



Lesson Plans

Server+

(Exam SK0-002)

Version 2.0

Table of Contents

Table of Contents	1
Course Overview	3
Section 1.1: Course Introduction	5
Section 1.2: Roles and Services	6
Section 1.3: Networking Overview	8
Section 1.4: Server Operating Systems	9
Section 1.5: Physical Issues	10
Section 1.6: Using the Hardware Simulator	12
Section 2.1: System Resources	13
Section 2.2: Buses	14
Section 2.3: Memory	16
Section 2.4: CPUs	18
Section 2.5: External Components	19
Section 2.6: BIOS	20
Section 3.1: Server Storage	21
Section 3.2: PATA	22
Section 3.3: SATA	23
Section 3.4: SCSI	24
Section 3.5: Fibre Channel	26
Section 3.6: Network Storage	27
Section 3.7: iSCSI and FCIP	28
Section 4.1: Fault Tolerance Concepts	29
Section 4.2: System Restore	30
Section 4.3: Backup	31
Section 4.4: RAID	33
Section 4.5: UPS	35
Section 4.6: Network	36
Section 5.1: Remote Management	37
Section 5.2: Server Performance	38
Section 5.3: SNMP	40
Section 5.4: DMI and IPMI	41
Section 6.1: Project Planning	42
Section 6.2: Server Installation	43
Section 6.3: Network Cabling	45
Section 6.4: Windows Installation	46
Section 6.5: NetWare Installation	47
Section 6.6: Linux Installation	48
Section 7.1: Upgrades	49
Section 7.2: CPUs	53
Section 7.3: Memory	55
Section 7.4: BIOS	57
Section 7.5: Storage	59
Section 7.6: Components	61
Section 7.7: Operating System	63

Section 7.8: Software	64
Section 7.9: UPS	65
Section 8.1: Troubleshooting Process.....	67
Section 8.2: Server Shutdown.....	69
Section 8.3: System Logs.....	70
Section 8.4: Resources	71
Section 8.5: Networking	72
Section 8.6: Storage	73

Course Overview

This course prepares students for CompTIA's Server+ exam SK0-002 which certifies the knowledge and skills of a server administrator.

The prerequisites that are strongly recommended, but not required, are that the students have the following certifications or equivalent knowledge before taking this course:

- A+
- Network+

TestOut training is also available for the both of these courses.

Module 1 – Introduction

This module introduces the students to the Server+ certification requirements. It also discusses common roles and services of a server on a network, an overview of networking, various server operating systems, and physical issues to maintain the security of server data. Students will learn how to use the hardware simulator.

Module 2 – System Components

This module teaches the basics of system components. This includes configuring system resources, understanding common expansion buses, selecting memory, installing a CPU, heat sink, and fan, and supporting external components with high capacity connectivity options.

Module 3 – Storage

In Module 3 students will learn about the most common storage device interfaces: PATA, SATA, SCSI, and Fibre Channel. They will learn about adding storage capacity to a network using Storage Area Network (SAN) and Network-Attached Storage (NAS) storage options. Also discussed are how to produce optimal data transfer rates using iSCSI and FCIP.

Module 4 – Fault Tolerance

In Module 4 students will learn fault tolerance concepts to protect system data. They will learn about creating a Disaster Recovery Plan, using a last-resort backup and restore option, selecting backup types and strategies, and using RAID volumes to provide fault tolerance. They will also learn about selecting and installing an Uninterruptible Power Supply (UPS) to protect the system against power fluctuations.

Module 5 – Management

Module 5 provides a basic overview of the concepts and tools to manage and monitor the network. Students will learn the basics of remote management, maintaining and monitoring server performance, monitoring network-attached devices using SNMP, and monitoring the network using DMI and IPMI.

Module 6 – Installation

Module 6 provides an overview of installation. This includes guidelines for implementing a project plan, selecting the correct server hardware for a given situation, preparing cabling, and installing Windows Server 2003, Open Enterprise Server (OES) NetWare server, and a SUSE Linux server.

Module 7 – Upgrades

In Module 7 students will learn the basics of upgrading server components. This includes upgrading CPUs, memory, hard disks, expansion boards, and peripheral devices connected to a server. Students will learn how to flash the BIOS and install operating system updates. They will also learn how to update system monitoring agents and system service tools.

Module 8 – Troubleshooting

In this module students will learn guidelines for troubleshooting hardware and software problems. They will learn how to shutdown servers, use system log files to monitor and troubleshoot networks, access troubleshooting resources, and use networking tools. They will also learn how to recover a failed RAID array.

Section 1.1: Course Introduction

Preparation

The video introduces the student to the Server+ course and the topics they will need to be familiar with to pass the Server+ exam:

- Server hardware
- Procedural issues
- Troubleshooting skills
- Disaster recovery
- Preventative maintenance techniques
- Server Operating Systems
- Networking

Lecture Focus Questions:

- What does passing the Server+ exam certify you to do?
- What are the major areas of focus for the Server+ exam?
- How can you best prepare yourself to pass the exam?
- Which other certifications should you have before taking the Server+ exam?

Time

About 5 minutes

Section 1.2: Roles and Services

Preparation

In this section students will become familiar with the concept of a *server*, and common roles and services of a server on a network. Network services that can be hosted by the server are also discussed.

Server+ Objectives

- 1.3 Know the basic purpose and function of the following types of servers.
 - Server types include:
 - Server as a Gateway
 - Server as a Router
 - Server as a Bridge
 - Firewall Server
 - Proxy Server
 - Database Server
 - Client/Server
 - Application Server
 - Mail Server
 - FTP Server
 - SNA Server
 - RAS Server
 - File and Print Server
 - Fax Server
 - DNS Server
 - WINS Server
 - DHCP Server
 - Web Server
- 1.4 Know the function of the following application server models.
 - Dedicated Application
 - Distributed Application
 - Peer-to-peer application

Lecture Focus Questions:

- What is the role of a server that connects two dissimilar systems which require translation services in order to communicate?
- What is the role of a server that connects two physical network segments as one logical network?
- How are firewalls and proxy servers similar?
- What advantages does an application server provide?
- In what situations would you use RAS services?
- What are three specific functions that infrastructure services provide?
- What are the similarities and differences between WINS and DNS?

- One application server running one application is an example of which application server model?

Time

About 90 minutes

Section 1.3: Networking Overview

Preparation

This section provides an overview of the basics of networking. Students will learn the components that make up a network, the advantages of using a network, common network types, and network protocol suites that provide communication between devices. This section focuses on Ethernet networks, which are the most common network architecture used for local area networks. Students will become familiar with specifications for various Ethernet implementations.

Server+ Objectives

- 2.1 Conduct pre-installation planning activities.
 - Activities include:
 - Verify network protocols, naming conventions, domain names.
- 2.2 Install hardware using best practices.
 - Characteristics of common network interface protocols.
 - Ethernet
 - Fast Ethernet
 - Gigabit Ethernet

Lecture Focus Questions:

- How do network components work together to form a network?
- What is the role of workstations in a peer-to-peer networking system?
- What is the role of workstations in a client/server system?
- What cable types does Ethernet support?
- What advantages does an intelligent hub offer over a passive hub?
- What are the guidelines for using repeaters on Fast Ethernet?
- What is the 5-4-3 rule?
- How can you resolve the IP address of a host?

Time

About 50 minutes

Section 1.4: Server Operating Systems

Preparation

This section teaches the students the differences between a network operating system and a workstation operating system. It also reviews the various network operating system versions of Microsoft Windows, which is the dominant network operating system in use today. Students will also obtain a basic introduction to the NetWare network operating system and Linux operating system.

Server+ Objectives

- 1.14 Understand the processor subsystem of a server.

