

# CIS 054: ROUTING AND SWITCHING ESSENTIALS

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**Originator**

fmarhuenda

**Justification / Rationale**

Adding C-ID in correct place

**Effective Term**

Fall 2023

**Credit Status**

Credit - Degree Applicable

**Subject**

CIS - Computer Information Systems

**Course Number**

054

**Full Course Title**

Routing and Switching Essentials

**Short Title**

ROUTERS & SWITCHES

**Discipline****Disciplines List**

Computer Information Systems (Computer network installation, microcomputer technology, computer applications)

**Modality**

Face-to-Face

100% Online

Hybrid

**Catalog Description**

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, RIPv2, single-area and multi-area OSPF, virtual LANs, and inter-VLAN routing in both IPv4 and IPv6 networks. This course, along with CIS 053 - Computer Network Fundamentals, should prepare students for the current version of the Cisco Certified Entry-level Network Technician (CCENT) certification exam. C-ID: ITIS 151

**Schedule Description**

This course, along with CIS-053, Computer Network Fundamentals, should prepare students for the current version of the Cisco Certified Entry-level Network Technician (CCENT) certification exam. Prerequisite: CIS-053 or equivalent

**Lecture Units**

2

**Lecture Semester Hours**

36

**Lab Units**

1

**Lab Semester Hours**

54

**In-class Hours**

90

**Out-of-class Hours**

72

**Total Course Units**

3

**Total Semester Hours**

162

**Prerequisite Course(s)**

CIS 053 or equivalent

**Required Text and Other Instructional Materials****Resource Type**

Book (Recommended)

**Author**

TestOut

**Title**

Routing and Switching Pro

**Edition**

7.0

**Publisher**

TestOut

**Year**

2022

**Class Size Maximum**

32

**Entrance Skills**

Show proficiency in IP Addressing, routing fundamentals, and subnets.

**Requisite Course Objectives**

CIS 053-Describe the role of protocol layers in data networks.

**Entrance Skills**

Understand the different networking media.

**Requisite Course Objectives**CIS 053-Describe and differentiate the devices and services used to support communications in data networks and the Internet.  
CIS 053-Explain fundamental Ethernet concepts such as media, services, and operations.**Entrance Skills**

Show proficiency in networking fundamentals and terminology.

**Requisite Course Objectives**CIS 053-Explain fundamental Ethernet concepts such as media, services, and operations.  
CIS 053-Build a simple Ethernet network using routers and switches.**Entrance Skills**

Demonstrate the principles and structure of IP (Internet Protocol) addressing and the fundamentals of Ethernet.

**Requisite Course Objectives**

CIS 053-Evaluate the importance of addressing and naming schemes at various layers of data networks in IPv4 and IPv6 environments.

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**Entrance Skills**

Understand cabling LAN's and WAN's.

**Requisite Course Objectives**

CIS 053-Build a simple Ethernet network using routers and switches.

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**Course Content**

1. Introduction to Switched Networks
  - a. LAN Design
  - b. The Switched Environment
2. Basic Switching Concepts and Configuration
  - a. Basic Switch configuration
  - b. Switch Security Management and Implementation
  - c. Configuring Basic Switch Settings
  - d. Configuring Switch Security Features
3. VLANs
  - a. VLAN Segmentation
  - b. VLAN Implementation
  - c. VLAN Security and Design
  - d. Configuring VLANs and Trunking
  - e. Troubleshooting VLAN Configurations
  - f. Implementing VLAN Security
4. Routing Concepts
  - a. Initial configuration of a Router
  - b. Routing Decisions
  - c. Router Operation
  - d. Mapping the Internet
  - e. Configuring Basic Router Settings with IOS CLI
  - f. Configuring Basic Router Settings with CCP
5. Inter-VLAN Routing
  - a. Inter-VLAN Routing
  - b. Troubleshoot Inter-VLAN Routing
  - c. Layer 3 Switching
  - d. Configuring Per-Interface Inter-VLAN Routing
  - e. Configuring 802.1Q Trunk-Based Inter-VLAN Routing
  - f. Troubleshooting Inter-VLAN Routing
6. Static Routing
  - a. Static Routing Implementation
  - b. Configure Static Routing and Default Routes
  - c. Review CIDR and VLSM
  - d. Configure Summary and Floating Static Routes
  - e. Troubleshoot Static and Default Route Issues
  - f. Configuring IPv4 Static and Default Routes
  - g. Configuring IPv6 Static and Default Routes
  - h. Designing and Implementing IPv4 Addressing with VLSM
  - i. Calculating Summary Routes with IPv4 and IPv6
  - j. Troubleshooting IPv4 and IPv6 Static Routes
7. Routing Dynamically
  - a. Dynamic Routing Protocols
  - b. Distance Vector Dynamic Routing
  - c. RIP and RIPv6 Routing

