education courses address these areas within course curriculum.

- Receives instruction in writing legible reports for warranty work.

Thinking Skills – thinks creatively, make decisions, solve problems, visualize, know how to learn, and reasons.

- Development and administration of a network inherently utilizes these skills.
- Demonstrates abilities during laboratory applications by diagnosing a problem, determining the cause of a problem, and resolving the problem.

Personal Qualities – displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.

- Receives instruction in customer relations.
- Receives instruction in office management in relation to supervision and teamwork.
- Demonstrates ability and receives ratings on each of the above while on internship.
- Is encouraged to participate in Phi Beta Lambda (PBL).
- Is encouraged to participate in Vocational Industrial Clubs of America (VICA) activities.

Five Competencies:

Resources – identifies, organizes, plans, and allocates resources.

- Demonstrates the ability to financial planning and budgeting.
- Demonstrates cost effective use and creation of computer programs and files.
- Demonstrates ability and receives ratings on these skills during internship.

Interpersonal – works with others.

- Receives instruction in office management procedures in relationship to teamwork and supervision.
- Demonstrates abilities and receives ratings on these skills during classroom performance exercises.
- Demonstrates ability and receives ratings on these skills during internship.
- Is encouraged to participate in Vocational Industrial Clubs of America (VICA) activities.

Information – acquires and uses information.

- Must utilize ability to utilize various industry produced trade journals and magazines.

Systems – understands complex interrelationships.

- Understand an organizational structure.
- Creating a network, which support an organization mission.

Technology – works with a variety of technologies.

- Utilize and document results of Internet for research projects.
- Utilize networked and non-networked personal computers.
- Utilize various CD-ROMs for diagnostic/research in relation to classroom assignments.

General Education Related Expectations:

General education competencies required for successful completion of this program include:

Oral Communication

- The ability to communicate effectively and appropriately with co-workers.
- The ability to communicate effectively and appropriately with supervisors.
- The ability to communicate effectively and appropriately with customers.

English Composition

- The ability to write a business letter.
- The ability to write an interoffice memorandum.
- The ability to fill out forms, such as an employment application, with accurate descriptions and details.

Written Communication

- The ability to write a business letter.
- The ability to write an interoffice memorandum.
- The ability to write reports, such as warranty and service, with accurate descriptions and details which monitor flat/rate time.
- The ability to fill out forms, such as an employment application, with accurate descriptions and details.

Reading

- The ability to analyze and interpret graphic information, such as technical manuals, reference books, and charts.
- The ability to evaluate and apply information within written instructional documents.
- Interpret and use diagrams and schematics.

Introductory Algebra

- The ability to perform basic math calculations.

American Political Institutions

- An understanding of the society in which we live.

Physical Science

- Understand scientific methods and application with special emphasis on scientific principles encountered in our everyday interaction with our environment.

Computer Skills

- Understand concepts and use of a word processor by using Microsoft Word.
- Understand concepts and use of an electronic spreadsheet by using Excel.
- Understand concepts and use of a database by using Access.

Specific Course Competencies Required for Major:

Principles of Data Communications and Local Area Networking (CNT 109)

- Discuss basic communications.
  - Analyze various communication procedures.
- Analyze hardware, media, and software.
  - Discuss uses of modems.
  - Describe various communications media.
  - Describe data transmission codes and protocols.
- Discuss communications networks.
  - Discuss network basics.

- Analyze local area networks.
- Analyze wide area networks.
- Discuss planning, design and implementation of networks.

- Discuss the future of communication.
  - Analyze current trends and issues.
  - Utilize teleconferencing/video conferencing techniques.
- Demonstrate the use of the Internet.
  - Explain what the Internet is.
  - Use electronic mail on the Internet.
  - Use gopher and the worldwide web.
  - Utilize browsers to scan the Internet.

Internet Concepts (CNT 151)

- Develop an understanding of Internet basics.
  - Define the Internet and the Virtual Community.
  - Define the World Wide Web and its principles.
  - Identify Internet applications.
  - Discuss browser.
- Use search engines to locate information.
  - Define search engines.
  - Demonstrate the use of various search engines.
- Examine the components of e-mail.
  - Define electronic mail applications.
  - Demonstrate the use of e-mail applications.
  - Organize a personal mailbox.
- Demonstrate the use of listservers and newsgroups.
  - Join a listery.
  - Subscribe to a newsgroup.
- Create and post a home page.
  - Develop an understanding of HTML concepts.
  - Develop an HTML file.
  - Use the HTML editor.
  - Explore other home page development tools.
- Define FTP.
  - Utilize Telnet.
  - Discuss anonymous FTP.
  - Use the Internet to download files.
- Discuss future development of the Internet.
  - Analyze WWW commercial development.
  - Explore interactive Internet.

System Maintenance (CNT 242)

- Discuss basic elements of computer maintenance.
  - Identify types of tools.
  - Demonstrate knowledge of chips, buses, and other features.
- Perform system disassembly/inspection.

- Demonstrate the ability to tear down system.
- Demonstrate the ability to identify each component.

- Discuss preventive maintenance.
  - Develop knowledge of steps for preventive maintenance.
  - Establish a preventive maintenance plan.
  - Perform preventive maintenance of components.
- Illustrate ability to troubleshoot.
  - Perform basic troubleshooting steps.
  - Run diagnostic software.
  - Troubleshoot various devices.
- Upgrade computer components.
  - Install boards.
  - Install drives.
  - Install peripherals.

Network Planning and Design (CNT 253)

- Review basic network principles.
  - Discuss capabilities of a LAN.
  - List and describe components of a LAN.
  - Discuss software and hardware.
  - Discuss haring computer resources.
  - Define and describe file servers.
- Examine network topology and standards.
  - Identify various topologies.
  - Discuss standards in relationship to network topologies.
  - Describe OSI larger architecture.
- Describe Network Transport Systems.
  - Describe Ethernet requirements.
  - Identify Token Ring requirements.
  - Explain ARCNET requirements.
  - Introduce FDDI systems.
  - Discuss ATM environments.
- List and describe Protocols.
  - Discuss the properties of TCP/IP, TCP, and IP.
  - Examine Telnet.
  - Identify IPX and SPX characteristics.
  - Explain X.25 protocol.
  - Specify ISDN properties.
  - Describe Frame Relay and Cell Relay.
- Discuss Internetworking devices.
  - Explain multiplexers.
  - Identify the uses of repeaters.
  - Examine the uses of bridges and gateways.
  - Describe the uses of routers and brouters.
  - Analyze the uses of hubs and switches.

- Discuss ATM switches.
- Specify wireless networking equipment.
- Explain the uses of CSU/DSU.

- Examine testing procedures.
  - Discuss hardware and software analyzers.
  - Discuss troubleshooting techniques.

Project Management (CNT 254)

- Plan network solution.
  - Perform analysis and design.
  - Determine hardware design.
  - Determine software design.
- Install network server.
  - Set up server.
  - Install network operating system.
- Install client.
  - Connect server and workstations.
  - Set up workstations.
- Install peripherals.
  - Connect printers.
- Evaluate network solution.
  - Judge effectiveness of the solution.

Network Administration Using Microsoft Windows NT Server. (CNT 162)

- Develop knowledge of domains.
  - Describe the purpose of a domain.
  - Compare and contrast domains and workgroups.
  - Discuss the different trust relationships in domains.
  - Configure devices to participate within a domain.
- Set up user accounts and login security.
  - Create and modify domain's users.
  - Describe login security.
  - Assign access restrictions using User Manager for Domains.
  - Create user accounts by copying existing user accounts.
  - Create user environment profiles.
  - Add group membership to users.
- Set up groups.
  - Discuss default groups.
  - Create groups.
  - Add rights to groups.
- Manage files and directories.
  - Discuss directory structure.
  - Set directory attributes.
  - Set directory permissions.
  - Create shares.
  - Discuss installation of applications.

- Establish network-printing services.
  - Explain print spooling.
  - Install a printer and printer driver.
  - Share a printer on the network.
  - Manage printer properties.
  - Set printer share security.
  - Manage print jobs.
  - Discuss printer pooling.
- Establish a backup and recovery policy.
  - Describe the different backup types.
  - Discuss backup strategies.
  - Discuss NT's backup utility.
  - Discuss third party backup software.
  - Implement a server restoration from backup media.
- Audit system resources.
  - Introduce resource auditing.
  - Establish audit policy.
  - Perform system resource auditing.
  - Review audit logs.
- Monitor system resources.
  - Discuss system resource monitoring.
  - Use utilities to manage server properties.
  - Set administrative alerts using Server manager.
  - Perform remote administration.

Network Administration using Novell. (CNT 161)

- Develop knowledge of Novell Directory Services.
  - Describe the purpose of NDS.
  - Identify the types of NDS objects.
  - Use NWADMIN to browse the Directory tree.
  - Formulate NDS names.
- Develop knowledge of a network file system.
  - Describe the organization of the network file system.
  - Explain the required server volume and directories.
  - Use NWADMIN to browse the file system.
- Maintain the NDS tree.
  - Use Netware commands and utilities to work with the NDS tree structure.
  - Create, move, rename, and delete container objects.
  - Create, move, rename, and delete leaf objects.
- Access directories and files on the network.
  - Describe the use of network and search drive.
  - Use utilities to create drive mappings.
  - Use NWADMIN to create a Directory map object.
  - Use FILER to work with files and directories.
  - Salvage and purge deleted files.