Lecture Focus Questions:

- What qualities do network operating systems generally have that workstation operating systems do not?
- How does Linux significantly differ from Windows and NetWare network operating systems?
- What is a Linux distribution?
- How are Active Directory and Novell Directory Services similar?

Time

About 70 minutes

Section 1.5: Physical Issues

Preparation

This section discusses the physical issues that must be considered to maintain the security and the integrity of the information on the server. This includes how to protect computer equipment, personnel and the environment. It stresses how to protect computer equipment from damage from Electrostatic Discharge (ESD) by implementing appropriate grounding procedures.

Server+ Objectives

- 2.2 Install hardware using best practices.
 - Supporting knowledge includes:
 - Physical infrastructure requirements (e.g., proper layout of equipment in the rack, adequate air flow, etc.)
 - Cable management
 - KVM implementation
 - Rack mount security
- 5.4 Perform physical housekeeping.
 - Activities include:
 - Periodic checks for dust buildup
 - Cable management
- 6.1 Recognize and report on physical security issues.
 - Activities include:
 - Limit access to server room and backup tapes
 - Ensure physical locks exist on doors
 - Establish anti-theft devices for hardware (lock server racks)
 - Supporting knowledge includes:
 - Fundamentals of server security (Importance of physically securing a server)
- 6.2 Recognize and report on server room environmental issues.
 - Issues include:
 - Temperature
 - Humidity
 - ESD
 - Power surges
 - Back-up generator
 - Fire suppression
 - Flood considerations

Lecture Focus Questions:

- What is the proper method for removing dust from computer systems?
- How does standardizing cable coloring simplify troubleshooting?
- What are the guidelines for physical security access?

- What are the qualities of a well-maintained, secure server room?
- How should security for backup tapes be implemented?
- How can ESD be a hazard to electronic computer components?
- When should you use a static-shielding bag?
- What steps can you take to reduce ESD if you do not have the proper equipment handy?

Time

About 60 minutes

Section 1.6: Using the Hardware Simulator

Preparation

Preparation

This section teaches the students how to use the hardware simulator included in this course. Experiment with the simulations in this section until you are familiar with how the hardware simulator works. You will recognize the simulations in this course by the mouse icon to the left of the entry.

Time

About 30 minutes

Lab/Activity

- Put an Item on the Workbench
- Select an Item Based on its Documentation
- Select Item Categories
- Install and Uninstall Components
- Set Dials and Switches
- Add Cabled Components

Section 2.1: System Resources

Preparation

This section discusses configuring system resources by assigning Interrupt Request (IRQ) channels, Direct Memory Access (DMA) channels, and I/O addresses. Students will learn the most common settings for I/O addresses, IRQs, and DMA addresses.

Server+ Objectives

- 1.1 Know the characteristics, purpose, function, limitations, and performance of the following system bus architectures.
 - PCI Interrupts
- 1.7 Know differences between different ATA (IDE) solutions, their advantages, limitations and specifications.
 - Ultra DMA
- 4.7 Upgrade peripheral devices, internal and external. Verify appropriate system resources.
 - Resources include:
 - Expansion slots
 - IRQ
 - DMA

Lecture Focus Questions:

- Why is it important to memorize common IRQ, I/O and DMA assignments?
- What function does the cascade from IRQ 2 to cascade IRQ 9 provide?
- What are the different methods of configuring system resources?
- How are interrupts 0, 1, and 8 different than other interrupts?
- How are high-speed devices able to communicate with RAM without going through the CPU?
- How do Ultra DMA drives differ from DMA drives?
- How do you determine which devices need an I/O address? Which devices can share I/O addresses?
- What are the requirements for using Plug-and-Play resource configuration?

Time

About 45 minutes

Section 2.2: Buses

Preparation

In this section students will learn the historical development of common expansion buses in a PC system, and how buses work. The standards and features of different expansion buses are presented. This section focuses on the currently popular PCI bus. Students will learn how to visually identify given expansion slots.

Server+ Objectives

- 1.1 Know the characteristics, purpose, function, limitations, and performance of the following system bus architectures.
 - PCI Bus Mastering
 - PCI Hot swap
 - PCI-Express
 - PCI-X
 - Hierarchical PCI Bus
 - Peer PCI Bus
 - I2O – Intelligent Input-Output
 - Hot Plug PCI
 - PCI Expansion Slots
 - PCI Interrupts
 - EISA
- 2.2 Install hardware using best practices. Hardware includes:
 - Boards
- 4.6 Upgrade adapters (e.g., NICs, SCSI cards, RAID, etc.). Supporting knowledge includes:
 - Available bus types
 - PCI-X
 - PCI –Express
 - Hot swap PCI
 - PCI (bus architecture, bus speed)
 - EISA
 - Implementation of hot swappable PCI in servers.
- 4.7 Upgrade peripheral devices, internal and external. Verify appropriate system resources (e.g., expansion slots, IRQ, DMA, etc.).
 - Resources include:
 - Expansion slots
 - Expansion cards

Lecture Focus Questions:

- How are the motherboard clock speed and the expansion board clock speed coordinated?
- What is the function of the Northbridge? The Southbridge?

- What advantages do EISA boards offer over ISA boards?
- What is the benefit of point-to-point communication used with PCI Express boards?
- How does hot plug differ from hot swap?
- How does the I2O chip increase processing speed?

Time

About 70 minutes

Lab/Activity

- Install a PCI-X Card
- Install Expansion Cards
- Install a PCI NIC and an EISA Modem

Section 2.3: Memory

Preparation

In this section students will learn how to recognize RAM packaging by sight. They will also learn the factors to consider when selecting a memory module for a PC system and how to select the correct memory for a server. Students will learn how to install a memory module in a motherboard.

Server+ Objectives

- 1.5 Know the characteristics of the following types of memory and server memory requirements.
 - Memory types
 - EDO
 - SDRAM
 - DDR
 - DDR-2
 - RAMBUS
 - Memory Interleaving
 - ECC vs. Non ECC vs. Extended ECC
 - Unbuffered vs. buffered vs. registered
 - Hardware compatibility list
 - Memory caching
- 2.2 Install hardware using best practices.
 - Hardware includes:
 - Memory
- 4.4 Increase memory.
 - Supporting knowledge includes:
 - Verify memory compatibility
 - Speed
 - Brand
 - Capacity
 - EDO
 - DDR
 - RAMBUS
 - ECC/non-ECC
 - SDRAM/RDRAM
 - Supporting knowledge includes:
 - Number of pins on each type of memory
 - How servers deal with memory pairings

Lecture Focus Questions:

- What are two ways that you can use memory to increase the speed of the system?

- How does unbuffered, registered, and buffered memory differ?
- How does DDR compare with other types of RAM?
- How do you apply the banking rule?
- What is the primary factor in selecting memory for a system?
- What motherboard factors must you consider when selecting memory?
- For which types of memory do you need to consider the motherboard clock speed?

Time

About 90 minutes

Lab/Activity

- Install Memory
- Select and Install Memory
- Install RDRAM
- Identify and Install Memory
- Install Registered Memory
- Install Memory to Motherboard Capacity

Section 2.4: CPUs

Preparation

This section discusses considerations when using multiple processors in a system. It also introduces the 64-bit processor environment. Students will learn how to install a CPU in a motherboard, and how to install a heat sink and fan to protect the CPU from heat.

