Curriculum for enterprise networking specialist at Citrus College

Leigh John Buchwald
CURRICULUM FOR ENTERPRISE NETWORKING
SPECIALIST AT CITRUS COLLEGE

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education:
Vocational Education Option

by
Leigh John Buchwald
June 2001
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ABSTRACT

California's economy is dependent upon the availability of a highly skilled workforce. California's Community Colleges are uniquely positioned to assist in preparing this workforce. Its curriculum must maintain pace with the current job markets. In 1998 computer support specialists held 57,600 jobs in the Los Angeles County. By the year 2008 it is projected that 109,400 computer support specialists will be in the workplace.

The purpose of this project was to develop a curriculum for Citrus College Engineering department. The skills and competencies for this course are based on the newest certification recommendations developed by the Computer Technology Industry Association (CompTIA).
ACKNOWLEDGMENTS

Joseph Scarcella Ph.D.
Tim Thelander
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Citrus College Engineering Advisory Committee
Bruce Stoner
Dave Schneider
DEDICATION

My Wife Rosalinda

You have supported and assisted me throughout my education and riggers of daily life. With all my love, thank you.
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CHAPTER ONE
BACKGROUND

Introduction

The contents of Chapter One present an overview of the project. The context of the problem is discussed, followed by the purpose, significance of the project, and assumptions. Next, the limitations and delimitations that apply to this project are reviewed. Finally, definitions of terms are presented.

Context of the Problem

California's economy is dependent upon the availability of a highly skilled workforce. California's Community Colleges are uniquely positioned to assist in preparing this workforce. Its curriculum must maintain pace with the current job markets (Chancellor's Office, California Community Colleges, 2000). In 1998, computer support specialists held 57,600 jobs in the Los Angeles County. By the year 2008 it is projected, that 109,400 computer support specialists will be in the workplace. This is the second fastest growing occupation in Los Angeles County job market (Employment Development Department [EDD], 1998).

Many of the students entering this field are at a disadvantage when attempting to seek employment due to the
lack of broad technical training that they have received. Many entering the workforce have specific skills to provide to the employer. Once duties expand beyond these specialized skills the worker must learn the new technology, with little advanced training to help them. Preparation in general technical skills along with certification in vendor neutral material can assist in providing necessary advanced skills. Armed with this knowledge workers will be able to avoid the frustration of constantly changing technology, and employers will be able to combat job abandonment that is prevalent in this industry (Vanne, 2000).

Purpose of the Project

The purpose of the project was to develop a single-semester curriculum for Citrus College. The curriculum was directed at adults returning from the workplace to update their skills, and college students that are enrolled in the information technology (IT), or computer science (CS) tracks. The skills and competencies for this course are based on the newest certification recommendations developed by the Computer Technology Industry Association (CompTIA). This is an advanced training course covering the latest technologies being introduced to the computer-networking marketplace. The
project will include media presented via the World Wide Web, as well as Presentations for use in the classroom, using Microsoft's PowerPoint program.

**Significance of the Project**

The curriculum and materials developed in this project will correspond with the CompTIA Server+ objectives, concepts and skills. Upon completion of this course a student may be prepared to pass the industry standard exam developed by CompTIA.

**Assumptions**

The following assumptions were made regarding this project:

1. It was assumed that the technology presented would be used in industry;
2. It was assumed that the objectives, and skills as presented are appropriate to the industry;
3. It was assumed that this project might be used by other training facilities throughout the State of California, or nationwide;
4. It was assumed that the students of this course are seeking certification.

**Limitations and Delimitations**

During the development of this project, a number of limitations and delimitations were noted. These
limitations and delimitations are presented in the next section.

Limitations.
The following limitations apply to this project:

1. The course was developed based on the objectives, skills, and concepts as presented by the organization CompTIA;

2. The curriculum was developed specifically for the campus and needs of Citrus College.

Delimitations.
The following delimitations apply to this project:

1. The curriculum may be used by any organization or business to update an individual's skills to current standards;

2. The curriculum and schedule may be revised to match any institutions schedule.

Definition of Terms
The following terms are defined as they apply to this project.

- **Curriculum** - the sum of the learning activities and experiences that a student has under the auspices or direction of the school (Finch & Crunkilton, 1979).

- **CompTIA** - Computer Technology Industry Association (Vanne, 2000).
• **Enterprise** - An entire organization, including local and remote offices, a mixture of computer systems, and a number of departments. Enterprise-wide computing takes into account the breadth and diversity of a large organization's computer needs (Dean, 2000).

• **Information Technology** - (IT) is one of America's fastest growing industries, encompassing computers, software, telecommunications products and services, Internet and online services, systems integration, and professional services (Information Technology Association of America [ITAA], 1999).

• **IP Address** - (IP) - A logical address used in TCP/IP networking. This unique 32-bit number is divided into four groups of digits that are separated by periods (Dean, 2000).

• **Network** - A group of computers and other devices, such as printers, that are connected by some type of transmission media, usually wire or cable (Dean, 2000).

• **Server** - A computer on the network that manages shared resources. They run network-operating software that can manage data, but also users, groups,
security and applications on the network (Dean, 2000).

- **TCP/IP** - Transport control protocol/Internet protocol
  - An industry standard suite of protocols providing communications in a heterogeneous environment. Almost all networks support TCP/IP (Dean, 2000).

- **Host** - "A computer system with a registered IP address" (Zakon, 2000, p. 18).

- **World-Wide-Web** - A collection of Internet worked servers that share resources and exchange information according to specific protocols and formats (Dean, 2000).

**Organization of the Project**

This project was divided into four chapters. Chapter One provides an introduction to the context of the problem, purpose of the project, and significance of the project, limitations and delimitations and definitions of terms. Chapter Two consists of a review of relevant literature. Chapter Three details the steps used in developing this project. Chapter four presents conclusions and recommendations drawn from the development of the project. Project references follow Chapter Four. Finally, the Appendix consists of the project: Appendix consists of four sections. Section one - contains the introduction to
the handbook. In addition course policies, syllabus and a sample schedule are presented. Section two - contains sample homework assignments. Section three - contains server+ concepts and skills. Section four - contains a curriculum consisting of Lesson Plans.
CHAPTER TWO
REVIEW OF THE LITERATURE

Introduction
Chapter Two consists of a discussion of the relevant literature. First, development of computers and the progression of electronics technology are reviewed. Next, job titles and responsibilities for information technology workers are explored. Education for entry-level placement is included in each job description. Finally, sources and processes involved in providing development of curriculum and presentation methods are discussed. Information was referenced through sources such as scholarly journals, books, Internet sources, professional associations, and Government publications.