- Set up user accounts and login security.
  - Create new users.
  - Describe login security.
  - Create user templates, groups, organizational roles, and profiles.
  - Assign access restrictions using NWADMIN, NETADMIN, and UIMPORT.
  - Discuss the Netware accounting system.
- Set up file system security.
  - Describe netware file system security.
  - List the directory and file trustee assignments.
  - Describe the purpose of the inherited rights filter.
  - Use utilities to set file and directory access rights.
  - Calculate effective rights.
  - List directory and file attributes and explain the effect of each.
  - Use utilities to set file and directory attributes.
- Manage NDS security.
  - Explain object trustees, object rights, and property rights.
  - Determine effective rights for objects and properties.
  - Describe the purpose of the inherited rights filter in Directory tree security.
  - List the default NDS object and property rights.
  - Use utilities to assign NDS object and property rights.
- Discuss application installation.
  - Determine netware compatibility.
  - Determine single-user or multi-user capability.
  - Describe management of applications using NAL.
  - Prepare file system structure of accessing applications with NAL.
  - Launch an application using NAL.
- Establish network-printing services.
  - Discuss network-printing methods to include local, remote, and direct.
  - Create print queue, printer, and print server objects.
  - Manage print jobs in the queue.
  - Establish print users and operators.
  - Discuss customizing print jobs.
- Create Login scripts.
  - Discuss the categories of login scripts.
  - Explore login script commands.
  - Create, execute and debug login scripts.
- Establish a backup and recovery policy.
  - Describe the different backup types.
  - Discuss backup strategies.
  - Discuss NetWare's backup utility.
  - Discuss third party backup software.
  - Implement a server restoration from backup media.

- Discuss Netware Loadable Modules.
  - Discuss the categories of NLMs.
  - Identify the functions of major NLMs.
  - Explore RCONSOLE.
- Discuss additional topics.
  - Explore trends in new and emerging technologies.

Advanced Network Administration Using Novell. (CNT 263)

- Review network administration.
  - Discuss NDS.
  - Discuss file system.
  - Discuss security.
  - Discuss object creation and properties.
  - Discuss printing.
- Connect client to the network.
  - Describe client communication with the network.
  - Identify software required to connect.
  - Execute client files to connect.
  - Discuss login files based on client type.
- Install and configure Client software.
  - Install Client Windows 95.
  - Configure the network connection for Windows 95.
  - Install client of windows 3.1.
  - Configure the network connection for Windows 3.1.
  - Discuss automatic update of client.
- Wire and set up functional network.
  - Discuss steps involve in installing netware.
  - Identify and load drivers.
  - Run INSTALL program.
  - Practice loading and unloading NLMs.
  - Use console commands to evaluate installation and configuration.

Advanced Network Administration Using Windows NT. (CNT 264)

- Planning a Windows NT Enterprise Network.
  - Understand the Windows NT Domain.
  - Identify the NT Server Roles.
  - Create trust relationships between domains.
  - Identify Domain models.
  - Understand Directory Services.
- Configuring Windows Protocols and Protocol bindings.
  - Understand Network protocols and the OSI Model.
  - Identify the five transport protocols.
  - Identify the TCP/IP Components.
  - Install and configure protocols.
  - Bind multiple protocols.
  - Troubleshoot network protocol problems.

- Windows NT Core and Optional Services.
  - Understand Windows NT Core Services.
  - Understand Windows NT Optional Services.
- Remote Access Service (RAS).
  - Know connection types.
  - Know protocols supported by RAS.
  - Install and configure RAS.
  - Manage RAS with remote access administration.
  - Configure Dial-up networking.
  - Implement callback security.
  - Understand other RAS features:
    - Auto Dial
    - RAS Logging
    - Null-Modem Cable
    - Single common protocol
    - DUN monitor
    - Restartable file copy
- Configuring and Protecting Hard Disks.
  - Recognize server failure in different environments.
  - Understand SCSI technologies.
  - Configure disk volumes.
  - Understand RAID fault tolerances.
  - Back up enterprise servers.
- Managing Clients and Servers.
  - Connect clients to the server.
  - Create client rollouts.
  - Understand duties of the client administrator.
  - Understand services for Macintosh Clients.
  - Administer remote servers and other network resources.
- Manage user and group accounts.
  - Establish new user accounts.
  - Establish Global Groups
  - Establish Local Groups
  - Manage account policies.
  - Audit security events.
- Create and manage user profiles and system policies.
  - Configure and manage user profiles.
  - Configure and manage system policies.
- Interoperability with NetWare Servers.
  - Understand Microsoft services for NetWare.
  - Understand Gateway Services for NetWare.
  - Use migration tool for NetWare.
  - Understand file and print services for NetWare.
- Install and configure multi-protocol routing.

- Understand fundamentals of IP routing.
- Add static Routes.
- Understand BOOTP/DHCP relay Agents.
- Understand AppleTalk router.

- Basics of Server analysis and Optimization.
  - Implement a measurement baseline.
  - Identify bottlenecks.
  - Use performance monitor.
  - Monitor network traffic.
- Printing.
  - Print model of Window NT.
  - Use printer's folder.
  - Install local printers.
  - Manage print jobs.
  - Attach to a network printer.
  - Configure printer.
  - Understand print pooling.
  - Manage print servers.
- Choose an appropriate response for problems.
  - Respond to installation failures.
  - Respond to boot failures.
  - Respond to printer problems.
  - Respond to RAS connectivity problems.
  - Respond to connectivity problems.
  - Respond to resource access and permission problems.
  - Respond to Fault-tolerance failures.
- Perform advance problem resolution.
  - Use dump file and recovery tools.
  - Configure Alerts.
  - Use the Event Log.
  - Diagnose and Interpret kernel-level errors.
  - Analyze the dump file.

Network Components (CNT 270)

- Review Basic Network Principles:
  - Discuss Capabilities of LAN.
  - List and describe components of LAN.
  - Discuss software and hardware.
  - Discuss sharing computer resources.
  - Define and describe the file servers.
- Examine Network Topology and Standards:
  - Identify various topologies.
  - Disucss standards in relationship to network topologics.
  - Describe OSI layer architecture.
- Describe Network Transport Systems:

- Describe ethernet requirements.
- Identify Token Ring Requirements.
- Explain ARCNET requirements.
- Introduce FDDI systems.
- Discuss ATM environments.

- List and Describe Protocols:
  - Discuss properties of TCP/IP, TCP and IP.
  - Examine Telnet.
  - Identify IPX and SPX characteristics.
  - Explain X.25 protocol.
  - Specify ISDN properties.
  - Describe Frame Relay and Cell Relay.

Lewis & Clark Career Center
Computer Maintenance & Networking Advisory Committee Meeting
May 12, 2009

Attendees:

Susan Hoernschemeyer	Ken Rickard
Mike Fuszner	Sharon Wheeler

Minutes:

The meeting was held at Grappa Grill Restaurant in St. Charles. One member, Jim Elkins, was unable to attend.

I presented a textbook that I am considering for next year and the members discussed alternatives. I talked about the MOACTE conference and about how I hope to find other textbook selections there as well.

We also discussed the need for students to have strong skills repairing such things as power jacks in portable devices and email configuration for cell phones and Exchange server email, something that we don't currently cover. They also talked about laptop reliability and repair issues and the prevalent use of air cards for Internet access.

We discussed the equipment that I have currently in the lab and suggested ways to upgrade it. One member also has a friend that he will ask to donate equipment to us.

The members suggested that I have the students assess their desktop computers and see what could be upgraded in them inexpensively. Sharon Wheeler offered to supply us with some RAM if she had any we could use.

Sharon Wheeler also donated two PC technician tool kits for me to present to my students of the year. She also asked about any outstanding students I had this year. She has had good success hiring our graduates in the past.

We also discussed other additions to the advisory committee. The members suggested that I contact IT people in the healthcare industry and major employers such as Boeing.

The meeting was adjourned at 7:30 pm with all the members agreeing to be on the advisory committee for next year. We will plan to meet again in the fall at the beginning of the next school year. The members also offered their assistance between now and then.

Lewis & Clark Career Center
Computer Maintenance & Networking Advisory Committee Meeting
November 6, 2008

Attendees:
Susan Hoernschemeyer
Mike Fuszner
Jim Elkins
Ken Rickard
Sharon Wheeler

Minutes:

Meeting was called to order about 5:40 pm. Each member introduced themselves and told about their business or position.

The current textbook was reviewed by the members. The members recommended that we use the Cisco Academy curriculum and advised about how to go about that process. They also advised that we add more networking to the program and allow the students to begin working on a CCNA certification. Mike Fuszner, from St. Charles Community College, volunteered to help us with the process. He also supplied a list and cost of the equipment necessary to teach the Cisco Academy curriculum. They are discussed how the program could be funded through enhancement grants and DESE 50/50 funds.

We discussed CompTia A+ certification and how one of the educator's school pays for the students to take the certification tests through fundraisers.

We also discussed the skills and attributes they are looking for in employees. These included being able to deal with the public, being about to explain things without using "tech talk", having good research skills, enthusiasm and good handwriting.

The members also discussed salaries and resources available to research salaries to get students interested in pursuing a career in computer maintenance and networking.

They also discussed the need for the program to have "known good" equipment for troubleshooting systems. They also recommended that we have a power supply tester. One of the committee members, Sharon Wheeler, volunteered to donate one to the school. They talked about the need for the students have experience with basic troubleshooting and for them not to be afraid to get inside a computer case.

The committee also discussed Microsoft's Academic Alliance and its benefits to a program such as ours, including having the necessary software available and the ability to provide copies of the software programs to the students for their personal use at home. This has been a big recruitment factor for another area school.

The advisory committee took a tour of Lewis & Clark and of the Computer Maintenance classroom.

The meeting was adjourned at 7:40 pm with plans to meet again in the spring. The members also offered their assistance between now and then as well.

