Updated 8/27/06 - Dirksen

NIACC
COURSE SYLLABUS

NET-233
CISCO Switches
Credit Hours: 4
Prerequisites: NET-223 CISCO Routing
Website: http://www.niaccist.niacc.edu/

Instructors Information

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COURSE DESCRIPTION

Switching Basics and Intermediate Routing is the third of four courses leading to the Cisco Certified Network Associate (CCNA) designation. Cisco Switches (CCNA 3) focuses on advanced IP addressing techniques (Variable Length Subnet Masking [VLSM]), intermediate routing protocols (RIP v2, single-area OSPF, EIGRP), command-line interface configuration of switches, Ethernet switching, Virtual LANs (VLANs), Spanning Tree Protocol (STP), and VLAN Trunking Protocol (VTP). Particular emphasis is given to students being able to demonstrate the ability to apply learning from CCNA 1 and 2 to a network and to be able to explain how and why a particular strategy is employed. (60-0)

REQUIRED COURSE MATERIALS

Text: CCNA Guide to Cisco Networking, Second Edition
Authors: Kurt Hudson, Kelly Cannon, Kelly Caudle
ISBN: 0-619-03477-7 © 2003
Pub date: 8/2/2002

Other: 3 ring binder and paper and /or good quality bond notebook for Engineering Journal
1 or more 3 1/2" floppy diskette, Headset

EVALUATION PROCEDURES

Grade Breakdown	Approx. points	Minimum required *
Assessment Exams	45	70% average*
Assessment Final	100	70%*
Midterm	75	
Skilled Activities / Hands on Final **	50	Pass / Fail*
Presentation / Report (Case Study)	50	
Engineering Journal	20	
Work Experience	30	Pass / Fail*
Lab Activities	30	Pass / Fail*

Grading Scale	
A	93% - 100%
A -	90% - 92%
B+	87% - 89%
B	83% - 86%
B-	80% - 82%
C+	77% - 79%
C	73% - 76%
C-	70% - 72%
D+	67% - 69%
D	63% - 66%
D -	60% - 62%
F	59 & Below

** To be able to advance to next NET-243 Wide Area Networking (WAN)*
Case Study - Network design project
*** highest possible score on Skills Based Exam retake is 70 %*
Above policies can be adjusted upon individual instructor's discretion

ENGINEERING JOURNAL

Each student must maintain a journal. It must be a 3 ring binder with tabs indicating the five main points shown below. It will be a combination of hand written information and some typed information.

Identification

- Title, name, personal contact information, table of contents, evaluations, course information, professional statement (signed), dates, journal evaluations, and other materials related to the course.

Procedures

- Access Curriculum, both sites / Assessments / view assessment results / File management
- Configuration workstation to connect to a network / Basic LAN setup
- Conversions (binary, decimal, hexadecimal)
- Cabling and pin layouts
- IP addressing and subnets
- Use of Network Inspector and Protocol Analyzer
- Basic troubleshooting steps 1
- Configure passwords on a router allowing access (console, telnet, privileged mode)
- Configure router serial interfaces for WAN communication across an HDLC connection using TCP/IP protocol
- Configure router Ethernet interfaces for LAN communication using TCP/IP
- Configure routing protocol RIP
- Configure routing protocol IGRP
- Password recovery, Cisco 2500 router
- Upload/download ISO images (tftp)
- Create Access Control List (ACL), standard and extended
- Apply ACL to an interface
- Basic troubleshooting steps 2
- IP addressing using VLSM (classless routing)
- Configure routing protocol RIPv2
- Configure routing protocol OSPF in a single area
- Configure routing protocol EIGRP
- Basic switch configuration (passwords, name, …)
- Configure static VLANs on a Cisco Catalyst Switch
- Configure trunking between switches
- Configuring Inter-VLAN routing
- Basic troubleshooting steps 3

Notes

- Curriculum materials
- Reviews
- Questions missed on exams and topic it covered

Lab Log

- Date and participants recorded on the lab handout or in journal if no handout provided.
- Fill out lab handout in your journal.
- Fill in IST log information for each lab.
- Mark your lab handout that the logbook has been filled in per lab.