- d. Link-State Dynamic Routing
  - e. The Routing Table
  - f. Lab - Configuring Basic RIPv2 and RIPv3
8. Single-Area OSPF
- a. Characteristics of OSPF
  - b. Configuring Single-Area OSPFv2
  - c. Configure Single-Area OSPFv3
  - d. Configuring Basic Single-Area OSPFv2
  - e. Configuring Basic Single-Area OSPFv3
9. Access Control Lists
- a. IP ACL Operations
  - b. Standard IPv4 ACLS
  - c. Extended IPv4 ACLS
  - d. Troubleshoot ACLS
  - e. IPv6 ACLs
  - f. Configuring and Verifying Standard ACLS
  - g. Configuring and Verifying VTY Restrictions
  - h. Configuring and Verifying Extended ACLS
  - i. Troubleshooting ACL Configuration and Placement
  - j. Configuring and Verifying IPv6 ACLS
10. DHCP
- a. Dynamic Host Configuration Protocol v4
  - b. Dynamic Host Configuration Protocol v6
  - c. Configuring Basic DHCPv4 on a Router
  - d. Configuring Basic DHCPv4 on a Switch
  - e. Troubleshooting DHCPv4
  - f. Configuring Stateless and Stateful DHCPv6
  - g. Troubleshooting DHCPv6
11. Network Address Translation for IPv4
- a. NAT Operation
  - b. Configuring NAT
  - c. Troubleshooting NAT
  - d. Configuring Dynamic and Static NAT
  - e. Configuring NAT Pool Overload and PAT

### Lab Content

#### Chapter 3 CISCO DEVICES

##### Command Line Interface (CLI)

- Find Device Information

##### Device Settings

- Configure Hostnames and Descriptions
- Configure Banners
- Modify Banners

##### Device Passwords

- Set Console and Virtual Terminal Lines (VTY) Passwords
- Explore Enable Passwords
- Modify System Passwords

##### Cisco Discovery Protocol (CDP)

- Explore CDP
- Configure CDP
- Modify the CDP Configuration
- Find CDP Information

#### Chapter 4 IP ADDRESSING

##### Subnet Planning and Design

- Configure Subnet Masks 1
- Configure Subnet Masks 2

#### Dynamic Host Configuration Protocol (DHCP)

- Configure a DHCP Server
- Configure DHCP Manual Bindings
- Configure a DHCP Relay Agent

#### The Domain Name System (DNS)

- Configure DNS Addresses
- Create Standard DNS Zones
- Create Host Records
- Create CNAME Records
- Troubleshoot DNS Records

#### Chapter 5 SWITCHING

##### Switch Interface Configuration

- Configure Switch Ports
- Configure IP Settings on a Switch
- Configure the Host and Interface on a Switch
- Configure Device IP Settings
- Explore Switch Port Status

