DRAFT CCNA Routing and Switching (version 6.0) Scope and Sequence

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Target Audience

The Cisco CCNA® Routing and Switching curriculum is designed for Cisco Networking Academy® students who are seeking entry-level jobs in the ICT industry or hope to fulfill prerequisites to pursue more specialized ICT skills. CCNA Routing and Switching provides an integrated and comprehensive coverage of networking topics, from fundamentals to advanced applications and services, while providing opportunities for hands-on practical experience and career skills development.

The curriculum is appropriate for students at many education levels and types of institutions, including high schools, secondary schools, universities, colleges, career and technical schools, and community centers.

Curriculum Overview

The CCNA Routing and Switching curriculum consists of four courses that make up the recommended learning path. Students will be prepared to take the Cisco CCENT® certification exam after completing a set of two courses and the CCNA Routing and Switching certification exam after completing a set of four courses. The curriculum also helps students develop workforce readiness skills and builds a foundation for success in networking-related careers and degree programs. Figure 1 show the different courses included in the CCNA Routing and Switching curriculum.

Figure 1.   CCNA Routing and Switching Courses
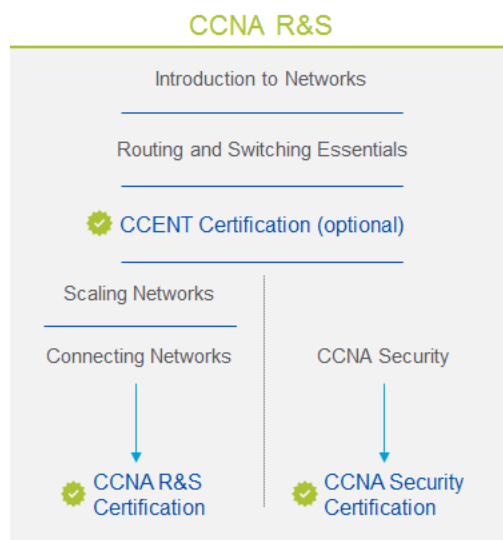
In each course, Networking Academy™ students will learn technology concepts with the support of interactive media and apply and practice this knowledge through a series of hands-on and simulated activities that reinforce their learning.

CCNA Routing and Switching teaches comprehensive networking concepts and skills, from network applications to the protocols and services provided to those applications by the lower layers of the network. Students will progress from basic networking to more complex enterprise and theoretical networking models later in the curriculum.

CCNA Routing and Switching includes the following features:

- Students learn the basics of routing, switching, and advanced technologies to prepare for the Cisco CCENT and CCNA R&S certification exams, networking related degree programs, and entry-level networking careers.
- The language used to describe networking concepts is designed to be easily understood by learners at all levels and embedded interactive activities help reinforce comprehension.
- Courses emphasize critical thinking, problem solving, collaboration, and the practical application of skills.
- Multimedia learning tools, including videos, games, and quizzes, address a variety of learning styles and help stimulate learning and promote increased knowledge retention.
- Hands-on labs and Cisco® Packet Tracer simulation-based learning activities help students develop critical thinking and complex problem solving skills.
- Embedded assessments provide immediate feedback to support the evaluation of knowledge and acquired skills.

Course Structure and Sequences

Market research and global employers have consistently indicated that the skills gap for general networking skills is shrinking, while the skills gap for essential networking technologies such as security, voice, and wireless, and for emerging technologies such as data center, cloud, and video, is growing. As a global leader in technology and networking, Cisco developed the CCENT and CCNA Routing and Switching certifications and curriculum to remain aligned with the rapidly changing global job market and trends.

Students may choose to pursue Cisco advanced technology certifications after achieving the prerequisite CCENT certification. The CCNA Routing and Switching course flow supports student flexibility by helping students prepare for the CCENT certification exam after the first two courses, and helps them prepare for the CCNA certification exam after completing all four courses.

