

## Scope and Sequence

### CCNA Exploration v4.0

*The course objectives and outline of the final two CCNA Exploration courses, LAN Switching and Wireless and Accessing the WAN, are subject to change since the courses are still under development. The English versions of those two courses are scheduled to be available in the November–December 2007 timeframe.*

#### Target Audience

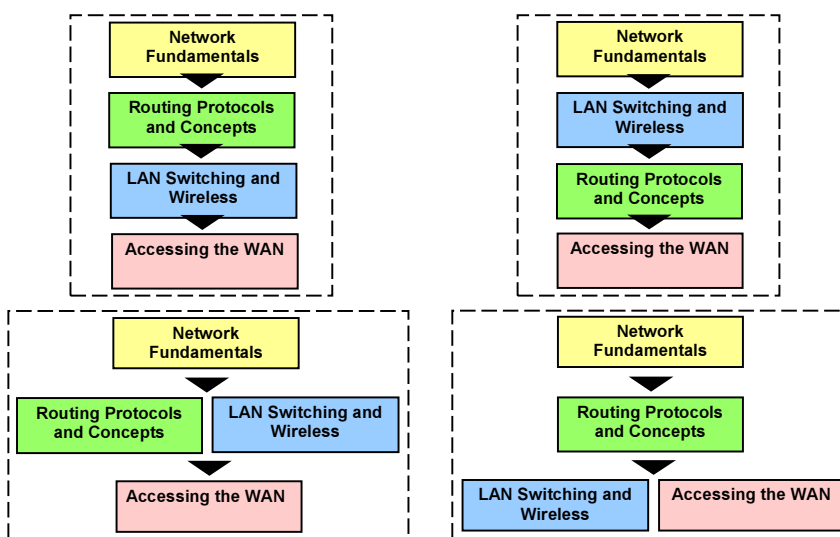
The target audience for CCNA Exploration includes Cisco Networking Academy® students with advanced problem solving and analytical skills typically associated with degree programs in engineering, math, or science.

#### Prerequisites

CCNA Exploration is composed of four courses: Network Fundamentals, Routing Protocols and Concepts, LAN Switching and Wireless, and Accessing the WAN. Network Fundamentals is the first course and it has no prerequisites. It is a prerequisite for the other three courses.

Routing Protocols and Concepts is the preferred second course in the sequence, but variations are possible as shown in Figure 1. LAN Switching and Wireless can be taught before Routing Protocols and Concepts, or concurrently. LAN Switching and Wireless can also be taught at the same time as Accessing the WAN, after Routing Protocols and Concepts.

**Figure 1.** CCNA Exploration Course Delivery Options



## Target Certifications

After completing CCNA Exploration, students will be prepared to take the CCNA Certification Exam.

## Curriculum Description

This curriculum presents a comprehensive overview of networking; from fundamentals to advanced applications and services. It is based on the top-down approach to networking that is popular in many colleges and universities. The course emphasizes concepts and skills required to design networks, while providing opportunities for practical application and hands-on experience by teaching students how to install, operate, and maintain networks.

Some of the main features of CCNA Exploration are as follows:

- Can be part of an integrated curriculum or continuing education program at postsecondary institutions such as career and technical schools, colleges, and universities
- Allows students to learn skills in a more comprehensive, theoretical, and practical way that is reflective of common educational practices at the college level; and uses language that integrates related engineering concepts
- Presents comprehensive coverage of networking topics, ranging from fundamentals to advanced applications and services
- Includes highly-complex and challenging hands-on labs
- Offers more flexibility in the curriculum delivery and permits shortened course delivery time
- Helps prepare students for continuing education and professional careers in IT

## Curriculum Objectives

This curriculum provides students with the skills needed to succeed in networking-related degree programs and helps them prepare for CCNA certification. It also helps students develop the skills necessary to fulfill the job responsibilities of network technicians, network administrators, and network engineers. It provides a theoretically-rich, hands-on introduction to networking and the Internet.