Brief History of Computing Technology
Technology as defined by The International Encyclopedia of Science and Technology (1998), is, “Any practical application of scientific discoveries in the production of mechanisms and in the solution of problems that confront human beings” (p. 353).

For example, the first electronic digital computer, the Atanasoff-Berry-Computer or simply the ABC computer was developed at Iowa State College in Ames, Iowa in 1938. The ABC computer set the stage for the first large-scale
electronic digital computer. It was developed for the U.S. Army to produce trajectories for artillery and bombing during World War II. It was named, Electronic Numerical Integrator and Calculator (ENIAC) and could multiply two numbers in approximately 3 milli-seconds. This computer was large, cumbersome, used over eighteen thousand vacuum tubes and cost about $400,000.00 in 1946 (Shelly & Cashman, 1980).

The next major step in computing technology development occurred in 1954 when Bell Labs, the creator of the solid-state transistor, built the first transistorized digital computer (Floyd, 1993). Development of the transistor allowed manufacturers to begin mass production of computers for scientific and business communities. The number of computers in use in the mid 1950’s was estimated to be two hundred twenty four. By 1958, approximately two thousand five hundred fifty computer systems were being used in research, government, and businesses. By 1964, a tremendous growth, due to the inexpensive large-scale integration (LSI) of transistors, was underway and it was projected that there were in excess of eighteen thousand two hundred computers in use in the United States (Shelly & Cashman, 1980). Electronics technology progressed so quickly that by the mid 1960’s
the first integrated circuit (IC) had been developed. The computing and technology boom was under way. The periods from the 1960’s until the early 1980’s were described as a frantic time of development and change (Tocci, 1988). This dramatic change affected society, business and education.

The early 1980’s saw development that would cause computers and technology to become common to every business, household and classroom. The desktop microprocessor became a reality. The evolution of the desktop computer industry began in 1975 when the magazine Popular Electronics presented a project to build the MITS Altair. Although the Altair was not the first microcomputer, it made them readily available to the general public. Companies such as IBM, Apple, Radio Shack, Commodore, and Heath followed by producing the first true personal computers (PC). These computers were factory built, inexpensive and easy to learn and use (Viet, 1993).

Running parallel with rapid computer development was information technology. Beginning in 1957, the United States formed the Advanced Research Projects Agency (ARPA). The goal of this agency was to establish the United States as the leader in science and technology. In 1965, ARPA began development of a cooperative network of time-sharing computers. This project was known as the
experimental network. Four locations were selected to participate in the development of this cooperative network. These four research nodes were the University of California, Los Angeles, the Stanford Research Institute, the University of California, Santa Barbara, and the University of Utah. In 1969, these four remote locations were successfully connected together to form the first wide area network (WAN). These rudimentary connections have evolved into what is today called the Internet (Zakon, 2000).

One growth measure of the Internet is the number of hosts that are connected. Beginning in December of 1969, four hosts were connected to what became known as the Internet. This number grew slowly throughout the first years of initial development. By 1980, there were 213 hosts on the network. These hosts were principally education and military sites. The development of the World-Wide-Web in 1991 exploded the number of hosts to 617,000. By July of 2000 the number of hosts grew exponentially to 93,047,785 on the Internet, and growing every day (Zakon, 2000). The Internet and the technology it has spawned have again affected our environment. It is providing extraordinary opportunities for the growth and proliferation of business, enhancement and expansion of
education, and personal growth that society has never before been afforded.

These advancements in computers, technology and information systems have advanced at such a rapid rate that an entire job workforce has been built surrounding computers and technology.

Information Technology Worker

The definition of an Information Technology (IT) worker varies depending on whom you ask. In it’s broadest sense an information technology worker is anyone who uses a computer to perform data entry, an auto mechanic who uses computer diagnostic equipment, medical technician who operates computerized equipment, or anyone who uses computers to access information stored either locally or on global access networks such as the Internet (Parker, 1999). Using this interpretation leaves a limited number of individuals that are not in the information technology workforce. To further narrow the scope of information technology workers, The Information Technology Association of America (ITAA) defines IT as the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware. Finally, the Bureau of Labor Statistics, classifies the occupations of computer
scientists and engineers, systems analysts, computer support specialists and computer programmers as core IT workers. Each of these occupations may have any number of job titles within them, but there are specific job skills related to each one. These skills are as varied as the individuals employed in these fields. In order to produce skilled workers, training courses in these fields are constantly being developed and updated.

**Education Required**

Due to the wide range of educational requirements there are a variety of ways a worker may enter the computer-related workforce. There is no universally accepted way to prepare for a job as a computer professional. Most employers place a premium on some formal education. A Bachelors degree is a prerequisite for many jobs; some may require only a 2-year degree. Relevant work and life experience is deemed very important (EDD, 1998).

According to the 2000 Occupational Outlook Handbook, the following is general guidelines for education in the IT workforce.

**Computer Engineers** - Requires a Bachelor’s degree in computer engineering or electrical engineering. A Ph.D., or at least a Master’s degree in computer science or
engineering is usually required for jobs in research laboratories or academic institutions.

**Systems Analyst, Programmer Analyst, or Database Administrator** - Require bachelor's degree in computer science, information science, or management information systems (MIS). These workers are based mainly in the business areas.

**Computer Support Specialists** - Requires an Associate degree or industry standard certification. Occupations in this field include personal computer (PC) hardware repair specialists, local area network specialists, and enterprise networking specialists.

Education for most information technology occupations have seen extended growth over the past 15 years, however, this growth has not kept pace with industry's need for IT workers.

**Demand for Information Technology Workers**

According to data from the Current Population Survey (CPS), the number of workers employed in core information technology fields in 1983 was approximately 719,000. In 1998, the population of IT workers grew to 2,084,000. This represents a growth rate of approximately 276 percent. Companies that specialize in information technology and those who's main business is anything other than
information technology will be hiring in excess of 1.6 million IT workers in the year 2000-2001. Of these 1.6 million workers, ITAA estimates that eighty seven percent of these workers will need skills in networking, server hardware, server configuration, and upgrade skills. These are the basic skills for the enterprise-networking specialist (ITAA, 1999). Finding and preparing enough skilled workers to enter these fields has become a crisis for industry. Today, there are many more jobs available than there are skilled persons to fill those positions.