The journal will be evaluated based on the following:

- Chronological or topical order - maintain consistency in organization - tabs to identify sections
- Efficiency - well labeled and easy to use - can be used to solve a problem.
- Contains the 4 main points above
- Neat and Professional

These items will be evaluated on a scale of 1 to 5 as listed below:

1. very little signs of item covered
2. some requirements present but not fulfilled
3. requirements minimally fulfilled
4. good job of fulfilling the requirements
5. excellent work done with all requirements fulfilled

CABLING

- Passes cable test
- Jacket (shielding) has to be in the connector and compressed
- Ability to see all the coloring on the end
- Follows standards (right sequence)

WORK EXPERIENCE

Students are required to work in the technology field for 20 hours. This work can be for any business but must be approved by the instructor. The student should journal (hand written) the work. This will include the following information to be record in an internship logbook.

- Date, Location, Supervisor, Hours
- What type of work did you do?
- What did you experience?
- Was it a worthwhile experience? (scale 1 to 5, 5 being excellent)
- What did you anticipate learning or achieving in your internship?
- Did you accomplish it?

Items that must be considered:

- ❑ Only work experience hours completed during the term may be used to meet the requirement prearranged with an IST instructor.
- ❑ All work experience hours must be completed by one week prior to the end of the term of the course. Some hour must be completed by midterm.
- ❑ All work experience hours must be approved and validated by an IST instructor and entered in the Work Experience Log book on-line.
- ❑ Hours will be validated by the instructors upon completion of hours and submission of signed Work Experience form.
- ❑ All work experience hours are subject to approval by IST instructors.
- ❑ This is a pass / fail rubric. In order to pass you must complete both the following tasks
  - ❑ Correct number of hours
  - ❑ All log information correctly recorded

CASE STUDY

This is a project in which you design a network. The documentation for this project will be distributed later. The project is imbedded within the curriculum or a substitute will be given by the instructor. We will make adjustments to the project as the term progresses.

PORTFOLIO

Your portfolio is an accumulation of key pieces of work that you have done related to technology. It will also contain a current resume and your Case Study (CS) with documentation stating your part in the project and what you learned from doing the project. This information will be stored in an electronic form that is easy to navigate and use. It will be accessible from the web.

CLASSROOM POLICIES AND PROCEDURES

Refer to the NIACC Information Technology Professionalism statement. This can be located at http://www.niaccist.niacc.com/IT/policies/professionalism.pdf . Check with your instructor for further information.

TARGET AUDIENCE

Anyone desires a practical, technical introduction to the field of networking. High-school, community college, and lifelong-learning students interested in careers as network technicians, network engineers, network administrators, and network help-desk staff.

PREREQUISITES

- Students should have Reading Age Level (RAL) of 13.
- Successful completion of CCNA 2.

COURSE OBJECTIVES

The CCNA certification indicates knowledge of networking for the small-office, home-office (SOHO) market and the ability to work in small businesses or organizations whose networks have fewer than 100 nodes. A CCNA certified individual can:

- Install and configure Cisco switches and routers in multiprotocol internetworks using LAN and WAN interfaces
- Provide Level 1 troubleshooting service
- Improve network performance and security
- Perform entry-level tasks in the planning, design, installation, operation and troubleshooting of Ethernet, TCP/IP Networks.

CCNA 3 is an integral step towards achieving CCNA Certification.
Upon completion of this course, students will be able to perform tasks related to:

- Variable Length Subnet Masking (VLSM)
- Intermediate routing protocols (RIP v2, single-area OSPF, EIGRP)
- Switching Concepts
- Switches
- Switch Configuration
- Spanning Tree Protocol (STP)
- Virtual LANs (VLANs)
- VLAN Trunking Protocol (VTP)

CERTIFICATION ALIGNMENT

The curriculum is aligned with ILSGs CCNAB and ICND courses and the upcoming xxx exams.