Lab Equipment Requirements

Detailed equipment information, including descriptions and part numbers, is available in the CCNA Equipment List, which is located on the Cisco NetSpace Equipment Information site. Please refer to that document for the latest information, which includes specifications for the following minimum equipment required:

- 3 CISCO1941/K9 Integrated Services Routers Generation 2 (ISR-G2)
- 3 HWIC-2T Serial WAN Interface Cards
- 3 WS-C2960-24TT-L Cisco Catalyst switches
- 2 Linksys EA Series routers (2700, 3500, 4500) or equivalent
- Assorted Ethernet and Serial cables and hubs

CCNA Routing and Switching Courses Outlines

Table 1. Introduction to Networks and Routing and Switching Essentials Course Outlines

Chapter	Introduction to Networks	Routing and Switching Essentials
1	Exploring the Network	Routing Concepts
2	Configuring a Network Operating System	Static Routing
3	Network Protocols and Communications	Dynamic Routing
4	Network Access	Switched Networks
5	Ethernet	Switch Configuration
6	Network Layer	VLANs
7	IP Addressing	Access Control Lists
8	Subnetting IP Networks	DHCP
9	Transport Layer	NAT for IPv4
10	Application Layer	Device Management and Maintenance
11	Build a Small Network	

Introduction to Networks

This course introduces the architecture, structure, functions, components, and models of the Internet and other computer networks. 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. By the end of the course, students will be able to build simple LANs, perform basic configurations for routers and switches, and implement IP addressing schemes.

Students who complete Introduction to Networks will be able to perform the following functions:

- Understand and describe the devices and services used to support communications in data networks and the Internet
- Understand and describe the role of protocol layers in data networks
- Understand and describe the importance of addressing and naming schemes at various layers of data networks in IPv4 and IPv6 environments
- Design, calculate, and apply subnet masks and addresses to fulfill given requirements in IPv4 and IPv6 networks
- Explain fundamental Ethernet concepts such as media, services, and operations
- Build a simple Ethernet network using routers and switches
- Use Cisco command-line interface (CLI) commands to perform basic router and switch configurations
- Utilize common network utilities to verify small network operations and analyze data traffic

Routing and Switching Essentials

This course describes the architecture, components, and operations of routers and switches in a small network. Students learn how to configure a router and a switch for basic functionality. By the end of this course, students will be able to configure and troubleshoot routers and switches and resolve common issues with RIPv1, RIPng, single-area and multi-area OSPF, virtual LANs, and inter-VLAN routing in both IPv4 and IPv6 networks.

Students who complete the Routing and Switching Essentials course will be able to perform the following functions:

- Understand and describe basic switching and routing concepts
- Understand and describe the purpose, nature, and operations of a router, routing tables, and the route lookup process
- Configure and troubleshoot static routing and default routing (RIP and RIPng)
- Understand and describe how VLANs create logically separate networks and how routing occurs between them
- Understand, configure, and troubleshoot access control lists (ACLs) for IPv4 and IPv6 networks
- Understand, configure, and troubleshoot Dynamic Host Configuration Protocol (DHCP) for IPv4 and IPv6 networks
- Understand, configure, and troubleshoot Network Address Translation (NAT) operations
- Understand and configure device management and maintenance tasks including Cisco Discovery Protocol (CDP), Link Layer Discovery Protocol (LLDP), Network Time Protocol (NTP), Syslog, device back and recovery, password recovery, and IOS management

Table 2.   Scaling Networks and Connecting Networks Course Outlines

Chapter	Scaling Networks	Connecting Networks
1	LAN Design	WAN Concepts
2	Scaling VLANs	Point-to-Point Connections
3	Spanning Tree Protocols	Branch Connections
4	Etherchannel and HSRP	Access Control Lists
5	Dynamic Routing	Network Security and Monitoring
6	EIGRP	Quality of Service
7	EIGRP Tuning and Troubleshooting	Network Evolution
8	Single-Area OSPF	Network Troubleshooting
9	Multiarea OSPF	
10	OSPF Tuning and Troubleshooting	

Scaling Networks

This course describes the architecture, components, and operations of routers and switches in larger and more complex networks. Students learn how to configure routers and switches for advanced functionality. By the end of this course, students will be able to configure and troubleshoot routers and switches and resolve common issues with OSPF, EIGRP, and STP in both IPv4 and IPv6 networks. Students will also develop the knowledge and skills needed to implement a WLAN in a small-to-medium network.