CMN

Lewis & Clark Career Center
Computer Information Systems
Advisory Committee Member Profile

Name: _____Ross Baker_____ Age: 49

Address: 712 Balboa Ct

City: Weldon Spring State: MO Zip: 63304

Telephone: 314-853-4619 Type: Mobile

Telephone: 636-441-8524 Type: Home

Telephone: _____ Type: _____

E-mail Address: rbaker@win.org

Company name: Missouri Systems, Inc

Position/Title: Owner/Consultant

Company Field: Management & Systems Consulting

Do you have children enrolled in public school? ___ Yes __X_ No

If so, how many? _____

Community involvement (Little League, church, civic, etc)
Boy scout leader – Troop 957

Grace Presbyterian Church – youth Sunday school teacher

_____

_____

Reason for member profile form: To qualify for a vocation enhancement grant at 75% funding, we must have an advisory committee comprised of local business persons, educators, parents, community members, and community leaders. Thank you for helping us out with this requirement.

CMN

Lewis & Clark Career Center
Computer Information Systems
Advisory Committee Member Profile

Name: Jim Elkins Age: 43

Address: 220 Braddock Way

City: St. Peters State: MO Zip: 63376

Telephone: 636-294-9193 Type: Home

Telephone: 314-989-7626 Type: Work

E-mail Address: jelkins@stchas.edu; jelkins@ssdmo.org

Company name: Special School District

Position/Title: Instructor – Cisco Networking Academy

Company Field: Education

Do you have children enrolled in public school? _X_ Yes ___ No

If so, how many? 2

Community involvement (Little League, church, civic, etc)

Soccer, baseball coach, YMCA volunteer, PTA

Reason for member profile form: To qualify for a vocation enhancement grant at 75% funding, we must have an advisory committee comprised of local business persons, educators, parents, community members, and community leaders. Thank you for helping us out with this requirement.

CMN

Lewis & Clark Career Center
Computer Information Systems
Advisory Committee Member Profile

Name: _Penny Frame_____ Age: _42_____

Address: _213 Bluffview Ct._____

City: _Troy_____ State: _MO_____ Zip: _63379_____

Telephone: _____ Type: _____

Telephone: _314.750.7011_____ Type: _Cell_____

Telephone: _____ Type: _____

E-mail Address: _____

Company name: _____

Position/Title: _____

Company Field: _____

Do you have children enrolled in public school? ___ Yes _X_ No

If so, how many? _____

Community involvement (Little League, church, civic, etc)

I am on the board of, and sing with the Choral Arts Singers (a community choir serving St. Charles, Lincoln and Warren counties). I also sing with a community chorus in St. Louis.

I am also a supporter of the St. Charles County Social Justice Alliance.

Reason for member profile form: To qualify for a vocation enhancement grant at 75% funding, we must have an advisory committee comprised of local business persons, educators, parents, community members, and community leaders. Thank you for helping us out with this requirement.

CMN

Lewis & Clark Career Center
Computer Information Systems
Advisory Committee Member Profile

Name: __Mark J. Madras_____ Age: __51_____

Address: __9715 Greenwood Terrace_____

City: _Rock Hill_____ State: _MO_____ Zip: 63119

Telephone: _314-918-2630_____ Type: ___Home_____

Telephone: _314-378-8157_____ Type: ___Cell_____

Telephone: _____ Type: _____

E-mail Address: __mmadras@gmail.com_____

Company name: __Construction Data Services_____

Position/Title: ___IT Director_____

Company Field: __Construction_____

Do you have children enrolled in public school? ___ Yes __x No

If so, how many? _____

Community involvement (Little League, church, civic, etc)

_____

Treasurer – High School Alumni_____

_____

_____

Reason for member profile form: To qualify for a vocation enhancement grant at 75% funding, we must have an advisory committee comprised of local business persons, educators, parents, community members, and community leaders. Thank you for helping us out with this requirement.

CMN

Lewis & Clark Career Center
Computer Information Systems
Advisory Committee Member Profile

Name: _Tiffany Nelson_____ Age: _25_____

Address: _3640 Corporate Trail Drive_____

City: _Earth City_____ State: _MO_____ Zip: _63045_

Telephone: _314-513-5776_____ Type: __Work_____

Telephone: _314-489-6340_____ Type: _Cell_____

Telephone: _____ Type: _____

E-mail Address: __tnnelson@itt-tech.edu_____

Company name: _ITT Technical Institute_____

Position/Title: __Community Relations Specialist_____

Company Field: __Technical Education_____

Do you have children enrolled in public school? ___ Yes _X_ No

If so, how many? _____

Community involvement (Little League, church, civic, etc)

Fundraising with Backstoppers, Inc.

Reason for member profile form: To qualify for a vocation enhancement grant at 75% funding, we must have an advisory committee comprised of local business persons, educators, parents, community members, and community leaders. Thank you for helping us out with this requirement.

CMN

Lewis & Clark Career Center
Computer Information Systems
Advisory Committee Member Profile

Name: __David Ray_____ Age: __32_____

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Telephone: _____ Type: _____

E-mail Address: ____david.ray@stellarrad.com_____

Company name: __StellarRAD Systems_____

Position/Title: ___Business Development Mnager_____

Company Field: ___Telecommunications/Software Development_____

Do you have children enrolled in public school? ___ Yes _X_ No

If so, how many? _____

Community involvement (Little League, church, civic, etc)

_____

_____

_____

_____

Reason for member profile form: To qualify for a vocation enhancement grant at 75% funding, we must have an advisory committee comprised of local business persons, educators, parents, community members, and community leaders. Thank you for helping us out with this requirement.

CMN

Lewis & Clark Career Center
Computer Information Systems
Advisory Committee Member Profile

Name: Mr. Ken Rickard Age: 59

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Telephone: 314-443-4710 Type: Mobile

Telephone: _____ Type: _____

E-mail Address:
Ken@tomscomputerguys.com

Company name: Tom's Computer Guys, LLC

Position/Title: Owner/Member

Company Field: Computer Consulting, Repair and Installation.

Do you have children enrolled in public school? __ Yes _X__ No

If so, how many? _____

Community involvement (Little League, church, civic, etc)

VFW Post 5972

Note: Retired from the US Postal Inspection Service in August 2006. I Served as a Forensic Computer Analyst for 5 Years.

Reason for member profile form: To qualify for a vocation enhancement grant at 75% funding, we must have an advisory committee comprised of local business persons, educators, parents, community members, and community leaders. Thank you for helping us out with this requirement.

CMN

Lewis & Clark Career Center
Computer Information Systems
Advisory Committee Member Profile

Name: Alan G. Schroeder Age: 46

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E-mail Address: al.schroeder@stellarrad.com

Company name: Stellarrad Systems

Position/Title: Senior Programmer/Analyst

Company Field: Telecommunications

Do you have children enrolled in public school? X Yes ___ No

If so, how many? 2

Community involvement (Little League, church, civic, etc)
Video ministry at Calvary Chruch, Boy Scouts

Reason for member profile form: To qualify for a vocation enhancement grant at 75% funding, we must have an advisory committee comprised of local business persons, educators, parents, community members, and community leaders. Thank you for helping us out with this requirement.

Course: Computer Maintenance Technology
Instructor: Mark Ward

Instructional Methods Used:

The class is designed to emulate a workplace environment. Students are expected to act and respond to each other in a professional manner.

Text books are used in conjunction with Internet-based research, in order to provide a wide range of current information on computer related topics.

Students utilize a computer workstation, the Internet, and a word processor and other applications to type assignments and organize information.

Lectures/Demonstrations: Lectures and demonstrations are utilized to detail more complex concepts and procedures. Lectures are provided on a weekly basis along with lecture notes and handouts. A computer data projector is utilized.

Text books: The text books are divided into lessons. Each lesson has various amounts of exercises to teach particular concepts and procedures. A lab manual with detailed activities for each chapter us utilized. Students answer questions at the end of each chapter.

Tests: Written and practical are taken upon the completion of each lesson. At the end of each major course, students are expected to pass an industry certification test as well.

Lab Projects: Students must apply information received in lectures and text books to actual computer applications as defined by structured lab exercises. Students develop skills of critical thinking, troubleshooting, and organization by directly applying tasks in a hands-on scenario.

Computer Maintenance Technology
Grading Criteria

Written & Practical Tests	**50%**
Lab Activities	**25%**
Notebook	**10%**
Employability*	**15%**

*

- Workplace Readiness includes professionalism, reliability, interaction with others.
- Attendance is counted in this category

LESSON PLAN

Chapter 7: Network Protocols

Objectives

After reading this chapter and completing the exercises students will be able to:

- Understand the network protocols supported by Windows 2000
- Configure TCP/IP

Teaching Tips

Windows 2000 Network Components

1. Describe how Windows 2000 can function, as a network client, as a network server, as a peer-to-peer system, client/server, and terminal/host. Note that Windows 2000 also has all tools needed to access the Internet including necessary protocols, Web browser and utilities.

2. Discuss how Windows 2000 uses numerous components to define networking capabilities, allowing the support of multiple protocols. Note that in Windows 2000, applications communicate using a standard application programming interface (API).

3. Note that networking components can be added or deleted from a Windows 2000 system, except in such cases where the components to be removed are bound to other components.

Network Protocols

1. List and discuss the three network transport protocols supported by Windows 2000, (NetBEUI, NWLink, and TCP/IP), and describe the limitations of each.

NetBEUI

1. Mention that NetBEUI is an enhanced version of NetBIOS (Network Basic Input/Output System) and is also known as NetBIOS Frame Transport (NBF). It is the simplest of the three basic protocols used by Windows 2000. IBM developed it in the 1980's for use with O/S 2 and LAN Manager O/S. It works best with networks consisting of 2 to 100 nodes, and is NOT routable.

NetBEUI Advantages

1. Note that NetBEUI is compact and speedy. Stress that it is the fastest of all the TDI (Transport Driver Interface) transports in Windows 2000.

2. Discuss the most significant features including the speed on small networks, support of up to 1023 sessions, performance across slower serial links, ease of installation and configuration, self-tuning ability, and most important, incurrence of the lowest memory overhead.

NetBEUI Drawbacks

1. Emphasize that NetBEUI is not useable on internetworks or networks that include both LAN and WAN links.

2. Note that NetBEUI has limited diagnostic/troubleshooting utilities available and is not recommended for large networks.