With the extreme need of new highly skilled workers in the IT fields, businesses are finding it difficult to fill open positions. In the Silicon Valley of California, companies attempting to hire workers as enterprise networking specialists are averaging five to six months to find a person with the necessary skills. Personal computer specialists, and local area network (LAN) specialists are next most difficult positions to fill with an average replacement time of four to five months (Joint Venture, 2000).

Developing Curriculum

Curriculum development includes an expanse of different skills and resources to bring together a cohesive presentation (Finch & Crunkilton, 1979). The
starting point of developing a curriculum for a vocational education course is to identify the basic skills needed for success in the desired field of study. These basic skills may be obtained from multiple resources. Professionals in the specific occupation are a vital resource and must be tapped in order to develop an effective course. Professional organizations, apprentice programs, and industry committees are also valuable locations for basic skills information (U.S. Department of Commerce Technology Administration [USDCTA], 1999).

During research there were several existing programs covering similar course information. These programs all had the disadvantage that they covered mostly information specific to one vendor in the industry. Standard course outlines and materials from Microsoft, Cisco, and Novell were all collected and compared for similar content. Information was obtained from The Computer Technology Industry Association (CompTIA), which provides vendor neutral certifications. CompTIA has recognized the need for a certification in the enterprise server technology market. Since February 2000, CompTIA has been involved in the task of identifying the skills necessary for the enterprise networking specialist. Industry leaders that are participating in the identification of these skills
include; 3Com, Adaptec, Compaq computers, IBM, Intel, and many others (CompTIA, 2000). The concepts and skills collected from CompTIA as well as other curriculums have been presented to instructors and the Citrus College Engineering Advisory Committee. All involved agreed that the information included in the basic skills are valid and meet the needs of industry, however, it was suggested that extensive hands on training be added to the curriculum.

Summary

A history of computers and information technology was presented. Job titles and responsibilities for information technology workers were addressed. The current and future job market needs for an enterprise networking specialist was discussed. The educational requirement for entry-level placement was outlined. The process used for developing skills and curriculum for enterprise networking specialist was outlined.
CHAPTER THREE

METHODOLOGY

Introduction

Chapter Three details the steps used in developing the project. Specifically, the population served was discussed. Next, the curriculum development process including curriculum structure and content validation was presented. The chapter concludes with a summary.

Population Served

The project was developed for students age 16 through adult who will be training for entry into the enterprise-networking specialist workforce. It is recommended that each student have at least 18 to 24 months work experience in the information technology industry. This should include hands-on experience with server hardware and network operating systems (NOS). Further it is recommended that the student have at least one other IT certification such as CompTIA A+, Network+, Novell CNA, or Microsoft MCP. Finally, the student should have the ability to communicate and document effectively.

The core curriculum is appropriate for use in any information technology program or for use as a tool for the world of School-to-Work. It was developed in accordance with the guidelines presented by CompTIA, and
the Citrus College Engineering Advisory Committee. The CompTIA guidelines were developed with the cooperation of major companies such as; 3Com, Hewlett-Packard, and Intel. The Citrus College Engineering Advisory Committee included members who work in the area of the programs served. Members of the committee included representatives from local companies; Future Concepts, an Internet based company; Raytheon, Jet Propulsion Laboratory, and Instructors from Citrus College.

**Curriculum Development**

The next section of the project provides an overview of the curriculum development process. Specifically, the curriculum structure and content validation process are reviewed.

**Curriculum Design**

This curriculum guideline was developed in alignment with the concepts and skills put forward by the Citrus College Engineering Advisory Committee. During research it was identified that numerous companies offered similar certification, however each covered only information specific to their corporation. Through careful review of existing outlines of these specific certifications and from CompTIA, the Citrus College Engineering Advisory Committee identified the areas of basic skills required
for an enterprise server specialist. The competencies identified as essential to obtaining and maintaining meaningful employment were included in the curriculum. Through a consensus of the Engineering Advisory Committee the following outline was developed: (1) lesson title; (2) lesson outline; (3) lesson objectives; (4) materials and equipment; (5) evaluation; and (6) comprehension. No prerequisites for this class will be required. However, Engineering 107-Networking Technologies, and a basic reading skill level will be strongly recommended. The advisory committee also recognized that this is an advanced computing course and previous work experience, strong science, English and computer skills would be highly advised.

Course Content (One Semester Program)

1. Introduction
   a. Rules and Regulations
      i. Classroom
      ii. Industry Rules
   b. Certification
   c. Portfolio
   d. Written Reports
   e. Syllabus
2. Computing Safety
a. Classroom
b. Workplace
c. Electrical
d. Hand tools
e. Power tools

3. Review of Networking
   a. Hubs
   b. Switches
c. Routers
d. Media
e. Protocols
   i. TCP/IP
      1. Protocol suite
   ii. IPX/SPX
   iii. NetBeui
   iv. SNMP

4. Server Hardware
   a. SCSI
      i. SCSI - 1, 2, and 3
   ii. SCSI Bus Width
   iii. SCSI Bus Speed
   iv. SCSI Connectors
   v. SCSI Identification and LUNs
   vi. Low Voltage Differential
vii. High Voltage Differential

b. IDE
   i. ATA 33
   ii. ATA 66
   iii. ATA 100
   iv. Ultra DMA
   v. Cabling and connectors
   vi. Master/Slave/Cable Select

c. RAID
   i. RAID 0
   ii. RAID 1
   iii. RAID 5
   iv. RAID 0/1
   v. Hardware vs. Software RAID

d. Hot Swap

e. Fibre Channel

f. Memory
   i. ECC
   ii. EDO
   iii. Interleaving

g. System Bus Architectures
   i. PCI Bus Mastering
   ii. PCI Hot Swap
   iii. Peer PCI
iv. Hot Plug PCI
v. EISA
vi. AGP
vii. Performance based on BUS

5. Server Installation
   a. KVM implementation
   b. Cable management
   c. Proper Layout
   d. Power sources
   e. UPS
   f. Environment
      i. Temperature
      ii. Humidity
      iii. Fire suppression
      iv. Flood considerations

6. Configuration and Upgrades
   a. BIOS
   b. DRIVERS
   c. Network Operating System

7. Backup
   a. Media
   b. Storage
   c. Disaster planning and recovery
      i. Off site storage of media
8. Server Functions
   a. Server as a Gateway
   b. Server as a Router
   c. Server as a Bridge
   d. Firewall Server
   e. Proxy Server
   f. Database Server
   g. Client/Server
   h. Application Server
      i. Distributed
      ii. Dedicated
      iii. Peer to Peer
   i. Mail Server
   j. FTP Server
   k. SNA Server
   l. RAS Server
   m. File and Print Server
   n. Fax Server
   o. DNS Server
   p. WINS Server
   q. DHCP Server
   r. Web Server
9. Server operating systems
advantages/disadvantages. Major features of each.