Server+ Objectives

- 1.12 Know the features, advantages, and disadvantages of multiprocessing.
- 1.14 Understand the processor subsystem of a server.
 - Multiprocessing systems
 - What they are
 - How they differ from dual-processor systems
 - 64-bit Server Environments
 - What they are
 - Why and when they are important
 - What are the different architectures
- 2.2 Install hardware using best practices.
 - Hardware includes
 - Processors and power modules

Lecture Focus Questions:

- What components are necessary to support multiprocessing?
- What is multithreading and how does it work to support multiprocessing?
- In which situations would it be best to use SMP (symmetric multiprocessing) instead of (AMP) asymmetric multiprocessing?
- How do dual core CPUs differ from multiprocessor CPUs?
- How do 64-bit CPUs improve system processing?
- What is hardware compatibility mode?
- When should you use thermal paste?

Time

About 45 minutes

Lab/Activity

- Choose a Processor
- Install a Processor in a Dual Processor Motherboard

Section 2.5: External Components

Preparation

In this section students will learn the basics of two high capacity connectivity options used to connect external components to the PC system: Universal Serial Bus (USB) and Firewire. Both technologies are extremely fast and support a wide variety of external devices.

Server+ Objectives

- 2.5 Configure external peripherals.
 - Supporting knowledge includes:
 - Know available cable types for peripheral devices
 - Firewire
 - USB

Lecture Focus Questions:

- How is USB able to support up to 127 devices?
- How do devices connected to a USB hub share bandwidth?
- How does a USB hub implement IRQs?
- How is power obtained by passive power USB devices?
- How does Firewire differ from USB?

Time

About 20 minutes

Section 2.6: BIOS

Preparation

This section discusses the Basic Input Output System (BIOS), which is a collection of programs that allow the CPU to communicate with other devices. The BIOS cannot be rewritten. Also discussed is the Complementary Metal-Oxide Semiconductor (CMOS) that contains basic configuration data the computer uses to start up. The CMOS can be written to and the parameters can be changed as necessary, using the CMOS editor. Students will learn the correct key sequence to enter the CMOS editor, and how to view and modify common BIOS settings such as the date and time, boot sequence, and port settings.

Server+ Objectives

- 3.1 Check/upgrade BIOS/firmware levels (system board, RAID controller, hard drive, etc.).

Lecture Focus Questions:

- What are the functions of the BIOS?
- What is the role of CMOS? How does it differ from the BIOS?
- Why does the CMOS require a battery?
- What determines the keystroke to open a CMOS editor? How can you find this information?

Time

About 25 minutes

Lab/Activity

- Configure Server BIOS Settings

Section 3.1: Server Storage

Preparation

This section presents the factors that should be considered when implementing storage in a server, the benefits of using hot swappable drives, and a comparison of the most common storage device interfaces.

Server+ Objectives

- 1.5 Know the characteristics hot swap and hot plug boards.

Lecture Focus Questions:

- What are the benefits of hot swappable drives?
- How do hot swap and hot plug differ?
- What makes PATA drives unsuitable for mirroring?
- What advantage does an SATA drive have over a SCSI drive?
- Which factors would lead you to implement Fibre Channel for storage instead of SCSI?

Time

About 25 minutes

Section 3.2: PATA

Preparation

In this section presents a historical review of ATA/IDE drive standards and features. Students will learn how to install a PATA device and set the master/slave relationship.

Server+ Objectives

- 1.7 Know the differences between different ATA (IDE) solutions, their advantages, limitations, and specifications.
 - ATA 33
 - ATA 66
 - ATA 100
 - ATA 133
 - Ultra DMA
 - Cabling and connectors
 - Master/slave/cable select (CSEL)
 - Jumper settings
- 4.3 Add hard drives
 - Activities include:
 - Verify that drives are the appropriate type.
 - For ATA/IDE drives, confirm cabling, master/slave and potential cross-brand capability.

Lecture Focus Questions:

- How is the speed of an ATA system affected when different types of ATA boards are used?
- When you have only one ATA drive in a system, which setting do you use for the controller?
- How do you configure the controller settings for drives using the secondary ATA bus?
- What role does CMOS have in an ATA board installation?
- What advantages does the ATA auto configuration have over the two other configuration types?
- What are the roles of LBA, CHS, and INIT13 extensions?
- What does DMA mode 4 indicate?

Time

About 60 minutes

Lab/Activity

- Install PATA Drives

Section 3.3: SATA

Preparation

This section discusses Serial ATA (SATA), which replaces and overcomes the slower speed limits of the older parallel technology of ATA, EIDE, and IDE. SATA can transfer data at extremely fast rates. Students will learn the steps to install an SATA drive in a PC system.

Server+ Objectives

- 1.7 Know differences between different ATA (IDE) solutions, their advantages, limitations, and specifications.
 - Serial ATA
 - SATA
 - SATA II (SATA v1.2)
 - Cabling and connectors
- 3.4 Configure external peripherals
 - Supporting knowledge includes:
 - Know available cable types for peripheral devices.
 - Serial ATA
- 4.3 Add hard drives.
 - Activities include:
 - Verify that drives are the appropriate type.
 - Verify connections on serial ATA drives.

Lecture Focus Questions:

- In what ways does the SATA architecture differ from IDE, EIDE and PATA?
- Which ATA/IDE limitations does the SATA architecture overcome?
- How does the connection topology differ between SATA, IDE, EIDE and PATA?
- What is the advantage of a point-to-point connection topology?
- What is the compatibility between SATA and IDE, EIDE and PATA devices?
- How are channels used with SATA?

Time

About 25 minutes

Lab/Activity

- Install SATA Drives
- Install SATA Drives in a RAID Set

Section 3.4: SCSI

Preparation

This section discusses the Small Computer System Interface (SCSI). Students will learn the details of SCSI standards. They will learn how to configure a SCSI chain by setting the SCSI ID numbers and terminating appropriate devices on the SCSI chain. Students will learn how to install SCSI drives.

Server+ Objectives

- 1.6 Know differences between different SCSI solutions, their advantages, and their specifications.
 - SCSI-1, 2, & 3
 - SCSI Bus Width (Narrow and Wide)
 - SCSI Bus Speed (Fast and Ultra, Ultra Wide, Ultra 2, Ultra 160, Ultra 320, iSCSI, SAS)
 - SCSI connectors, cables, termination (passive, active, multi-mode)
 - SCSI IDs and LUNs
 - Single Ended Devices
 - Low Voltage Differential (LVD)
 - High Voltage Differential (HVD)
 - BUS lengths
 - Multi-tasking
 - Multi-threading
 - Disconnect and reconnect
- 3.4 Configure external peripherals.
 - Supporting knowledge includes:
 - SCSI cabling termination
- 4.3 Add hard drives.
 - Activities include:
 - Verify that drives are the appropriate type.
 - Confirm SCSI termination and cabling.
- 4.6 Upgrade adapters (e.g., NICs, SCSI cards, RAID, etc.).
 - Supporting knowledge includes:
 - Characteristics of SCSI
 - Levels
 - Cabling
 - Termination
 - Signaling

Lecture Focus Questions:

- How do the functions of SCSI connectors differ?
- How are multiple devices attached to a SCSI bus internally? Externally?

- How is the priority level of a SCSI device determined by the SCSI controller?
- When would you typically use LUNs?
- How do SCSI-2 and SCSI-3 differ?
- What are cable links will SCSI support?

Time

About 65 minutes

Lab/Activity

- Install A SCSI Adapter and Device
- Install an Internal SCSI Device

Section 3.5: Fibre Channel

Preparation

In this section students will learn the basics of how Fibre Channel works, standards for Fibre Channel, and Fibre Channel implementations.