3. As a group project, have students install NetBEUI and demonstrate the features discussed, as shown in Hands-on Project 7-6.

NWLink

1. Note that NWLink is based on Novell's IPX/SPX (Internetwork Packet Exchange/Sequenced Packet Exchange) protocol stack.

2. Describe how NWLink works with the NDIS (Network Driver Interface Specification-driver technology native to Windows 2000).

3. Stress that NWLink can support the most important IPX/SPX APIs including Novell's Windows Sockets and NetBIOS over IPX. Discuss how the NetBIOS interface links with the NWLink transport protocol.

4. It is important to note that versions prior to Netware 5 supported IPX/SPX as the default protocol but Netware 5 supports TCP/IP protocol as the default protocol.

NWLink Advantages

1. Discuss the powerful capabilities of NWLink including SPX II (newer version of SPX, sets frame size), Autodetection of frame types, and direct hosting over IPX (ability to host ongoing network sessions-increases network performance).

NWLink Drawbacks

1. Discuss how address conflicts occur due to IPX lacking a facility for centralized address management like DNS in TCP/IP.

2. Mention the disadvantage of not supporting a collection of network management tools.

3. Compared to NetBEUI, it has greater memory requirements on DOS machines.

TCP/IP

1. Define TCP/IP (Transmission Control Protocol/Internet Protocol) as a suite of protocols that cover a wide range of capabilities. Point out that more than 100 component protocols belonging to TCP/IP have been standardized.

2. Note that the original version of TCP/IP emerged from research funded by the ARPA (Advanced Research Projects Agency, Department of Defense) and has been in use since 1969.

3. Stress that TCP/IP is the most common network protocol in use throughout the world and is the protocol that makes the Internet possible.

4. Discuss the wide variety of network services using the TCP/IP platform such as newsgroups (NNTP), email (SNMP and MIME), file transfer (FTP), remote printing, remote boot, Dynamic Host Configuration Protocol (DHCP) and Windows Internet Naming Service (WINS), and the World Wide Web (HTTP).

5. Describe how Windows 2000 can implement NBT (NetBIOS over TCP/IP) to provide NetBIOS support.

TCP/IP Advantages

1. Note that TCP/IP supports network services better than other Windows 2000 protocols through the use of multiple components such as FTP, SMTP, DNS, TCP, ARP, RARP...

2. As a group project, have students detail the many protocols used by Windows 2000 as shown in Table 7-1.

3. Mention that TCP/IP supports multiple routing protocols that support large, complex networks and incorporate better error detection and handling. TCP/IP also works on a wider variety of computers.

TCP/IP Drawbacks

1. Note that TCP/IP based networks require expertise to configure and manage and constant maintenance and attention. Stress that each of the protocols supported has its own unique installation, configuration and management tasks. There must be careful planning when establishing and maintaining a TCP/IP based network.

Data Link Control

1. Define Data Link Control (DLC) transport mechanism and its use for connectivity to IBM mainframes and to access network attached printers.

2. Discuss the limited functionality and the disadvantage of relying on excessive broadcast traffic.

3. Point out that DLC cannot support higher-level file transfer protocols, it is unroutable and difficult to bridge, and is a primitive network transport unsuited for higher-level services.

Interprocess Communication (IPC)

1. Define Interprocess Communication (IPC) as a way for processes to exchange information, whether the exchange is on one computer or between networked computers.

2. Discuss that IPC defines the way for a client to request service from a server and a way from the server to reply. Note that IPC works directly below the redirector on the client side and below the network file system on the server side.

3. Describe the two categories of IPC, programming interfaces (permit general, open-ended client/server dialog) and file systems (support file sharing between clients and servers).

IPC File System Mechanisms

1. Discuss the two IPC interfaces included in Windows 2000: named pipes and mailslots.

Named Pipes

1. Describe the named pipes interface as a connection-oriented message passing service for clients and servers that offers a reliable method for exchanging requests, replies, and associated files.

2. Note that the receiver of the message must acknowledge each message received when using this interface.

3. Stress that this interface is useful when using unreliable protocols such as User Datagram Protocol (UDP).

4. Point out that Windows 2000 version of named pipes includes a security feature called impersonation, which allows a server to masquerade as a client to check the client's access rights and legality of the request, before returning a reply to the actual client.

Mailslots File System

1. Describe Mailslots as a connectionless version of named pipes without the delivery or receipt guarantee.

2. Note that using Mailslots is an internal method of supporting nonessential system-to-system communication such as registering names of computers, domains and users across a network, and provides support for broadcasting text messages across the network.

IPC Programming Interfaces

1. Mention that Windows 2000 supports several programming interfaces including NetBIOS, Windows Sockets, RPC and NetDDE.

NetBIOS

1. Note that NetBIOS services are required to permit a Windows network to operate, and is a widely used but simple client/server IPC mechanism.

Windows Sockets (Winsock)

1. Describe Windows Sockets as a standardized and widely used interface to network transports such as TCP/IP and IPX. Note that Winsock was created to migrate UNIX applications to the Windows environment.

2. Stress that Winsock includes the majority of Internet Utilities such as Web browsers, email software and file transfer programs.

3. Sometimes problems occur because of the version of winsock.dll installed. Have the students do a search for winsock to see where it is stored, and also to see whether there are multiple copies present. Right-click on the file to examine its properties and its version.

RPC

1. Discuss how RPC (Remote Procedure Call) implements IPC tools that invoke separate programs on remote computers, supply input, and collect the results produced. Note that this permits distribution of a single processing task among multiple computers, improving overall performance and balancing the processing load across numerous machines.

2. Mention how RPC enables an application to be built on a single computer using LPC (Local Procedure Call) to communicate. Note that this allows for processing to be distributed on one machine or across many machines, creating a powerful and flexible environment.

3. Describe the four components of RPC including the remote stub procedure, an RPC run-time system that passes data from local to remote machine, the application stub procedure, and remote procedures, which may be called for service whether locally or across the network.

NetDDE

1. Define Network Dynamic Data Exchange (NetDDE) and discuss how this creates ongoing data streams called exchange pipes between two applications across a network. Note that this process is similar to Microsoft's Dynamic Data Exchange (DDE), which creates pipelines between two applications on the same machine.

2. Note that NetDDE facilitates data sharing, object linking and embedding (OLE), and dynamic updates between applications.

3. Stress that NetDDE services are installed by default but must be explicitly started using the Services control in Computer Management, under the headings Network DDE (the client side) and Network DDE DSDM (DDE Share Database Manager, the server side). To look at DDE in action, click Start, click Run, then type DDE share.

Distributed Component Object Model (DCOM)

1. Define Distributed Component Object Model (formerly known as "Network OLE") as a protocol that facilitates the communication of application components over a network by providing a reliable, secure and efficient mechanism for exchanging information.

Windows Network (WNet) Interface

1. Note that this interface allows applications to be network independent while still able to interact with network-based resources.

Win32 Internet API (WinInet)

1. Note that this interface enables applications to take advantage of Internet functionality without requiring proprietary programming.

Redirectors

1. State that redirectors handle transmission of remote requests and redirect them to an appropriate network provider. For example: \\server\printer - jobs sent to this port are transferred over the network to the named share by the network redirector.

2. Stress that Windows 2000 file and print sharing are the most important functions supplied by any network operating system.

3. Discuss the two components Windows 2000 uses to deliver these services: Workstation service and Server service. Note that both are file system drivers that operate in unison with other file system drivers accessing local file systems.

4. Give examples of redirectors such as Workstation service, Server service, Multiple Universal Naming Convention Provider (MUP), and Multi-Provider Router (MPR).

Workstation Service

1. Discuss the functions of the Workstation service including support of client access to network resources and the handling of functions such as logging in, connecting to network shares (directories and printers) and creating links.

2. Describe the two elements of the Workstation service, User mode-interface (determines the particular file system that any User-mode file I/O request is referencing) and the redirector (recognizes and translates requests for remote file and print services and forwards them to lower-level boundary layers.)

3. Stress that the Workstation service, like any other redirector, communicates with transport protocols through the common TDI (Transfer Driver Interface).

Server Service

1. Describe how Windows 2000 Server service handles the creation and management of shared resources and performs security checks against requests for resources. Note that the Server service allows a Windows 2000 computer to act as a server on a client/server network, up to the maximum number of licensed clients.

2. Note that the Server service operates as a file system driver and uses other file system drivers to satisfy I/O requests.

3. Discuss the two elements of a Server service including SERVER.EXE (manages client connection requests) and SRV.SYS (redirector file system that operates across network and interacts with other local file system drivers).

Multiple Universal Naming Convention Provider (MUP)

1. Note that Windows 2000 supports multiple redirectors working simultaneously.

2. Discuss the NetWare redirector, Client Service for NetWare (CSNW), noting that this redirector handles the interface between network shares and NetWare clients.

3. Stress that Windows 2000 uses a common provider interface that allows all redirectors to be treated the same, enabling multiple client support.

4. Define Multiple Universal Naming Convention Provider (MUP) as defining a link between applications that make UNC requests for different redirectors.

5. Note that the MUP also decides which redirector should handle the request based on the highest registered response time, claimed by each redirector, to connect to a UNC name. Note that it can be very time consuming when trying a series of redirectors and this explains why the binding order of protocols is important.

Universal Naming Convention

1. Discuss the Universal Naming Convention (UNC) as used to represent the format used in NetBIOS oriented name resolution systems.

2. Demonstrate an example such as \\computername\sharename\dir-path\filename.ext where the name of the computer is "computername", the name of the share is "sharename", the directory path is named "\dir-path", and the file name is named "filename.ext".

Multi-Provider Router (MPR)

1. Discuss the Multi-provider Router (MPR), used to support programs that call the Win32API. Note that this file system must be used when using older Microsoft specification programs.