a. Microsoft
   i. Windows NT 4.0
   ii. Windows 2000

1. Terminal Server
2. Enterprise Server
3. Server

iii. Novell Netware
iv. IBM OS/2
v. Linux
vi. Unix

10. Shutdown Procedures

a. Novell Netware
b. Microsoft Windows NT/2000
c. UNIX/Linux
d. IBM OS/2

Content Validation

Two methods of validation were applied to this curriculum. First, the final outline, objectives and skills were compared to the CompTIA Server+ required competencies. The Server+ competencies were developed in coordination with major IT corporations such as Intel,
IBM, and Compaq. Second, the Citrus College Engineering Advisory Committee reviewed and made recommendations for the course. The advisory committee invites local industry representatives who have been employed in the IT or Electronics industry for at least 5 years. The companies represented include Jet Propulsion Laboratories, Pasadena; Raytheon, Los Angeles, Hughes Laboratories, Los Angeles.

The major recommendations put forth were to review the course content on a bi-yearly basis and perform updates to include new information on the ever-changing world of operating systems, and computers. A second recommendation is to include a large component of hands-on work. Third is to develop a job shadow program with local industry to strengthen the hands-on abilities of the students.

Summary

The steps used to develop this project were outlined. The target populations for this course are students with information technology experience, wishing to upgrade their skills to enterprise server technologies. The curriculum development process including curriculum structure and contend was presented.
CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

Introduction

Included in Chapter Four is a presentation of the conclusions gleamed as a result of completing this project. Further, the recommendations extracted from this project are presented. Lastly, the chapter concludes with a summary.

Conclusions

The conclusions extracted from this project follow.

1. During research for this project, the conclusion was made that since no current curriculum for Server+ programs were found this curriculum was necessary.

2. Programs of this type are needed to prepare individuals for employment in today’s high technology fields.

Recommendations

The recommendations resulting from this project follow.

1. Continued development of this project is recommended to keep pace with industry.

2. It is recommended that this course be taught by a professional from the field with at least 4
years experience dealing with Servers and Networking.

3. It is strongly recommended that Industry resources be brought into the classroom in an effort to produce quality graduates from this course.

4. It is recommended that a Career Ladder be developed which includes this course.

Summary

Chapter Four reviewed the conclusions derived from this project. Lastly, the recommendations extracted from this project were presented.

The recommendations for this project have been forwarded to the Citrus College Engineering Technology Advisory Committee for review and implementation.
APPENDIX

ENGINEERING 108
ENGINEERING 108
Network Operating Systems

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INTRODUCTION

In 1998 computer support specialists held 57,600 jobs in the Los Angeles County. By the year 2008 it is projected that 109,400 computer support specialists will be in the workplace. California’s Community Colleges are uniquely positioned to assist in preparing this workforce. Its curriculum must maintain pace with the current job markets.

The following curriculum was developed using the newest certification recommendations by Computer Technologies Industry Association (CompTIA) objectives. This course aligns with the CompTIA Server+ exam.

The attached curriculum includes lesson plans developed for a course being presented in a three-hour lecture and three-hour lab format.

All information is presented to students using the World Wide Web. Each student is required to have access to a computer and be able to use e-mail before entering this course. Homework and Quizzes are taken on-line in an effort to simulate the actual test taking for the Industry certification exams. No textbook is required as all material is presented using Microsoft’s PowerPoint presentation program. All presentations are accessible to the students via the World Wide Web.
Section 1

COURSE POLICIES AND GUIDELINES
ENGR 108 • Network Operating Systems

Catalog Course Description
Strongly recommended: READ 099 if reading score is below level 2.
This 4-unit course provides information covering the areas of Network Operating systems used on LANs and WANS. This Course includes installation and overview of popular server software. May be taken two times.

2913E MW 6:30 - 9:20 TB 316
This course is designed to meet the objectives and competencies required for the CompTIA Server+ exam.

Course Objectives
Upon successful completion of this course, the student should be able to:
1. Identify network security models.
2. Identify common network topologies, and their key characteristics, and when each might be used.
3. Identify Hardware requirements for a server platform.
4. Be able to construct a server based network.
5. Be able to connect clients to a network server.
6. Identify basic attributes, and function of multiple types of servers: Firewall, Database, Mail, DNS, Web

Major Topics Covered
• Planning a server based network
• Installation and Configuration of major operating systems
• Managing Resources
• Creating & Maintaining Security
• Internet and Intranet
• Monitoring and Optimization
• Client/server configuration issues
• Internet / Intranet services
• Trouble-shooting

Class Syllabus

Required Text and Materials
There is currently no required text for this class. Students will be responsible for maintaining a portfolio of information during the course. If you have any questions, please check with the instructor before purchasing any books for this course.

Instructional Methods and Techniques
This class will meet for six hours each week. Three hours will be for lecture, and three hours for lab.

Lecture
The lecture portion will be presented using multimedia presentations supplemented with handouts, interactive classroom discussions, and demonstrations using in class computer equipment. All assigned material will not be covered in lecture. It is the student’s responsibility to ask questions and perform reading outside of class.

Laboratory
The lab will consist of one computer per two students. Students will be working on their own to complete any written assignments relating to the labs.

Written Reports
The ability to communicate verbally and in writing is of prime importance to getting and keeping a job. Requirements of this course are to present verbal information to the class, complete substantial written assignments, and to prepare a documentation portfolio.

Other Recommended Texts and Materials
At least 5 (five) 1.4MB floppy disks are required.

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Class Policies

Course Work
Two hours of independent work done out of class are required for each hour of lecture. This time will consist of studying assigned material and completing "Exercises." Reading and preparation for labs will also be assigned. Since classroom lab time will be at a premium, a student should not use lab time for doing reading and writing assignments. Assignments will also include using e-mail to communicate with the instructor on a regular basis. On campus access will be provided or a personal provider may be used.

Attendance
Students are expected to arrive on time and attend all class meetings of the course. Success depends upon regular attendance. The instructor does not re-teach class session on an individual basis. If you must be absent from one or more class meetings, it is suggested that you arrange for a "substitute," to turn in any of your assignments that are due, collect any materials that you would normally receive, take notes on class and brief you on everything that occurred in your absence. There are some things your "substitute" cannot do for you: take quizzes or tests.

