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

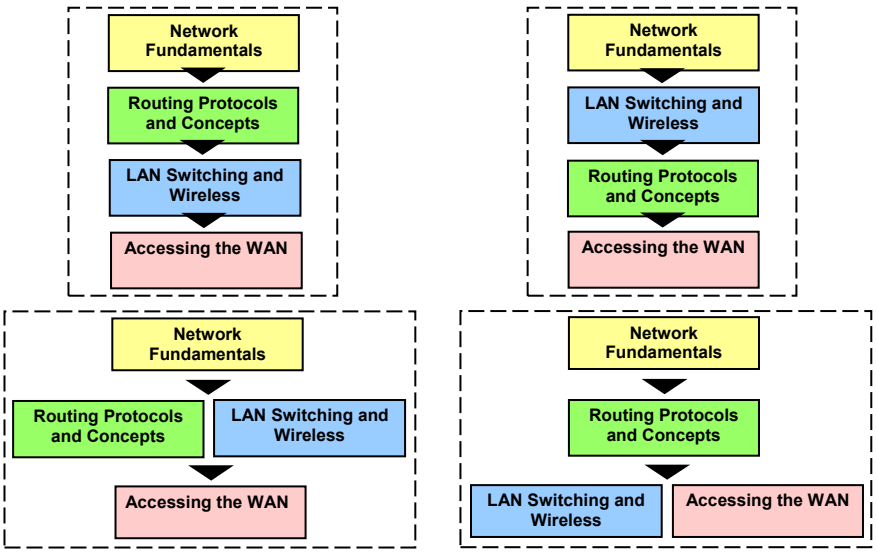
The target audience for CCNA Exploration includes Cisco Networking Academy® students with advanced problem solving and analytical skills typically associated with degree programs in engineering, math, or science.

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 and TCP/IP models and describe how this layer operates in various 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
- Analyze the operations and features of common Application layer protocols such as HTTP, DNS, DHCP, SMTP, Telnet, and FTP.
- Utilize common network utilities to verify small network operations and analyze data traffic.

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
- Explain the route lookup process and determine the path packets will take in the network.
- Configure and verify basic router operation for a newly installed router
- Describe the purpose and procedure for configuring static routes
- Configure and verify static and default routing.
- 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
- Describe the main features and operations of the Enhanced Interior Gateway Routing Protocol (EIGRP)
- Use advanced configuration commands with routers implementing EIGRP and OSPF

- 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
- Configure and verify basic RIPv1, RIPv2, single area OSPF, and EIGRP operations in a small routed network.
- Use router show and debug commands to troubleshoot common errors that occur in small routed networks.