2. Note that any redirector that wants to support the MBR must provide a DLL (Dynamic Link Library) that communicates through the common MBR interface. While in the Explorer, do a search of all DLL files, noting that there are literally thousands of shared library files on a typical system. Many of these are stored in the directory \WINNT\system32.

Networking Under Windows 2000

1. Note that Windows 2000 uses a single multifaceted interface called "Network and Dial-up Connections" to control the networking system. Stress that this interface combines networking access for LAN, Internet, and modem.

2. Mention that the Network and Dial-up Connection is an Internet Explorer-based tool used to create and configure network connections.

3. As a group presentation, have students "Make New Connection" using the wizard accessed by clicking Start, Settings, Network and selecting Dial-up Connection.

4. Tip: If there are two or more LAN connections, rename the Local Area Connection icons to reflect the domain, network, or purpose of the link.

5. Have a second group of students demonstrate configuring an existing Local Area Connection by opening the Properties for that object via the File menu or the right-click pop-up menu.

6. Demonstrate to students how the TCP/IP settings can be configured using a computer with an overhead projection system. As a real example, show actual TCP/IP settings used by the college.

Managing Bindings

1. Define Binding as the order in which Windows 2000 networking components are linked. Note that the order in which multiple components are linked determines how the systems behave and how well they perform.

2. Demonstrate the use of Binding using the Advanced Settings dialog box, accessed using the Advanced Settings command from the Advanced menu of the Network and Dial-up Connections window. (See Hands-on Project 7-5)

3. Note that by default, Windows 2000 binds any two components that share a common boundary layer, called "complete binding". Stress that protocol bindings that will not be used MUST be disabled to prevent system inefficiencies. Note that unused bindings could possibly appear higher in the binding order, causing delays in the system.

4. Stress that binding priority affects network performance because Windows 2000 makes connections according to the order in which protocols are bound. Therefore, it may be necessary to change the binding order of protocols on clients.

5. Demonstrate how to change the priority level for any transport protocol by highlighting the object on the Adapters and Bindings tab, then using the arrow keys to increase or decrease the priority level.

TCP/IP Architecture

1. Note that TCP/IP supports cross-platform communications and provides the technical foundation for the Internet and can be broken down into TCP and IP.

Internet Protocol

1. Define Internet Protocol (IP) as a protocol that provides source and destination addressing and routing in the TCP/IP suite.

2. Define an IP address as the logical address of a device and is 32 bits (4 bytes) long. Note that each byte or octet is represented using dotted decimal notation (183.24.206.18). Try to use your college's IP address scheme as a real world example.

3. Note that IP is a "connectionless" datagram protocol that is fast but unreliable, and assumes that other protocols will ensure reliable delivery of the data.

4. As a special note, discuss the range of numbers used for each byte, the reserved addresses used to identify the network, and the reserved addresses used for broadcasts (typically a value of 255 or 11111111 in binary).

5. Look at the mathematical binary pattern of class A through E addresses:
   Class A 1-126 (127 is reserved as a loop back address)
   Class B 128-191 (binary 1000000 = 128 or 2 to the power of 7)
   Class C 192-223 (binary 1100000 = 192 or 2 to the power of 7, plus 2 to the power of 6)
   Class D 224-239 (binary 1110000 = 224)
   Class E 240-254 (binary 1111000 = 240)

6. To see the IP addresses assigned to a particular system, go to the command prompt (Start, Run, cmd) and type IPCONFIG or IPCONFIG/? to see how this command can be used in Windows.

7. As a group project, have students discuss and define the use of IP addresses to separate the network and the host.

8. Examine Subnet Masks noting that the job of the subnet mask is to block out the network section of the address so that only the host ID portion remains significant.

9. Discuss another form of addressing known as Classless Interdomain Routing (CIDR), used by Internet Service Providers to separate their address into more subnetworks.

10. Stress that all TCP/IP addresses must be unique on the Internet or on any IP based network. If two machines share an IP address, neither machine will be able to access the network.

11. Discuss the new version of TCP/IP (Ipv6) that will extend the address space to 128 bits as compared to the 32 bits used currently. Address the benefits of this new version.

12. Note that all IP-based devices on a single network segment must use the same subnet mask.

Internet Control Message Protocol (ICMP)

1. Define Internet Control Message Protocol as the protocol used to send control messages (such as error messages) between IP hosts.

Address Resolution Protocol (ARP)

1. Define Address Resolution Protocol as the protocol that is used to associate logical (IP) addresses to physical (MAC) address. To demonstrate this, at the command prompt (Start, Run, cmd), type ARP/?.

2. Describe how a system sends an ARP broadcast packet to request a physical address (MAC) that corresponds to the logical address (IP) of an intended recipient.

Dynamic Host Configuration Protocol

1. Describe how the Dynamic Host Configuration Protocol is used to automatically assign a temporary IP address and configure the computer to temporarily use the IP address. Compare this to the tedious process of assigning "Static" addresses.

2. Note that a DHCP server manages a block of IP addresses that can be assigned to computers needing access to the network. If a temporary connection is requested, a dynamic IP address is assigned. For computers that cannot communicate with the DHCP server, static addresses (fixed IP address) are assigned.

3. Stress that using DHCP makes it easier for network administrators to manage IP addresses and makes it more or less automatic for users to gain access to IP-based resources.

4. Demonstrate DHCP by clicking Start, Settings, Network and selecting Dial-up Connection. Make a new connection. Select the Networking tab of the new connection. Click on the TCP/IP protocol. Click on the properties button and make note of the "Obtain an IP address automatically" option button.

Transmission Control Protocol

1. Discuss the primary Internet transport protocol, Transmission Control Protocol (TCP) and note the features including accepting messages of any length and providing transportation to a TCP peer on a remote network host.

UDP

1. Describe User Datagram Protocol as a faster, but connectionless and less reliable protocol than TCP. Note that UDP is used to transport purely local services where it is safe to assume network reliability.

2. Discuss the distributed file systems like Network File System (NFS) and Trivial File Transfer Protocol (TFTP) that use UDP.

FTP

1. Describe File Transfer Protocol as the protocol used to provide file transfer service and manipulation of directories and files.

2. Note that Windows 2000 has a command line version of FTP and can be accessed using a DOS window (Start, Run, cmd). Type FTP and tap enter. At the ftp> prompt, type ? to show the Help file for this command. Type bye to exit.

Telnet

1. Define Telnet the protocol as a remote terminal emulation protocol used to provide connectivity to dissimilar systems (PC and VAX/VMS, PC and router, UNIX and VMS).

2. Describe how the remote client emulates a terminal that is directly attached to the host, allowing the remote configuration and monitoring of routers and switches.

3. Mention that although Telnet is a primitive, character-oriented interface, it is one of the most important IP services.

4. Note that Windows 2000 has a command line version of Telnet and can be accessed using a DOS window (Start, Run, cmd). Type telnet/? to see how this command can be used in Windows.

SMTP

1. Discuss how Simple Mail Transfer Protocol (SMTP) is used to provide IP-based messaging services. Note that most experts regard SMTP as the basis for Internet email.

SNMP

1. Describe Simple Network Management Protocol (SNMP), the protocol used for network management, including the ability to query collections of management data, called management information bases (MIBs), on networked devices.

2. Stress the benefit of management programs being able to poll devices on the network, obtaining regular status updates about their operating conditions.

3. Note that this service is NOT enabled by default on Windows 2000. To enable, open Network and Dial-up Connections, on the Advanced menu, click Optional Networking Components, and select Management and Monitoring tools. Use Windows help and enter SNMP to research and demonstrate this tool.

The Berkeley R Utilities

1. Discuss the collection of "R" (remote) utilities, found in the Berkeley Software Distribution of the 1980's, used for network administration. Discussion should include rsh (remote shell), used to permit a user on one network host to access shell commands on another network host, and rexec (remote execution), used to permit a user on one network host to execute a program remotely across the network on another network host.

2. Note that Windows 2000 supports both of these utilities from the client side (but cannot act as rsh or rexec server to other machines on the network).

3. As a group presentation, have a group of students demonstrate the rsh and rexec commands by starting a DOS window (Start, Run, cmd) and enter either rsh ? or rexec ? to access the help files for these utilities.

PING

1. Define PING (Packet Internet Grouper), as a useful utility used to see if a designated host is reachable on the network.

2. Discuss the various uses of this utility including the ability to check the network connection on your machine, a nearby machine or a host on another segment of the network.

3. As a group presentation, have students demonstrate the use of PING by entering the command PING 127.0.0.1 to do a PING loop back. If you have the IP or host name for a nearby machine, PING that address using the PING command as shown above, replacing the 127.0.0.1 with the actual host name or IP address.

TFTP

1. Discuss and define Trivial File Transfer Protocol (TFTP) noting that TFTP is a simplified version of FTP and uses UDP instead of TCP as the transport protocol. Note that this protocol is used primarily for communicating with a TFTP server elsewhere on the network, to copy relatively small files from the workstation to the remote host or vice versa.

2. As a group project, have students demonstrate TFTP by starting a DOS window (Start, Run, cmd), and enter TFTP ? at the command prompt to access the online Help files.

The HOSTS File

1. Define and discuss the HOSTS file, noting that this is a static file placed on nodes of a network to provide a resolution mechanism between host names and IP addresses. The HOSTS file is a list of IP address of that particular segment or network, and the corresponding host number or name. (Used before DNS was created)

DNS

1. Define Domain Name Service (DNS) as a powerful, highly distributed database that organizes IP names into hierarchical domains. Note that HOSTS files are used on small networks that do not warrant a DNS server.

2. Note that when a name resolution occurs, all the DNS servers, that can identify each other, cooperate to quickly locate the related host or address.

3. Stress that DNS is a critical component of the Internet's ability to span the globe. DNS handles the job of translating a symbolic name such as mybusiness.com into a corresponding numeric IP address.