Upon completion of the Network Fundamentals course, students will be able to perform the following tasks:

- Explain the importance of data networks and the Internet in supporting business communications and everyday activities
- Explain how communication works in data networks and the Internet
- Recognize the devices and services that are used to support communications across an Internetwork
- Use network protocol models to explain the layers of communications in data networks
- Explain the role of protocols in data networks
- Describe the importance of addressing and naming schemes at various layers of data networks
- Describe the protocols and services provided by the application layer in the OSI model and describe how this layer operates in sample networks
- Analyze the operations and features of the transport layer protocols and services
- Analyze the operations and feature of the network layer protocols and services and explain the fundamental concepts of routing
- Design, calculate, and apply subnet masks and addresses to fulfill given requirements

- Describe the operation of protocols at the OSI data link layer and explain how they support communications
- Explain the role of physical layer protocols and services in supporting communications across data networks
- Explain fundamental Ethernet concepts such as media, services, and operation
- Employ basic cabling and network designs to connect devices in accordance with stated objectives
- Build a simple Ethernet network using routers and switches
- Use Cisco CLI commands to perform basic router and switch configuration and verification

Upon completion of the Routing Protocols and Concepts course, students will be able to perform the following functions:

- Describe the purpose, nature, and operations of a router
- Explain the critical role routers play in enabling communications across multiple networks
- Describe the purpose and nature of routing tables
- Describe how a router determines a path and switches packets
- Configure and verify router interfaces
- Describe the purpose and procedure for configuring static routes
- Describe the role of dynamic routing protocols and place these protocols in the context of modern network design
- Describe how metrics are used by routing protocols and identify the metric types used by dynamic routing protocols
- Identify the characteristics of distance vector routing protocols
- Describe the network discovery process of distance vector routing protocols using Routing Information Protocol (RIP)
- Describe the functions, characteristics, and operations of the RIPv1 protocol
- Compare and contrast classful and classless IP addressing
- Describe classful and classless routing behaviors in routed networks
- Design and implement a classless IP addressing scheme for a given network
- Demonstrate comprehensive RIPv1 configuration skills
- Apply the basic RIPv2 configuration commands and evaluate RIPv2 classless routing updates
- Describe the main features and operations of the Enhanced Interior Gateway Routing Protocol (EIGRP)
- Use advanced configuration commands with routers implementing EIGRP
- Describe the basis features and concepts of link-state routing protocols
- Describe the purpose, nature, and operations of the Open Shortest Path First (OSPF) Protocol

Upon completion of the LAN Switching and Wireless course, students will be able to perform the following functions:

- Identify and correct common network problems at layers 1,2,3 and 7 using a layered model approach
- Interpret network diagrams
- Select the appropriate media, cables, ports, and connectors to connect switches to other network devices and hosts.

- Explain the technology and media access control method for Ethernet networks.
- Explain basic switching concepts and the operation of Cisco switches.
- Perform and verify initial switch configuration tasks including remote access management.
- Describe enhanced switching technologies (VTP, RSTP, VLAN, PVSTP, 802.1q)
- Describe how VLANs create logically separate networks and the need for routing between them.
- Configure, verify, and troubleshoot VLANs
- Configure, verify, and troubleshoot trunking on Cisco switches
- Configure, verify, and troubleshoot interVLAN routing
- Configure, verify, and troubleshoot VTP
- Configure, verify, and troubleshoot RSTP operation
- Interpret the output of various show and debug commands to verify the operational status of a Cisco switched network.
- Verify network status and switch operation using basic utilities (ping, traceroute, telnet, SSH, arp, ipconfig), SHOW & DEBUG commands.
- Identify, prescribe, and resolve common switched network media issues, configuration issues, autonegotiation, and switch hardware failures
- Manage Cisco IOS.
- Manage IOS configuration files. (save, edit, upgrade, restore)
- Describe standards associated with wireless media (IEEE WI-FI Alliance, ITU/FCC)
- Identify and describe the purpose of the components in a small wireless network. (SSID, BSS, ESS)
- Identify the basic parameters to configure on a wireless network to ensure that devices connect to the correct access point.
- Compare and contrast wireless security features and capabilities of WPA security(open, WEP, WPA-1/2)
- Identify common issues with implementing wireless networks. (Interference, Misconfiguration)

Upon completion of the Accessing the WAN course, students will be able to perform the following functions:

- Describe the impact of applications (Voice Over IP and Video Over IP) on a network
- Identify and correct common network problems at layers 1,2,3 and 7 using a layered model approach
- Interpret network diagrams
- Describe the components required for network and Internet communications.
- Implement basic switch security (port security, trunk access, management vlan other than vlan1,etc.)
- Explain the operation and benefits of using DHCP and DNS.
- Configure, verify and troubleshoot DHCP and DNS operation on a router.(CLI/SDM)

- Describe today's increasing network security threats and explain the need to implement a comprehensive security policy to mitigate the threats
- Explain general methods to mitigate common security threats to network devices, hosts, and applications.
- Describe the functions of common security appliances and applications
- Describe security recommended practices including initial steps to secure network devices
- Describe the purpose and types of ACLs.
- Configure and apply ACLs based on network filtering requirements.(CLI/SDM)
- Configure and apply an ACLs to limit telnet and SSH access to the router using (SDM/CLI)
- Verify and monitor ACLs in a network environment.
- Troubleshoot ACL issues.
- Explain the basic operation of NAT.
- Configure NAT for given network requirements using (CLI/SDM)
- Troubleshoot NAT issues
- Describe different methods for connecting to a WAN
- Configure and verify a basic WAN serial connection.
- Configure and verify a PPP connection between Cisco routers
- Configure and verify Frame Relay on Cisco routers
- Troubleshoot WAN implementation issues.
- Describe VPN technology (importance, benefits, role, impact, components)

### **Minimum System Requirements**

Curriculum requirements:

- 1 Student PC per student; 1 local curriculum server

Lab bundle requirements:

- 3 Cisco 1841 routers with Base IP IOS, 128 MB DRAM, 32 MB Flash
- 3 2960 switches,
- 2 Linksys wireless routers (Linksys 300N is preferred; 54G is an alternative) or SOHO equivalent
- 1 Lab PC with Microsoft Windows 2000 Server
- 3 Lab PCs or laptops (Microsoft Windows 2000 or Windows XP)
- Assorted Ethernet and Serial cables and hubs

## Course Outline

### Network Fundamentals

This course introduces the architecture, structure, functions, components, and models of the Internet and other computer networks. It uses the OSI and TCP layered models to examine the nature and roles of protocols and services at the application, network, data link, and physical layers. The principles and structure of IP addressing and the fundamentals of Ethernet concepts, media, and operations are introduced to provide a foundation for the curriculum. Labs use a “model Internet” to allow students to analyze real data without affecting production networks. Packet Tracer (PT) activities help students analyze protocol and network operation and build small networks in a simulated environment. At the end of the course, students build simple LAN topologies by applying basic principles of cabling; performing basic configurations of network devices, including routers and switches; and implementing IP addressing schemes.

Prerequisites: None

### 1. Living, Learning, Working, and Playing in a Network-Centric World

- 1.0 Introduction
- 1.1 Communication – an essential part of our lives
- 1.2 A network-centric world – supporting the way we communicate
- 1.3 What are networks?
- 1.4 Quality of service (QoS) – controlling our communications
- 1.5 Security – protecting our communications
- 1.6 Summary

### 2. Communications with Data Networks and the Internet

- 2.0 Introduction
- 2.1 What data networks support the human network?
- 2.2 Network models – a layered approach to communication
- 2.3 Protocols – the rules of communication
- 2.4 Labeling the pieces – addressing and naming of communications
- 2.5 Summary

### 3. OSI Application Layer

- 3.0 Introduction
- 3.1 Applications – the interface between the human and data networks
- 3.2 Application layer protocols – making provision for applications and services
- 3.3 Examples of application layer protocols
- 3.4 Applications and services supporting our communications