Server+ Objectives

- 1.8 Know the features and benefits of fibre channel hardware.
 - Storage arrays
 - Disk drives
 - Adapters
 - Cables, connectors, GBICs, SFP GBICs
 - Single -- and Multi-mode
 - 1 Gbit, 2 Gbit, 10 Gbit
 - Bus lengths
 - Point-to-point vs. switched vs. LOOP
- 3.4 Configure external peripherals.
 - Peripherals include:
 - Data storage subsystems
 - Supporting knowledge includes:
 - Fibre channel cabling

Lecture Focus Questions:

- How does multimode differ from single mode?
- Which fibre channel implementation (point-to-point, arbitrated loop, switched) would you select when you want to set up clustering on a highly reliable network?
- When are SFP GBICs used instead of GBICs?

Time

About 25 minutes

Section 3.6: Network Storage

Preparation

This section presents the basics of two types of network storage: Storage Area Network (SAN) and Network Attached Storage (NAS). Students will learn how each storage option works, concepts to be considered, and differences between the SAN and NAS options.

Server+ Objectives

- 1.15 Know the basic specifications of and differences between SAN and NAS.
 - Block and file

Lecture Focus Questions:

- How is access controlled in a SAN?
- How do NAS and SAN systems differ in the way stored data is accessed?
- How are NAS systems configured?
- How does the hardware used in a NAS system differ from the hardware used in a SAN system?
- What is a typical SAN configuration when two or more servers access the SAN?

Time

About 25 minutes

Section 3.7: iSCSI and FCIP

Preparation

This section covers the features and benefits of Internet SCSI (iSCSI) and Fibre Channel over IP (FCIP). These two technologies provide powerful storage area networks using Ethernet hardware to provide the benefits of a FC SAN without the high cost of fibre channel hardware. iSCSI and FCIP are not as fast as Fibre Channel, but using Gigabit Ethernet hardware will produce optimal data transfer speeds. Students will learn how to set up an iSCSI SAN.

Server+ Objectives

- 1.9 Know the features and benefits of iSCSI and FCIP.
 - Storage arrays
 - Adapters
 - Cables, connectors
 - 1 Gbit, 2 Gbit, 10 Gbit
 - Bus lengths

Lecture Focus Questions:

- What are the advantages of implementing an iSCSI subsystem?
- How can you ensure the fastest speed using iSCSI?
- What types of RAID arrays can you use with iSCSI?
- What are the benefits of using FCIP instead of fibre channel?
- How do iSCSI and FCIP differ?

Time

About 40 minutes

Section 4.1: Fault Tolerance Concepts

Preparation

This section discusses fault tolerance concepts such as server scalability and Disaster Recovery Planning (DRP) to protect system data. Students will learn what scalability is and how to make a server scalable. They will also learn the need for a DRP and the different components to include in the DRP.

Server+ Objectives

- 1.13 Know the attributes, purpose, function, and advantages of clustering, scalability, high availability and fault tolerance.
- 8.1 Read and follow the disaster recovery plan.
 - Activities include:
 - Find, read, and implement the recovery plan.
 - Confirm and use offsite storage for backup.
 - Participate in testing of disaster recovery.
 - Supporting knowledge includes:
 - The need for redundancy (e.g., hard drives, power supplies, fans, NICs, processors, UPS).
 - Ability to read and comprehend a disaster recovery plan.
 - Identify types of backup and restoration schemes.
 - Grandfather schemes
 - Differential and incremental backups
 - Concept of hot, cold, and warm sites.

Lecture Focus Questions:

- What facts would you give when asked to justify the need for a quality power supply for a server?
- What is the purpose of a disaster recovery plan?
- How do you determine where backups should be stored?
- How does verifying the backup differ from testing the backup?
- How does redundancy differ from scalability?
- How does RAID supplement a backup? How must the RAID array be implemented in order to supplement a backup?
- How does a warm server differ from a hot server?

Time

About 60 minutes

Section 4.2: System Restore

Preparation

In this section students will learn about the last-resort method to back up and restore the operating system on a Windows system. Automated System Recovery (ASR) should only be used after backups and system restore points have failed. Students will learn how to create an ASR disk.

Server+ Objectives

- 4.1 Perform backup.
 - Activities include:
 - Update the ERD/recovery disk (if applicable)
 - Supporting knowledge includes:
 - When full backups might be necessary
- 5.1 Perform regular backup.
 - Activities include:
 - Update the ERD/recovery disk (if applicable)

Lecture Focus Questions:

- What role should the ASR disk play in your total recovery plan?
- What role should the ASR disk play in your total recovery plan?
- How many ASR disks do you need?
- What does an ASR contain?
- Where can you find detailed information on how to restore your system using an ASR disk?

Time

About 10 minutes

Section 4.3: Backup

Preparation

This section presents an overview of backup types and strategies. Commonly used backup implementations are also presented. Students will learn how to backup Windows, Linux, and NetWare systems.

Server+ Objectives

- 3.6 Install service tools (SNMP, backup software, system monitoring agents, event logs, etc.).
 - Service tools include:
 - Backup software
- 4.1 Perform backup.
 - Activities include:
 - Update the ERD/recovery disk (if applicable)
 - Verify backup
 - Supporting knowledge includes:
 - When full backups might be necessary
 - How to select the appropriate type of backup
 - Differential
 - Appended
 - Copy
 - Full
- 8.1 Read and follow the disaster recovery plan.
 - Supporting knowledge includes:
 - Types of backup hardware and media
 - DAT
 - SDAT
 - DLT
 - Super DLT
 - Optical backup device
 - AIT
 - LTO
 - Disk to disk
 - Libraries vs. stand-alones
 - Identify types of backup and restoration schemes
 - Differential and incremental backups

Lecture Focus Questions:

- How does data consolidation streamline the backup process?
- What criteria should you consider when choosing a backup media?
- How does the archive attribute work with the different types of backups?
- How does a differential backup differ from an incremental backup?

- What criteria do you use to choose the combination of full, incremental, or differential backups that will work best for an organization?
- How does a backup media rotation system work?
- What advantages do hard drive backups have over tape drive backups?

Time

About 75 minutes

Section 4.4: RAID

Preparation

This section covers concepts using Redundant Array of Independent Disks (RAID) volumes to improve performance or provide fault tolerance. Four different levels of volumes are described: RAID 0, RAID 1, RAID 3, and RAID 5. RAID arrays can be combined to increase fault tolerance and performance: RAID 0 + 1, RAID 1 + 0, RAID 5 + 0, and RAID 5 + 1. Students will learn how to mirror an existing drive, configure a RAID array, and recover a failed RAID array.

Server+ Objectives

- 1.10 Know the features and capabilities of the following RAID levels, when they apply, and how each relates to fault tolerance or high availability: (non-proprietary).
 - RAID 0
 - RAID 1
 - RAID 3
 - RAID 5
 - RAID 5+1
 - RAID 0+1
 - RAID 1+0
 - RAID 5+0
 - Zero Channel RAID
 - Differences between hardware RAID and software RAID and the advantages of one over the other.
- 3.2 Configure RAID.
 - Activities include:
 - Use manufacturer's tool to configure the array
 - Testing (simulate a failure)
 - Supporting knowledge includes:
 - Familiarity with OCE
 - Characteristics of fail over and spare drive types (i.e., cold, hot, warm, dedicated and global)
 - Characteristics, purpose, and function of RAID cache including when to turn off write caching
 - How to calculate storage capacity
 - Functionality of RAID controller battery

Lecture Focus Questions:

- What are the advantages of mirroring over striping?
- How does duplexing differ from mirroring?
- How does parity protect data?
- Which RAID level offers the highest level of protection and performance?

- What are the advantages of RAID 0+1?
- How is RAID 3 implemented?
- How does block-level striping differ from byte-level striping?