4. Note that DNS also provides reverse lookup services to detect machines that are masquerading as other hosts.

5. Emphasize that Windows 2000 Professional can communicate with DNS servers but only Windows 2000 Server supports a full-fledged DNS server implementation.

The LMHOSTS

1. Discuss LMHOSTS files and the similarities to HOSTS files.

2. Note that LMHOSTS files are used on small networks and provide a resolution mechanism between NetBIOS names and IP addresses.

3. Mention that LMHOSTS was used before WINS was created.

WINS

1. Describe Windows Internet Naming Service (WINS) as a mechanism that dynamically associates NetBIOS names with IP addresses and automatically updates its database of associations as systems enter and leave the network.

2. Note that WINS is not a "native" TCP/IP service; it is an extension added by Microsoft.

3. Stress that on a TCP/IP network, NetBIOS names must be resolved so packets can be properly delivered to the intended recipient.

TCP/IP Configuration

1. Discuss the information needed to configure TCP/IP such as a unique IP address for the computer, the subnet mask for the network the computer belongs to, the address of the default gateway, the addresses for several DNS servers, and possibly the address for a WINS server.

2. Describe TCP/IP configuration and demonstrate using the Internet Protocol Properties dialog box. Demonstrate this by using the Network & Dial-up Connections, Local Area Connections, under components select TCP/IP, and click the Properties button. (See Hands-on Project 7-4)

3. Note that if your network has access to a DHCP server, you should select "Obtain an IP address automatically". If no DHCP server is available, select "Use the following address" option and enter the valid "static" IP address provided by your network administrator (and the subnet mask) or ISP (Internet Service Provider). Note: use the period key to jump from one octet to the next. Do not use the tab key, as it will advance to the next input field, not the next octet.

4. Mention that when installed, Windows 2000 is configured to seek a DHCP server to provide configuration settings.

5. Note that Private IP addresses can be used for networks that do not access the Internet directly.

6. As a group project, have students prepare a presentation about private IP addresses and how they are used. They may download a copy of the RFC 1918 from InterNic at ftp://ds.internet.net/rfc/rfc1918.txt or view a website version at http://www.cis.ohio-state.edu/rfc/rfc1918.txt for additional information.

7. Discuss subnet masks including how the left part of the IP address represents the network and the subnets.

8. Define default gateway (such as a router- a device that forwards IP traffic to other networks). Note that when connectivity to other networks is required, the default gateway must be given an IP address.

9. Explore the tabs on the Advanced TCP/IP Settings dialog box.

Class Discussion Topics

1. Have students familiar with different networks discuss the different network protocols used.

2. Look at the mathematical binary pattern of class A through E addresses:
   Class A 1-126 (127 is reserved as a loop back address)
   Class B 128-191 (binary 1000000 = 128 or 2 to the power of 7)
   Class C 192-223 (binary 1100000 = 192 or 2 to the power of 7, plus 2 to the power of 6)
   Class D 224-239 (binary 1110000 = 224)
   Class E 240-254 (binary 1111000 = 240)

3. Look for other binary patterns such as how
   2^1 = 10 in binary, which looks like 10 in decimal, which is 10^1
   2^2 = 100 in binary, which looks like 100 in decimal, which is 10^2
   2^3 = 1000 in binary, which looks like 1000 in decimal, which is 10^3

4. While looking for patterns, note that 2^1 has one 0, 2^2 has two 0s, 2^3 has three 0s, 2^7 (128) has seven 0s.

LAB ACTIVITY

LAB 7.1 DOCUMENTING AND REMOVING NETWORK PROTOCOLS

Student Answer Sheet

Name: _____ **Computer ID:** _____

Step 2: Document protocol settings.

Record local area connection information below:

Speed: _____

Packets sent: _____

Packets received: _____

Installed network protocols:

_____

_____

_____

Network card configuration:

Manufacturer/Model: _____

Driver date: _____ Version: _____

Resource settings:

Interrupt request: _____

Input/output range: _____

Existing clients and services:

_____

_____

_____

Internet Protocol (IP) information:

IP address: _____.____.____.____

Subnet mask: _____.____.____.____

DNS Server: _____.____.____.____

Default gateway: _____.____.____.____

NetBEUI protocol information:

NWLink protocol information:

Step 3: Component removal

Record the steps necessary to remove a protocol:

Record the steps you used to remove a service:

Record the steps you used to remove a client:

LAB 7.2 DEFINING AN IP ADDRESS SCHEME

IP Address Planning Sheet

Name: _____ **Computer ID:** _____

Office

Network address: _____

Subnet mask: _____

Default gateway: _____

Computer	IP Address
LabHost/Gateway	
OFFPRO-1	
OFFPRO-2	
OFFPRO-3	
OFFPRO-4	

Lab 212

Network address: _____

Subnet mask: _____

Default gateway: _____

Computer	IP Address
LabHost/Gateway	
212PRO-1	
212PRO-2	
212PRO-3	
212PRO-4	
212W98-1	
212W98-2	
212W98-3	
212W98-4	
212W98-5	
212W98-6	

LAB 7.3 INSTALLING AND CONFIGURING THE TCP/IP PROTOCOL

Student Answer Sheet

Name: _____ **Computer ID:** _____

Activity 1, Step 2: Install TCP/IP protocol.

Possible protocols

_____ _____

_____ _____

_____ _____

Activity 1, Step 3: Configure TCP/IP settings.

DNS settings applied to all connections:

1. _____
2. _____
3. _____

Default IP Security settings: _____

TCP/IP filtering options:

1. _____
2. _____
3. _____

Activity 2, Step 1: Record possible clients:

1. _____
2. _____

Activity 2, Step 2: Record possible services:

1. _____
2. _____
3. _____

Activity 2, Step 3: Advanced Settings

Briefly describe the purpose of the Provider Order tab:

Management and Monitoring Tools options:

Networking Services options:

Other Network File and Print Services options:

Activity 2, Step 4: Possible TCP/IP services assigned to the proxy server

1. _____
2. _____
3. _____
4. _____

Activity 2, Step 5: Changing network configuration

Record the message you received when you clicked the Properties button from the Connection Status window:

Install button results: _____

Uninstall button results: _____

Properties button results: _____

Activity 3, Step 2: Using the PING command

Record the results of PINGing your Windows 2000 computer:

Number of replies: _____

Message: _____

Bytes: _____

Time: _____ms.

TTL: _____

Record the results of PINGing the server:

Number of replies: _____

Message: _____

Bytes: _____

Time: _____ms.

TTL: _____

LAB 7.4 ASSIGNING IP ADDRESSES AUTOMATICALLY

Student Answer Sheet

Name: _____ **Computer ID:** _____

Activity 1, Step 2: Modify TCP/IP configuration.

IP address setting: _____

Activity 1, Step 3: Automatic IP address information

DNS suffix: _____

Autoconfiguration IP address: _____.____.____.____

Subnet mask: _____.____.____.____

Default gateway: _____.____.____.____

Activity 1, Step 4: Assigning a default gateway

Default gateway: _____.____.____.____

Activity 1, Step 6: IP address information

DNS suffix: _____

Autoconfiguration IP address: _____.____.____.____

Subnet mask: _____.____.____.____

Default gateway: _____.____.____.____

Activity 2, Step 1: Using DHCP

Initial IP address information:

DNS suffix: _____

Autoconfiguration IP address: _____.____.____.____

Subnet mask: _____.____.____.____

Default gateway: _____.____.____.____

Activity 2, Step 2: Releasing the IP Address

IP address information received after releasing the IP address:

DNS suffix: _____

Autoconfiguration IP address: _____.____.____.____

Subnet mask: _____.____.____.____

Default gateway: _____.____.____.____

IP address information received after obtaining a new DHCP address:

DNS suffix: _____

Autoconfiguration IP address: _____.____.____.____

Subnet mask: _____.____.____.____

Default gateway: _____.____.____.____

LAB 7.5 WORKING WITH IP PROTOCOLS

Student Answer Sheet

Name: _____ **Computer ID:** _____

Step 2: IP address information

DNS suffix: _____

Autoconfiguration IP address: _____.____.____.____

Subnet mask: _____.____.____.____

Default gateway: _____.____.____.____

Step 3: ARP command

Record the results of your initial ARP command:

Record the results of the ARP command after PINGing the server computer:

Step 5: Using the HOSTS file

Briefly record the results of PINGing the computer name from the Hosts file:

Step 6: The Telnet protocol

Briefly describe the contents of the Telnet client window:

Record the following current user information from the Telenet Server Administration screen:

Username: _____ Domain: _____ Session ID: _____

Remote machine: _____ Logon time: _____

Lewis Clark Career Center

2005 - 2006 Placement Summary

Ward, Mark

Total Students:	13	
Total Placed:	12	92%
Total Placed Related:	7	54%
Positive MSIP Placement:	10	77%
Employed Related:	0	0%
Employed Not Related:	2	15%
Military Related:	0	0%
Military Not Related:	0	0%
Continuing Education Related:	7	54%
Continuing Education Not Related:	3	23%
Not Available:	0	0%
Not Placed:	1	8%
Status Unknown (Not Found):	0	0%

Computer Support Specialist

Description

Provides technical assistance and training to computer system users. Investigates and resolves computer software and hardware problems.

Typical Tasks

- Installs and performs minor repairs on computer hardware, software, and peripheral equipment.
- Confers with staff, users, and management to determine need for system modifications.
- Develops training materials and procedures, and conducts training sessions for users.
- Tests software, hardware, and peripheral equipment to evaluate performance and effectiveness.
- Evaluates computer software and hardware operations.
- Refers major hardware or software problems to vendors or technicians for service.
- Keeps records of data transactions, problems, maintenance, and installation activities.
- Reads technical journals and attends seminars to stay current on hardware and software technologies.

Field of Work

A field of work represents a broad, general area of work activity. Occupations that have similar types of work are assigned to the same field.

- **Computer and Mathematical Occupations**

Missouri Career Paths

Occupations have been organized into Career Paths to help students with high school course planning.

