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Tools & Frameworks

College Curriculum

NETWORKING CURRICULUM

NWCET

NATIONAL WORKFORCE CENTER *for* EMERGING TECHNOLOGIES

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Networking

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We wish to thank Networking faculty from across the state of Washington, who generously gave of their time and expertise in a two-day intensive workshop to help generate and review the This report presents the competency-based curriculum developed by the NorthWest Center for Emerging Technologies (NWCET). The curriculum was translated through a "fast-track" development process, using the skill standards for the Networking career cluster published in *Building a Foundation for Tomorrow: Skill Standards for Information Technology* (NWCET, 1999).

This report includes the following:

- **Program Learning Components**: meaningful categories of related skills and knowledge.

- **Learner Program Outcomes**: what the learners must be able to know and demonstrate at the end of the program.

- **Key Competencies**: specific, observable knowledge and skills that support and lead to the program learner outcomes.

- **Sample Activities**: activities or projects that provide a context for learners to acquire technical and foundation skills and knowledge, with associated competencies and suggested assessments.

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PROGRAM LEARNING COMPONENTS

The Learning Components are meaningful categories of related skills and knowledge that are best taught/learned together and represent logical pieces of curriculum.

Technical Components

- Math and Science for Networking
- Network Administration
- Network Architecture
- Network Configuration
- Network Hardware Components
- Network History and Trends
- Network Installation
- Network Maintenance
- Network Monitoring and Optimization
- Network Operating Systems
- Network Operations
- Network Recovery
- Network Security
- Network Software Applications
- Network Standards and Protocols
- Network Terminology and Concepts
- Network Testing and Troubleshooting
- Network Upgrade
- Network Vendors and Products
- Office Software Applications
- Programming

Foundation Components

- Business Organization and Environment
- Communication (Verbal and Written)
- Continuous Learning
- Customer Relations
- Design
- Operational Impact
- Problem Solving and Analytical Thinking
- Professional Development/ Professionalism
- Project Planning and Organization
- Requirements Analysis
- Research
- Resource Management
- Team Process and Leadership
- Technical Documentation

LEARNER PROGRAM OUTCOMES

Learner Program Outcomes are statements that support the Learning Components by describing what students must know and be able to do by the end of the program.

Math and Science for Networking – *Technical Learning Component*
- Explain and apply basic electronics and scientific principles used in networking
- Apply scientific principles to develop cost/benefit analysis and budget estimates
- Apply mathematical reasoning and functions to analyze network performance and solve network problems

Network Administration – *Technical Learning Component*
- Define, set up, and implement group and user accounts based on organizational and usage policies
- Maintain and document administrative procedures for security, resource access, and backup
- Make recommendations and follow procedures for network resource allocation and access, backup and security

Network Architecture – *Technical Learning Component*
- Contribute to the design and implementation of the network architecture based on organizational requirements and constraints
- Gather, analyze, and document customer requirements and organizational constraints as they relate to network architecture
- Compare different network architectures as they apply to specific requirements and constraints

Network Configuration – *Technical Learning Component*
- Research client configuration needs, develop a proposed network configuration and present recommendations
- Implement a proposed configuration plan and test network after implementation
- Compare various configuration strategies to determine appropriate plan for organization and user requirements

Network Hardware Components – *Technical Learning Component*
- Document system components and their performance
- Select and install network components according to system requirements and constraints
- Compare features and functions of components

Network History and Trends – *Technical Learning Component*
- Research past and current technology to identify network trends
- Explain the history and development of network topologies, hardware, and software
- Explain the evolution of network standards and protocols, and their impact on network design

Network Installation – *Technical Learning Component*
- Test and troubleshoot performance of network components during and after installation
- Install network according to design and vendor specifications
- Plan and document component and network installation

Network Maintenance – *Technical Learning Component*
- Develop and implement an effective network maintenance plan and schedule
- Perform maintenance functions following maintenance plan, schedule and procedures
- Maintain, replace, and/or upgrade network hardware and software components according to maintenance plan

Network Monitoring and Optimization – *Technical Learning Component*
- Select and effectively apply system monitoring and optimization tools and methods
- Establish and document baseline performance and make recommendations to management for system optimization

Network Operating Systems – *Technical Learning Component*
- Troubleshoot, maintain, and repair network operating systems
- Install, configure, and document network operating system and software
- Present advantages, limitations, and preferred applications of various network operating systems

Network Operations – *Technical Learning Component*
- Perform the daily operations of a network system
- Evaluate and document network system performance
- Analyze and troubleshoot network problems

Network Recovery – *Technical Learning Component*
- Develop and document disaster recovery plan procedures and train users
- Develop and implement network disaster control, recovery and backup procedures with minimal impact to users
- Make recommendations for disaster recovery procedures and strategies

Network Security – *Technical Learning Component*
- Analyze and apply security policies, requirements, procedures, and tools
- Identify, document, and report security risks to network and make recommendations for security improvement
- Install and update security software and patches, establish firewalls and setup user access

Network Software Applications – *Technical Learning Component*
- Analyze needs of organization and research vendors to identify and obtain appropriate software applications
- Install, configure, upgrade, and document network software applications and recommend procedures to train users
- Monitor and document software performance, troubleshoot software malfunctions and test functionality

Network Standards and Protocols – *Technical Learning Component*
- Explain the importance of standards and protocols in implementing networks
- Identify and implement the appropriate standards and protocols for the network
- Research and monitor industry trends in network standards and protocols

Network Terminology and Concepts – *Technical Learning Component*
- Explain networking concepts and define networking terminology
- Apply concepts and terminology to solve problems in networking

Network Testing and Troubleshooting – *Technical Learning Component*
- Select and use diagnostic tools and equipment to identify and analyze network malfunctions
- Develop, document, and implement testing and troubleshooting procedures in accordance with organization requirements
- Document source of malfunction and solutions implemented

Network Upgrade – *Technical Learning Component*
- Develop and implement an upgrade plan that meets organizational needs
- Perform upgrade installation, test effectiveness and functionality of upgrade, and document results
- Analyze current system and organization requirements to identify system upgrade requirements

Network Vendors and Products – *Technical Learning Component*
- Evaluate and document strengths and limitations of specific vendors, products and services
- Research, select and document vendors, products and services that meet organizational, user and technical support needs

Office Software Applications – *Technical Learning Component*
- Use software applications to analyze and solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process

Programming – *Technical Learning Component*
- Define and document program specifications and program design
- Plan and implement testing and debugging procedures to verify program reliability
- Use programming language statements, functions, variables and control and data structures correctly

Business Organization and Environment – *Foundation Learning Component*
- Identify and discuss contemporary business principles, practices, and organization
- Present and discuss how computer systems impact the operation and management of business
- Identify and work within an organization's environmental dynamics and constraints

Communication (Verbal and Written) – *Foundation Learning Component*
- Develop and deliver effective oral communications
- Create and adapt effective written communications according to audience and purpose
- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

Continuous Learning – *Foundation Learning Component*
- Evaluate needs for training and education and implement a personal development plan
- Identify and take advantage of learning opportunities to develop skills and knowledge
- Research and maintain current training information from various sources

Customer Relations – *Foundation Learning Component*
- Gather and interpret information to understand customer requirements
- Effectively communicate and interact with customers
- Identify and meet the needs of the customer and the business

Design – *Foundation Learning Component*
- Develop design to meet specifications and present to management for approval
- Evaluate product design, document the specifications, create and test a prototype
- Identify and document the effectiveness of the design and design process, implement solutions, and test for functionality

Operational Impact – *Foundation Learning Component*
- Communicate technology changes to customers and assess the impact on productivity
- Evaluate the impact of management decisions on the technology environment
- Analyze operational and budgetary impact of technology changes

Problem Solving and Analytical Thinking – *Foundation Learning Component*
- Apply analytical thinking to gathering information, designing and testing solutions to a problem, and formulating plans
- Create, test and document resolution processes and solutions
- Select, implement, and evaluate appropriate problem-solving techniques and tools

Professional Development/Professionalism – *Foundation Learning Component*
- Develop and document a commitment to professionalism through the demonstration of professional attitudes and actions
- Create and sustain a professional network to further professional development goals

Project Planning and Organization – *Foundation Learning Component*
- Efficiently organize and monitor project resources and tasks to meet requirements
- Develop a complete & realistic project plan that meets the requirements identified by stakeholders

Requirement Analysis – *Foundation Learning Component*
- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

Research – *Foundation Learning Component*
- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research
- Develop and implement an effective process to gather research data from a variety of sources

Resource Management – *Foundation Learning Component*
- Evaluate project to identify required resources
- Develop and implement an inventory plan to monitor and maintain resources
- Obtain necessary resources and optimize resource usage to meet objectives

Team Process and Leadership – *Foundation Learning Component*
- Select and apply a leadership style that is most effective for the team and the environment
- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

Technical Documentation – *Foundation Learning Component*
- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

KEY COMPETENCIES

Key Competencies are specific, observable behaviors, knowledge, abilities and skills that detail and support the Learner Program Outcomes.