Time

About 110 minutes

Lab/Activity

- Mirror an Existing Drive
- Create a RAID Volume
- Create a Mirrored Array
- Create a RAID 5 Array

Section 4.5: UPS

Preparation

This section discusses the role of an Uninterruptible Power Supply (UPS) to protect hardware and data from fluctuations in power. Three types of UPS systems are presented: standby UPS, line-interactive UPS, and Online UPS. Factors to consider when selecting a UPS are also presented. Students will learn how to install and configure UPS software.

Server+ Objectives

- 2.1 Conduct pre-installation planning activities.
 - Supporting knowledge includes:
 - UPS sizes and types
 - Server power requirements
 - Power issues (stability, spikes, etc.)
 - BTUs for the UPS and associated equipment

Lecture Focus Questions:

- What functions do a UPS provide?
- How does an online UPS system differ from an offline UPS system?
- Which type of UPS system should you use for a server?
- What is the importance of configuring a clean shutdown of the system in cases where the power outage may exceed the capacity of the UPS?
- What is the difference between a power sag and a brownout?

Time

About 40 minutes

Lab/Activity

- Install a UPS Device

Section 4.6: Network

Preparation

In this section students will learn concepts to provide high availability, reliability and stability of network components. These include concepts that will provide fault tolerance for network adapters through: implementing adapter teaming, using multiple systems with network load balancing, and clustering. Students will learn how to configure network load balancing.

Server+ Objectives

- 1.2 Know the characteristics of adapter fault tolerance.
 - Adapter load balancing
 - Adapter teaming
- 1.13 Know the attributes, purpose, function, and advantages of clustering, scalability, high availability, and fault tolerance.

Lecture Focus Questions:

- How does adapter teaming for fault tolerance differ from adapter teaming for load balancing?
- How are IP addresses used in server load balancing?
- When should you use unicast as the cluster operation mode? Multicast?
- What benefits do server farms provide?
- What is the protocol restriction for load balancing?

Time

About 50 minutes

Section 5.1: Remote Management

Preparation

This section teaches students the concepts and tools to remotely manage a server. Both In-band Remote Management and Out-of-band Remote Management are discussed, with the disadvantages of each type. Students will learn how to configure remote management on Windows, Linux and NetWare servers.

Server+ Objectives

- 3.9 Implement the server management plan (OS-dependent and OS-independent components).
 - Plans typically include:
 - Server management software installation
 - Availability
 - Server change management requirements
 - Security plan
 - Remote management hardware
 - Supporting knowledge includes:
 - Purposes and function of server management tools.

Lecture Focus Questions:

- How does in-band remote management differ from out-of-band remote management?
- Which situations would make in-band remote management difficult or impossible?
- What is an advantage of SSH? A disadvantage?
- What is RBS (Role Based Services) and how is it implemented?
- What advantages do in-band remote management hardware solutions provide?
- How can you manage security when using a modem for out-of-band remote management?

Time

About 70 minutes

Lab/Activity

- Enable Remote Desktop

Section 5.2: Server Performance

Preparation

This section provides an overview of factors that should be addressed to protect and preserve the server and its performance. These will include maintaining and monitoring the server in the server room, using baseline strategies to monitor the overall performance of the server system, and identifying and resolving bottlenecks. Students will learn how to create a server baseline using the Performance Utility in Windows Server 2003. They will also learn how to use diagnostic software to identify server bottlenecks.

Server+ Objectives

- 3.7 Perform server baseline.
 - Supporting knowledge includes:
 - Purpose and types of baseline
 - Processor utilization
 - Page file
 - Disk utilization
 - Memory utilization
 - Network utilization
 - Conditions under which different baselines might be useful
 - When baselines should be updated
- 5.2 Create baseline and compare performance.
 - Activities include:
 - Regular comparisons to the original baseline
 - Verify backup
 - Supporting knowledge includes:
 - Importance and use of maintenance logs and service logs (documentation)
- 7.3 Identify bottlenecks.
 - Bottlenecks include:
 - Processor
 - Bus transfer
 - I/O
 - Disk I/O
 - Network I/O
 - Memory
 - Activities include:
 - Run performance tool and compare against baseline
 - Supporting knowledge includes:
 - How to run performance tools and compare against baseline
 - Processor utilization
 - Page file

- Disk utilization
- Memory utilization
- Network utilization

Lecture Focus Questions:

- What are three physical environment concerns in a server room?
- When should you perform your first baseline on a server?
- What items should be included in the server baseline?
- When is virtual memory used?
- What guidelines should be followed regarding the frequency of performing server baselines?
- Which factors are typically the most significant in determining network performance?

Time

About 60 minutes

Section 5.3: SNMP

Preparation

This section discusses implementing a server management tool, Simple Network Management Protocol (SNMP), on the network to monitor network-attached devices. Students will learn how to monitor and manage SNMP thresholds to determine if thresholds are too high or low. They will also learn how to configure an SNMP agent.

Server+ Objectives

- 3.6 Install service tools (SNMP, backup software, system monitoring agents, event logs, etc.).
 - Service tools include:
 - SNMP
 - System monitoring agents
 - Supporting knowledge includes:
 - How to set up SNMP
 - How system monitoring software and MIBs are implemented on hardware
- 4.8 Upgrade system monitoring agents.
 - Supporting knowledge includes:
 - Purpose and function of the following Management Protocols
 - SNMP
 - Function of monitoring agents
 - Dependencies between SNMP and MIBs
- 5.3 Adjust SNMP thresholds.

Lecture Focus Questions:

- How do the MIB and the agents work together?
- How is the MIB organized? Why is the MIB structure important?
- What is the role of the community name?
- How does polling differ from traps?
- What security risk do traps present?

Time

About 70 minutes

Lab/Activity

- Install and Configure the SNMP Client
- Configure Traps and Security for the SNMP Client

Section 5.4: DMI and IPMI

Preparation

This section teaches the students about two network monitoring tools used to manage the workstations and servers on a network. Desktop Management Interface (DMI) is used to track components in individual systems on the network. Intelligent Platform Management Interface (IPMI) allows a network administrator to manage and monitor a remote system, even if the remote system is not powered on.

Server+ Objectives

- 4.8 Upgrade system monitoring agents.
 - Supporting knowledge includes:
 - Purpose and function of the following Management Protocols:
 - DMI
 - IPMI 1.5 & 2.0
 - Function of monitoring agents

Lecture Focus Questions:

- How can SNMP and DMI work together?
- What advantages does IPMI provide?
- What two components make up the DMI system? How do they work?
- What is the purpose of IPMI?
- How are IPMI 1.5 and 2.0 different?

Time

About 15 minutes

Section 6.1: Project Planning

Preparation

This section presents the guidelines for implementing a project plan. These will include defining: goals, stakeholders, scope, schedule, possible risks, technical details, support, management plan, and documentation.

Server+ Objectives

- 2.1 Conduct pre-installation planning activities.
 - Activities include:
 - Plan the installation.
 - Verify the installation plan.
 - Verify hardware compatibility with operating system.
 - Verify power sources, space, UPS and network availability.
 - Verify network protocols, naming conventions, domain names.
 - Verify that all correct components and cables have been delivered.
- 3.8 Document the configuration.
 - Supporting knowledge includes:
 - Document contents:
 - What components are in the box
 - Where components are located in the box
 - What updates have been applied
 - Warranty information
 - Baseline
 - Server configuration information (e.g., BIOS information, RAID levels used, what drives were put into what arrays, server network information).
 - Install date

Lecture Focus Questions:

- Why is it so important to have management's approval of all aspects of a project?
- Who are stakeholders?
- How can you avoid scope creep?
- What should you include in your documentation?
- What are the biggest differences between a security log and a maintenance log?

Time

About 45 minutes

Section 6.2: Server Installation

Preparation

This section teaches the basics of tower, rack, and blade servers including the advantages of rack and blade servers over tower servers. Students will become familiar with U, the rack unit size standard that defines the thickness a rack mounted server. A rack unit U is 1.75 inches. A rack mounted server can come in different U sizes (e.g. 1U, 2U, 4U, etc.).

