



**NIACC**

**Course Syllabus**

**NET-223**

**Cisco Routing**

Credit Hours: 4

Prerequisites: NET-213

Cisco Networking

Website:

<http://web.niaccist.niacc.edu/~ist/links.html>

**Instructors Information**

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**Course Description**

Routers and Routing Basics is the second of four CCNA courses leading to the Cisco Certified Network Associate (CCNA) designation. Networking II (CCNA 2) focuses on initial router configuration, Cisco IOS Software management, routing protocol configuration, TCP/IP, and access control lists (ACLs). Students will develop skills on how to configure a router, managing Cisco IOS Software, configuring routing protocol on routers, and set the access lists to control the access to routers. (60-0)

**Required Course Materials**

**Text:** Routers and Routing Basics CCNA 2 Lab s and Study Guide

Author: Allan Johnson

ISBN: 1-58713-167-6 © 2006, Pub date: 7/06

**Other:** 3 ring binder and paper and /or good quality bond notebook for Engineering Journal

**Evaluation Procedures**

Grade Breakdown	Approx. points	Minimum required	Grading Scale
Assessment Lessons	55	70% average	A 93% - 100%
Assessment Final	100	70%	A - 90% - 92%
Quizzes	25		B+ 87% - 89%
Midterm	75		B 83% - 86%
Engineering Journal	50		B- 80% - 82%
Portfolio Evaluation			C+ 77% - 79%
Skills-Based Assessment **	50	Pass / Fail	C 73% - 76%
Lab Activities	25	Pass / Fail	C- 70% - 72%
Participation points			D+ 67% - 69%
Skilled Activities			D 63% - 66%
			D - 60% - 62%
			F 59 & Below

*Above policies can be adjusted upon individual instructor's discretion. Everything above affects your grade in the class*

*\*\* Highest possible score on Skill-Based Assessment retake is 50%.*

**Skills-Based Assessment**

Individual student will able to demonstrate competency in use of:

- Basic router configuration (passwords, access, ...)
- Routed Protocols (IP addressing and subnetting, assigning addresses to routers and workstations)
- Routing protocols (RIP and IGRP)
- WAN connection (HDLC)
- Physically connect equipment
- Security issues using Access Control Lists (ACLs)
- Troubleshoot any of the above

This exam may occur in stages. In each stage students will be asked to carry out a simple set of instructions. The proctor(s) will score the students on their ability to COMPLETE each task. The proctor will give their initials next to task that are completed no initial will be given for tasks that are not completed. Students are also required to keep a journal for this assignment. The student must also be able to troubleshoot up to three problems with the configuration. A basic theme will be used with the use of actual equipment

## **Engineering Journal**

Each student must maintain a journal. It must be a 3 ring binder with tabs indicating the main points shown below. It will be a combination of hand written information and some typed information. No printed materials from the Cisco curriculum.

### **Identification**

- Title, name, personal information, table of contents, evaluations, course information, professional statement (signed), dates, journal evaluations, and your course goals.

### **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)
- Basic troubleshooting steps 2

### **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 book 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 5 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

Evaluations will be a self review, peer review, instructor review, and an in-class quiz/project in which you will use your journal.

## ***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)

## ***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. It will contain important parts of your networking journals. This information will be stored in an electronic form that is easy to navigate and use. It will be accessible from the web. Some of the skills involved are networking skills, OS skills (both UNIX and Windows), html use, word processing, spreadsheet, ftp, graphics, directory organization, directory rights, organizational skills in general, and other miscellaneous skills.

The portfolio will be evaluated by your instructor and also must be presented to an advisory committee for comment during Networking 4.

## ***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.

## ***Course Outcomes***

### **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 2 is an integral step towards achieving CCNA Certification.

### **EXPECTED OUTCOMES:**

Upon completion of this course, students will be able to perform tasks related to:

- Routers and their role in WANs
- Cisco IOS
- Router Configuration
- Router File Management
- RIP and IGRP Routing Protocols
- TCP/IP Error and Control Messages
- Router Troubleshooting
- Intermediate TCP
- Access Control Lists
- Course Outline

## UNITS OF INSTRUCTION:

### CCNA 2

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#### Module 1. WANs and Routers

##### Overview

#### 1.1 WANs

- 1.1.1 Introduction to wide-area networks (WANs)
- 1.1.2 WAN devices
- 1.1.3 WAN standards
- 1.1.4 Introduction to routers in a WAN
- 1.1.5 Router functions
- 1.1.6 Academy approach to hands-on labs

#### 1.2 WAN Technologies

- 1.2.1 WAN services
- 1.2.2 Circuit switching
- 1.2.3 Packet switched services
- 1.2.4 Cell switched services
- 1.2.5 Other WAN services