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 in a Network-Centric World

1.0 Chapter Introduction

1.1 Communicating in a Network-Centric World

1.2 Communication – An Essential Part of Our Lives

1.3 The Network as a Platform

1.4 The Architecture of the Internet

1.5 Trends in Networking

1.6 Chapter Labs

1.7 Summary

1.8 Chapter Quiz

2. Communications over the Networks

2.0 Chapter Introduction

2.1 The Platform for Communications

2.2 LANs, WANs, and Internetworks

2.3 Protocols

2.4 Using Layered Models

2.5 Network Addressing

2.6 Chapter Labs

2.7 Chapter Summary

2.8 Chapter Quiz

3. OSI Application Layer Functionality

3.0 Chapter Introduction

3.1 Applications – The Interface Between the Networks

3.2 Making Provisions for Applications and Services

3.3 Application Layer Protocols and Services Examples

3.4 Chapter Labs and Activites

3.5 Chapter Summary

3.6 Chapter Quiz

4. OSI Transport Layer

4.0 Chapter Introduction

4.1 Roles of the Transport Layer

4.2 The TCP Protocol – Communicating with Reliability

4.3 Managing TCP Sessions

4.4 The UDP Protocol – Communicating with Low Overhead

4.5 Lab Activities

4.6 Chapter Summary

4.7 Chapter Quiz

5. OSI Network Layer

5.0 Chapter Introduction

5.1 IPv4

5.2 Networks – Dividing Devices into Groups

5.3 Routing – How Our Data Packets are Handled

5.4 Routing Processes: How Routes are Learned

5.5 Labs

5.6 Summary

5.7 Quiz

6. Addressing the Network – IPv4

6.0 Chapter Introduction

6.1 IPv4 Addresses

6.2 Addresses for Different Purposes

6.3 Assigning Addresses

6.4 Is It On My Network?

6.5 Calculating Addresses

6.6 Testing the Network Layer

6.7 Labs and Activities

6.8 Chapter Summaries

6.9 Chapter Quiz

7. Data Link Layer

7.0 Chapter Introduction

7.1 Data Link Layer – Accessing the media

7.2 Media Access Control Techniques

7.3 Media Access Control Addressing and Framing Data

7.4 Putting it All Together

7.5 Labs and Activities

7.6 Chapter Summary

7.7 Chapter Quiz

8. OSI Physical Layer

8.0 Chapter Introduction

8.1 The Physical Layer - Communication Signals

8.2 Physical Signaling and Encoding: Representing

8.3 Physical Media – Connecting Communication

8.4 Lab – Media Connectors

8.5 Chapter Summary

8.6 Chapter Quiz

9. Ethernet

9.0 Chapter Introduction

9.1 Overview of Ethernet

9.2 Ethernet - Communication through the LAN

9.3 The Ethernet Frame

9.4 Ethernet Media Access Control

9.5 Ethernet Physical Layer

9.6 Hubs and Switches

9.7 Address Resolution Protocol (ARP)

9.8 Chapter Labs

9.9 Chapter Summary

9.10 Chapter Quiz

10. Planning and Cabling Networks

10.0 Chapter Introduction

10.1 LANs – Making the Physical Connection

10.2 Device Interconnections

10.3 Developing an Addressing Scheme

10.4 Calculating the Subnets

10.5 Device Interconnections

10.6 Chapter Labs

10.7 Chapter Summary

10.8 Chapter Quiz

11. Configuring and Testing Your Network

11.0 Chapter Introduction

11.1 Configuring Cisco Devices – IOS® basics

11.2 Applying a Basic Configuration Using Cisco IOS

11.3 Verifying Connectivity

11.4 Monitoring and Documenting of Networks

11.5 Lab Activity

11.6 Summary

11.7 Chapter Quiz

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 Chapter Introduction

1.1 Inside the Router

1.2 CLI Configuration and Addressing

1.3 Building the Routing Table

1.4 Path Determination and Switching Functions

1.5 Router Configuration Labs

1.6 Summary

1.7 Chapter Quiz

2. Static Routing

2.0 Chapter Introduction

2.1 Routers in Networks

2.2 Router Configuration Review

2.3 Exploring Directly Connected Networks

2.4 Static Routes with “Next Hop” Addresses

2.5 Static Routes with Exit Interfaces

2.6 Summary and Default Static Routes

2.7 Managing and Troubleshooting Static Routes

2.8 Static Route Configuration Labs

2.9 Chapter Summary

2.10 Chapter Quiz

3. Introduction to Dynamic Routing Protocols

3.0 Chapter Introduction

3.1 Introduction and Advantages

3.2 Classifying Dynamic Routing Protocols

3.3 Metrics

3.4 Administrative Distances

3.5 Routing Protocol and Subnetting Activities

3.6 Summary

3.7 Chapter Quiz

4. Distance Vector Routing Protocols

4.0 Chapter Introduction

4.1 Introduction to 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

4.7 Quiz

5. RIP version 1

5.0 Chapter Introduction

5.1 RIPv1: 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 Summary

5.7 Quiz

6. VLSM and CIDR

6.0 Chapter Introduction

6.1 Classful and Classless Addressing

6.2 VLSM

6.3 CIDR

6.4 VLSM and Route Summarization Activity

6.5 Summary

6.6 Chapter Quiz

7. RIPv2

7.0 Chapter Introduction

7.1 RIPv1 Limitations

7.2 Configuring RIPv2

7.3 VLSM and CIDR

7.4 Verifying and Troubleshooting RIPv2

7.5 RIPv2 Configuration Labs

7.6 Chapter Summary

7.7 Chapter Quiz

8. The Routing Table: A Closer Look

8.0 Chapter Introduction

8.1 The Routing Table Structure

8.2 Routing Table Lookup Process

8.3 Routing Behavior

8.4 Routing Table Labs

8.5 Chapter Summary

8.6 Chapter Quiz

9. EIGRP

9.0 Chapter Introduction

9.1 Introduction to EIGRP

9.2 Basic EIGRP Configuration

9.3 EIGRP Metric Calculation

9.4 DUAL

9.5 More EIGRP Configuration

9.6 EIGRP Configuration Labs

9.7 Chapter Summary

9.8 Chapter Quiz

10. Link-State Routing Protocols

10.0 Chapter Introduction

10.1 Link-State Routing Protocols

10.2 Implementing Link-State Routing Protocols

10.3 Chapter Summary

10.4 Chapter Quiz

11. OSPF

11.0 Chapter Introduction

11.1 Introduction to OSPF

11.2 Basic OSPF Configuration

11.3 The OSPF Metric

11.4 OSPF and Multiaccess Networks

11.5 More OSPF Configuration

11.6 OSPF Configuration Labs

11.7 Chapter Summary

11.8 Chapter Quiz

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

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

Asia Pacific Headquarters
Cisco Systems, Inc.
168 Robinson Road
#28-01 Capital Tower
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

Europe Headquarters
Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: +31 0 800 020 0791
Fax: +31 0 20 357 1100

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at **www.cisco.com/go/offices.**

©2006 Cisco Systems, Inc. All rights reserved. CCVP, the Cisco logo, and the Cisco Square Bridge logo are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn is a service mark of Cisco Systems, Inc.; and Access Registrar, Aironet, BPX, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, Follow Me Browsing, FormShare, GigaDrive, GigaStack, HomeLink, Internet Quotient, IOS, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, iQuick Study, LightStream, Linksys, MeetingPlace, MGX, Networking Academy, Network Registrar, Packet, PIX, ProConnect, RateMUX, ScriptShare, SlideCast, SMARTnet, StackWise, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0609R)