Excessive absences after or near the 9th week will likely result in a semester grade of "F." If you decide to drop this or any class it is strongly recommended that you go to the Admissions Office and do the paper work in person. DO NOT think that being dropped by the instructor is automatic, it is not at any time.

If you have any special problems with attendance that you will know of, in advance or due to forces out of your control, special arrangements can be made. You must request, in writing, any special consideration needed.

Electronic Devices
The use of Electronic Devices such as phones or pagers is prohibited. When entering the classroom make sure these devices are turned off or set to a silent mode. If it becomes necessary to use one of these devices please quietly leave the classroom.

General
Please use common courtesy and proper etiquette at all times. Students are encouraged to help one another during lab time, but it is important to keep the noise down to a tolerable level and not to "impose" on other students.

If any problems with equipment are found, please report them to the instructor as soon as possible, so they may be repaired.

No eating or drinking is allowed in the classroom.
### Class Schedule

<table>
<thead>
<tr>
<th>Meeting Date</th>
<th>Lecture / Lab Topics</th>
<th>Objectives Covered</th>
<th>Assignments Due</th>
<th>Quiz #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting 1</td>
<td>Introduction</td>
<td>Portfolio, Reports,</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Standards</td>
<td></td>
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</tr>
<tr>
<td>Meeting 2</td>
<td>Review of Networking</td>
<td>Networking</td>
<td>Homework # 1</td>
<td></td>
</tr>
<tr>
<td>Meeting 3</td>
<td>Management Protocols</td>
<td>Protocols - SNMP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 4</td>
<td>Network Interface Protocols</td>
<td>Network Protocols</td>
<td></td>
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</tr>
<tr>
<td>Meeting 5</td>
<td>Server Hardware - SCSI</td>
<td>SCSI, ATA</td>
<td></td>
<td>Quiz # 1</td>
</tr>
<tr>
<td>Meeting 6</td>
<td>Server Hardware RAID - IDE</td>
<td>SCSI, ATA</td>
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<tr>
<td>Meeting 7</td>
<td>Server Hardware - Memory</td>
<td>Memory, Bus Architectures</td>
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<tr>
<td>Meeting 8</td>
<td>Server Hardware - System Bus Architectures</td>
<td>Memory, Bus Architectures</td>
<td></td>
<td>Quiz # 2</td>
</tr>
<tr>
<td>Meeting 9</td>
<td>Server Hardware - CPU</td>
<td>CPU, Multiprocessing</td>
<td></td>
<td></td>
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<tr>
<td>Meeting 10</td>
<td>Server Performance</td>
<td>Load Balance, Teaming, Fault Tolerance</td>
<td></td>
<td>Quiz # 3</td>
</tr>
<tr>
<td>Meeting</td>
<td>Physical Installation</td>
<td>BIOS, UPS, KVM, Racks</td>
<td>Homework # 5</td>
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<tr>
<td>Meeting 12</td>
<td>Physical &amp; Environmental Considerations</td>
<td>Physical, Environmental</td>
<td>Quiz # 4</td>
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<tr>
<td>Meeting 13</td>
<td>Data Protection &amp; Recovery</td>
<td>Backup &amp; Disaster Recovery</td>
<td></td>
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</tr>
<tr>
<td>Meeting 14</td>
<td>Midterm Exam</td>
<td>Written Report # 1 Homework # 6</td>
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<tr>
<td>Meeting 15</td>
<td>Server Functions Hardware Replacement</td>
<td>Types of Servers</td>
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<tr>
<td>Meeting 16</td>
<td>Types of Servers - Proxy &amp; Firewall</td>
<td>Types of Servers</td>
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<tr>
<td>Meeting 17</td>
<td>Types of Server - Database &amp; Application</td>
<td>Types of Servers</td>
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<tr>
<td>Meeting 18</td>
<td>Types of Server - Communication</td>
<td>Types of Servers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 19</td>
<td>Types of Server - Network operations</td>
<td>Types of Servers Homework # 7 Quiz # 5</td>
<td></td>
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</tr>
<tr>
<td>Meeting 20</td>
<td>Operating Systems - Windows NT 4.0</td>
<td>Operating Systems Features</td>
<td></td>
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<tr>
<td>Meeting 22</td>
<td>Operating Systems - Novell Netware</td>
<td>Operating Systems Features</td>
<td></td>
<td></td>
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<tr>
<td>Meeting 23</td>
<td>Operating Systems - UNIX</td>
<td>Operating Systems Features</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting</td>
<td>Topic</td>
<td>Operating Systems - LINUX</td>
<td>Operating Systems - IBM OS/2</td>
<td>Operating Systems - Features</td>
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<tr>
<td>24</td>
<td></td>
<td>Operating Systems - LINUX</td>
<td>Operating Systems - IBM OS/2</td>
<td>Operating Systems - Features</td>
</tr>
<tr>
<td>25</td>
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<tr>
<td>26</td>
<td></td>
<td>Shutdown Procedures</td>
<td></td>
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<tr>
<td>27</td>
<td></td>
<td>Windows NT 4.0 Installation</td>
<td></td>
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<tr>
<td>28</td>
<td></td>
<td>Windows 2000 Installation</td>
<td></td>
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<tr>
<td>29</td>
<td></td>
<td>Linux Installation</td>
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<tr>
<td>30</td>
<td></td>
<td>Novell Installation</td>
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<tr>
<td>31</td>
<td></td>
<td>Final Lab Night</td>
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</tr>
<tr>
<td>32</td>
<td></td>
<td>Review for Final Exam</td>
<td></td>
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<tr>
<td>33</td>
<td></td>
<td>Final Exam Server + Exam</td>
<td></td>
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</tr>
</tbody>
</table>

This schedule is subject to update and does not include all assignments to be submitted. All future additions will be presented during class.

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Web Resources

WWW.MICROSOFT.COM
WWW.KINGSTON.COM
WWW.NOVELL.COM
WWW.REDHAT.COM
WWW.HOWITWORKS.COM
WWW.ASANTE.COM

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Course Grading

Check Online Student Progress

There will be one Midterm Exam and one Final Exam.

There will be approximately 10 quizzes given over individual subjects.

All Quizzes will be taken on-line. These may be taken from home using all available resources. It is expected that each student will independently complete all assignments. The student will be allowed to retake any quiz on which a score of 90 percent was not reached. When retaking any quiz the maximum score will be 85 percent of the total possible.

Homework exercises will be made available on-line. These assignments will receive 5 points per assignment.