#### Chapter 6 IPV4 ROUTING

##### Static Routing

- Configure Static Routes

##### Dynamic Routing

- Find Routing Table Information

##### Network Communications Troubleshooting

- Explore TCP/IP Communications

#### Chapter 7 IPV4 ROUTING PROTOCOLS

##### Open Shortest Path First (OSPF) Configuration

- Enable OSPF
- Explore OSPF
- Configure OSPF Routing

##### Adjacency Troubleshooting

- Troubleshoot OSPF 1
- Troubleshoot OSPF 2

##### Enhanced Interior Gateway Protocol (EIGRP) for IPV4 Configuration

- Enable EIGRP

#### Chapter 9 WIRELESS NETWORKS

##### Wireless Configuration

- Create a Home Wireless Network
- Secure a Home Wireless Network

##### Wireless Network Design

- Design an Indoor Wireless Network
- Design an Outdoor Wireless Network

##### Wireless Network Implementation

- Implement an Enterprise Wireless Network

##### Small Office Home Office Configuration (SOHO)

- Configure a Wireless Infrastructure

##### Wireless Security

- Secure an Enterprise Wireless Network

##### Wireless Troubleshooting

- Optimize a Wireless Network
- Explore Wireless Network Problems
- Troubleshoot Wireless Network Problems

## Chapter 10 WIDE AREA NETWORK (WAN) IMPLEMENTATION

### Leased Line WAN Links

- Explore Serial Interface Status
- Configure Back-to-Back Routers

### Network Address Translation (NAT)

- Configure Dynamic NAT
- Configure Static NAT

### Wan Troubleshooting

- View Serial Interface Status
- Troubleshoot a Serial Connection 1
- Troubleshoot a Serial Connection 2

## Chapter 11 ADVANCED SWITCHING

### Virtual Local Area Network (VLANs)

- Create VLANs
- Configure Trunking
- Configure the Native VLAN
- Configure Allowed VLANs

### Spanning Tree

- Configure EtherChannel with Port Aggregation Protocol (PAGP)
- Configure EtherChannel with Link Aggregation Protocol (LACP)

### Spanning Tree Configuration

- Configure the Root Bridge
- Configure the Primary and Secondary Root Bridges
- Configure Rapid Pre-VLAN Spanning Tree+ (PVST+)
- Find Spanning Tree Protocol (STP) Information 1
- Find Spanning Tree Protocol (STP) Information 2

### Router-on-a-Stick InterVLAN Routing

- Configure InterVLAN Routing

### Switch InterVLAN Routing

- Configure SVI for InterVLAN Routing 1
- Configure SVI for InterVLAN Routing 2
- Troubleshoot InterVLAN Routing 1
- Troubleshoot InterVLAN Routing 2

### Switch Troubleshooting

- Find VLAN Information
- Troubleshoot VLANs 1
- Troubleshoot VLANs 2

## Chapter 12 ACCESS CONTROL LISTS (ACLs)

### Access Control Lists

- Restrict Telnet and Secure Shell (SSH) Access
- Permit Traffic
- Block Source Hosts

### IPV6 and Extended ACLs

- Configure Allowed Networks
- Create Access List Statements
- Block Invalid Addresses
- Allow Only Specific Services

## Chapter 13 Network Management

### Default Gateway Redundancy

- Configure Hot Standby Router Protocol (HSRP)

## Chapter 14 Network Security

### Network Security Best Practices

- Change the Default Password on a Switch

### Switch Security

- Configure DHCP Snooping and Dynamic Address Resolution Protocol (ARP) Inspection
- Configure Port Security 1
- Configure Port Security 2
- Configure Port Security 3
- Harden a Switch
- Secure Access to a Switch
- Secure Access to a Switch 2

### Combat Malware

- Detect Open Ports with Nmap
- View Open Ports with netstat
- Scan for Open Ports from a Remote Computer
- Counter Malware with Windows Defender

### Sniffing

- Spoof Media Access Control (MAC) Addresses with Sensor-MAC (SMAC)
- Filter and Analyze Traffic with Wireshark
- Capture HTTP POST Packets with Wireshark