COURSE OVERVIEW

The course has been designed for 70 contact hours. Approximately 35 hours will be designated to lab activities and 35 hours on curriculum content. A case study on structured cabling is required, but format and timing are determined by the Local Academy.

What has changed from CCNA versions 2.x?

- Removal of IPX, Network Management, and TCS Chapters
- Case study required; format and timing determined by Local Academy
- IGRP and Access Lists moved to CCNA 2
- Addition of VLSM (IP Address technique for "subnetting subnets")
- Addition of RIP v2, EIGRP, and Single-Area OSPF routing protocols
- Addition of CLI configuration of switches
- Additional material on VLANs and VTP
- More interactive Flash activities
- Sequence of > 40 eLabs
- Lab focus on intermediate routing and command-line interface configuration of switches

COURSE OUTLINE

Module 1. Introduction to Classless Routing

Overview

1.1 VLSM

- 1.1.1 What is VLSM and Why Use It?
- 1.1.2 A waste of space (IP addresses)
- 1.1.3 When to use VLSM
- 1.1.4 Calculating subnets with VLSM
- 1.1.5 Route aggregation with VLSM
- 1.1.6 Configuring VLSM

1.2 RIP Version 2

- 1.2.1 RIP history
- 1.2.2 RIP v2 features
- 1.2.3 Comparing RIP v1 and v2
- 1.2.4 Configuring RIP v2
- 1.2.5 Verifying RIP v2
- 1.2.6 Troubleshooting RIP v2
- 1.2.7 Default routes

Summary

Module 2. Single-Area OSPF

Overview

2.1 Link State Routing Protocol

- 2.1.1 Overview of link state routing
- 2.1.2 Link state routing features
- 2.1.3 How routing information is maintained

2.1.4 Link state routing algorithms
2.1.5 Benefits and problems with link state routing
2.1.6 Compare and contrast distance vector and link state routing
2.2 Single Area OSPF Concepts
2.2.1 OSPF overview
2.2.2 OSPF terminology
2.2.3 Comparing OSPF with distance vector routing protocols
2.2.4 Shortest path algorithm
2.2.5 OSPF network types
2.2.6 OSPF Hello protocol
2.2.7 Steps in operation of OSPF
2.3 Single Area OSPF Configuration
2.3.1 Configuring the OSPF routing process
2.3.2 Configuring OSPF loopback address and router priority
2.3.3 Modifying OSPF cost metric
2.3.4 Configuring OSPF authentication
2.3.5 Configuring OSPF timers
2.3.6 OSPF propagating a default route
2.3.7 Common OSPF configuration Issues
2.3.8 Verifying the OSPF configuration
Summary

Module 3. EIGRP

Overview
3.1 EIGRP Concepts
3.1.1 Comparing EIGRP with IGRP
3.1.2 EIGRP concepts and terminology
3.1.3 EIGRP design Features
3.1.4 EIGRP technologies
3.1.5 EIGRP data structures
3.1.6 EIGRP algorithm
3.2 EIGRP Configuration
3.2.1 Configuring EIGRP
3.2.2 Configuring EIGRP summarization
3.2.3 Verifying basic EIGRP
3.2.4 Building neighbor tables
3.2.5 Discover routes
3.2.6 Select routes
3.2.7 Maintaining routing tables
3.3 Troubleshooting Routing Protocols
3.3.1 Routing protocol troubleshooting process
3.3.2 Troubleshooting RIP configuration
3.3.3 Troubleshooting IGRP configuration
3.3.4 Troubleshooting EIGRP configuration
3.3.5 Troubleshooting OSPF configuration
Summary

Module 4. Switching Concepts

Overview
4.1 Introduction to Ethernet/802.3 LANs
4.1.1 Ethernet/802.3 LAN development
4.1.2 Factors that impact on network performance

4.1.3 Elements of Ethernet/802.3 networks
4.1.4 Half-Duplex networks
4.1.5 Network congestion
4.1.6 Network latency
4.1.7 Ethernet 10BASE-T transmission time
4.1.8 The benefits of using repeaters
4.1.9 Full-duplex transmitting