Server+ Objectives

- 1.3 Know the basic purpose and function of the following types of servers.
 - Description of the following hardware types, including module types, basic spec, limitations and requirements (especially power and cooling):
 - Blade servers
 - Tower servers
 - Rack-mount servers
- 2.2 Install hardware using best practices.
 - Hardware includes:
 - Internal cable
 - Internal fans
 - Installation activities include:
 - Mount the rack installation (if appropriate)
 - Install external devices (e.g. keyboards, monitors, subsystems, modem rack, etc.)
 - Verify power-on via power-on sequence
 - Supporting knowledge includes:
 - Physical infrastructure requirements (e.g., proper layout of equipment in the rack, adequate air flow, etc.)
 - Cable management
 - KVM implementation
 - Rack mount security
- 3.8 Document the configuration.
 - Supporting knowledge includes:
 - Document contents:
 - What components are in the box
 - Where components are located in the box
 - What updates have been applied
 - Warranty information
 - Baseline
 - Server configuration information (e.g., BIOS information, RAID levels used, what drives were put into what arrays, server network information).
 - Install date

Lecture Focus Questions:

- Why is it necessary to identify the stakeholders as part of installation planning?
- In addition to holding servers, what other functions do racks provide?
- What does a KVM switch allow you to do?
- What information should be included in installation documentation?

Time

About 15 minutes

Section 6.3: Network Cabling

Preparation

This section discusses the advantages and disadvantages of three types of bounded network cabling: coaxial, twisted pair, and fiber optic. Students will learn how to make and prepare different types of cabling. This will include using a crimping tool to make a network drop cable.

Server+ Objectives

- 2.2 Install hardware using best practices.
 - Supporting knowledge includes:
 - Basic understanding of network cabling and connector types.

Lecture Focus Questions:

- What is the function of the 3 and 6 pins on a standard Ethernet?
- What is the correct order of the wires when using the T568A standard?
The T568B standard?
- What is the easiest way to create a crossover cable?
- Which type of twisted pair cabling should you use when your cables will be exposed to high EMI levels?
- Which type of connector is used for high-bandwidth communications such as those supported by gigabit Ethernet?

Time

About 60 minutes

Lab/Activity

- Connect to an Ethernet
- Connect Fiber Optic Cables

Section 6.4: Windows Installation

Preparation

This section provides an overview of the steps to complete a Windows Server 2003 installation. Students will learn how to prepare the system before the installation, complete the installation, and what to do after the installation.

Server+ Objectives

- 3.3 Install NOS.

Lecture Focus Questions:

- What are the strengths of Windows as a network operating system?
- What advantages does Active Directory offer?
- How are domains used in NT 4?
- What capability for large server environments does Windows 2000 Datacenter and Windows Server 2003 Datacenter Edition offer?
- What is the most reliable way to check for hardware compatibility with a Windows server?

Time

About 25 minutes

Section 6.5: NetWare Installation

Preparation

This section discusses the steps for installing an Open Enterprise Server (OES) NetWare version. Students will learn how to prepare the system before the installation, complete the installation, and what to do after the installation.

Server+ Objectives

- 3.3 Install NOS.

Lecture Focus Questions:

- How has the focus of NetWare changed from NetWare 5 to NetWare 6?
- What are the strengths of NetWare network operating system?
- What functionality does NDS and eDirectory provide?
- What significant differences were introduced in NetWare 4?
- Which NetWare versions support TCP/IP?

Time

About 50 minutes

Section 6.6: Linux Installation

Preparation

In this section students will learn how to install a SUSE distribution of Linux server. Students will learn how to prepare the system before the installation, complete the installation, and what to do after the installation.

Server+ Objectives

- 3.3 Install NOS.

Lecture Focus Questions:

- What challenges does the open source distribution model present when installing Linux servers?
- How should the IP address be assigned to a server?
- What are the strengths of Linux as a network operating system?
- How does Samba provide file and print services for Linux servers?
- How does the Password File method of authentication differ from the Open LDAP method? Which is recommended for servers?

Time

About 45 minutes

Section 7.1: Upgrades

Preparation

This section discusses general upgrade procedures that should be followed when upgrading any server component: backing up data, setting up a test lab, completing installation, verifying system works properly, redeploying the system, verifying functionality, and documenting the details of the upgrade.

Server+ Objectives

- 4.2 Add processors.
 - Activities include:
 - Perform upgrade checklist, including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade
- 4.3 Add hard drives.
 - Activities include:
 - Perform upgrade checklist, including:
 - Locate/obtain latest drivers, OS updates, software, etc
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Importance and use of maintenance logs and service logs (documentation)
 - 4.4 Increase memory.
 - Supporting knowledge includes:
 - Perform upgrade checklist including
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues
 - Test and pilot

- Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Importance and use of maintenance logs and service logs (documentation)
- 4.5 Upgrade BIOS/firmware.
 - Activities include:
 - Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Importance and use of maintenance logs and service logs (documentation)
- 4.6 Upgrade adapters (e.g., NICs, SCSI cards, RAID, etc.).
 - Supporting knowledge includes:
 - Perform backup
 - Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues.
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Importance and use of maintenance logs and service logs (documentation)
- 4.7 Upgrade peripheral devices, internal and external. Verify appropriate system resources (e.g., expansion slots, IRQ, DMA, etc.).
 - Activities include:
 - Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues

- Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Potential effects on performance of adding devices
 - Importance and use of maintenance logs and service logs (documentation)
 - Validation via hardware compatibility list, tips, documentation and FAQ's.
- 4.8 Upgrade system monitoring agents.
 - Activities include:
 - Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues.
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Importance and use of maintenance logs and service logs (documentation)
- 4.9 Upgrade service tools (e.g., diagnostic tools, EISA configuration, diagnostic partition, SSU, etc.).
 - Activities include:
 - Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Most utilities are vendor specific
 - Importance and use of maintenance logs and service logs (documentation)
- 4.10 Upgrade UPS.
 - Activities include:

- Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
- Supporting knowledge includes:
 - Importance and use of maintenance logs and service logs (documentation)

Lecture Focus Questions:

- What are suggested steps for researching a proposed upgrade?
- How should drivers be obtained?
- What are guidelines for taking the server out of production?
- When should baselines be obtained on an upgraded system?
- What steps should be performed after the system upgrade is installed and tested?

Time

About 20 minutes

Section 7.2: CPUs

Preparation

This section discusses the considerations when upgrading a CPU in a server. Students must understand the *N+1 Stepping* to recognize the revision number of a CPU. They will also learn the procedures for upgrading a single CPU and upgrading a multi CPU system.

Server+ Objectives

- 4.2 Add processors.
 - Activities include:
 - On single processor upgrade, verify compatibility
 - Verify N+1 stepping
 - Verify speed and cache matching
 - Perform BIOS upgrade
 - Perform OS upgrade to support multiprocessors
 - Ensure proper ventilation
 - Perform upgrade checklist, including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade
 - Supporting knowledge includes:
 - What it means to verify stepping

Lecture Focus Questions:

- What are considerations for selecting a CPU to upgrade a system?
- How does CPU utilization for a server differ from a workstation?
- What is N + stepping? How does it affect upgrading CPUs?
- How can the BIOS affect a CPU upgrade?
- What software considerations must be made when upgrading to a multiple CPU system?

Time

About 40 minutes

Lab/Activity

- Upgrade a Processor

- Identify Processor Stepping
- Add a Second Processor

Section 7.3: Memory

Preparation

This section covers upgrading memory on a server. This will include considerations before you start, issues when selecting memory, and concerns when physically replacing memory. Students will learn how to identify and install the correct memory for a given scenario.