#### 1.3 Routers

- 1.3.1 Router internal components
- 1.3.2 Router physical characteristics
- 1.3.3 Router external connections
- 1.3.4 Management port connections
- 1.3.5 Connecting console interfaces
- 1.3.6 Connecting LAN interfaces
- 1.3.7 Connecting WAN interfaces

##### Summary

#### Module 2. Introduction to Router

##### Overview

#### 2.1 Operating Cisco IOS

- 2.1.1 The purpose of Cisco IOS
- 2.1.2 Router user interface
- 2.1.3 Router user interface modes
- 2.1.4 Cisco IOS features
- 2.1.5 Operation of the Cisco IOS

#### 2.2 Starting a Router

- 2.2.1 Initial startup of Cisco routers
- 2.2.2 Router LED indicators
- 2.2.3 Examining the initial bootup output of the router
- 2.2.4 Establishing a HyperTerminal session
- 2.2.5 Logging into the router
- 2.2.6 Keyboard help in the router CLI
- 2.2.7 Enhanced editing commands
- 2.2.8 Router command history
- 2.2.9 Troubleshooting command line errors
- 2.2.10 The show version command

##### Summary

## Module 3. Configuring a Router

### Overview

#### **3.1** *Configuring a Router*

- 3.1.1 Command-line interface command modes
- 3.1.2 Configuring name of a router
- 3.1.3 Configuring router passwords
- 3.1.4 Examining the show commands
- 3.1.5 Configuring a serial interface
- 3.1.6 Executing adds, moves, and changes
- 3.1.7 Configuring an Ethernet interface

#### **3.2** *Finishing the Configuration*

- 3.2.1 Importance of configuration standards
- 3.2.2 Interface descriptions
- 3.2.3 Configuring interface descriptions
- 3.2.4 Login banners
- 3.2.5 Configuring message of the day (MOTD)
- 3.2.6 Host name resolutions
- 3.2.7 Configuring host tables
- 3.2.8 Configuration backup and documentation
- 3.2.9 Copying, editing, and pasting configurations

### Summary

## Module 4. Learning about Other Devices

### Overview

#### **4.1** *Discovering and Connecting to Neighbors*

- 4.1.1 Introduction to CDP
- 4.1.2 Information obtained with CDP
- 4.1.3 Implementation, monitoring, and maintenance of CDP
- 4.1.4 Creating a network map of the environment
- 4.1.5 Disabling CDP
- 4.1.6 Troubleshooting CDP

#### **4.2** *Getting Information about Remote Devices*

- 4.2.1 Telnet
- 4.2.2 Establishing and verifying a Telnet connection
- 4.2.3 Disconnecting Telnet operation
- 4.2.4 Advanced Telnet operation
- 4.2.5 Alternate connectivity tests
- 4.2.6 Troubleshooting IP address issues

### Summary

## Module 5. Managing Cisco IOS

### Overview

#### **5.1** *Router Boot Sequence and Verification*

- 5.1.1 Stages of the router power-on boot sequence
- 5.1.2 How a Cisco device locates and loads IOS
- 5.1.3 Using the boot system command
- 5.1.4 Configuration register
- 5.1.5 Troubleshooting IOS boot failure

## **5.2      *Managing the Cisco Router File System***

- 5.2.1    IOS file system overview
- 5.2.2    IOS naming conventions
- 5.2.3    Configuration file management using TFTP
- 5.2.4    Configuration file management by using cut and paste
- 5.2.5    Managing IOS images with TFTP
- 5.2.6    Managing IOS images with Xmodem
- 5.2.7    File system verification

Summary

## **Module 6.    Routing and Routing Protocols**

Overview

### **6.1      *Overview of Static Routing***

- 6.1.1    Introducing routing
- 6.1.2    Static route operation
- 6.1.3    Configuring static routes
- 6.1.4    Configuring default route forwarding
- 6.1.5    Verifying static route configuration
- 6.1.6    Troubleshooting static route configuration

### **6.2      *Dynamic Routing Overview***

- 6.2.1    Introduction to routing protocols
- 6.2.2    Autonomous systems
- 6.2.3    Purpose of a routing protocol and autonomous systems
- 6.2.4    Identifying the classes of routing protocols
- 6.2.5    Distance vector routing protocol features and examples
- 6.2.6    Link state routing protocol features and examples
- 6.2.7    Hybrid routing protocol features and examples

### **6.3      *Routing Protocols Overview***

- 6.3.1    Route determination
- 6.3.2    Routing configuration
- 6.3.3    Routing protocols (RIP, IGRP, OSPF, EIGRP, BGP)
- 6.3.4    Autonomous systems and IGP versus EGP
- 6.3.5    Distance vector routing
- 6.3.6    Link state routing

Summary

## **Module 7.    Distance Vector Routing Protocols**

Overview

### **7.1      *Distance Vector Routing***

- 7.1.1    Distance vector protocol updates
- 7.1.2    Distance vector routing loop issues
- 7.1.3    Defining a maximum count to prevent count to infinity
- 7.1.4    Eliminating routing loops through split horizon
- 7.1.5    Route Poisoning
- 7.1.6    Avoiding routing loops with triggered updates
- 7.1.7    Preventing routing loops with hold-down timers