### Session Hijacking

- Hijack a Web Session

### Denial of Service

- Analyze ICMP Traffic in Wireshark
- Analyze a DDoS Attack

## Chapter 15 CRYPTOGRAPHY

### Cryptography

- Compare an MD5 Hash

## Course Objectives

	Objectives
Objective 1	Describe basic switching concepts, how VLANs create logically separate networks and how routing occurs between them, and enhanced switching technologies such as VLANs, VLAN Trunking Protocol (VTP), Rapid Spanning Tree Protocol (RSTP), Per VLAN Spanning Tree Protocol (PVSTP), and 802.1q.
Objective 2	Configure and troubleshoot basic operations of a small switched network, VLANs, and inter-VLAN routing.
Objective 3	Understand and describe the purpose, nature, and operations of a router, routing tables, and the route lookup process, dynamic routing protocols, distance vector routing protocols, and link-state routing protocols, the purpose and types of access control lists (ACLs), and the operations and benefits of Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS) for IPv4 and IPv6, and Network Address Translation (NAT).
Objective 4	Configure and verify static routing and default routing; configure and troubleshoot basic operations of routers in a small routed network including Routing Information Protocol (RIPv1 and RIPv2) and Open Shortest Path First (OSPF) protocol (single-area OSPF); Configure, monitor, and troubleshoot ACLs for IPv4 and IPv6; and configure and troubleshoot NAT operations.

## Student Learning Outcomes

	Upon satisfactory completion of this course, students will be able to:
Outcome 1	Describe and implement basic switching concepts and enhanced switching technologies.
Outcome 2	Assemble, configure, and troubleshoot a small switched network and perform basic routing operations.
Outcome 3	Categorize and describe the purpose, nature, and operations of various network hardware.
Outcome 4	Set up and verify static routing and default routing using basic operations of routers in a small routed network.

**Methods of Instruction**

Method	Please provide a description or examples of how each instructional method will be used in this course.
Activity	Projects in order to facilitate and demonstrate the acquisition of skills required to determine which wildcard mask should be used and the difference between standard ACLs and Extended ACLs.
Technology-based instruction	Web-based/web-enhanced/online/distance learning tasks/activities such as Cisco testing, Netlab lab assignments, online curriculum, and online lab submissions in order for students to understand the principles of routing troubleshooting and access control lists.
Participation	Presentation of class lectures/discussions/demonstrations in order to clarify the principles of Routing protocols RIP/ICMP and IP addressing.
Lecture	Presentation of class lectures/discussions/demonstrations in order to model and explain the fundamental concepts of routing, managing Cisco IOS software, distance vector routing protocols, IGRP, and Access Control Lists (ACLs).
Discussion	Online and hands on Laboratory activities and application assignments in order to address areas of improvement in the fundamental concepts of how ACL's provide security and control to a network.
Collaborative/Team	Collaborative projects/cooperative learning tasks in order to encourage students to develop and apply Cisco networking skills.

**Methods of Evaluation**

Method	Please provide a description or examples of how each evaluation method will be used in this course.	Type of Assignment
Self-paced testing	Computer laboratory assignments/projects designed to clarify students' individual router fluency strengths and areas of improvement.	In and Out of Class
Self-paced testing	Exercises/lab projects designed to demonstrate the acquisition of Access Control List and interface placement.	In and Out of Class
Mid-term and final evaluations	The 100-105 ICND1 v3.0 exam will be used as the final exam for the course.	In and Out of Class
Tests/Quizzes/Examinations	Quizzes/examinations designed to measure students' degree of mastery of routing fundamentals.	In and Out of Class
Group activity participation/observation	Collaborative projects designed to demonstrate successful understanding of routing configuration skills and team work skills.	In and Out of Class
Laboratory projects	Lab projects and oral presentations combing the use of router configurations, static routing, using RIP, using IGRP and basic router troubleshooting.	In and Out of Class

**Assignments**
**Other In-class Assignments**

- Initializing and Reloading a Router and Switch
- Installing the IPv6 Protocol with Windows XP
- Configuring Basic Switch Settings
- Configuring Switch Security Features
- Configuring VLANs and Trunking
- Troubleshooting VLAN Configurations
- Implementing VLAN Security
- Configuring Basic Router Settings with IOS CLI
- Configuring Basic Router Settings with CCP
- Configuring Per-Interface Inter-VLAN Routing
- Configuring 802.1Q Trunk-Based Inter-VLAN Routing