Career Path:

- **Business, Management and Technology Career Path**

Career Subpath:

- **Computer, Mathematical, and Operations Research Occupations**

Specialties and Similar Occupations

Other occupations that are more detailed or similar to this broad occupation. DOT codes are from the Dictionary of Occupational Titles.

- Microcomputer Support Specialist (DOT 039.264-010)

Installs, modifies, and makes minor repairs to microcomputer hardware and software systems and provides technical assistance and training to system users.

- Network Control Operator (DOT 031.262-014)

Monitors data communications network to ensure that network is available to all system users and resolves data communications problems.

- Supervisor, Network Control Operators (DOT 031.132-010)

Supervises and coordinates activities of workers engaged in monitoring or installing data communication lines and resolving user data communication problems.

- Technical Support Specialist (DOT 033.162-018)

Performs any combination of following duties to provide technical support to workers in information processing departments.

- User Support Analyst Supervisor (DOT 032.132-010)

Supervises and coordinates activities of workers who provide problem-solving support to computer users.

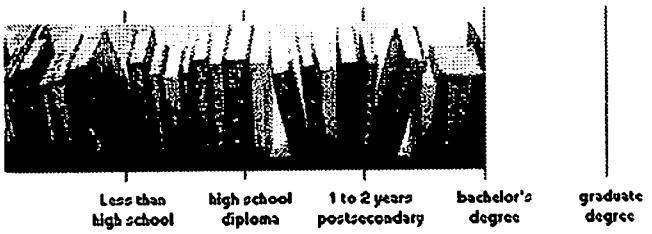
Computer Support Specialist

Related Resources

- O*NET occupation: 25104 Computer Support Specialists
- SOC occupation: 15-1041 Computer Support Specialists
- DOT occupation: 032.262-010 USER SUPPORT ANALYST

Education, Training and Work Experience

Education, training, and experience are required at different levels for success in different occupations. The education level for this occupation:



- **Bachelor's degree or higher, plus work experience**

There is no universally accepted way to prepare for a job as a computer professional; however, employers almost always seek college graduates for these positions, especially with related degrees. Computer support specialists also need significant experience working with computers, including programming skills.

Related Education Programs and Notes:
- Computer and Information Sciences, General (11.0101)
- Information Sciences and Systems (11.0401)
- Computer Science (11.0701)
- Computer and Information Sciences, Other (11.9999)
- Management Info. Systems and Business Data Processing, General (52.1201)
- Business Systems Analysis and Design (52.1203)
- Business Systems Networking and Telecommunications (52.1204)

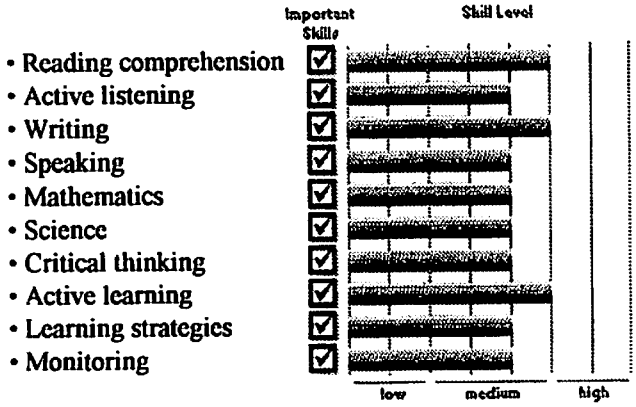
Transferable Work Content Skills

Skills used in this occupation that are used in other occupations:
- **Giving advice on computer programs and data (high level)**
- **Answering questions about products and services (high level)**
- **Working as a member of a data processing team (high level)**
- **Planning and giving information and help (high level)**
- **Preparing technical or research reports (high level)**
- **Preparing electronic data files (high level)**
- **Processing data on computers (high level)**

Basic Skills / Basic SCANS Skills

Basic Skills information comes from O*NET. Basic skills provide the foundation for learning other types of material. Many of these skills are related to SCANS Skills. For each skill, the level needed to perform the occupation is shown. Skills important to the occupation are checked.

Computer Support Specialist



General Workplace Skills

Information for General Workplace Skills comes from O*NET (Cross Functional Skills). General Workplace Skills are practiced activities that help workers achieve success in various occupations. The significant skills for this occupation are:

Social Skills

- Social perceptiveness ... (medium level)
- Coordination ... (medium level)
- Persuasion ... (medium level)
- Instructing ... (medium level)
- Service orientation ... (medium level)

Complex Problem Solving Skills

- Problem identification ... (medium level)
- Information gathering ... (medium level)
- Information organization ... (medium level)
- Synthesis/reorganization ... (medium level)
- Idea generation ... (medium level)
- Idea evaluation ... (medium level)
- Implementation planning ... (medium level)
- Solution appraisal ... (medium level)

Technical Skills

- Operations analysis ... (medium level)
- Technology design ... (medium level)
- Equipment selection ... (medium level)
- Installation ... (medium level)
- Programming ... (medium level)
- Testing ... (high level)
- Operation and control ... (medium level)
- Product inspection ... (medium level)
- Troubleshooting ... (medium level)

Systems Skills

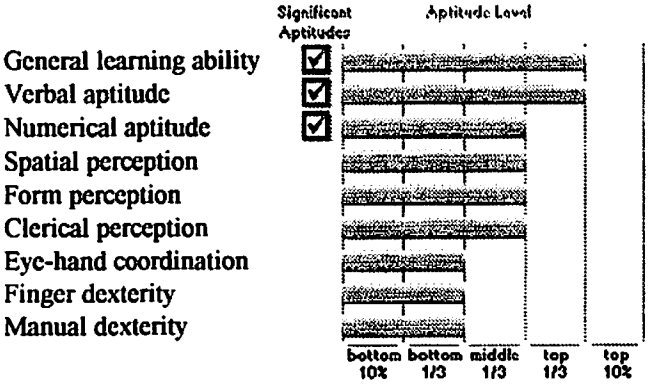
- Visioning ... (medium level)
- Systems perception ... (medium level)
- Identifying downstream consequences ... (medium level)
- Identification of key causes ... (medium level)
- Judgment and decision making ... (medium level)
- Systems evaluation ... (medium level)

Computer Support Specialist

Resource Management Skills
- Time management ... (medium level)
- Management of material resources ... (medium level)
- Management of personnel resources ... (medium level)

Aptitudes

Aptitudes reflect a person's ability to acquire skills and knowledge. Significant aptitudes for this occupation are checked.



Physical Demands

Physical Demands reflect the overall strength generally needed to work in this occupation.
- **Light (10 lbs to 20 lbs)**

Physical Abilities

Physical Abilities information comes from O*NET 98. Only those factors that are a significant part of the occupation are listed.
- **Near vision ... (medium level)**
- **Color discrimination ... (medium level)**
- **Speech clarity ... (medium level)**

Career Area (Interests) and GOE

Career Areas relate to basic types of interests that people have.
- **Social/Business ... (Career Area 11)**
- **Mathematics and Statistics ... (GOE 11.01)**

Mathematics and Statistics involves working with numerical data and computer systems. Workers in this group apply mathematics in theories to solve problems or conduct research.

Personality Types

O*NET uses six categories to describe work environments and personality types (compatible with Holland's Model). The following codes reflect the categories which best describe this occupation:
- **Investigative**
- **Conventional**
- **Realistic**

Computer Support Specialist

National Employment and Outlook

Separate employment figures for Computer Support Specialist are not available. However, this occupation is included in the larger group of "Database administrators, computer support specialists, and all other computer scientists."

Annual number of job openings (1996 to 2006):

Job Openings	small number	A total of 26,834 annual job openings is expected for this occupation between 1996 and 2006.
Outlook	increasing	The employment change from 1996 to 2006 is estimated to be +119%.
Employment	medium sized occupation	This was a medium sized occupation in the United States, employing 206,318 workers in 1996.
OES occupation	25196 Database administrators, computer support specialists, and all other computer scientists	

Missouri Employment and Outlook

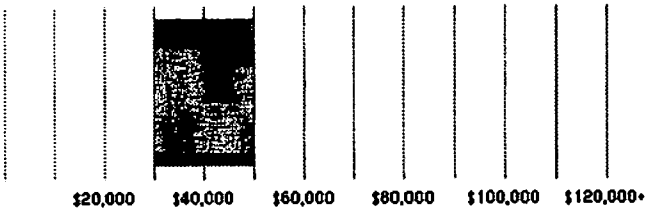
	Outlook	Employment, Growth, and Openings
LMA 1	• Stable	In this occupation, employment is projected to change from 21 in 1994 to 37 in 2005. It is estimated that less than 10 annual job openings will result from growth and persons leaving the labor force.
LMA 2	• Stable	In this occupation, employment is projected to change from 27 in 1994 to 47 in 2005. It is estimated that less than 10 annual job openings will result from growth and persons leaving the labor force.
Kansas City	• Increasing	In this occupation, employment is projected to change from 329 in 1994 to 574 in 2005. It is estimated that 26 annual job openings will result from growth and persons leaving the labor force.
LMA 4	• Stable	In this occupation, employment is projected to change from 14 in 1994 to 24 in 2005. It is estimated that less than 10 annual job openings will result from growth and persons leaving the labor force.
LMA 5	• Increasing	In this occupation, employment is projected to change from 130 in 1994 to 241 in 2005. It is estimated that 11 annual job openings will result from growth and persons leaving the labor force.
St. Louis	• Increasing	In this occupation, employment is projected to change from 421 in 1994 to 705 in 2005. It is estimated that 31 annual job openings will result from growth and persons leaving the labor force.