## **7.2 RIP**

- 7.2.1 RIP process
- 7.2.2 Configuring RIP
- 7.2.3 Using the ip classless command
- 7.2.4 Common RIP configuration issues
- 7.2.5 Verifying RIP configuration
- 7.2.6 Troubleshooting RIP update issues
- 7.2.7 Preventing routing updates through an interface
- 7.2.8 Load balancing with RIP
- 7.2.9 Load balancing across multiple paths
- 7.2.10 Integrating static routes with RIP

## **7.3 IGRP**

- 7.3.1 IGRP features
- 7.3.2 IGRP metrics
- 7.3.3 IGRP routes
- 7.3.4 IGRP stability features
- 7.3.5 Configuring IGRP
- 7.3.6 Migrating RIP to IGRP
- 7.3.7 Verifying IGRP configuration
- 7.3.8 Troubleshooting IGRP

Summary

## **Module 8. TCP/IP Suite Error and Control Messages**

Overview

### **8.1 Overview of TCP/IP Error Message**

- 8.1.1 Internet Control Message Protocol (ICMP)
- 8.1.2 Error reporting and error correction
- 8.1.3 ICMP message delivery
- 8.1.4 Unreachable network
- 8.1.5 Using PING to test destination reachability
- 8.1.6 Detecting excessively long routes
- 8.1.7 Echo message
- 8.1.8 Destination unreachable message
- 8.1.9 Miscellaneous error reporting

### **8.2 Overview of TCP/IP Control Messages**

- 8.2.1 Introduction to control messages
- 8.2.2 ICMP redirect/change requests
- 8.2.3 Clock synchronization and transit time estimation
- 8.2.4 Information requests and reply message formats
- 8.2.5 Address mask requests
- 8.2.6 Router discovery message
- 8.2.7 Router solicitation message
- 8.2.8 Congestion and flow control messages

Summary

## Module 9. Basic Router Troubleshooting

### Overview

#### **9.1 Examining the Routing Table**

- 9.1.1 The show ip route command
- 9.1.2 Determining the gateway of last resort
- 9.1.3 Determining the route source and destination address
- 9.1.4 Determining L2 and L3 addresses from the route source to the route destination
- 9.1.5 Determining the route administrative distance
- 9.1.6 Determining the route metric
- 9.1.7 Determining the route next hop
- 9.1.8 Determining last route update
- 9.1.9 Observe multiple paths to destination

#### **9.2 Network Testing**

- 9.2.1 Introduction to network testing
- 9.2.2 Using a structured approach to troubleshooting
- 9.2.3 Testing by OSI layers
- 9.2.4 Layer 1 troubleshooting using indicators
- 9.2.5 Layer 3 troubleshooting using ping
- 9.2.6 Layer 7 troubleshooting using Telnet

#### **9.3 Troubleshooting Router Issues Overview**

- 9.3.1 Troubleshooting Layer 1 using show interface
- 9.3.2 Troubleshooting Layer 2 using show interface
- 9.3.3 Troubleshooting using show cdp
- 9.3.4 Troubleshooting using traceroute
- 9.3.5 Troubleshooting routing issues using show ip route and show ip protocol
- 9.3.6 Troubleshooting using show controllers serial
- 9.3.7 Introduction to debug

### Summary

## Module 10. Intermediate TCP/IP

### Overview

#### **10.1 TCP Operation**

- 10.1.1 TCP operation description
- 10.1.2 Synchronization process (3 way handshake)
- 10.1.3 Denial-of-service attacks
- 10.1.4 Windowing and window size
- 10.1.5 Sequencing numbers
- 10.1.6 Positive ACK
- 10.1.7 UDP operation

#### **10.2 Overview of Transport Layer Ports**

- 10.2.1 Multiple conversations between hosts
- 10.2.2 Ports for services
- 10.2.3 Ports for clients
- 10.2.4 Port numbering and well known ports
- 10.2.5 Example of multiple sessions between hosts
- 10.2.6 Comparison of MAC addresses, IP addresses, and port numbers

### Summary

## **Module 11. Access Control Lists (ACLs)**

### Overview

#### **11.1 Access Control List Fundamentals**

- 11.1.1 What are ACLs
- 11.1.2 How ACLs work
- 11.1.3 Creating ACLs
- 11.1.4 The purpose and function of wildcard mask bits
- 11.1.5 Verifying ACLs

#### **11.2 Access Control Lists**

- 11.2.1 Standard ACLs
- 11.2.2 Extended ACLs
- 11.2.3 Named ACLs
- 11.2.4 Placing ACLs
- 11.2.5 Firewalls
- 11.2.6 Restricting virtual terminal access

### Summary