The points will be awarded as follows:

- 1 point - Completed on time
- 1 point - All questions answered
- 1 point - 0 - 50% Correct
- 2 points - 51 - 85% Correct
- 3 points - 86 - 100 % Correct

Course grade will be calculated as follows:

<table>
<thead>
<tr>
<th>Classroom Work</th>
<th>Points</th>
<th>Homework</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Exercises</td>
<td>250</td>
<td>Portfolio</td>
<td>100</td>
</tr>
<tr>
<td>Quizzes</td>
<td>150</td>
<td>Exercises</td>
<td>100</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>150</td>
<td>Written Reports</td>
<td>100</td>
</tr>
<tr>
<td>Final Exam</td>
<td>150</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Course Grade will be awarded as follows:

- A = 1000 - 900 Points
- B = 899 - 800 Points
- C = 799 - 600 Points
- D = 599 - 500 Points
- F = below 500 Points

Cheating

It is assumed that all work turned in for grading is original, not copied from others, that the work being graded is indeed done by the student who is receiving the grade. Copying or any other form of cheating will result in a failing grade.

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## Course Materials

### Online Presentations

- Introduction
- Review of Networking Management Protocols
- Network Interface Protocols
- Server Hardware - SCSI
- Server Hardware - RAID, IDE
- Server Hardware - Memory
- Server Hardware - System Bus
- Server Hardware - CPU
- Server Performance
- Physical Installation
- Physical Environment
- Data Protection & Recovery
- Server Functions - Hardware
- Types of Servers
- Operating Systems

### Handouts

- Introduction
- Review of Networking Management Protocols
- Network Interface Protocols
- Server Hardware - SCSI
- Server Hardware - RAID, IDE
- Server Hardware - Memory
- Server Hardware - System Bus
- Server Hardware - CPU
- Server Performance
- Physical Installation
- Physical Environment
- Data Protection & Recovery
- Server Functions - Hardware
- Types of Servers
- Operating Systems

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Section 2

HOMEWORK
ENGR 108 • Network Operating Systems

Instructor: Mr. Leigh Buchwald
E-mail: lbuchwald@citrus.cc.ca.us

HOMEWORK ASSIGNMENT # 1

Part # 1

E-mail Address
The first homework assignment in this class is to obtain an Internet e-mail address. This may be accomplished by several methods

1. Citrus College provides free e-mail accounts to all currently registered students. To obtain your e-mail account sign up online at www.citrus.cc.ca.us.

2. Your place of employment may provide you with an e-mail account. Please check company policies about use of this account for educational purposes.

3. Your home Internet Service Provider (assuming you have already signed up for one) will provide you with at least one account.

Part # 2

Student Information Sheet

1. To complete homework # 1, please print the form on the above link, fill it out following all directions on the form and bring it to class on the due date.
Citrus College, Glendora, California  
Physical Sciences and Engineering Department  

**Student Confidential Information**

You are not required to provide any information other than your name, and e-mail address. Print clearly in the space provided for each item. If there is no appropriate response, print "N/A" in that space.

<table>
<thead>
<tr>
<th>Date</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

"Preferred" Name  

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
</tr>
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<tbody>
<tr>
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</tr>
</tbody>
</table>

College I.D. number  

**Contact Address**  
Street:  
City:  
State:  
Zip:  

**Phone**  
Home:  
Work:  

**E-mail Address**  

**Employment Information**  
Company Name:  
Street:  
City:  
State:  
Zip:  

**Mini Survey**  

Please answer on the back of this page the following questions.

1. Why did you sign up for this class?

2. What do you expect to be able to do after successfully completing this course? Please be as specific as possible.

3. What is your level of experience with computers?
Section 3
SERVER + CONCEPTS AND SKILLS
1. Define Backup, Restore, and Disaster Recovery Concepts
Server + Concepts and Skills

Physical Environment

1. Describe Security Concepts (Importance of physically securing a server)

2. Recognize and report on server room environmental issues
   a. Temperature
   b. Humidity
   c. Fire suppression
   d. Flood considerations
Server + Concepts and Skills

Server Hardware

1. Identify and describe the differences, strengths and specifications of the following SCSI solutions
   a. SCSI-1, 2, & 3
   b. SCSI Bus Width (Narrow and Wide)
   c. SCSI Bus Speed (Fast and Ultra, Ultra Wide, Ultra 2, Ultra 160, Ultra 320)
   d. SCSI connectors, cables, termination
   e. SCSI IDs and LUNs
   f. Single Ended Devices
   g. Low Voltage Differential (LVD)
   h. High Voltage Differential (HVD)
   i. BUS lengths
2. Describe Physical Drives and Logical Drives and describe their functionality.
3. Identify and describe the differences, strengths and specifications of IDE
   a. ATA 33
   b. ATA 66
   c. ATA 100
   d. Ultra DMA
   e. Cabling and connectors
   f. Master/slave/cable select (CSEL)
   g. Jumper settings
4. Define the features, capabilities, and implementation of the following RAID levels and explain how each relates to fault tolerance or high availability: (non-proprietary)
   a. RAID 0
   b. RAID 1
   c. RAID 5
   d. RAID 0/1
5. Describe the benefits of Hardware RAID over Software RAID
6. Describe fail over and hot spare
7. Describe clustering, scalability, and high availability
8. Identify the basic attributes, purpose, function and advantages of Fibre Channel
1. Define the following cache memory and explain how it works in a server
   a. Processor cache
   b. RAID cache
   c. Write back vs write thru
2. Describe the characteristics of the following types of memory and server memory requirements:
   a. Memory Interleaving
   b. ECC
   c. EDO
   d. Unbuffered vs buffered vs registered
   e. Hardware compatibility list
3. Identify the basic attributes, purpose, function and performance of the following System Bus Architectures
   a. PCI Bus Mastering
   b. PCI Hot swap
   c. Hierarchical PCI Bus
   d. Peer PCI Bus
   e. I2O - Intelligent Input-Output
   f. Hot Plug PCI
   g. PCI Expansion Slots
   h. PCI Interrupts
   i. EISA
   j. AGP
4. Explain how the System Bus affects the performance of a server
5. Describe Network Interface Cards as they relate to the System Bus
Server + Concepts and Skills

Equipment Installation

1. Describe the basic concepts for the following aspects of rack mounting servers
   a. KVM implementation
   b. Cable management
   c. Proper layout

2. Conduct pre-installation planning activities
   a. Verify hardware compatibility with operating system
   b. Verify power sources, space, UPS and network availability
   c. Verify that all correct components and cables have been delivered
Server + Concepts and Skills