4.2 Intro to LAN Switching
4.2.1 LAN segmentation
4.2.2 LAN segmentation with bridges
4.2.3 The advantages and disadvantages of LAN segmentation with routers
4.2.4 The advantages and disadvantages of LAN segmentation with switches
4.2.5 Describe the basic operations of a switch
4.2.6 Ethernet switch latency
4.2.7 Layer 2 and Layer 3 switching
4.2.8 Symmetric and asymmetric switching
4.2.9 Memory buffering
4.2.10 Two switching methods

4.3 Switch Operation
4.3.1 Functions of Ethernet switches
4.3.2 Frame transmission modes
4.3.3 How switches and bridges learn addresses part 1
4.3.4 How switches and bridges filter frames
4.3.5 LAN segmentation using bridging
4.3.6 Microsegmentation
4.3.7 Microsegmentation Implementation
4.3.8 Switches and collision domains
4.3.9 Switches and broadcast domains
4.3.10 Communications between switches and workstations

Summary

Module 5. Switches

Overview

5.1 LAN Design
5.1.1 LAN design goals
5.1.2 LAN design considerations
5.1.3 LAN design methodology
5.1.4 Layer 1 design
5.1.5 Layer 2 design
5.1.6 Layer 3 design

5.2 LAN Switches
5.2.1 Switched LANs, access layer overview
5.2.2 Access layer switches
5.2.3 Distribution layer overview
5.2.4 Distribution layer switches
5.2.5 Core layer overview
5.2.6 Core layer switches

Summary

Module 6. Switch Configuration

Overview

6.1 Starting the Switch
6.1.1 Physical startup of the Catalyst switch

6.1.2 Switch LED indicators
6.1.3 Verifying port LEDs during switch POST
6.1.4 Viewing initial bootup output from the switch
6.1.5 Examining keyboard help in the switch command-line interface
6.1.6 Showing the switch initial startup status
6.2 Configuring the Switch
6.2.1 Verifying the Catalyst switch default configuration
6.2.2 Configuring the Catalyst switch
6.2.3 Managing the MAC address table
6.2.4 Configuring static MAC addresses
6.2.5 Configuring port security
6.2.6 Executing adds, moves, and changes
6.2.7 Managing switch operating system images and device configuration files
6.2.8 1900/2950 password recover
6.2.9 1900/2900 firmware upgrade
Summary

Module 7. Spanning Tree Protocol

Overview
7.1 Redundant Topologies
7.1.1 Redundancy
7.1.2 Redundant topologies
7.1.3 Redundant switched topologies
7.1.4 Broadcast storms
7.1.5 Multiple fame transmissions
7.1.6 MAC database instability
7.2 STP Overview
7.2.1 Redundant topology and spanning tree
7.2.2 Spanning Tree Protocol
7.2.3 Spanning tree operation
7.2.4 Selecting a root bridge
7.2.5 Stages of spanning tree port states
7.2.6 Spanning tree recalculation
7.2.7 Rapid Spanning Tree Protocol
Summary

Module 8. VLANs

Overview
8.1 VLAN Concepts
8.1.1 VLAN introduction
8.1.2 Broadcast domains with VLANs and routers
8.1.3 VLAN operation
8.1.4 Benefits of VLANs
8.1.5 VLAN types
8.2 VLAN Configuration
8.2.1 VLAN basics
8.2.2 Geographic VLANs
8.2.3 Configuring static VLANs
8.2.4 Verifying VLAN configuration
8.2.5 Saving VLAN configuration
8.2.6 Deleting VLANs
8.3 Troubleshooting VLANs
8.3.1 Overview

8.3.2 VLAN troubleshooting process
8.3.3 Preventing broadcast storms
8.3.4 Troubleshooting VLANs
8.3.5 VLAN troubleshooting scenarios
Summary