### 3.5 Summary

## 4. OSI Transport Layer

### 4.0 Introduction

4.1 Roles of the transport layer – managing the pieces of our communications

4.2 The User Datagram Protocol (UDP) – communicating with low overhead

4.3 The Transmission Control Protocol (TCP) – communicating with reliability

4.4 TCP – reassembling the pieces and managing data loss

### 4.5 Summary

## 5. OSI Network Layer and Routing

### 5.0 Introduction

5.1 Roles of the network layer – carrying our communications from device to device

5.2 Networks – dividing devices into groups

5.3 Routing – enabling our communications between networks

### 5.4 Summary

## 6. Addressing the Network – IPv4

### 6.0 Introduction

6.1 Internet Protocol v4 (IPv4) addresses

6.2 Addresses for different purposes

6.3 Overview of IPv6

6.4 Subnetting – dividing networks into the right sizes

6.5 Testing the network layer with ping and traceroute

### 6.6 Summary

## 7. OSI Data Link Layer

### 7.0 Introduction

7.1 Data link layer – controlling the communication pieces on the media

7.2 Media Access Control – how does the media look?

7.3 Media Access Control – addressing and framing the pieces

### 7.4 Summary

## 8. OSI Physical Layer

### 8.0 Introduction

- 8.1 Physical layer – carrying the bits of our communications
- 8.2 Physical signaling – transmitting the bits of our communications to the media
- 8.3 Physical media – the connections for our communications
- 8.4 Summary

## **9. An Example LAN Technology – Ethernet**

- 9.0 Introduction
- 9.1 Ethernet media – sending our communications through the LAN
- 9.2 Ethernet overview
- 9.3 Ethernet in the layers – MAC technology
- 9.4 Ethernet in the layers – MAC addressing
- 9.5 Address Resolution Protocol (ARP) – connecting the two layers of addresses
- 9.6 Shared versus dedicated Ethernet – a closer look at hubs and switches
- 9.7 Summary

## **10. Planning and Cabling Your Network**

- 10.0 Introduction
- 10.1 Establishing device interconnection
- 10.2 Developing an addressing scheme
- 10.3 Importance of network diagrams
- 10.4 Creating simple network diagrams
- 10.5 Summary

## **11. Configuring and Testing Your Network**

- 11.0 Introduction
- 11.1 Configuring Cisco devices – Cisco IOS® basics
- 11.2 Applying a basic configuration using Cisco IOS
- 11.3 Host configuration
- 11.4 Verifying connectivity
- 11.5 Monitoring and documenting networks
- 11.6 Summary

## Routing Protocols and Concepts

This course describes the architecture, components, and operation of routers, and explains the principles of routing and routing protocols. Students analyze, configure, verify, and troubleshoot the primary routing protocols RIPv1, RIPv2, EIGRP, and OSPF. By the end of this course, students will be able to recognize and correct common routing issues and problems. Each chapter walks the student through a basic procedural lab, and then presents basic configuration, implementation, and troubleshooting labs. Packet Tracer (PT) activities reinforce new concepts, and allow students to model and analyze routing processes that may be difficult to visualize or understand.

Prerequisites: Network Fundamentals

### 1. Introduction to Routing and Packet Forwarding

- 1.0 Introduction
- 1.1 Inside the router
- 1.2 CLI configuration and addressing review
- 1.3 Introducing the routing table
- 1.4 Path determination and switching functions
- 1.5 Router configuration labs
- 1.6 Summary

### 2. Static Routes

- 2.0 Introduction
- 2.1 Routers in networks
- 2.2 Directly connected networks
- 2.3 Static routes with "next hop" addresses
- 2.4 Static routes with exit interfaces
- 2.5 Summary and default static routes
- 2.6 Topology review
- 2.7 Managing and troubleshooting static routes
- 2.8 Static route configuration labs
- 2.9 Summary

### 3. Introduction to Dynamic Routing

- 3.0 Introduction
- 3.1 Advantages
- 3.2 Classifying dynamic routing protocols

- 3.3 Routing domains, process IDs, and autonomous systems
- 3.4 Metrics
- 3.5 Administrative distances
- 3.6 Routing protocol and subnetting labs
- 3.7 Summary

#### **4. Distance Vector Routing Protocol**

- 4.0 Introduction
- 4.1 Overview of distance vector routing protocols
- 4.2 Network discovery
- 4.3 Routing table maintenance
- 4.4 Routing loops
- 4.5 Distance vector routing protocols today
- 4.6 Summary

#### **5. RIPv1**

- 5.0 Introduction
- 5.1 RIPv1: a distance vector, classful routing protocol
- 5.2 Basic RIPv1 configuration
- 5.3 Verification and troubleshooting
- 5.4 Automatic summarization
- 5.5 Default route and RIPv1
- 5.6 Troubleshooting
- 5.7 RIPv1 configuration labs
- 5.8 Summary