Server Hardware

1. Explain the differences, strengths and specifications of CPU
2. Describe Multiprocessing functionality
3. Define the following cache memory and explain how it works in a server
   a. Processor cache
   b. RAID cache
   c. Write back vs write thru
Server + Concepts and Skills

Server Configuration

1. Describe Adaptive Fault Tolerance
2. Describe Adapter Load Balancing
3. Describe Adapter Teaming
1. Identify the basic attributes, purpose, and function of the following Management Protocols
   a. SNMP
   b. DMI
2. Describe the following common network interface protocols
   a. Ethernet
   b. Fast Ethernet
   c. Gigabit Ethernet
   d. Token Ring
1. Describe Shutdown Procedures across the following network operating systems
   a. Novell NetWare
   b. Microsoft Windows NT/2000
   c. UNIX/Linux
   d. IBM OS/2

2. Identify the major features of the following Server Operating Systems
   a. Novell NetWare
   b. Microsoft Windows NT/2000
   c. UNIX/Linux
   d. IBM OS/2
Server + Concepts and Skills

Server Functions

1. Identify the basic attributes, purpose, and function of the following types of servers
   a. Server as a Gateway
   b. Server as a Router
   c. Server as a Bridge
   d. Firewall Server
   e. Proxy Server
   f. Database Server
   g. Client/Server
   h. Application Server
   i. Mail Server
   j. FTP Server
   k. SNA Server
   l. RAS Server
   m. File and Print Server
   n. Fax Server
   o. DNS Server
   p. WINS Server
   q. DHCP Server
   r. Web Server

2. Identify the function of the following models of Application Servers
   a. Dedicated Application
   b. Distributed Application
   c. Peer to peer Application
1. Describe when BIOS/Firmware upgrade should be performed
2. Describe the importance and use of maintenance logs and service logs (documentation)
Section 4

LESSON PLANS
LESSON PLANS

Engineering 108 Network Operating System
Lesson Title: Introduction

Lesson Outline:

1. Course Outline
2. Course Requirement
   a. e-mail
   b. Web access
   c. Word-processing
3. Portfolio
4. Written Reports
5. Grading
6. Classroom Conduct
7. Safety
   a. Classroom
   b. Industry

Lesson Objectives:

Upon completion of this unit the student will be able to:

1. Identify requirements for successful completion of this course
2. Locate class schedule and assignments posted on the Internet
3. List safety issues in classroom and industry

Materials and Equipment:

Computer with PowerPoint & LCD Projector

Evaluation:

Safety Exam
Homework

Comprehension:

All students will complete each unit of this lesson with 100% accuracy before proceeding to the next unit.
Lesson Title: **Review of Networking**

<table>
<thead>
<tr>
<th>Lesson Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. OSI Layer</td>
</tr>
<tr>
<td>2. Basic Networking Protocols</td>
</tr>
<tr>
<td>a. TCP/IP</td>
</tr>
<tr>
<td>b. NetBEUI</td>
</tr>
<tr>
<td>c. IPX/SPX</td>
</tr>
<tr>
<td>3. Networking Equipment</td>
</tr>
<tr>
<td>a. Hubs</td>
</tr>
<tr>
<td>b. Switches</td>
</tr>
<tr>
<td>c. Routers.</td>
</tr>
<tr>
<td>4. Network Media</td>
</tr>
<tr>
<td>a. Category 5 Cable</td>
</tr>
<tr>
<td>b. Fiber</td>
</tr>
<tr>
<td>c. Wireless</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Lesson Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upon completion of this unit the student will be able to:</td>
</tr>
<tr>
<td>1. List in order all layers of the OSI model.</td>
</tr>
<tr>
<td>2. List Networking equipment as related to the OSI model.</td>
</tr>
<tr>
<td>3. Identify the basic networking equipment.</td>
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<tr>
<td>4. Understand the operation and purpose of basic network equipment.</td>
</tr>
<tr>
<td>5. List the common network media and their purpose.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials and Equipment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Network equipment – hubs, router, switch</td>
</tr>
<tr>
<td>Basic network media Category 5 cable, fiber cable, wireless equipment</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiz</td>
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<tr>
<td>Practical Exam</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Comprehension:</th>
</tr>
</thead>
<tbody>
<tr>
<td>All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.</td>
</tr>
</tbody>
</table>
Lesson Title: Management Protocols

Lesson Outline:

1. SNMP
   a. Purpose
   b. Function
   c. Attributes
2. DMI
   a. Purpose
   b. Function
   c. Attributes

Lesson Objectives:

Upon completion of this unit the student will be able to:

1. Identify the attributes of SNMP
2. Identify the purpose of SNMP
3. Identify the function of SNMP
4. Identify the function of DMI
5. Identify the basic attributes of DMI
6. Identify the basic purpose of DMI

Materials and Equipment:

Computer with Microsoft PowerPoint Program & LCD Projector

Evaluation:

Quiz
Homework

Comprehension:

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Network interface protocols**

**Lesson Outline:**

1. Ethernet  
2. Fast Ethernet  
3. Gigabit Ethernet  
4. Token Ring

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Describe Ethernet protocols.  
2. Describe Fast Ethernet protocols.  
3. Describe Gigabit Ethernet protocols.  
4. Describe Token Ring protocols.  
5. List the common network media and their purpose.

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz  
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Server Hardware – SCSI Interface**

**Lesson Outline:**

1. SCSI – Small Computer Systems Interface  
   a. SCSI – 1, 2, 3  
   b. SCSI Bus Width  
   c. SCSI Bus Speeds  
      A. Fast  
      B. Ultra and Ultra Wide  
      C. Ultra 2  
      D. Ultra 160  
      E. Ultra 320  
   d. SCSI connectors, cables, termination  
   e. BUS lengths

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Identify the different SCSI connectors, cables, and termination  
2. Identify the different SCSI Speeds  
3. Identify the SCSI BUS lengths  
4. Describe the strengths of SCSI  
5. Describe the specifications of SCSI

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz  
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Server Hardware – RAID and IDE Interfaces**

**Lesson Outline:**

1. IDE Interface
   a. ATA 33
   b. ATA 66
   c. ATA 100
   d. Ultra DMA
   e. Cable and connectors
   f. Master/slave/cable select
   g. Jumper settings
2. RAID
   a. RAID 0
   b. RAID 1
   c. RAID 5
   d. RAID 0/1
3. Hot swap
4. Fibre Channel

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Identify and describe the differences, strengths and specifications of the IDE interface.
2. Define the features, capabilities and implementations of RAID.
3. Explain how RAID relates to fault tolerance or high availability.
4. Describe the benefits of Hardware RAID over Software RAID.
5. Describe hot swap, hot plug, and redundant capability of different components.