Students who complete the Scaling Networks course will be able to perform the following functions:

- Configure, verify and troubleshoot VLANs spanning multiple switches: VTP, DTP and EtherChannel
- Configure, verify and troubleshoot STP protocols: Rapid Spanning Tree Protocol (RSTP), Per VLAN Spanning Tree Plus Protocol (PVST+) and Rapis Per VLAN Spanning Tree Plus Protocol (RPVST+)
- Understand, configure, and troubleshoot first hop redundancy protocols (HSRP)
- Understand and describe dynamic routing protocols, distance vector routing protocols, and link-state routing protocols
- Configure, verify and troubleshoot routers in a complex routed IPv4 or IPv6 network using single-area OSPF, multi-area OSPF, and Enhanced Interior Gateway Routing Protocol (EIGRP)

Connecting Networks

This course discusses the WAN technologies and network services required by converged applications in a complex network. The course enables students to understand the selection criteria of network devices and WAN technologies to meet network requirements. Students learn how to configure and troubleshoot network devices and resolve common issues with data link protocols. Students will also develop the knowledge and skills needed to implement virtual private network (VPN) operations in a complex network.

Students who complete the Connecting Networks course will be able to perform the following functions:

- Understand and describe different WAN technologies and their benefits
- Understand and describe the operations and benefits of virtual private networks (VPNs) and tunneling
- Configure, verify and troubleshoot serial connections: PPP and PPPoE
- Configure, verify and troubleshoot tunneling operations
- Configure, verify and troubleshoot eBGP in a single-homed remote access network.
- Configure, verify and troubleshoot IPv4 and IPv6 ACLs
- Configure SNMP to monitor network operations in a small to medium-sized business network
- Troubleshoot a network problem using SPAN
- Describe basic QoS concepts: network transmission characteristics, queueing algorithms and QoS mechanisms
- Describe Cloud Computing and Network Programmability in an enterprise network architecture
- Describe the pillars and the values of the Internet of Everything
- Troubleshoot end-to-end connectivity in a small to medium-sized business network, using a systematic approach

Recommended Courses Detailed Outlines

Table 3.   Introduction to Networks and Routing and Switching Essentials Detailed Course Outlines

Ch.	Introduction to Networks		Routing and Switching Essentials	
1	Exploring the Network		Routing Concepts	
	1.1	Globally Connected	1.1	Router Initial Configuration
	1.2	LANs, WANs, and the Internet	1.2	Routing Decisions
	1.3	The Network as a Platform	1.3	Router Operations
	1.4	The Changing Network Environment		
2	Configuring a Network Operating System		Static Routing	
	2.1	IOS Bootcamp	2.1	Implement Static Routes
	2.2	Basic Device Configuration	2.2	Configure Static and Default Routes
	2.3	Addressing Schemes	2.3	Troubleshoot Static and Default Route Issues
3	Network Protocols and Communications		Dynamic Routing	
	3.1	Rules of Communication	3.1	Dynamic Routing Protocols
	3.2	Network Protocols and Standards	3.2	RIPv2
	3.3	Data Transfer in the Network	3.3	The Routing Table
4	Network Access		Switched Networks	
	4.1	Physical Layer Protocols	4.1	LAN Design
	4.2	Network Media	4.2	The Switched Environment
	4.3	Data Link Layer Protocols		
	4.4	Media Access Control		
5	Ethernet		Switch Configuration	
	5.1	Ethernet Protocol	5.1	Basic Switch Configuration
	5.2	LAN Switches	5.2	Switch Security
	5.3	Address Resolution Protocol		
6	Network Layer		VLANs	
	6.1	Network Layer Protocols	6.1	VLAN Segmentation
	6.2	Routing	6.2	VLAN Implementations
	6.3	Routers	6.3	Inter-VLAN Routing Configuration
	6.4	Configuring a Cisco Router		
7	IP Addressing		Access Control Lists	
	7.1	IPv4 Network Addresses	7.1	ACL Operation
	7.2	IPv6 Network Addresses	7.2	Standard IPv4 ACLs
	7.3	Connectivity Verification	7.3	Troubleshoot ACLs
8	Subnetting IP Networks		DHCP	
	8.1	Subnetting an IPv4 Network	8.1	DHCPv4
	8.2	Addressing Schemes	8.2	DHCPv6
	8.3	Design Considerations for IPv6		
9	Transport Layer		NAT for IPv4	
	9.1	Transport Layer Protocols	9.1	NAT Operation