Math and Science for Networking – *Technical Learning Component*

Learner Program Outcomes

- Explain and apply basic electronics and scientific principles used in networking
- Apply scientific principles to develop cost/benefit analysis and budget estimates
- Apply mathematical reasoning and functions to analyze network performance and solve network problems

Key Competencies

Demonstrate the ability to:

- Explain the difference between a baud per second and a bit per second
- Explain and accurately use basic electrical concepts and terminology such as voltage, current, resistance, impedance, capacitance and inductance
- Identify cable needs and calculate cable length for a network installation project
- Explain the features of electrical components essential to an effective network
- Explain the principles of frequency, amplitude, and phase modulation, and their application in a networking environment
- Perform the conversion between binary, hexadecimal, and decimal numbers
- Explain the advantages and limitations of serial versus parallel communications within a network
- Calculate resistance in series and parallel circuits
- Explain the advantages and limitations of analog versus digital technology as they apply to networks
- Explain the principles of data compression for files on the network
- Explain the difference in properties between alternating current (AC) and direct current (DC)
- Explain the importance of electronics to telecommunications media
- Explain the advantages and limitations of wireless media and cable media
- Calculate the costs and compare the benefits of installing a variety of network topologies
- Produce a budget proposal for a given design using mathematical and statistical tools
- Use a math model to demonstrate the limitations of IP addressing on the network
- Analyze and document error detection and correction processes using scientific processes
- Design and implement procedures to identify parity, stop and start bits on the network
- Define and apply scientific methods to solve network problems
- Define logic gates and perform calculations using Boolean Algebra

Network Administration – *Technical Learning Component*

Learner Program Outcomes

- Define, set up & implement group/user accounts based on organizational & usage policies
- Maintain and document administrative procedures for security, resource access & backup
- Make recommendations and follow procedures for network resource allocation and access, backup and security

Key Competencies

Demonstrate the ability to:

- Establish and document dial-in procedures for remote users
- Document and apply security requirements and procedures used to protect the network from malicious tampering or accidental damage
- Establish a process to record technical information and regularly update technical documentation to support reliable network performance
- Determine availability of resources assigned to users to maintain access in accordance with network usage policy
- Disseminate necessary documentation to users to assist them in successfully accessing resources on the network
- Perform and document virus-scanning procedures used to protect the computer system and files from corruption
- Establish, perform and document necessary steps used to successfully implement user backup procedures to avoid data loss
- Access & utilize available resources on the network to effectively manage the system
- Develop & maintain an administrative log to document day-to-day network administrative tasks
- Create processes for administering & controlling access to resources on the network
- Identify and implement share-level and user-level access as needed
- Use proper methods to access software applications on the network
- Develop, implement & maintain procedures that establish user access to the network
- Ensure compliance of network procedures with organization requirements
- Analyze network hierarchy structure; make recommendations for user accounts according to the organization framework
- Establish and document user-friendly login procedures and provide instructions for user access to the network
- Monitor resource sharing & user permissions to maintain network application security
- Assign proper characteristics to network accounts to maintain network security and allow users to perform tasks effectively
- Recommend usage policies that support network security
- Establish group account controls that meet network and organization usage policies
- Establish password authentication, rules and policies to secure the network
- Propose user help-desk access procedures to provide technical assistance and improve customer relations
- Design and implement methods to monitor user accounts
- Set up directories on the network to store user files
- Record and perform steps to set up and modify user accounts on the network according to usage policies

Network Architecture – *Technical Learning Component*

Learner Program Outcomes

- Contribute to the design and implementation of the network architecture based on organizational requirements and constraints
- Gather, analyze, and document customer requirements and organizational constraints as they relate to network architecture
- Compare different network architectures as they apply to specific requirements and constraints

Key Competencies

Demonstrate the ability to:

- Propose architecture recommendations that meet customer and organization needs
- Identify the advantages and limitations of network connectivity devices to determine the appropriate device for a topology
- Properly design a network wiring schematic to meet the planned architecture
- Assess and present to management the benefits and risks associated with implementation of a specific architecture
- Propose intranet architecture for processing information within a specific organization
- Select, use and document the appropriate connectivity devices needed to expand, optimize and interconnect networks
- Design the physical topology to meet the network architecture requirements
- Design a physical layout for an organized wiring closet
- Design a network architecture using multiple protocol suites to enable communication with other network-connected machines
- Evaluate building structure for proper cabling installation
- Research and apply building and wiring codes to design the physical and logical network topologies
- Develop alternative design for an enterprise network using different architectures
- Analyze & document bandwidth requirements to plan for increased network capacity
- Analyze the effectiveness of various media access control methods for a given set of architecture requirements
- Interview customers to identify network architecture requirements and organizational constraints
- Estimate and document the costs and benefits associated with a planned architecture
- Analyze and document customer and organizational requirements as they relate to network architecture
- Identify, select and document a logical topology to meet system requirements and organizational needs
- Identify the advantages, limitations and applicability of various protocols
- Identify, select and document an appropriate physical topology to meet architecture requirements and organizational needs
- Explain and document the advantages and limitations of various network operating systems to support selection of an operating system
- Design a scalable network that allows users and resources to be easily added without excessive delays or loss in performance
- Discuss the differences between peer-to-peer and client server network architectures

Network Configuration – *Technical Learning Component*

Learner Program Outcomes

- Research client configuration needs, develop a proposed network configuration and present recommendations
- Implement a proposed configuration plan and test network after implementation
- Compare various configuration strategies to determine appropriate plan for organization and user requirements

Key Competencies

Demonstrate the ability to:

- Identify current and anticipated user software application needs and incorporate into network configuration plan
- Develop and implement a test plan for the network system after configuration
- Produce a configuration plan document that outlines network configuration schedule, flowcharts, and project management charts
- Gather and analyze user feedback to determine whether the network configuration meets client requirements
- Develop a proposed network configuration plan to meet client needs
- Present proposed network configuration plan to users in non-technical terms
- Estimate the cable plant needs for future expansion of the system configuration
- Apply network configuration procedures to monitor and maintain network resources
- Implement configuration plan according to system and organization requirements
- Interview users and document requirements to analyze network configuration needs
- Determine future equipment configuration requirements based on network usage trends and growth plan
- Implement appropriate solution to configuration problems and assess the outcome
- Organize tasks and team members to implement the configuration plan
- Assess the effectiveness of the configuration and document areas for improvement
- Determine the impact of a network configuration change on the overall system including system downtime and loss in productivity
- Develop alternative solutions to a given network configuration problem
- Estimate and document the costs and benefits associated with a given network configuration plan
- Evaluate network configuration and its compliance with industry-based standards
- Compare various network configurations to identify the advantages and limitations for each configuration
- Document physical constraints to a given configuration and present to management in non-technical terms

Network Hardware Components – *Technical Learning Component*

Learner Program Outcomes

- Document system components and their performance
- Select and install network components according to system requirements and constraints
- Compare features and functions of components

Key Competencies

Demonstrate the ability to:

- Recognize the differences between hardware and software problems to determine the appropriate solutions
- Identify & document safety/security issues related to network hardware components
- Identify and document network, media and connectivity devices
- Research & select appropriate types of cables & connectors for network installation
- Identify and document critical traffic bottlenecks in an enterprise network and make recommendations for improved usage procedures and hardware solutions
- Determine the cause of hardware component failure and repair or replace according to vendor guidelines
- Document the repair or replacement of hardware components and notify key personnel of changes to the network
- Research the organization technical requirements and user needs to support the selection of hardware components
- Compare functionality & reliability of hardware products; make recommendations
- Read instructions and install hardware according to specifications
- Develop and implement a maintenance schedule to support the optimal performance of hardware components on the network
- Select and install network hardware components to solve specific problems and document changes to the network
- Document & install hardware components in accordance with organization requirements
- Compare quality of service of various hardware vendors and make recommendations
- Communicate hardware component needs to management; secure approval for installation
- Install network adapter cards & software; verify functionality according to specifications
- Obtain and install driver software updates that enable the system to function properly
- Evaluate effectiveness of hardware implementation procedures for given scenarios
- Identify and interview vendors to research available hardware components and their cost for a given network upgrade
- Make hardware upgrade recommendations to meet network performance requirements
- Develop a feasibility study for a given network upgrade and estimate and document the hardware costs associated with it
- Identify the functions and features of the physical layer of the OSI model to assist in resolving hardware problems
- Evaluate security procedures & policies; propose guidelines to secure workstations/ network
- Identify the advantages and limitations of various network media access controls to determine methods appropriate for a given system

Network History and Trends – *Technical Learning Component*

Learning Program Outcomes

- Research past and current technology to identify network trends
- Explain the history and development of network topologies, hardware, and software
- Explain the evolution of network standards and protocols, and their impact on network design

Key Competencies

Demonstrate the ability to:

- Explain the evolution of standards and their relevance to the development of an open networking environment
- Compare past and current networking standards and their present impact on data communication
- Present the key technology advances that impacted the evolution of data communication
- Summarize trends in network operating systems
- Research and explain the history, development and challenges of remote LAN access
- Explain the history and trends in media access control methods
- Discuss the basic protocols developed for telegraphy and their importance to the development of networks
- Explain the purpose and importance of standards organizations and their relationships to the technical community
- Research and explain the history and trends in network hardware devices
- Research and explain the history and trends in network architectures
- Present trends in network standards and their potential impact on the industry
- Identify and document the converging technologies and trends that led to current network architectures
- Identify trends in development and use of software applications for networks and discuss their impact on operations
- Evaluate the future capabilities of the Internet and WWW and explain their impact on network design and resources
- Research and compare the various industry-accepted protocols

Network Installation – *Technical Learning Component*

Learner Program Outcomes

- Test and troubleshoot performance of network components during and after installation
- Install network according to design and vendor specifications
- Plan and document component and network installation

Key Competencies

Demonstrate the ability to:

- Develop and implement a test plan for the network system after installation
- Install network operating system and test for performance
- Select and install the appropriate fault-tolerance devices on a network and test their performance
- Identify network device compatibility problems and develop appropriate solutions
- Utilize appropriate test equipment to measure network performance
- Select hardware devices and document their connectivity requirements
- Prioritize steps of installation and document installation procedures
- Organize tasks and team members to implement the installation plan
- Interpret blueprints to evaluate the feasibility of network installation plan
- Present installation plan to team members and management
- Select and document appropriate media access control methods for a given network installation plan
- Evaluate power requirements and availability to ensure necessary capacity for network
- Evaluate and document HVAC and other environmental constraints in the development of the network installation plan
- Research current industry standards and apply these standards in the installation of the network
- Interpret blueprints and user requirements to identify the appropriate physical location for the server
- Develop and document a plan for the physical security of servers on the network
- Draw sketches of proposed wire runs and assess their compatibility with the network installation plan
- Create an accurate and complete wire list schema from a network installation plan
- Document device installation and configuration of network components on the system
- Evaluate and select appropriate mount outlets for installation of required equipment
- Install server software with minimal impact on user productivity
- Use standard practices to locate and label patch panels
- Select and implement appropriate protocols for installation of the network
- Follow vendor specifications and recommendations when installing network components
- Select and use appropriate tools to install the network components
- Install and configure network interface cards on the network
- Install and configure connectivity devices on the network
- Install client software on workstations with minimal delays or loss in productivity

Network Maintenance – *Technical Learning Component*

Learner Program Outcomes

- Develop and implement an effective network maintenance plan and schedule
- Perform maintenance functions following maintenance plan, schedule and procedures
- Maintain, replace, and/or upgrade network hardware and software components according to maintenance plan

Key Competencies

Demonstrate the ability to:

- Prioritize network maintenance service requests according to user requirements and level of impact on users and system
- Promptly address network problems as they are identified through maintenance reports
- Perform assigned network maintenance tasks without supervision
- Select and use appropriate tools to test network operating system components
- Seek & incorporate feedback to develop effective solutions to identified maintenance issues
- Properly use performance and monitoring tools to assess network performance
- Evaluate & document results of maintenance performed to solve specific failures
- Create a network maintenance schedule that regularly assesses performance of network components
- Develop hardware/software maintenance plan to meet user needs & system specifications
- Develop and implement a test plan for checking network system operations after maintenance
- Interpret & update network maintenance reports that document current network performance
- Read and interpret warranty information; document impact on maintenance plan and schedule
- Assess the costs and benefits of repairing versus replacing equipment and make recommendations
- Develop a contingency plan for network failure; propose an effective recovery strategy
- Effectively communicate with end-users and administration to coordinate a maintenance schedule
- Select and coordinate equipment needed to implement a network maintenance plan
- Interview users to determine the effectiveness of maintenance; interpret and document feedback
- Estimate the budgetary impact of network maintenance plan and make recommendations to team and management
- Organize maintenance tasks & team members to follow appropriate maintenance plan
- Identify & document hardware required to maintain and improve network performance
- Accurately fill out warranty forms to guarantee compliance with vendor requirements
- Identify and develop criteria for network maintenance baseline performance
- Install hardware and software components in accordance with maintenance plan
- Effectively use hardware and software tools to identify network media problems
- Identify and obtain appropriate software upgrades, drivers and patches using available vendor resources to maintain system performance
- Research and assess the reliability of network hardware and software components

Network Monitoring and Optimization – *Technical Learning Component*

Learner Program Outcomes

- Select and effectively apply system monitoring and optimization tools and methods
- Establish and document baseline performance and make recommendations to management for system optimization

Key Competencies

Demonstrate the ability to:

- Select and implement procedures to resolve traffic bottlenecks within the network and document the results
- Evaluate hardware and software malfunctions, prioritize the problems according to importance and propose resolution plan
- Identify changes in network performance and compare against specifications
- Organize tasks and team members to perform optimization of the network
- Implement monitoring procedures from a remote location in accordance with organization procedures
- Recognize the differences between hardware and software problems to identify problem areas accurately
- Analyze network performance trends and synthesize results to determine areas for optimization
- Identify and monitor potential environmental hazards that could impact network performance
- Analyze and summarize collected monitoring data to determine system performance
- Identify monitoring requirements, and develop and document monitoring procedures
- Properly use monitoring tools according to vendor specifications
- Follow industry standards and use appropriate tools to monitor the system
- Interview vendors to determine appropriate monitoring tools for the network
- Gather and analyze data to verify that changes to the network achieved optimization goals
- Create statistical report of problems and solutions with necessary graphs to present to management
- Estimate time and budgetary impacts of optimization and make recommendations to management
- Compare network performance to baseline data to identify problems and optimize system performance
- Develop and implement a comprehensive schedule to optimize and monitor network performance
- Modify monitoring procedures as necessary to support optimal system performance and user productivity
- Install and run monitoring software to optimize network performance
- Identify and document abnormal system performance and implement a solution with minimal disruption to user productivity

Network Operating Systems – *Technical Learning Component*

Learner Program Outcomes

- Troubleshoot, maintain, and repair network operating systems
- Install, configure, and document network operating system and software
- Present advantages, limitations, and preferred applications of various network operating systems

Key Competencies

Demonstrate the ability to:

- Install and configure client server software within time and resource constraints
- Install network operating systems in accordance with vendor guidelines and specifications
- Identify and document existing network standards related to operating systems to ensure compliance
- Develop and implement acceptance tests to verify that the operating system is performing according to specifications
- Document network operating system installation procedures and server configuration
- Configure the network operating system to meet user and organization requirements
- Install a network operating system and test its performance
- Develop and implement a directory replication procedure to maintain a master set of directories and files
- Create emergency startup disks and boot procedures to restart the system in case of system failure
- Connect and integrate network users with different operating systems
- Create and interpret system logs to identify problems in the network operating system
- Implement and review appropriate logging procedures and resolve logging errors
- Identify and apply appropriate patches and upgrades to the operating system according to vendor specifications
- Compare network performance to baseline data and identify network operating system problems
- Develop and implement network operating system backup procedures to prevent loss of data
- Determine and implement the most appropriate disk file system based on user and security needs
- Identify and use appropriate tools to test a network operating system
- Follow troubleshooting procedures & utilize diagnostic tools to test operating system
- Document operating system backup procedures and make recommendations for improvement
- Develop procedures for communicating the impact of operating system installation and upgrade plans to users
- Explain and document the advantages and limitations of various network operating systems to support selection of a specific operating system
- Make recommendations for new network operating system installations and/or upgrades to management for approval

Network Operations – *Technical Learning Component*

Learner Program Outcomes

- Perform the daily operations of a network system
- Evaluate and document network system performance
- Analyze and troubleshoot network problems

Key Competencies

Demonstrate the ability to:

- Implement backup procedures to secure user data and system configurations
- Properly use system measurement techniques including probes, performance and protocol monitoring tools
- Configure and monitor network printers and other peripherals to meet user needs
- Set up file systems and directory structures to support network users
- Select and use server tools to administer the network and document results
- Produce operational reports using network documentation application, word processing and chart programs
- Prepare and present a report of necessary upgrades to enhance hardware and software to meet user requirements and optimize system
- Make recommendations to add and install client workstations to network to enhance system usage
- Utilize documentation and system logs to analyze and solve problems on the network
- Evaluate hardware problems and test the operation of hardware components to verify functionality according to specifications
- Implement and document solutions to problems at the server level
- Implement appropriate procedures to correct problems and document changes to the network
- Perform start up and shut down procedures and evaluate effective system operation
- Evaluate hardware or software malfunctions, prioritize the problems in order of importance and propose resolution strategy
- Contribute to the development and implementation of network security procedures to prevent unauthorized use
- Create a security assessment checklist and implement procedures to assess system security
- Identify and correct connectivity and protocol problems to enhance network performance
- Relate symptoms to different OSI levels to identify problems and enhance network performance
- Evaluate software problems and test the operation of the software to verify functionality according to specifications
- Simulate various problems locally to assess their impact on the network and test solutions

Network Recovery – *Technical Learning Component*

Learner Program Outcomes

- Develop and document disaster recovery plan procedures and train users
- Develop and implement network disaster control, recovery and backup procedures with minimal impact to users
- Make recommendations for disaster recovery procedures and strategies

Key Competencies

Demonstrate the ability to:

- Install network components into fault-tolerant configurations to minimize the impact of hardware failure
- Test the network system and generate reports regarding the effectiveness of the recovery process
- Identify and train individuals who will perform backup and recovery operations
- Develop a disaster recovery plan in cooperation with network team and vendors, and present to management for approval
- Apply appropriate fault tolerance methods to the current network to optimize network response
- Present the differences between primary and backup servers and explain their respective roles during disaster recovery
- Develop and document a network recovery plan in accordance with the organization requirements
- Select & install uninterruptible power supply hardware and software to prevent data loss
- Develop & implement an effective network recovery and backup training plan for users
- Effectively reconfigure hardware and software after recovery to reestablish optimal performance
- Choose a disaster recovery plan for a given situation and justify selection
- Analyze and interpret data retrieved from error log files to troubleshoot problem areas
- Create a network recovery disk to protect against data loss
- Utilize software to assist in the analysis of error log files
- Identify and repair network media faults
- Identify specific network media failures and implement an effective recovery process
- Identify & recover from virus and other security-related issues with minimal downtime
- Recognize the differences between hardware and software problems to implement appropriate recovery procedures
- Restore data from tape backup after system failure and document procedures
- Analyze and implement the necessary steps to backup a primary and backup server
- Develop and implement a contingency plan to restore stability to the network after a system failure
- Identify conflicting or erroneous data after a system failure and reconcile with backup
- Restore database integrity after identifying and solving problems on the network
- Document system deficiencies and implement appropriate software patches to improve network reliability
- Follow the recovery implementation plan and procedures, and document activities and results
- Discuss the importance of server synchronization and explain how it affects recovery