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Server Hardware – Memory**

**Lesson Outline:**

1. Cache  
   a. Processor  
   b. RAID  
   c. Write back VS Write through  
2. Memory  
   a. Memory Interleaving  
   b. ECC  
   c. EDO  
   d. Unbuffered vs. buffered vs. registered

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Describe how cache memory works.  
2. Describe the characteristics of server memory requirements and types of memory.

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz  
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: Server Hardware – System Bus Architectures

Lesson Outline:

1. PCI Bus Mastering
2. PCI Hot swap
3. Hierarchical PCI Bus
4. Peer PCI Bus
5. Hot Plug PCI
6. PCI Interrupts
7. EISA
8. AGP

Lesson Objectives:

Upon completion of this unit the student will be able to:

1. Identify the basic attributes, purpose, function and performance of System Bus Architectures
2. Explain how the System Bus affects the performance of a server
3. Identify PCI system Bus
4. Describe Network Interface Cards as they relate to the system bus

Materials and Equipment:

Computer with Microsoft PowerPoint Program & LCD Projector

Evaluation:

Quiz
Homework

Comprehension:

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: Server Hardware – CPU

Lesson Outline:

1. CPU
   a. Intel
   b. Sun
   c. Hewlett Packard
   d. Apple
2. Multiprocessing

Lesson Objectives:
Upon completion of this unit the student will be able to:

1. Explain the differences, strengths and specifications of CPU’s.
2. Describe multiprocessing functionality

Materials and Equipment:
Computer with Microsoft PowerPoint Program & LCD Projector

Evaluation:
Quiz
Homework

Comprehension:
All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Server Performance**

### Lesson Outline:

1. Fault Tolerance
2. Load Balancing
3. Adapter teaming

### Lesson Objectives:

Upon completion of this unit the student will be able to:

1. Describe fault tolerance.
2. Describe Load Balancing.
3. Describe adapter teaming.

### Materials and Equipment:

Computer with Microsoft PowerPoint Program & LCD Projector

### Evaluation:

- Quiz
- Homework

### Comprehension:

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Physical Installation**

**Lesson Outline:**

1. Pre installation planning  
   a. Hardware compatibility with operating system  
   b. Verify Power sources, space UPS and network availability  
2. KVM implementation  
3. Cable management  
4. Proper layout

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Describe the basic concepts for aspects of rack mounting servers.  
2. Conduct pre-installation planning activities

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz  
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Physical & Environmental Considerations**

**Lesson Outline:**

1. Security  
   a. Physical  
   b. Software  
2. Environmental Issues  
   a. Temperature  
   b. humidity  
   c. fire suppression  
   d. flood considerations

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Describe security concepts  
2. Recognize and report on server room environmental issues

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz  
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Data Protection and Recovery**

**Lesson Outline:**

1. Backup  
   a. Media  
   b. Methods  
2. Restore  
   a. From Backup  
   b. From Image  
   c. Reconstruct  
3. Disaster Recovery Concepts  
   a. Hot Spare  
   b. Off Site Resume

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Define Backup, Restore, Disaster Recovery Concepts

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz  
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Server Functions – Hardware Replacements**

**Lesson Outline:**

1. Server as a Gateway
2. Server as a Router
3. Server as a Bridge

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Identify the basic attributes, purpose and function of the different types of servers

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: Types of Server – Firewall and Proxy

Lesson Outline:

1. Firewall Server
2. Proxy Server

Lesson Objectives:

Upon completion of this unit the student will be able to:

1. Identify the basic attributes, purpose, and function of the listed types of servers
2. List security considerations requiring firewall and proxy server
3. List advantages and disadvantages of each type of server

Materials and Equipment:

Computer with Microsoft PowerPoint Program & LCD Projector

Evaluation:

Quiz
Homework

Comprehension:

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: Types of Servers – Database, Client/Server, Application

Lesson Outline:

1. Database Servers
   a. Oracle
   b. Microsoft SQL Server
2. Client / Server
3. Application
   a. Dedicated
   b. Distributed
   c. Peer to peer

Lesson Objectives:

Upon completion of this unit the student will be able to:

1. Identify the basic attributes, purpose, and function of the listed types of servers.
2. List the advantages and disadvantages of application servers.
3. Define the purpose and function of an application server.
4. Describe the function of a server while operating in client / server mode.
5. Identify the function of the listed models of application servers.

Materials and Equipment:

Computer with Microsoft PowerPoint Program & LCD Projector

Evaluation:

Quiz
Homework

Comprehension:

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: Server Types – Communications

Lesson Outline:
1. Fax Server
2. Mail Server
3. FTP Server
4. RAS Server
5. Web Server

Lesson Objectives:
Upon completion of this unit the student will be able to:

1. Identify the basic attributes, purpose, and function of the listed types of servers
2. Identify the advantages and disadvantages of the listed types of server
3. Describe the function and client software needed to communicate with listed types of servers

Materials and Equipment:
Computer with Microsoft PowerPoint Program & LCD Projector

Evaluation:
Quiz
Homework

Comprehension:
All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Server Types – Network Operations**

**Lesson Outline:**

1. DNS Server
2. WINS Server
3. DHCP Server
4. SNA Server

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Identify the basic attributes, purpose, and function of the listed types of servers.
2. Identify the limitations of each type of listed server.
3. Identify the environments each server is required for.

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Operating Systems**

**Lesson Outline:**

1. Novell NetWare
2. Microsoft Windows NT4.0/2000
3. Unix
4. Linux
5. IBM OS/2

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Identify the major features of the listed server operating systems
2. List the current versions of each operating system
3. List the current license plan for each operating system

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
Lesson Title: **Shutdown Procedures**

**Lesson Outline:**

1. Novell NetWare
2. Microsoft Windows NT4.0/2000
3. UNIX/Linux
4. IBM OS/2

**Lesson Objectives:**

Upon completion of this unit the student will be able to:

1. Describe Shutdown procedures across the listed network operating systems

**Materials and Equipment:**

Computer with Microsoft PowerPoint Program & LCD Projector

**Evaluation:**

Quiz
Homework

**Comprehension:**

All students will complete each unit of this lesson with 85% accuracy before proceeding to the next unit.
REFERENCES