Server+ Objectives

- 4.4 Increase memory.
 - Supporting knowledge includes:
 - Verify hardware and OS support for capacity increase
 - Verify memory is on hardware/vendor compatibility list
 - Verify memory compatibility
 - Speed
 - Brand
 - Capacity
 - EDO
 - DDR
 - RAMBUS
 - ECC/non-ECC
 - SDRAM/RDRAM
 - Verify that server and OS recognize the added memory
 - Perform server optimization to make use of additional RAM (BIOS and OS level)
 - Supporting knowledge includes:
 - Number of pins on each type of memory
 - How servers deal with memory pairings
 - Importance and use of maintenance logs and service logs (documentation)

Lecture Focus Questions:

- How can you increase memory capacity without adding memory?
- In what type of implementations is using generic memory usually acceptable?
- What compatibility factors between motherboard and memory should be checked before upgrading memory?
- How does pairing work when installing memory?
- What is the importance of pin 1 when installing memory?

Time

About 35 minutes

Lab/Activity

- Upgrade DDR
- Install Additional Memory

Section 7.4: BIOS

Preparation

This section covers flashing the BIOS to erase the flash ROM chip and loading the new BIOS on the chip. Students are warned to keep the power supply constant during the update process.

Server+ Objectives

- 2.1 Conduct pre-installation planning activities.
 - Supporting knowledge includes:
 - How to get drivers and BIOS updates
- 3.1 Check/upgrade BIOS/firmware levels (system board, RAID controller, hard drive, etc.).
- 4.5 Upgrade BIOS/firmware.
 - Activities include:
 - Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - When BIOS/firmware upgrades should be performed
 - How to obtain the latest firmware
 - Be aware that most hardware companies include self-installing installation applications for their components
 - Implications of a failed firmware upgrade
 - Multi-BIOS systems
 - Firmware recovery options available
 - Backup flashing (when applicable)
 - Failed flash implies inoperable device
 - Issues surrounding multi-BIOS systems (how to properly upgrade, etc.)
 - Need to follow manufacturers flash instructions
 - Importance and use of maintenance logs and service logs (documentation)

Lecture Focus Questions:

- What does flashing the BIOS do?

- When should the BIOS be flashed?
- Why is it sometimes necessary to change the boot order when updating the BIOS?
- How do you determine the version of the BIOS you are using?
- What consideration must be made for EPROM chips?

Time

About 15 minutes

Section 7.5: Storage

Preparation

This section discusses the procedures for upgrading or adding hard disks to a server and focuses on considerations related to upgrading a RAID array or RAID controller. Students will learn how to expand an existing array, replace a failed drive, and add a drive to an array.

Server+ Objectives

- 4.3 Add hard drives.
 - Activities include:
 - Verify that drives are the appropriate type
 - Confirm SCSI termination and cabling
 - For ATA/IDE drives, confirm cabling, master/slave and potential cross-brand compatibility
 - Verify connections on serial ATA drives
 - Upgrade mass storage
 - Make sure the RAID controller can support additions
 - Add drives to array
 - Replace existing drives
 - Integrate into storage solution and make it available to the operating system
 - Perform upgrade checklist, including:
 - Locate/obtain latest drivers, OS updates, software, etc
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Available types of hard drive array additions and when they are appropriate
 - Expansions
 - Extensions
 - What “hot-swappable” means
 - Difference between a RAID partition and an OS partition
 - Importance and use of maintenance logs and service logs (documentation)

Lecture Focus Questions:

- What are the guidelines for selecting disks to add to an array?
- What benefit does OCE provide?
- What is the impact of restriping a RAID array?
- When is restriping necessary?
- What is the relationship between the speed of the disk controller and disk drive?
- What considerations are specific to ATA drive installation? SCSI? SATA?

Time

About 35 minutes

Lab/Activity

- Create a RAID 10 Array
- Add a Hotfix Drive

Section 7.6: Components

Preparation

This section discusses installing hardware updates for server components (software embedded in devices) such as BIOS, firmware, software drivers, RAID board BIOS, hard disk and optical drives. It also discusses issues and procedures for upgrading an expansion board and peripheral devices connected to a server. Students will practice updating a driver.

Server+ Objectives

- 4.6 Upgrade adapters (e.g., NICs, SCSI cards, RAID, etc.).
 - Supporting knowledge includes:
 - Perform backup
 - Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues.
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Available bus types
 - PCI-X
 - PCI –Express
 - Hot swap PCI
 - PCI (bus architecture, bus speed)
 - EISA
 - Implementation of hot swappable PCI in servers
 - Implications on the array of changing RAID controller types
 - Characteristics of SCSI
 - Levels
 - Cabling
 - Termination
 - Signaling
 - Importance and use of maintenance logs and service logs (documentation)
- 4.7 Upgrade peripheral devices, internal and external. Verify appropriate system resources (e.g., expansion slots, IRQ, DMA, etc.).
 - Peripheral devices include:

- Disk drives
- Backup devices
- Optical devices
- KBM devices
- Resources include:
 - Expansion slots
 - IRQ
 - DMA
 - SCSI Ids
 - Expansion cards
- Activities include:
 - Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
- Supporting knowledge includes:
 - Potential effects on performance of adding devices
 - Importance and use of maintenance logs and service logs (documentation)
 - Validation via hardware compatibility list, tips, documentation and FAQ's.

Lecture Focus Questions:

- How can you avoid problems that updating firmware can potentially cause?
- How can you check system resources when using Windows Server 2003?
- What considerations does upgrading RAID boards present?
- How does drive geometry affect upgrading RAID controllers and boards?
- Why would you choose to upgrade a serial or parallel device to USB or Firewire?
- How does installing serial, parallel or SCSI devices differ from USB or Firewire?

Time

About 45 minutes

Lab/Activity

- Update a Driver

Section 7.7: Operating System

Preparation

This section provides an overview of the process for installing operating system updates. Students will learn how to install operating system updates for Linux, NetWare, and Windows operating system. They will practice configuring automatic updates.

Server+ Objectives

- 3.5 Install NOS and driver updates to design specifications.
 - Activities include:
 - Obtain update
 - Ensure that there is a backup and recovery plan
 - Make sure that the old drivers are available for reinstallation
 - Lab testing
 - Installation
 - Testing
 - Supporting knowledge includes:
 - Know how to obtain OS updates
 - Why updates might be needed
 - How updates can be used
 - How to decide whether an update is necessary

Lecture Focus Questions:

- Why is it important to install operating system updates?
- What is the process for installing operating system updates?
- What automatic update options allow you to maintain control of the update process?
- How does updating NetWare differ from updating Windows?

Time

About 25 minutes

Lab/Activity

- Configure Automatic Updates

Section 7.8: Software

Preparation

In this section students will learn the correct procedures to update system monitoring agents and system service tools. System monitoring agents provide valuable information about system devices to help determine if the system is working properly. The upgrade process for system monitoring agents will be different depending upon if the monitoring system is software-based or hardware-based. System service tools may include: a configuration utility, motherboard BIOS, SCSI configuration utility, and RAID configuration utility. Students are advised to periodically visit the vendor's site to check for updates and upgrade the tools when new updates are provided.

Server+ Objectives

- 3.5 Install NOS and driver updates to design specifications.
 - Activities include:
 - Obtain update
 - Ensure that there is a backup and recovery plan
 - Make sure that the old drivers are available for reinstallation
 - Lab testing
 - Installation
 - Testing
 - Supporting knowledge includes:
 - Know how to obtain OS updates
 - Why updates might be needed
 - How updates can be used
 - How to decide whether an update is necessary

Lecture Focus Questions:

- What is the process for upgrading hardware-based monitoring systems?
- What is the importance of updating service tools?
- What steps should you follow to upgrade system monitoring agents?
- Why is it important to monitor system monitoring agents in a production environment?
- How can you determine the impact of newly-installed system monitoring agents?