#### **6. Classless Routing Protocols, VLSM and CIDR**

- 6.0 Introduction
- 6.1 IP addressing
- 6.2 Overview of IPv4 enhancements
- 6.3 Variable-length subnet masking (VLSM)
- 6.4 Classless interdomain routing (CIDR)
- 6.5 VLSM and classless routing labs

6.6 Summary

## **7. RIPv2**

7.0 Introduction

7.1 RIPv1 configuration and limitations

7.2 Configuring RIPv2

7.3 VLSM and CIDR with RIPv2

7.4 Verifying and troubleshooting RIPv2

7.5 RIPv2 configuration labs

7.6 Summary

## **8. Routing Table: A Closer Look**

8.0 Introduction

8.1 Routing table structure

8.2 Routing table lookup process

8.3 Classful routing behavior

8.4 Classless routing behavior

8.5 Equal cost load balancing

8.6 Routing table lab

8.7 Summary

## **9. EIGRP**

9.0 Introduction

9.1 Basic EIGRP configuration

9.2 EIGRP metric calculation

9.3 Features of EIGRP

9.4 Establishing adjacencies

9.5 Diffusing Update Algorithm (DUAL)

9.6 More EIGRP configurations

9.7 Verifying and troubleshooting EIGRP

9.8 EIGRP configuration labs

9.9 Summary

## 10. Link-State Routing Protocols

- 10.0 Introduction
- 10.1 Concept of link-state routing protocols
- 10.2 Link-state process
- 10.3 Summary

## 11. OSPF

- 11.0 Introduction
- 11.1 Basic OSPF configuration
- 11.2 OSPF router ID
- 11.3 OSPF metric calculation
- 11.4 Establishing adjacencies
- 11.5 OSPF and multi-access networks
- 11.6 More OSPF configuration
- 11.7 Verifying and troubleshooting OSPF
- 11.8 OSPF lab configuration
- 11.9 Summary

## LAN Switching and Wireless

This course helps students develop an in-depth understanding of how switches operate and are implemented in the LAN environment for small and large networks. Beginning with a foundational overview of Ethernet, this course provides detailed explanations of LAN switch operation, VLAN implementation, Rapid Spanning Tree Protocol (RSTP), VLAN Trunking Protocol (VTP), Inter-VLAN routing, and wireless network operations. Students analyze, configure, verify, and troubleshoot VLANs, RSTP, VTP, and wireless networks. Campus network design and Layer 3 switching concepts are introduced.

Prerequisites: Network Fundamentals

### Preliminary chapter outline:

1. Ethernet Revisited
2. Switching Concepts – Cisco IOS® Software and Cisco Discovery Protocol
3. Inside the Switch
4. Campus Network Design
5. Basic Switch Configuration
6. VLANs and IP Telephony Basics
7. Rapid Spanning Tree Protocol
8. Trunking and VLAN Trunking Protocol
9. Inter-VLAN Routing

10. Wireless Networks and Mobility

11. Campus LANs

### Accessing the WAN

This course explains the principles of traffic control and access control lists (ACLs) and provides an overview of the services and protocols at the data link layer for wide-area access. Students learn about user access technologies and devices and discover how to implement and configure Point-to-Point Protocol (PPP), Point-to-Point Protocol over Ethernet (PPPoE), DSL, and Frame Relay. WAN security concepts, tunneling, and VPN basics are introduced. The course concludes with a discussion of the special network services required by converged applications and an introduction to quality of service (QoS).

Prerequisites: Routing Protocols and Concepts

#### Preliminary chapter outline:

1. Managing Traffic: Access Control Lists
2. Addressing Hosts: Network Address Translation, Dynamic Host Configuration Protocol, and IPv6 Basics
3. Security
4. Introduction to WAN Technologies
5. WAN Devices and Connections: CSU, Cable Modem, and DSL Modem
6. Connecting to the WAN: Leased Lines, Cable, and DSL
7. Point-to-Point Protocol and Point-to-Point Protocol over Ethernet
8. Frame Relay
9. QoS Considerations
10. Tunneling Concepts and VPN Basics
11. Capstone: Converged Networks



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