Module 9. VTP

Overview
9.1 Trunking
9.1.1 History of trunking
9.1.2 Trunking concepts
9.1.3 Trunking operation
9.1.4 VLANs and trunking
9.1.5 Trunking implementation
9.2 VTP
9.2.1 History of VTP
9.2.2 VTP concepts
9.2.3 VTP operation
9.2.4 VTP implementation
9.2.5 VTP configuration
9.3 Inter-VLAN Routing
9.3.1 VLAN overview
9.3.2 Introducing Inter-VLAN routing
9.3.3 Inter-VLAN issues and solutions
9.3.4 Physical, logical, and virtual interfaces
9.3.5 Dividing physical interfaces into subinterfaces
9.3.6 Configuring Inter-VLAN routing
Summary

Case Study:

MODULE 1 - 9 LABS

Module 1: Introduction to Classless Routing
1.1.4 Lab Exercise: Calculating VLSM Subnets
In this lab, students will use variable-length subnet mask (VLSM) to support more efficient use of the assigned IP addresses and to reduce the amount of routing information at the top level.
1.2.3 Lab Exercise: Review of Basic Router Configuration with RIP
In this lab, the students will setup an IP addressing scheme using Class B networks and configure Routing Information Protocol (RIP) on routers.
1.2.3 e-Lab Activity: Review of Basic Router Configuration including RIP
In this lab, the students will review the basic configuration of routers.
1.2.4 Lab Exercise: Converting RIP v1 to RIP v2
In this lab, the students will configure RIP v1 on the routers and then convert to RIP v2.
1.2.4 e-Lab Activity: Converting RIP v1 to RIP v2
In this lab, the student will configure RIP v1 and then convert to RIP v2.
1.2.5 Lab Exercise: Verifying RIP v2 Configuration
In this lab, the students will configure RIP v1 and v2 on routers and use show commands to verify RIP v2 operation.
1.2.6 Lab Exercise: Troubleshooting RIP v2 using debug
In this lab, the students will use debug commands to verify proper RIP operation and analyze data transmitted between routers.
1.2.6 e-Lab Activity: RIP v2 using debug
In this lab, the students will enable routing on the router, save the configuration, and ping interfaces on routers.

Module 2: Single-Area OSPF
2.3.1 Lab Exercise: Configuring the OSPF Routing Process
In this lab, students will setup an IP addressing scheme for OSPF area 0 and configure and verify OSPF routing.

2.3.2 Lab Exercise: Configuring OSPF with Loopback Addresses
In this lab, students will configure OSPF Loopback addresses and observe the election process.
2.3.3 Lab Exercise: Modifying OSPF Cost Metric
In this lab, students will setup an Open Shortest Path First (OSPF) area.
2.3.3 e-Lab Activity: Modifying OSPF Cost Metric
In this lab, the student will modify the OSPF cost metric.
2.3.4 Lab Exercise: Configuring OSPF Authentication
In this lab, students will introduce OSPF authentication into the area.
2.3.4 e-Lab Activity: Configuring OSPF Authentication
In this lab, the student will setup an IP addressing scheme for OSPF area, configure and verify OSPF routing, and introduce OSPF authentication in to the area.
2.3.5 Lab Exercise: Configuring OSPF Timers
In this lab, students will setup OSPF timers.
2.3.5 e-Lab Activity: Configuring OSPF Timers
In this lab, the student will adjust OSPF timers to maximize efficiency of the network.
2.3.6 Lab Exercise: Propagating Default Routes in an OSPF Domain
In this lab, students will configure the OSPF network so that all hosts in the OSPF area can connect to outside networks.
2.3.6 e-Lab Activity: Propagate Default Route Information in an OSPF Domain
In this lab, the student will configure the OSPF network so that all hosts in the OSPF area can connect to outside networks.

Module 3: EIGRP
3.2.1 Lab Exercise: Configuring EIGRP Routing
This lab is to setup an IP addressing scheme for the network.
3.2.1 e-Lab Activity: Configuring EIGRP
In this lab, the student will configure EIGRP routing.
3.2.3 Lab Exercise: Verifying Basic EIGRP Configuration
This lab is to setup an IP addressing scheme for the network and to verify EIGRP configuration.
3.2.3 e-Lab Activity: Verifying Basic EIGRP
In this lab, the student will configure and verify EIGRP Routing.