- Troubleshooting Inter-VLAN Routing
- Configuring IPv4 Static and Default Routes
- Configuring IPv6 Static and Default Routes
- Designing and Implementing IPv4 Addressing with VLSM
- Troubleshooting IPv4 and IPv6 Static Routes
- Configuring Basic RIPv2 and RIPv6
- Configuring Basic Single-Area OSPFv2
- Configuring Basic Single-Area OSPFv3
- Configuring and Verifying Standard ACLs
- Configuring and Verifying VTY Restrictions
- Configuring and Verifying Extended ACLs
- Troubleshooting ACL Configuration and Placement
- Configuring and Verifying IPv6 ACLs
- Configuring Basic DHCPv4 on a Router
- Configuring Basic DHCPv4 on a Switch
- Troubleshooting DHCPv4
- Configuring Stateless and Stateful DHCPv6
- Troubleshooting DHCPv6
- Configuring Dynamic and Static NAT
- Configuring NAT Pool Overload and PAT
- Troubleshooting NAT Configurations

#### **Other Out-of-class Assignments**

Students are required to read the Cisco Netacad Web site and the CCNA Exploration Routing Protocols and Concepts course booklet. Utilizing the concepts learned, students will write configurations files and implement Link-State and Distant Vector routing protocols. Students will also write configuration files to implement static routes and analyze the routing tables.

Students will be completing assignments outside of class utilizing Packet Tracer and Netlab. These assignments will consist of preset configuration requirements covering different router and switch networking scenarios.

#### **Grade Methods**

Letter Grade Only

#### **Distance Education Checklist**

Include the percentage of online and on-campus instruction you anticipate.

#### **Instructional Materials and Resources**

#### **Effective Student/Faculty Contact**

Which of the following methods of regular, timely, and effective student/faculty contact will be used in this course?

##### **Within Course Management System:**

Chat room/instant messaging  
Discussion forums with substantive instructor participation  
Online quizzes and examinations  
Private messages  
Regular virtual office hours  
Timely feedback and return of student work as specified in the syllabus  
Video or audio feedback  
Weekly announcements

##### **External to Course Management System:**

Direct e-mail  
Posted audio/video (including YouTube, 3cm mediasolutions, etc.)  
Synchronous audio/video  
Teleconferencing  
Telephone contact/voicemail

## Other Information

### Comparable Transfer Course Information

**University System**

CSU

**Campus**

CSU San Bernardino

**Course Number**

IST 275

**Course Title**

Information Networking and Security

**Catalog Year**

2016-2017

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## MIS Course Data

**CIP Code**

11.0101 - Computer and Information Sciences, General.

**TOP Code**

070100 - Information Technology, General

**SAM Code**

C - Clearly Occupational

**Basic Skills Status**

Not Basic Skills

**Prior College Level**

Not applicable

**Cooperative Work Experience**

Not a Coop Course

**Course Classification Status**

Credit Course

**Approved Special Class**

Not special class

**Noncredit Category**

Not Applicable, Credit Course

**Funding Agency Category**

Not Applicable

**Program Status**

Program Applicable

**Transfer Status**

Transferable to CSU only

**General Education Status**

Y = Not applicable

**Support Course Status**

N = Course is not a support course

**C-ID**

ITIS 151

**Allow Audit**

Yes

**Repeatability**

No

**Materials Fee**

No

**Additional Fees?**

No

**Approvals****Curriculum Committee Approval Date**

03/01/2022

**Academic Senate Approval Date**

03/10/2022

**Board of Trustees Approval Date**

06/16/2022

**Chancellor's Office Approval Date**

11/10/2022

**Course Control Number**

CCC000634448

**Programs referencing this course**Liberal Arts: Business and Technology AA Degree (<http://catalog.collegeofthedesert.eduundefined/?key=27>)Information Technology Specialist Certificate of Achievement (<http://catalog.collegeofthedesert.eduundefined/?key=312>)Computer Information Systems Associate of Science (<http://catalog.collegeofthedesert.eduundefined/?key=323>)Computer Information Systems AS Degree for Employment Preparation (<http://catalog.collegeofthedesert.eduundefined/?key=61>)