Network Security – *Technical Learning Component*

Learner Program Outcomes

- Analyze and apply security policies, requirements, procedures, and tools
- Identify, document, and report security risks to network and make recommendations for security improvement
- Install and update security software and patches, establish firewalls and setup user access

Key Competencies

Demonstrate the ability to:

- Identify and document secure locations for servers and printer resources on the network
- Evaluate installation procedures and server configurations to prevent system tampering
- Determine and establish appropriate client privilege access levels according to security policies
- Research and document applicable organization security policies and make recommendations to team and management
- Create and implement security logs to monitor usage and unauthorized access
- Identify and document potential password vulnerabilities and make recommendations for improvement
- Establish and document firewalls to protect network against external tampering and unauthorized access
- Research and interpret organizational structure to determine categories of users
- Identify security risks within the current system and make recommendations for improvement
- Plan and implement group and user file/directory permissions and resolve any conflicts
- Create and document user access in accordance with organization requirements
- Identify and document the current network security configurations to establish a baseline
- Select and apply standard testing tools and techniques to verify security configurations
- Analyze the current system to determine if the levels of security meet organization requirements
- Report and discuss findings of system violations with management to determine appropriate response
- Analyze security logs to identify potential risks and security violations
- Schedule and perform periodic security reviews to identify security risks
- Analyze current firewall system to determine if it meets the organization needs and make recommendations for improvement
- Identify and document vulnerabilities in software security and apply appropriate patch
- Install and update virus-scanning programs to secure the system from viruses
- Apply the appropriate security software updates when needed
- Configure and document various user password parameters to establish access rights to company data
- Monitor vendor websites to obtain security patches and upgrades
- Develop and implement procedures for updating virus software and security patches on the system

Network Software Applications – *Technical Learning Component*

Learner Program Outcomes

- Analyze needs of organization and research vendors to identify and obtain appropriate software applications
- Install, configure, upgrade, and document network software applications and recommend procedures to train users
- Monitor and document software performance, troubleshoot software malfunctions and test functionality

Key Competencies

Demonstrate the ability to:

- Develop and document troubleshooting procedures to test software applications
- Develop test plan to verify that applications are performing according to specifications
- Select and use diagnostic tools to identify software problems
- Examine the effectiveness and document the performance of current software applications
- Keep informed of new software application releases and make recommendations to management for possible installation/upgrade
- Determine needs and implement server-based and/or client-based applications
- Develop and document a software upgrade schedule and present to management for approval
- Discuss proposed software upgrade schedule with users to determine the impact on productivity
- Interview users and management to determine software needs and document the results
- Research software vendors and effectively download and install necessary software for users
- Research software vendors to identify applications that meet user needs within budgetary constraints
- Address software licensing issues in software implementation plan
- Install software applications and verify functionality according to specifications
- Develop and apply appropriate solutions to identified software problems, and test and document the results
- Configure software to meet needs of management and users and document the results
- Install software applications with minimal impact to user productivity
- Develop spreadsheets or other analysis tools to chart and analyze software application usage
- Contribute to the development of an effective software application training plan for users
- Effectively communicate to users the impact of installation of new software and upgrades on the network

Network Standards and Protocols – *Technical Learning Component*

Learner Program Outcomes

- Explain the importance of standards and protocols in implementing networks
- Identify and implement the appropriate standards and protocols for the network
- Research and monitor industry trends in network standards and protocols

Key Competencies

Demonstrate the ability to:

- Describe the advantages and limitations of packet switching on the network
- Discuss the evolution of various switching technologies and their significance to communications on the network
- Identify industry-accepted protocols and discuss their major features
- Research and document current standards and assess possible industry trends
- Compare the effectiveness of various server standards to determine appropriate method for network
- Compare the differences between different protocols and discuss their application to LAN and WAN systems
- Define and appropriately use network protocol acronyms and terminology
- Describe the different types of virtual circuits as they relate to specific protocols
- Identify the functions and features of network protocols and their relevance to the OSI model
- Design address schemes in accordance with Internet protocol requirements
- Assess network load balancing requirements and recommend the appropriate protocols
- Identify and select the appropriate multiplexing technology for specific data types
- Discuss the functions and features of Net BIOS Broadcast and its relevance to network standards
- Compare and contrast routing standards to determine the appropriate standard for a specific network
- Research and compare the various industry-accepted protocols and their impact on data communications standards
- Discuss the role of various regulatory agencies in determining standards and protocols
- Compare the differences between uni-cast and multi-cast network traffic and identify impacts on the network
- Discuss the functions and features of gateways and how standards apply to them
- Explain the purpose and importance of standards to the development of an open network environment

Network Terminology and Concepts – *Technical Learning Component*

Learner Program Outcomes

- Explain networking concepts and define networking terminology
- Apply concepts and terminology to solve problems in networking

Key Competencies

Demonstrate the ability to:

- Explain the differences between repeaters, bridges, routers, gateways and switches and explain their significance to network communications
- Describe the features and functions of various network communication media
- Explain and compare the different forms of network communications transmission
- Discuss the differences between a client-server network and a peer-to-peer network
- Define and apply the process of "connectionless" packet communication on the network
- Discuss the differences between uni-cast and multi-cast traffic on a network
- Identify and document the features and functions of protocols at each layer of the OSI model
- Explain the functions and features of firewall technology and its importance to the network
- Explain the principles of internetworking and intranetworking, and present the differences between these processes
- Explain the purpose and importance of the OSI model and its impact on network communications
- Define and apply the process of "connection-oriented" packet communication on the network
- Explain the differences between transmission rates and effective throughput in different network topologies
- Discuss the advantages and limitations of various encryption methods for securing the network
- Explain data representation and its relevance to data transmission on the network
- Explain the different data communication functions on the network
- Describe the features of statistical and time-division multi-plexing as related to specific types of data transmission
- Describe the process of packet addressing and the use of routers to modify a network address
- Explain the use of TCP/IP utilities and assess their performance on the network
- Explain the methods available to implement network security in WAN and LAN systems
- Explain and apply the various data compression methods to the network
- Define the term "bandwidth" and discuss its relevance to data transfer capacity on a network

Network Testing and Troubleshooting – *Technical Learning Component*

Learner Program Outcomes

- Select and use diagnostic tools and equipment to identify and analyze network malfunctions
- Develop, document, and implement testing and troubleshooting procedures in accordance with organization requirements
- Document source of malfunction and solutions implemented

Key Competencies

Demonstrate the ability to:

- Use appropriate console commands to troubleshoot the network
- Select and use standard analysis techniques that support the troubleshooting process
- Utilize console commands to analyze network and troubleshoot problem areas
- Regularly inspect network for potential wire breaks & other physical problems; repair as needed
- Use network protocol and segmenting analysis equipment to analyze the network
- Select and use electric and electronic diagnostic tools to identify problems and malfunctions on the network
- Organize tasks & team members to implement procedures for physical inspection of network
- Identify and resolve router and cable problems with minimal impact to users
- Research & identify industry trends in analysis techniques to enhance troubleshooting procedures
- Apply troubleshooting procedures and utilize diagnostic tools to test the operating system, and repair as needed
- Utilize physical media diagnostic equipment to identify cause of equipment malfunction
- Implement and document procedures to gather user feedback on network problems
- Analyze user feedback and implement appropriate technical support procedures to resolve user problems
- Select and implement usage procedures to resolve traffic bottlenecks within the network and document the results
- Analyze and document the effectiveness of troubleshooting procedures and make recommendations for improvement
- Produce and maintain an inventory schedule for ordering components used to test, troubleshoot, and repair network
- Implement backup procedures before troubleshooting the system to prevent data loss
- Outline and implement troubleshooting procedures and assess their effectiveness
- Research and document alternative testing methods to optimize testing procedures
- Troubleshoot data overload; implement appropriate solution with minimal user impact
- Interview users to assess severity of problem and accurately document communications
- Identify & document symptoms of network malfunctions; develop/implement solutions
- Identify & document source of a power outage; develop/implement solutions
- Propose & discuss with team members troubleshooting procedures to minimize user downtime
- Identify shielding-connection-grounding problems; develop & implement appropriate solutions
- Interpret building blueprints to locate problem components identified during testing & troubleshooting

Network Upgrade – *Technical Learning Component*

Learner Program Outcomes

- Develop and implement an upgrade plan that meets organizational needs
- Perform upgrade installation, test effectiveness and functionality of upgrade, and document results
- Analyze current system and organization requirements to identify system upgrade requirements

Key Competencies

Demonstrate the ability to:

- Determine and document hardware and software required to meet upgrade objectives and present to team and management for approval
- Develop and document upgrade plan according to the organization requirements
- Prioritize and document tasks to implement upgrade plan according to the organization time constraints
- Estimate and document the costs and benefits associated with network upgrade
- Assess organization and user needs to identify upgrade requirements and make recommendations to management
- Identify and interview vendor sources to determine the appropriateness and availability of components needed to perform upgrade
- Develop procedures to implement upgrade support to users
- Organize tasks and team members to provide upgrade support to users
- Develop and implement procedures to verify functionality of workstation and server connectivity after upgrade
- Develop a feasibility study to assess the effectiveness of proposed network upgrades
- Develop and document baseline performance to measure effectiveness of upgrades
- Develop and implement procedures to verify effectiveness of upgrade configuration changes
- Perform user acceptance tests after the upgrade is complete and document the results
- Install upgrade equipment and software according to vendor specifications and document changes to the network
- Select and install hardware components and software to upgrade the system and optimize system performance
- Evaluate the effectiveness of different architecture upgrades and make recommendations to management
- Interview vendors to identify emerging technologies and make recommendations to management for future upgrades to the network
- Develop and propose an upgraded network design to resolve system limitations
- Analyze and document performance of the existing network to identify system limitations
- Interview users and evaluate input to determine if upgrade needs are perceived or actual
- Identify and document network bottlenecks to determine areas for upgrade and make recommendations to management

Network Vendors and Products – *Technical Learning Component*

Learner Program Outcomes

- Evaluate and document strengths and limitations of specific vendors, products and services
- Research, select and document vendors, products and services that meet organizational, user and technical support needs

Key Competencies

Demonstrate the ability to:

- Document the products installed on the system and document their respective vendors
- Interview vendors to obtain and document equipment costs for a given network upgrade
- Interview vendors to determine appropriate monitoring tools for system requirements and resource constraints
- Interview users to identify and evaluate problems and determine appropriate solutions
- Interview vendors to obtain vendor, product and service information relevant to the organization system requirements
- Evaluate and document the advantages and limitations of various vendors' software products
- Evaluate and document strengths and weaknesses of various vendors' hardware components
- Develop a plan for multi-vendor installation and make recommendations to management for approval
- Identify and select vendor products that meet system requirements
- Install software and hardware according to vendor specifications
- Identify vendor, product and service alternatives to resolve network problems and make recommendations
- Evaluate trends in network vendors and products to plan for future network support and growth
- Research and compare various vendor service policies to determine their compatibility with the organization
- Assess and document vendor goals and strategies to determine their compatibility with the organization requirements and culture
- Regularly update vendor and product information
- Research and organize vendor and product information for easy access
- Interview management to determine and identify expectations in vendor relationships
- Estimate and document the costs and benefits of alternative vendor and product solutions

Office Software Applications – *Technical Learning Component*

Learner Program Outcomes

- Use software applications to analyze and solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process

Key Competencies

Demonstrate the ability to:

- Use the basic functions and tools of email applications
- Use email effectively and appropriately in business communication
- Present the basic components and organization of email systems
- Use email system support help facilities and advanced email tools
- Use the Internet as a research toll in an efficient manner
- Use the basic functions and tools of Internet applications
- Import text and images from Web pages into office applications
- Use basic word processing skills, such as document formatting, editing and using tables
- Create simple word processing documents such as letters, memos and basic reports
- Create compound documents, such as newsletters with graphics and objects from multiple software applications
- Design, create, modify and troubleshoot simple spreadsheets
- Create graphs and charts in spreadsheets
- Apply spreadsheet principles and tools to solve business problems
- Use the basic functions and tools of presentation software applications
- Use the components of presentation software creatively and effectively to create and deliver presentations
- Define and use the basic terminology of relational databases
- Design, create, modify and troubleshoot simple relational databases
- Design, create, modify and troubleshoot simple database queries and reports
- Apply database principles and tools to solve business problems
- Establish different levels of user access for reading and entering data into a database
- Import and export data and objects between different applications
- Effectively use online help to solve software application problems or learn new functions

Programming – *Technical Learning Component*

Learner Program Outcomes

- Define and document program specifications and program design
- Plan and implement testing and debugging procedures to verify program reliability
- Use programming language statements, functions, variables and control and data structures correctly

Key Competencies

Demonstrate the ability to:

- Write correct loop structures and use appropriately
- Perform cost/benefit analysis to determine program features that can be easily and inexpensively added and document recommendations
- Establish, implement, and document procedures to verify functionality of a program according to specifications
- Use correct data type specifications to define a data set and range of values
- Design user interface specifications that support user customization and productivity
- Produce program structure using appropriate programming standards and practices
- Design and implement programs using external files and access methods
- Create program design that effectively addresses user needs
- Document usability testing procedures and results
- Implement debugging procedures in a systematic and effective manner
- Analyze, design, and document solutions to programming problems
- Use debugging tools to identify and fix code and structure problems
- Develop and implement a testing plan to verify program reliability
- Perform usability testing, analyze results and make recommendation for program design change
- Design and write programs that are syntactically correct
- Translate formulas into computer statements, and apply correct arithmetic and logic operations
- Define and correctly scope programming variables according to specifications
- Appropriately use logic statements, data arrays and record structures when writing code
- Develop program structure using one or more programming languages
- Define and apply correct input and output specifications for a given problem statement
- Create and correctly apply subroutines, functions and modules

Business Organization and Environment – *Foundation Learning Component*

Learner Program Outcomes

- Identify and discuss contemporary business principles, practices, and organization
- Present and discuss how computer systems impact the operation and the management of business
- Identify and work within an organization's environmental dynamics and constraints

Key Competencies

Demonstrate the ability to:

- Discuss the concepts and issues of human resource management
- Identify and discuss intellectual property issues in business and possible resolutions
- Explain the concepts and issues of marketing products and services in a given market
- Discuss the legal and social aspects of the business environment
- Define and appropriately use general business terminology
- Identify and discuss the issues specific to corporations conducting business internationally
- Identify and discuss the main differences between small business environments and mid-to-large business environments
- Discuss the importance of management's commitment to organizational growth and change
- Discuss the concepts and issues of business management
- Identify and discuss the benefits and limitations of the use of virtual offices for business
- Identify and discuss the impact of political and budgetary constraints on the decision making process within an organization
- Identify and discuss internal and external factors that may affect an organization's ability to grow and change
- Discuss the benefits of the Internet for business growth and development
- Identify and discuss ethical issues as they relate to the use of computers and information in today's society
- Research e-commerce to identify its benefits and risks to business in a specific environment
- Discuss the issues influencing the selection of a computer system for a specific environment
- Discuss and describe how a network can support business objectives and goals
- Explain how information systems are used and how they impact specific areas of business operation
- Identify and discuss interpersonal skills appropriate to interacting with co-workers
- Present business problems and clearly articulate possible solutions
- Identify the organization culture and how to successfully work within it
- Create a clear and concise mission statement for a given organization
- Read and interpret organization charts to determine an organization's hierarchy and structure

Communication (Verbal and Written) – *Foundation Learning Component*

Learner Program Outcomes

- Develop and deliver effective oral communications
- Create and adapt effective written communications according to audience and purpose
- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

Key Competencies

Demonstrate the ability to:

- Use clear, specific and grammatically correct language in written and oral communication
- Recognize and appropriately address audience focus, level of expertise and need for detail
- Ask relevant and clarifying questions, and listen effectively for content and underlying issues
- Use the appropriate balance of information and personal interpretation in reports and presentations to achieve the intended purpose
- Explain the purpose and uses of written and oral communication in business and industry and give examples
- Be responsive to an audience, and adjust communication format and content accordingly
- Use precise and accurate technical terminology in written and oral communication
- Communicate effectively with audiences with various degrees of expertise in a wide range of technical and business contexts
- Be courteous and professional when communicating with others using a degree of formality appropriate to the situation
- Prepare and deliver professional presentations that are appropriate to purpose and intended audience
- Evaluate effectiveness of presentation by observing the audience and asking for feedback
- Effectively identify and resolve conflicts in communication
- Project a positive attitude and message when unforeseen problems arise during a formal presentation
- Analyze written communication to effectively extract content and underlying issues
- Present information persuasively and sustain an argument using appropriate evidence or examples
- Compose and present well-organized written and oral communication
- Sustain a definite focus and link ideas in a progressive and logical sequence
- Identify, prepare and use the appropriate written communication format for a specific purpose and situation

Continuous Learning – *Foundation Learning Component*

Learner Program Outcomes

- Evaluate needs for training and education and implement a personal development plan
- Identify and take advantage of learning opportunities to develop skills and knowledge
- Research and maintain current training information from various sources

Key Competencies

Demonstrate the ability to:

- Locate and identify online training and education resources
- Explain the importance of continuous learning in a technology environment
- Research, develop and maintain a library of relevant, current training resources
- Select and join appropriate user groups to discuss new technologies
- Select and read periodicals in related fields to continually improve one's knowledge base
- Research and analyze information from multiple resources to understand available training options
- Develop and document a personal training and education plan
- Assess one's own readiness for further training
- Evaluate effectiveness of training based on changes in performance
- Identify industry trends to assess one's needs for future training
- Implement a personal training and education plan and evaluate its effectiveness
- Identify one's own learning style and preferences in acquiring information and skills
- Share and acquire knowledge from others to compile multiple viewpoints
- Identify opportunities to continue education in related fields
- Take advantage of on-the-job self-learning opportunities
- Identify and use internet tutorials for self-learning
- Select and attend education forums that best meet training needs

Customer Relations – *Foundation Learning Component*

Learner Program Outcomes

- Gather and interpret information to understand customer requirements
- Effectively communicate and interact with customers
- Identify and meet the needs of the customer and the business

Key Competencies

Demonstrate the ability to:

- Communicate product features and services to the customer in a clear and accessible manner
- Ask appropriate questions to solicit meaningful input from customers
- Communicate administrative policies to customers and explain their importance to business operations
- Explain the importance of customer satisfaction to business operations
- Accept responsibility for one's own behavior and recognize its impact on others
- Recognize and interact with customers at their level of knowledge
- Listen to customer input and interpret feedback to ensure understanding of customer concerns
- Act as a liaison between technical groups to coordinate delivery of product or service
- Explain technical principles to non-technical customers
- Provide guidelines to customers with appropriate level of detail
- Deliver solutions that meet customer needs in a timely and appropriate manner
- Communicate product and service alternatives and options to the customer
- Follow up with customers to evaluate the effectiveness of service over time
- Assess the effectiveness of the customer interaction process and develop recommendations for improvement
- Educate customers on technology trends to obtain customer approval for change
- Analyze customer's technical abilities to determine experience and knowledge base
- Identify customer concerns and resolve conflicts to customer satisfaction
- Solicit feedback from customers and apply input to improve quality of service
- Evaluate and interpret customer requests to differentiate between requirements and desires
- Document customer needs and concerns according to organization procedures
- Conduct interviews with customers to assess needs
- Develop interviewing techniques to assess customer needs and concerns

Design – *Foundation Learning Component*

Learner Program Outcomes

- Develop design to meet specifications and present to management for approval
- Evaluate product design, document the specifications, create and test a prototype
- Identify and document the effectiveness of the design and design process, implement solutions, and test for functionality

Key Competencies

Demonstrate the ability to:

- Assess a design to identify required materials and resources
- Develop a design that incorporates scalability requirements
- Research and apply appropriate industry standards to design plan
- Select and use appropriate analysis and design tools
- Create a design within a given physical location and set of environmental constraints
- Create concise and accurate design documentation to present to management
- Create a design within given time and budgetary constraints
- Develop and document a strategic plan for implementation of a design
- Evaluate product design for ease of assembly and/or manufacturing
- Read blueprints to accurately identify the physical location of a proposed network project
- Create a prototype to be congruent with scope of project and to meet overall customer requirements
- Assess effectiveness of prototype and make recommendations for improvement
- Test and assess a design to determine if it meets identified specifications
- Create an accurate physical layout and wiring diagram of a design
- Develop and document design evaluation procedures
- Evaluate the prototype development processes and procedures and make recommendations for improvement
- Evaluate and document functionality of the design after implementation and make recommendations for improvement
- Accurately incorporate change orders into a design plan according to the organization's procedures
- Identify and evaluate a variety of analysis and design tools appropriate to the project
- Evaluate the design processes and procedures and make recommendations for improvement
- Compare a design with client requirements to identify differences and document the findings
- Implement and document solutions to improve design

Operational Impact – *Foundation Learning Component*

Learner Program Outcomes

- Communicate technology changes to customers and assess the impact on productivity
- Evaluate the impact of management decisions on the technology environment
- Analyze operational and budgetary impact of technology changes

Key Competencies

Demonstrate the ability to:

- Discuss industry regulations and their impact on management's technology decisions
- Evaluate business constraints on technology improvements
- Develop a plan to meet management's technology requirements
- Prepare a budget for technology improvements and present to management
- Establish baseline performance for technology improvements
- Calculate expected costs and productivity benefits of recommended technology changes
- Identify potential product and service limitations and the impact on productivity
- Assess the impact of technology changes on daily business operations
- Identify the personnel and associated costs required to implement a technology improvement plan
- Identify potential environmental risks and their impact on the network and overall productivity
- Recognize a wide range of problems and assess their impact on the system
- Estimate and report the costs associated with technology training
- Develop and implement a process to solicit user feedback and concerns regarding system changes
- Interpret and respond to user needs and concerns regarding technology changes
- Evaluate problems and implement solutions with minimal impact on users
- Evaluate the impact of technology failures on business operations
- Develop a project plan to implement technology changes and determine impact on users
- Communicate to management and personnel the importance of technology improvements to business operations

Problem Solving and Analytical Thinking – *Foundation Learning Component*

Learner Program Outcomes

- Apply analytical thinking to gathering information, designing and testing solutions to a problem, and formulating plans
- Create, test and document resolution processes and solutions
- Select, implement, and evaluate appropriate problem-solving techniques and tools

Key Competencies

Demonstrate the ability to:

- Communicate and implement solutions in a manner that minimizes risk and disruption to productivity
- Document technical procedures used to troubleshoot the system
- Evaluate effectiveness of processes, tools and communications used in problem resolution and make recommendations for improvement
- Select and use a wide range of tools and troubleshooting methods to isolate and resolve the problem
- Identify, develop and test a range of potential solutions to a given problem
- Document and communicate problem, analysis and resolution process
- Document and communicate the implemented solution and its outcome
- Examine a complex problem, its elements and their relationships to identify possible causes
- Diagram a given problem in order to facilitate the development of solutions
- Read and interpret technical documentation to analyze problem
- Perform systematic analysis and apply logic to identify problem causes
- Sustain a consistent and systematic approach in analyzing and solving complex, multi-step problems
- Formulate a logical resolution plan based on proposed solutions and available resources
- Recognize a wide range of problems and assess their impact on the system
- Formulate and ask appropriate questions and closely listen to input to identify the problem and possible causes
- Discuss problem causes and resolutions with users and management to develop procedures for prevention of problem recurrence
- Develop a solution implementation strategy and document and communicate the implementation plan
- Assess the cost/benefit of implementing specific solutions and make recommendations
- Identify the potential risks of implementing a specific solution and assess the risks and benefits of alternate solutions
- Monitor the implementation process and readjust, when necessary, to meet goals
- Follow up after a problem has been resolved to verify system performance and user satisfaction

Professional Development/Professionalism – *Foundation Learning Component*

Learner Program Outcomes

- Develop and document a commitment to professionalism through the demonstration of professional attitudes and actions
- Create and sustain a professional network to further professional development goals

Key Competencies

Demonstrate the ability to:

- Obtain relevant professional certifications to increase marketability
- Adapt or expand one's professional network to further or achieve goals
- Identify and attend professional organization meetings to learn from others
- Evaluate portability of skills and develop goals for enhancing and acquiring skills and knowledge
- Create and maintain a professional network
- Analyze the job market to anticipate needs for new skills and knowledge
- Display a positive attitude and foster a productive environment
- Evaluate personal goals and assess accomplishments
- Build upon one's strengths to effectively perform job responsibilities
- Identify employer expectations regarding job performance and attitudes
- Seek and use feedback on personal performance from a wide range of sources
- Develop personal strategies to improve on-the-job performance
- Present oneself in a professional manner

Project Planning and Organization – *Foundation Learning Component*

Learner Program Outcomes

- Efficiently organize and monitor project resources and tasks to meet requirements
- Develop a complete and realistic project plan that meets the requirements identified by stakeholders

Key Competencies

Demonstrate the ability to:

- Explain the principles of planning a project and identify critical elements of a successful plan
- Discuss and evaluate project requirements to identify conflicting or overlapping requirements
- Estimate and document realistic time requirements for each phase of the project and present for approval
- Identify and use software tools to support the planning process and create the project plan
- Refine and finalize plan based on available resources and time
- Assign project tasks to team members according to individual strengths and limitations
- Effectively organize and implement a project plan according to requirements identified by stakeholders
- Create and implement an evaluation plan to assess effectiveness and need for improvement
- Define roles and responsibilities of team members within a project
- Assess current team skills and identify the need for outside resources
- Select and use appropriate flowcharting tools to represent project flow
- Develop alternative plans for a given project and select the best alternative to fit project requirements
- Identify and resolve conflicts that arise during the planning and organization of the project
- Organize resources to most effectively accomplish the project tasks within the identified schedule and budget
- Develop a project flowchart to identify tasks and critical decision points
- Accurately identify and document project interdependencies
- Develop and document a detailed project plan identifying the scope and specific tasks
- Identify checkpoints at critical steps in the project to obtain progress reports from team members
- Communicate project plan to team members and solicit feedback to refine the plan
- Evaluate factors that may negatively impact the project and present recommendations to stakeholders
- Develop a project status report and present to stakeholders
- Schedule review dates to support completion of project and present the schedule to team members

Requirement Analysis – *Foundation Learning Component*

Learner Program Outcomes

- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

Key Competencies

Demonstrate the ability to:

- Access reliable and current sources to develop and refine requirements
- Identify missing information within requirements and locate relevant information
- Identify and document risks, constraints and dependencies in requirements
- Gather current and reliable data on a continuous basis to identify changes in customer requirements
- Apply appropriate information and data analysis techniques to interpret and evaluate requirements
- Clearly define and document the priority needs of the customer
- Assess requirement analysis procedures and make recommendations for improvement
- Identify and obtain outsource requirements according to the organization policies and procedures
- Analyze and resolve areas of conflict in specifications and requirements
- Develop and document procedures used to analyze customer requirements
- Gather relevant data in a cost effective and timely manner
- Communicate the complete set of requirements to stakeholders for validation and approval
- Document a final set of requirements in an accurate, complete, and succinct form
- Translate customer requirements into functional requirements
- Identify key stakeholders to contribute to the development of requirements
- Discuss and refine requirements with stakeholders

Research – *Foundation Learning Component*

Learner Program Outcomes

- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research
- Develop and implement an effective process to gather research data from a variety of sources

Key Competencies

Demonstrate the ability to:

- Analyze and synthesize different points of view on a given research topic
- Analyze research results for completeness and accuracy
- Identify resources that are appropriate for the topic and scope of work
- Identify and resolve conflicts between information from different sources
- Analyze gathered research information for relevance to research topic
- Use various industry journals to gather research information specific to the topic
- Describe ethical considerations related to copyright guidelines and appropriately apply guidelines to research project
- Present the advantages and limitations of different research processes
- Select and use a systematic method to obtain information specific to research topic
- Contact and interview business leaders, community leaders and advisory committees to obtain research information
- Identify and interview appropriate vendors to obtain information specific to research topic
- Document and implement a research process to meet project goals and objectives
- Select and use various Internet search techniques and tools to locate information
- Analyze and evaluate the effectiveness of different research tools and sources based on research goals
- Use library resources to research a specific topic
- Present research results at audience's level of understanding
- Effectively represent research results using appropriate graphics
- Accurately document references used for research material
- Reformat research and summary findings for different purposes and audiences
- Present research results in appropriate format and language
- Obtain and document permission granted for use of copyright material
- Summarize research results in an organized manner and present to stakeholders

Resource Management – *Foundation Learning Component*

Learner Program Outcomes

- Evaluate project to identify required resources
- Develop and implement an inventory plan to monitor and maintain resources
- Obtain necessary resources and optimize resource usage to meet objectives

Key Competencies

Demonstrate the ability to:

- Optimize the usage of resources to meet the project needs
- Discuss the concepts and issues of human resource management
- Gather and evaluate project requirements to identify necessary resources
- Evaluate costs and benefits of resource allocations and make recommendations
- Assess resource management procedures to determine effectiveness and make recommendations for improvement
- Secure and allocate relevant resources to meet project goals and accomplish project tasks
- Create a resource inventory plan to monitor and maintain technical resources
- Develop and optimize data collection procedures to track resources
- Develop stock level monitoring procedures and present to management for approval
- Propose policies for administering and controlling access to resources
- Assess resource inventory plan to determine effectiveness and make recommendations for improvement
- Develop and implement the resource management plan according to organizational requirements
- Track usage of resources to identify their availability and their applicability to the project
- Assess the impact of future plans on use and availability of resources
- Interact with vendors to obtain resources
- Identify critical checkpoints to verify that resources are being managed and utilized properly
- Develop procedures that increase the efficiency of resource management

Team Process and Leadership – *Foundation Learning Component*

Learner Program Outcomes

- Select and apply a leadership style that is most effective for the team and the environment
- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

Key Competencies

Demonstrate the ability to:

- Use a leadership style that supports team members freely disclosing ideas and opinions
- Compare various leadership styles and identify appropriate style for a given situation
- Recognize and respect differences in backgrounds, opinions and communication styles of team members
- Share information with others in a collaborative environment
- Support and assist team members to reach their goals and objectives
- Reply to team member requests in a timely and respectful manner
- Organize and facilitate the team process to meet goals and objectives
- Discuss the issues encountered in a diverse organization and identify effective strategies to address these issues
- Coordinate and delegate tasks according to strengths and limitations of team members
- Use appropriate interactive styles and strategies with team members
- Request assistance from team members when needed to perform tasks and reach goals
- Actively support productive ideas and processes to further team goals
- Appropriately resolve conflicts between team members to accomplish team goals and objectives
- Recognize and leverage strengths in self and others to further goals of the team
- Discuss the roles and responsibilities for individual team members in a given project
- Identify, discuss and document procedures used to reach team consensus
- Assess the effectiveness of the team process in a given context and make recommendations for improvement
- Discuss the overall benefits of diversity within a team

Technical Documentation – *Foundation Learning Component*

Learner Program Outcomes

- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

Key Competencies

Demonstrate the ability to:

- Assess the system repository for effectiveness and usability
- Explain the purpose of various forms of technical documentation
- Evaluate effectiveness of different technical documentation processes and make recommendations for improvement
- Adapt technical documentation to the requirements of the project and the organization
- Select and use appropriate word processing, drawing software and presentation tools to create and update technical documentation
- Plot and diagram data in visual formats appropriate to the project
- Establish processes to record and regularly update technical information
- Effectively organize the data in the systems repository to meet user needs
- Use industry-based technical documentation processes, standards and techniques
- Maintain and track source technical documents according to organization requirements
- Correctly complete work and part orders according to organization requirements
- Create a wiring diagram and label the wiring and naming schemes according to a documented design
- Regularly update documentation through all phases of a systems life cycle
- Accurately update activity log data on a regular basis
- Document design changes using an appropriate documentation process
- Prepare written materials to convey specific technical problems, related issues and solutions
- Accurately identify and record system specifications
- Present technical documentation to the client with an appropriate level of technical complexity
- Create and use appropriate online documentation
- Accurately update the system service log on a regular basis to document performance

SAMPLE ACTIVITIES

- **Activity**
- **Suggested Assessments for Activity**
- **Primary Program Outcomes Addressed by Activity**

The Learning Activities integrate the technical and foundation Program Competencies.

Activity 1 -- Network Administration

Utilizing an existing server with an installed network operating system, a team of students will demonstrate successful login and access to network resources with appropriate security by accomplishing the following tasks:

- Determine user group needs (access to appropriate network resources) by interviewing users
- Ascertain organizational policy and security as it relates to resource access by interviewing management or researching current policies
- Document findings based on interviews with users and management
- Prepare plan for user group organization and access, and present to management for validation
- Set up user groups on the network server
- Make resources available for group use with proper access and security
- Add appropriate users to groups
- Test operations of logins and user access
- Develop presentation (training) to educate users
- Communicate to users their login names, functional workgroups, password and usage policies
- Update existing administration logs showing changes made to server
- Update technical documentation to show changes made to existing network configuration
- Assess whether written network usage policies are appropriate to organization and user needs, including password policies, help desk access, and security requirements

Deliverables:

- Report documenting findings based on interviews with users and management
- Presentation to management on proposal for user group organization and access
- Step-by-step procedures for users outlining login names and passwords and process for accessing network resources
- Log of problems encountered with user access, and solutions implemented to resolve problems
- Updated technical logs
- Report assessing effectiveness of communication process, technical procedures and written usage policies

Suggested Assessments:

- Review reports and documentation for organization, accuracy and clarity of communication
- Review interview process for quality and efficiency, and effectiveness of analysis of survey input and conclusions
- Evaluate presentation to management for thoroughness, clarity and persuasiveness
- Evaluate step-by-step procedures for completeness, clarity, and ease of use
- Evaluate problem/solution log to determine if effective problem-solving processes were used

- Review report to determine whether an appropriate assessment of effectiveness of process and procedures was completed
- Feedback from users on effectiveness of training and effectiveness of overall access to network resources

Primary Program Outcomes Addressed by Activity:

Business Organization and Environment
- Identify and work within an organization's environmental dynamics and constraints

Communication (Verbal and Written)
- Develop and deliver effective oral communications
- Create and adapt effective written communications according to audience and purpose

Customer Relations
- Gather and interpret information to understand customer requirements
- Effectively communicate and interact with customers
- Identify and meet the needs of the customer and the business

Design
- Develop design to meet specifications and present to management for approval
- Identify and document the effectiveness of the design and design process, implement solutions, and test for functionality

Operational Impact
- Communicate technology changes to customers and assess the impact on productivity

Problem Solving and Analytical Thinking
- Apply analytical thinking to gathering information, designing and testing solutions to a problem, and formulating plans
- Create, test and document resolution processes and solutions
- Select, implement, and evaluate appropriate problem-solving techniques and tools

Requirement Analysis
- Gather, analyze and document information from relevant sources to develop requirements

Team Process and Leadership
- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

Technical Documentation
- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

Network Administration

- Define, set up, and implement group and user accounts based on organizational and usage policies
- Maintain and document administrative procedures for security, resource access, and backup
- Make recommendations and follow procedures for network resource allocation and access, backup and security

Network Architecture

- Contribute to the design and implementation of the network architecture based on organizational requirements and constraints
- Gather, analyze, and document customer requirements and organizational constraints as they relate to network architecture

Network Security

- Analyze and apply security policies, requirements, procedures, and tools
- Identify, document, and report security risks to network and make recommendations for security improvement

Activity 2 -- Network Upgrade

Given specific organization's business structure, objectives, hardware equipment and software, teams of students are asked to:

- Analyze network needs based on business requirements and constraints
- Develop possible configurations with associated cost/benefit analysis
- Develop plan for network upgrade including, hardware, software, and logistics
- Assess potential problems and develop contingency plans
- Assess impact of upgrade on operations and propose appropriate support and training
- Submit report defining current situation, recommended changes, and impact of upgrade to current operations

Based on their findings, students will:

- Research vendors and products available to accomplish the upgrade
- Prepare and deliver a presentation to management (made of other students and/or faculty) outlining proposed changes based on analysis of requirements, constraints, and cost/benefit analysis
- Document the potential problems that were identified and associated contingency plans
- Develop support and training plan for users impacted by upgrade

Deliverables:

- Report defining current situation, recommended changes, and impact of upgrade to current operations
- Documentation of research on vendors and products (who and what was researched? what information was obtained and analyzed?)
- Presentation defining upgrade recommendations based on research completed
- Report of identified problems and proposed solutions
- Report outlining training and support plan for users
- Brief report on how the team was organized, what role each team member played, and how effective the team process was during the activity

Suggested Assessments:

- Review reports and documentation for organization, accuracy and clarity of communication
- Evaluate research process for thoroughness and relevance
- Evaluate report outlining training and support plan for users for completeness, clarity, and ease of use
- Evaluate presentation for thoroughness, clarity and persuasiveness
- Evaluate presentation to determine whether appropriate recommendations were made based on research completed
- Review report on potential problems and contingency plan for thoroughness and creativity of solutions
- Review team report for effectiveness of the team process