	9.2	TCP and UPD		9.2	Configuring NAT
				9.3	Troubleshooting NAT
10	Application Layer		Device Management and Maintenance		
	10.1	Application Layer Protocols		10.1	Device Discovery
	10.2	Well-Known Application Layer Protocols and Services		10.2	Device Management
				10.3	Device Maintenance
11	Build a Small Network				
	11.1	Network Design			
	11.2	Network Security			
	11.3	Basic Network Performance			
	11.4	Network Troubleshooting			

Table 4. Scaling Networks and Connecting Networks Detailed Course Outlines

Ch.	Scaling Networks		Connecting Networks	
1	LAN Design		WAN Concepts	
	1.1	Campus Wired LAN Designs	1.1	WAN Technologies Overview
	1.2	Campus Network Device Selection	1.2	Selecting a WAN Technology
2	Scaling VLANs		Point-to-Point Connections	
	2.1	VLANs, VTP and DTP	2.1	Serial Point-to-Point Overview
	2.2	Troubleshoot Multi-VLAN Issues	2.2	PPP Operations
	2.3	Layer 3 Switching	2.3	Configure PPP
			2.4	Troubleshooting PPP
3	Spanning Tree Protocols		Branch Connections	
	3.1	Spanning Tree Concepts	3.1	Remote Access Connections
	3.2	Varieties of Spanning Tree Protocols	3.2	VPNs
	3.3	Spanning Tree Configuration	3.3	PPPoE
			3.4	GRE
			3.5	eBGP
4	Etherchannel and HSRP		Access Control Lists	
	4.1	Link Aggregation Concepts	4.1	Standard ACL Operation and Configuration Review
	4.2	Implement Link Aggregation	4.2	Extended IPv4 ACLs
	4.3	Implement HSRP	4.3	IPv6 ACLs
			4.4	Troubleshoot ACLs
5	Dynamic Routing		Network Security and Monitoring	
	5.1	Dynamic Routing Protocols	5.1	LAN Security
	5.2	Distance Vector Dynamic Routing	5.2	SNMP
	5.3	Link-State Dynamic Routing	5.3	Cisco Switch Port Analyzer (SPAN)
6	EIGRP		Quality of Service	
	6.1	EIGRP Characteristics	6.1	QoS Overview
	6.2	Implement EIGRP for IPv4	6.2	QoS Mechanism
	6.3	EIGRP Operation		
	6.4	Implement EIGRP for IPv6		
7	EIGRP Tuning and Troubleshooting		Network Evolution	
	7.1	Tune EIGRP	7.1	Hierarchical Network Design
	7.2	Troubleshoot EIGRP	7.2	Cloud and Virtualization
			7.3	Network Programming
			7.4	Internet of Everything
8	Single-Area OSPF		Network Troubleshooting	
	8.1	OSPF Operations	8.1	Troubleshooting Methodology
	8.2	Single-Area OSPFv2	8.2	Troubleshooting Scenarios
	8.3	Single-Area OSPFv3		

9	Multiarea OSPF		
	9.1	Multiarea OSPF Operations	
	9.2	Implement Multiarea OSPF	
10	OSPF Tuning and Troubleshooting		
	10.1	Tune OSPF	
	10.2	Troubleshoot OSPF	

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