Time

About 20 minutes

Section 7.9: UPS

Preparation

This section discusses the importance of a properly functioning UPS. Students will learn important factors to consider when upgrading a server UPS as well as the procedure for upgrading a UPS.

Server+ Objectives

- 4.10 Upgrade UPS.
 - Activities include:
 - Firmware updates
 - Battery replacement
 - Battery disposal
 - Determine physical requirements
 - Determine load requirements
 - Verify whether UPS supports hot swap replacement
 - Perform upgrade checklist including:
 - Locate/obtain latest drivers, OS updates, software, etc.
 - Review FAQs, instruction, facts and issues
 - Test and pilot
 - Schedule downtime
 - Implement ESD best practices
 - Confirm that upgrade has been recognized
 - Review and baseline
 - Document upgrade.
 - Supporting knowledge includes:
 - Some UPS support hot swap battery replacement
 - Some UPS support smart cabling
 - What can be upgraded
 - UPS MIBs
 - Management card
 - Management software
 - Importance and use of maintenance logs and service logs (documentation)

Lecture Focus Questions:

- How do you determine the load requirement for a UPS?
- What impact does adding a second server have on the capacity of a UPS system?
- What considerations should be made for determining server load requirements when choosing a UPS?

- How does the operating system influence your choice of UPS?
- What advantage does SNMP agent compatibility with a UPS system offer?
- What advantage does a hot-swappable UPS system offer?

Time

About 20 minutes

Section 8.1: Troubleshooting Process

Preparation

In this section students will learn the importance of using a methodical and organized approach to troubleshoot problems. They will also learn how to use online troubleshooting resources such as knowledge bases created by hardware and software vendors and search engines to identify the cause and resolution of a known problem.

Server+ Objectives

- 7.1 Perform problem determination
 - Activities include:
 - Problem isolation
 - Determine whether the problem is hardware or software related
 - Use questioning techniques to determine what, how, when.
 - Identify contact(s) responsible for problem resolution
 - Use senses to observe problem (e.g., smell of smoke, observation of unhooked cable, etc.)
 - Bringing it down to base
 - Removing one component at a time
- 7.2 Use diagnostic hardware and software tools and utilities.
 - Activities include:
 - Use documentation from previous technician successfully
 - Locate and effectively use hot tips (e.g., fixes, OS updates, E-support, web pages, CDs)
 - Gather resources to get problem solved:
 - Identify situations requiring call for assistance
 - Acquire appropriate documentation
 - Supporting knowledge includes:
 - Importance and use of maintenance logs and service logs (documentation)

Lecture Focus Questions:

- What are examples of obvious problems in a troubleshooting process?
- How can server documentation help with troubleshooting?
- After diagnosing a problem, what steps should a repair implementation plan include?
- What role should knowledge bases play in troubleshooting server problems?
- What are disadvantages of using telephone support?

Time

About 25 minutes

Section 8.2: Server Shutdown

Preparation

This section discusses proper shutdown procedures for servers to avoid data loss or corruption. Students will learn how to shutdown a Linux, NetWare and Windows server.

Server+ Objectives

- 7.2 Use diagnostic hardware and software tools and utilities.
 - Activities include:
 - Perform shut down across the following OSs: Microsoft Windows NT/2000/2003, Novell NetWare, UNIX, Linux
 - Supporting knowledge includes:
 - NOS shutdown procedures
 - Novell NetWare
 - Microsoft Windows NT/2000/2003
 - UNIX/Linux

Lecture Focus Questions:

- What is *flushing cache*?
- What should be the first step in planning a server shutdown?
- How can you use Computer Management in Windows Server systems to assist in server shutdown?
- When would you use the Linux *init0* command instead of *init6*?
- How can you specify the number of minutes before shutdown when using Linux?

Time

About 35 minutes

Lab/Activity

- Shut Down Linux

Section 8.3: System Logs

Preparation

This section discusses using system log files to monitor and troubleshoot networks. It examines the different system log files stored on Windows, NetWare, and Linux systems. Students will learn how to use Event Viewer to view Windows system logs. They will also learn how to view Linux and NetWare log files.

Server+ Objectives

- 3.6 Install service tools (SNMP, backup software, system monitoring agents, event logs, etc.).
 - Service tools include:
 - Event logs
 - Supporting knowledge includes:
 - Purpose of event logs
- 7.2 Use diagnostic hardware and software tools and utilities.
 - Activities include:
 - Interpret error logs, operating system errors, health logs, and critical events

Lecture Focus Questions:

- How are the contents of the application log determined?
- Which log file contains a record of the opening and closing of files?
- When does a server have a directory service log?
- Which types of events are user-defined?
- Which command allows you to view the most recent entries in the Linux messages file?
- What does the Linux `less` option allow you to do?

Time

About 35 minutes

Section 8.4: Resources

Preparation

This section discusses various troubleshooting resources that are available for the server administrator to speed up the troubleshooting process. These resources include: peers, knowledge bases, FAQs (frequently asked questions), search engines, forums, online support, and telephone technical support. Students will learn how to view resources for Linux, NetWare and Windows systems.

Server+ Objectives

- 7.2 Use diagnostic hardware and software tools and utilities.
 - Activities include:
 - Use documentation from previous technician successfully
 - Locate and effectively use hot tips (e.g., fixes, OS updates, E-support, web pages, CDs)
 - Gather resources to get problem solved:
 - Identify situations requiring call for assistance
 - Acquire appropriate documentation

Lecture Focus Questions:

- What is the typical source of knowledge base information?
- How do knowledge bases and FAQs differ?
- What are advantages of vendor-sponsored forums?
- How do vendor-sponsored forums differ from online support?
- Why is it suggested that you do your own research and apply updates before calling a vendor for support?
- Why do some system administrators prefer a text-based user interface for viewing system resources?

Time

About 25 minutes

Section 8.5: Networking

Preparation

In this section students will learn how to use networking tools to find information about Windows, Linux, and NetWare. Students will become familiar with ifconfig, ipconfig, Ping, and traceroute.

Server+ Objectives

- 7.2 Use diagnostic hardware and software tools and utilities.
 - Supporting knowledge includes:
 - Know common diagnostic tools
 - PING
 - IPCONFIG
 - TRACEROUTE
 - TELNET

Lecture Focus Questions:

- How does ifconfig differ from ipconfig?
- How are network adapters identified in ifconfig?
- Which command do you use to determine if IP routing is configured on a Windows server?
- Which command do you use to test communication between two servers?
- When do you use traceroute?

Time

About 40 minutes

Lab/Activity

- Find Windows Information
- Find Linux Information
- Find Path Information 1
- Find Path Information 2

Section 8.6: Storage

Preparation

This section discusses recovering from different types of RAID array failures. Students will learn how to recover a failed RAID array and repair a RAID volume.

Server+ Objectives

- 4.6 Upgrade adapters (e.g., NICs, SCSI cards, RAID, etc.).
 - Supporting knowledge includes:
 - Implications on the array of changing RAID controller types

Lecture Focus Questions:

- In which situations will a mirror need to be broken?
- What happens to availability when a disk in a mirrored set fails?
- How can you tell that drive in a striped set with parity has failed?
- What do you need to do if you're using a spare cold drive to replace a failed drive in an array?

Time

About 30 minutes

Lab/Activity

- Recover a RAID Array from a Disk Failure
- Repair a RAID Volume
- Recover a Failed Mirrored Volume