Computer Support Specialist

LMA 7	• Stable	In this occupation, employment is projected to change from 23 in 1994 to 45 in 2005. It is estimated that less than 10 annual job openings will result from growth and persons leaving the labor force.
LMA 8	• Stable	In this occupation, employment is projected to change from 79 in 1994 to 144 in 2005. It is estimated that less than 10 annual job openings will result from growth and persons leaving the labor force.
LMA 9	• Stable	In this occupation, employment is projected to change from 19 in 1994 to 30 in 2005. It is estimated that less than 10 annual job openings will result from growth and persons leaving the labor force.
LMA 10	• Stable	In this occupation, employment is projected to change from 11 in 1994 to 21 in 2005. It is estimated that less than 10 annual job openings will result from growth and persons leaving the labor force.
LMA 11	• Stable	In this occupation, employment is projected to change from 25 in 1994 to 42 in 2005. It is estimated that less than 10 annual job openings will result from growth and persons leaving the labor force.
Missouri Statewide	• Increasing	In this occupation, employment is projected to change from 830 in 1994 to 1402 in 2005. It is estimated that 70 annual job openings will result from growth and persons leaving the labor force.

National Earnings

National average annual earnings for the middle 50% of all workers in this occupation:



Annual earnings range for middle 50% of all workers in this occupation ... (all information from 1997 OES survey)	$27,851 to $47,112
Average annual earnings	$38,920
Average hourly earnings	$18.71

Missouri Earnings

	Middle 50% Range of Annual Earnings	Average Annual Earnings	Average Hourly Earnings
Missouri statewide	$25,584 to $45,573	$37,450	$18.00
LMA 1	$22,027 to $29,058	$28,558	$13.73
LMA 2	$22,942 to $32,365	$28,579	$13.74

Computer Support Specialist

Kansas City	$27,685 to $49,837	$40,680	$19.56
LMA 4	$23,837 to $34,528	$29,494	$14.18
LMA 5	$24,253 to $42,286	$33,654	$16.18
St. Louis	$26,790 to $48,339	$40,040	$19.25
LMA 7	$25,459 to $38,459	$31,866	$15.32
LMA 8	$18,512 to $24,794	$22,277	$10.71
LMA 9	$22,506 to $31,616	$28,371	$13.64
LMA 10	$26,645 to $41,226	$38,418	$18.47
LMA 11	$21,840 to $33,384	$28,517	$13.71

Work Conditions

Work conditions are taken from O*NET and refer to characteristics of the physical environment for an occupation. The following factors are frequently found in the work setting for this occupation:

- **Sitting**
- **Handling**

Work Hours and Travel

- Regular working hours and limited travel

Suggested School Courses

A course plan is available for the Career Pathway listed below:

- **Business, Information Management, and Marketing**

EVALUATION OF THE PROGRAM AND INSTRUCTION
Computer Maintenance Technology

	Always	Usually	Seldom	Never
1. The subject matter was well organized.	☐	☐	☐	☐
2. The instructor was concerned about student progress.	☐	☐	☐	☐
3. The instructor was knowledgeable in subject area.	☐	☐	☐	☐
4. The instructor had the ability to explain difficult topics.	☐	☐	☐	☐
5. The use of visual aids was of value to me.	☐	☐	☐	☐
6. The use of handouts was of value to me.	☐	☐	☐	☐
7. The instructor's exams effectively evaluate your knowledge of the assigned material.	☐	☐	☐	☐
8. The instructor spoke plainly and clearly.	☐	☐	☐	☐
9. I always felt free to ask questions about the subject.	☐	☐	☐	☐
10. The instructor appeared enthusiastic about the subject.	☐	☐	☐	☐
11. The instructor was open-minded to other points of view.	☐	☐	☐	☐
12. The instructor was available for help outside of class hours.	☐	☐	☐	☐
13. The class workload was reasonable.	☐	☐	☐	☐
14. The instructor's lectures were interesting as well as informative.	☐	☐	☐	☐
15. The instructor was prepared for class.	☐	☐	☐	☐

TRADES INDUSTRUAL EDUCATION PROGRAM STANDARDS

Computer Maintenance Technology

1. RESOURCE STANDARDS

1.A The program offers a coherent sequence of courses leading to occupational competence	_____ Met _____ Not Met

	YES	NO
• The program offers at least 5 courses.	☐	☐
• The program offers at least 3 units of credit.	☐	☐

1.B The teachers have a valid renewable teaching certificate for the program area.	_____ Met _____ Not Met

	YES	NO
• The district has on file a current teaching certificate for the teacher for the program area	☐	☐
• The teacher maintains a file containing documentation of completion of the requirements for renewal of the teaching certificate. (kept in office)	☐	☐

1.C Course offerings are appropriate for meeting the needs of students and employers	_____ Met _____ Not Met

	YES	NO
• Course offerings are based on enrollment trends, and employment needs.	☐	☐

1.D Class size is appropriate for the program area.	_____ Met _____ Not Met

	YES	NO
• Class size does not exceed 18.	☐	☐
• The number of students enrolled in the supervised trade experience component does not exceed 2 per business.	☐	☐

Comments on Resource Standards	Number of Standards Met:_____

PROCESS STANDARDS

2. Curriculum

2. A The program has a written curriculum and services to meet the needs of students. The curriculum is congruent with the overall philosophy of the program	_____ Met _____ Not Met

	YES	NO
• The written curriculum is formally adopted by the board.		
• The written curriculum guide includes the following components:	☐	☐
o Rationale which relates the program goals to the district's mission and philosophy	☐	☐
o A general description of the content of the program	☐	☐
o General goals for graduates in the program area	☐	☐
o Cross references to the knowledge (content), skills and competencies	☐	☐
(process) students need to meet the goals established by the district and the Show Me Standards.	☐	☐
• Curriculum and instructional strategies have been developed which integrate academic and vocational competencies.	☐	☐

2. B The curriculum has been developed with appropriate input and is reviewed on an annual basis.	_____ Met _____ Not Met

	YES	NO
• The curriculum guide is utilized by staff and advisory committee with the advisory committee in the delivery of educational services.	☐	☐
• Systematic procedures are in place to evaluate and revise the curriculum regularly based on actual student needs and indications of student mastery.	☐	☐
• The curriculum is articulated through grade levels and common subject areas to ensure continuity of learning.	☐	☐
• The curriculum is reviewed annually and revised as necessary to reflect changes occurring in industry, student needs, and instructional technology Internship.	☐	☐
• Resources in the community are used to enrich the curriculum.	☐	☐

2. C Learner outcomes and competencies for each course are clearly stated.	_____ Met _____ Not Met

	YES	NO
• The curriculum for each course/program has identified competencies organized as units of instruction, with appropriate assessment methods and resources.	☐	☐

Comments on Curriculum Standards:	Number of Standards Met:_____

3. Instruction

3. A Classroom instruction is congruent with the written curriculum		____ Met ____ Not Met
• Daily lesson plans derived from the curriculum guide are used to direct the educational process.	YES ☐	NO ☐
• The teacher is instructed in the use of non-biased practices and language which has been reinforced by policies, procedures and/or on-going awareness training to recognize racial, cultural, gender, or disability bias in curriculum and instructional practices.	☐	☐

3. B Students have the opportunity to participate in Supervised Trade Industrial Internship Experience.		____ Met ____ Not Met
• Students are enrolled in both the class and the supervised employment simultaneously.	YES ☐	NO ☐
• Training stations are appropriate for the occupational area of the program.	☐	☐
• There is a written Instructional Management Plan between the school and the training sponsor on file for each student.	☐	☐
• There is a written training agreement between the school and the training sponsor on file for each student.	☐	☐
• The teacher provides both in class instruction and supervision.	☐	☐
• The teacher and the workforce development specialist have adequate supervision time in his/her schedule based on the number of student's participation in the supervised work experience component.	☐	☐
• Evaluation of students on the job includes occupationally specific skills as well as general workplace readiness.	☐	☐
• The teacher provides frequent supervision at the training station.	☐	☐
• The teacher and/or workforce development specialist closely screens and approves training stations.	☐	☐
• There is evidence that the supervised internship experience component of the program has the support of the counselors, administrators and business community.	☐	☐

3. C The program provides students with assistance in the transition to the workplace and/or continued education.		____ Met ____ Not Met
• Worksite educational opportunities (job shadowing, experiential education, internship, etc.) are available.	YES ☐	NO ☐
• Articulation agreements have been implemented with postsecondary institutions and/or with other community resources, where applicable.	☐	☐

3. Instruction (cont.)

3. D Sufficient breadth and depth of instruction is provided in the classroom to meet the needs of all learners.	_____ Met _____ Not Met

	YES	NO
• Varied instructional strategies are used to address all learning styles, including IEP, slow students.	☐	☐
• Coordination procedures have been developed to insure appropriate instruction, review, and reinforcement for individual students served by special/support programs.	☐	☐
• Students are provided appropriate support services (including supplementary aids and accommodations, when needed) to enter and succeed in the vocational education program.	☐	☐
• The teacher is knowledgeable about special/support programs offered by the district, and actively participates in the Individual Education Plan/Vocational Education Plan process.	☐	☐

3. E The teacher monitors student progress toward course objectives and learner outcomes.	_____ Met _____ Not Met

	YES	NO
• Program and/or course objectives, assessment methods and performance expectations are shared with students and parents/guardians prior to instruction.	☐	☐
• An instructional management system exists for reporting student and class mastery of curriculum competences.	☐	☐

3. F The teacher and students have access to resources to effectively implement the curriculum of the program.	_____ Met _____ Not Met

	YES	NO
• Resources in the community are utilized to enrich the curriculum.	☐	☐
• Procedures are in place for the periodic updating and replacement of instructional materials.	☐	☐

3. G Equipment for the program supports the curriculum and instructional process.	_____ Met _____ Not Met

	YES	NO
• Appropriate instructional technology is available for students and staff.	☐	☐
• Equipment is ion good repair and proper working order.	☐	☐
• There are procedures for reporting and requesting repairs, and repairs are made promptly.	☐	☐

Comments on Instruction Standards:	Number of Standards Met:_____