Primary Program Outcomes Addressed by Activity:

Business Organization and Environment

- Identify and work within an organization's environmental dynamics and constraints

Communication (Verbal and Written)

- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

Customer Relations

- Identify and meet the needs of the customer and the business

Design

- Evaluate product design, document the specifications, create and test a prototype

Operational Impact

- Communicate technology changes to customers and assess the impact on productivity

Problem Solving and Analytical Thinking

- Select, implement, and evaluate appropriate problem-solving techniques and tools

Requirement Analysis

- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

Research

- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research

Technical Documentation

- Create effective technical documentation appropriate to various audiences and purposes

Network Architecture

- Gather, analyze, and document customer requirements and organizational constraints as they relate to network architecture

Network Hardware Components

- Compare features and functions of components

Network Software Applications

- Analyze needs of organization and research vendors to identify and obtain appropriate software applications
- Install, configure, upgrade, and document network software applications and recommend

Network Testing and Troubleshooting

- Document source of malfunction and solutions implemented

Network Upgrade

- Develop and implement an upgrade plan that meets organizational needs
- Analyze current system and organization requirements to identify system upgrade requirements

Network Vendors and Products

- Research, select and document vendors, products and services that meet organizational, user and technical support needs

Activity 3 -- Network Operations

Working as a team, students will create a daily routine for a systems administrator, addressing the following areas:

- Network management
- Protection/Security
- Documentation
- Backup procedures
- Organization of resources
- Set up/tune-up of network

Tasks:

- As a team, organize the work, develop a schedule for completion of tasks and assign tasks to each member
- Interview a current professional system administrator (either as a team or individually)
- Conduct research using the Internet and manufacturer specifications
- For each of the areas identified above, develop a two to five page step-by-step procedure for addressing each of the areas
- As a team, organize and compile a report including all the contributions from the different team members
- Choose one or two areas, and develop and deliver a team presentation detailing what steps are necessary
- Document the team process and organization of the project

Deliverables:

- Project scope, task schedule and assignment
- Notes from interview with professional system administrator
- Report on result of Internet research
- Report of step-by-step procedure/daily routine that will encompass all areas identified
- Detailed presentation to the class outlining one area
- Documentation of team and project organization process

Suggested Assessments for Teacher:

- Evaluate project organization for effectiveness and thoroughness
- Review interview results for completeness and relevance
- Ask feedback from interviewees on student professionalism and communication skills
- Evaluate thoroughness and relevance of research
- Evaluate completeness, accuracy and ease-of-use of procedures
- Evaluate presentations for organization, completeness and visual interest
- Evaluate team process throughout the project

Primary Program Outcomes Addressed by Activity:

Communication (Verbal and Written)

- Develop and deliver effective oral communications
- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

Problem Solving and Analytical Thinking

- Apply analytical thinking to gathering information, designing and testing solutions to a problem, and formulating plans

Research

- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research
- Develop and implement an effective process to gather research data from a variety of sources

Team Process and Leadership

- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

Technical Documentation

- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

Network Administration

- Maintain and document administrative procedures for security, resource access, and backup
- Make recommendations and follow procedures for network resource allocation and access, backup and security

Network Hardware Components

- Compare features and functions of components

Network Maintenance

- Develop and implement an effective network maintenance plan and schedule

Network Monitoring and Optimization

- Select and effectively apply system monitoring and optimization tools and methods
- Establish and document baseline performance and make recommendations to management for system optimization

Network Operations

- Evaluate and document network system performance
- Analyze and troubleshoot network problems

Network Recovery

- Develop and document disaster recovery-plan procedures and train users
- Develop and implement network disaster control, recovery and backup procedures with minimal impact to users
- Make recommendations for disaster recovery procedures and strategies

Network Security

- Analyze and apply security policies, requirements, procedures, and tools
- Identify, document, and report security risks to network and make recommendations for security improvement

Network Software Applications

- Monitor and document software performance, troubleshoot software malfunctions and test functionality

Network Terminology and Concepts

- Apply concepts and terminology to solve problems in networking

Network Testing and Troubleshooting

- Develop, document, and implement testing and troubleshooting procedures in accordance with organization requirements
- Document source of malfunction and solutions implemented

Network Vendors and Products

- Research, select and document vendors, products and services that meet organizational, user and technical support needs

Office Software Applications

- Use software applications to analyze and solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process

Activity 4 -- Network Software Applications

Students will be given a set of requirements/specifications for:

- Network print server
- Printer drivers
- Individual users
- Groups of users
- Rights/permissions for each group
- Applications (DOS, Windows applications, etc)

The students will then:
- Develop and document proposed procedure for installing the network printer
- Set up and install network printer (and appropriate drivers) on appropriate user machines
- Troubleshoot problems with print server or workstation access, given either real situations or written scenarios; identify possible trouble areas and solutions (using vendor websites, product documentation, Usenet groups, etc)
- Revise installation and troubleshooting procedure based on experience, including the documentation of potential problems and possible solutions

Deliverables:
- Proposed procedure for setting up/installing printer and driver(s)
- Report documenting problems that were identified, step-by-step procedures that were used to identify cause and test possible solutions, and solutions that were implemented
- Recommendation report for installation and troubleshooting

Suggested Assessments:
- Evaluate clarity and accuracy of procedure
- Evaluate problem/solution document to determine use of effective problem-solving process
- Evaluate recommendation report for appropriateness, creativity and thoroughness

Primary Program Outcomes Addressed by Activity:
Communication (Verbal and Written)
- Create and adapt effective written communications according to audience and purpose
- Evaluate & select appropriate written/oral communication strategies/styles for specific purposes

Customer Relations
- Gather and interpret information to understand customer requirements
- Effectively communicate and interact with customers
- Identify and meet the needs of the customer and the business

Operational Impact
- Communicate technology changes to customers and assess the impact on productivity

Problem Solving and Analytical Thinking
- Apply analytical thinking to gathering information, designing & testing solutions to a problem and formulating plans

- Create, test and document resolution processes and solutions
- Select, implement, and evaluate appropriate problem-solving techniques and tools

Requirement Analysis
- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

Team Process and Leadership
- Select and apply a leadership style that is most effective for the team and the environment
- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

Technical Documentation
- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

Network Configuration
- Research client configuration needs, develop a proposed network configuration and present recommendations
- Implement a proposed configuration plan and test network after implementation
- Compare various configuration strategies to determine appropriate plan for organization and user requirements

Network Hardware Components
- Select and install network components according to system requirements and constraints

Network Installation
- Test and troubleshoot performance of network components during and after installation
- Plan and document component and network installation

Network Operations
- Analyze and troubleshoot network problems

Network Terminology and Concepts
- Apply concepts and terminology to solve problems in networking

Network Testing and Troubleshooting
- Select & use diagnostic tools and equipment to identify & analyze network malfunctions
- Develop, document & implement testing and troubleshooting procedures in accordance with organization requirements
- Document source of malfunction and solutions implemented

Office Software Applications
- Use software applications to analyze & solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process

Activity 5-- Network Vendors and Products

Given a specific set of hardware and software requirements and network design, and specific budgetary and technology constraints, students will develop a buying list for the requested products

The students will:
- Develop a set of questions and a process to qualify vendors and products
- Investigate potential vendors/suppliers and products
- Conduct research and analyze results
- Develop options for specific vendors and products with associated cost/benefit analysis
- Assess reliability of equipment and level of vendor support
- Determine availability of products given required timeline
- Develop presentation to management on recommended vendors/products with supporting justification and estimated total budget

Deliverables:
- Documentation of research process and questions
- Report documenting research results and analysis
- Presentation to class outlining all options with cost/benefit analysis
- Presentation to class on chosen vendors/products with justifications supporting choice(s)

Suggested Assessments for Teacher:
- Evaluate thoroughness and relevance of research
- Evaluate research documentation for organization and completeness
- Evaluate the effectiveness of analysis of the research information and appropriateness of choices made during and after the research
- Evaluate effectiveness of presentation in presenting key information and recommendations
- Evaluate the validity and thoroughness of justifications supporting the recommendations

Primary Program Outcomes Addressed by Activity:
Business Organization and Environment
- Identify and work within an organization's environmental dynamics and constraints

Communication (Verbal and Written)
- Develop and deliver effective oral communications
- Create and adapt effective written communications according to audience and purpose
- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

Operational Impact
- Communicate technology changes to customers and assess the impact on productivity
- Analyze operational and budgetary impact of technology changes

Project Planning and Organization
- Efficiently organize and monitor project resources and tasks to meet requirements
- Develop a complete and realistic project plan that meets the requirements identified by stakeholders

Requirement Analysis
- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

Research
- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research
- Develop and implement an effective process to gather research data from a variety of sources

Network Hardware Components
- Compare features and functions of components

Network Installation
- Plan and document component and network installation

Network Operating Systems
- Present advantages, limitations, and preferred applications of various network operating systems

Network Software Applications
- Analyze needs of organization and research vendors to identify and obtain appropriate software applications

Network Terminology and Concepts
- Apply concepts and terminology to solve problems in networking

Network Upgrade
- Analyze current system and organization requirements to identify system upgrade requirements

Network Vendors and Products
- Evaluate and document strengths and limitations of specific vendors, products and services
- Research, select and document vendors, products and services that meet organizational, user and technical support needs

Office Software Applications
- Use software applications to analyze and solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process