Module 4: Switching Concepts
There are no labs for this module.

Module 5: Switches
There are no labs for this module.

Module 6: Switch Configuration
- 1.6.1 Catalyst 2950T and 3550 Series Basic Setup
- 1.6.2 Catalyst 2950T and 3550 Configuration and IOS Files
- 1.6.3 Catalyst 2950T and 3550 Series Password Recovery

6.2.1 e-Lab Activity: Basic Switch Operation
In this lab, the student will look at the configuration of a 2950 switch.
6.2.2 e-Lab Activity: Basic Switch Configuration
6.2.3 e-Lab Activity: Managing the MAC Address Tables
In this lab, the student will observe and clear the MAC address table.
6.2.4 e-Lab Activity: Configuring Static MAC Addresses
In this lab, the student will configure port security on individual FastEthernet ports.
6.2.5 e-Lab Activity: Configuring Port Security
In this lab, the student will reset the console password and recover access to the switch.
6.2.6 e-Lab Activity: Add, Move, and Change MAC Addresses on the Switch
In this lab, the student will add a MAC address to the switch, then move the address, and change it.
6.2.7 e-Lab Activity: Managing the Switch Operating System File
In this lab, the student will move files to and from the switch using a TFTP server.
6.2.7 e-Lab Activity: Managing the Startup Configuration File
In this lab, the student will move files to and from the switch using a TFTP server.
6.2.8 e-Lab Activity: Password Recovery Procedure on a 2900 Series Switch
In this lab, the student will go through the procedure for password recovery.

6.2.9 e-Lab Activity: Firmware Upgrade of a Catalyst 2950 Series Switch
In this lab, the student will upgrade the firmware of the switch.

Module 7: Spanning-Tree Protocol
7.2.4 Lab Exercise: Selecting the Root Bridge
In this lab, the student will create a basic switch configuration and verify it and determine which switch is selected as root switch with factory default settings.
7.2.4 e-Lab Activity: Selecting the Root Bridge
In this lab, the following functions will be performed. Verify configuration of hosts and switch by testing connectivity.
7.2.6 Lab Exercise: Spanning-Tree Recalculation
In this lab, the student will create a basic switch configuration and verify it and observe the behavior of spanning-tree algorithm in presence of switched network topology changes.
7.2.6 e-Lab Activity: Spanning-Tree Recalculation
In this lab, the students will create a basic switch configuration and verify it.

Module 8: Virtual LANs
8.2.3 e-Lab Activity: Configuring Static VLANs
In this lab, the students will create static VLANs.
8.2.4 e-Lab Activity: Verifying VLAN Configurations
In this lab, the students will create two separate VLANs on the switch.
8.2.6 e-Lab Activity: Deleting VLAN Configurations
In this lab, the students will delete a VLAN configuration.

Module 9: Virtual Trunking Protocol

2.9.1	Catalyst 2950T and 3550 Series Static VLANS
2.9.2	Catalyst 2950T and 3550 Series VTP Domain and VLAN Trunking
2.9.3	Catalyst 2950T and 3550 Series VTP Pruning
2.9.4	Catalyst 2950 and 3550 Series Intra-VLAN Security
4.3.1	Inter-VLAN Routing with an External Router
4.3.2	Inter-VLAN Routing with the Internal Route Processor
4.3.3	Routing Between an External Router and an Internal Route Processor

9.1.5 e-Lab Activity: Trunking with ISL
In this lab, students will create multiple VLANs on two separate switches, name the switches, and assign multiple member ports to the switches.
9.1.5 e-Lab Activity: Trunking with 802.1q
In this lab, students will create multiple VLANs on two separate switches, name the switches, and assign multiple member ports to the switches.
9.2.5 e-Lab Activity: 802.1q VTP Client and Server Configurations
In this lab, students will configure the VTP protocol to establish server and client switches.
9.3.6 e-Lab Activity: Configuring Inter-VLAN Routing
In this lab, students will create a basic configuration on a router and test the routing functionality.