

## Implementing Cisco IP Switched Networks (SWITCH)

### **COURSE OVERVIEW:**

Implementing Cisco Switched Networks (SWITCH) v2.0 is a five-day instructor-led training course developed to help students prepare for Cisco CCNP certification. The ROUTE course is a component of the CCNP Routing and Switching curriculum.

This course is designed to help learners create an efficient and expandable enterprise network by installing, configuring, and verifying network infrastructure equipment according to the Cisco Enterprise Campus Architecture. Some older topics from Version 1 have been removed or simplified, while several new IPv6 routing topics have been added. The course content has been adapted to Cisco IOS Software Release 15 and technically updated.

### **WHO WILL BENEFIT FROM THIS COURSE?**

This course is appropriate for learners with Cisco CCNA-level knowledge who aim to be network professionals. Typical job roles include network engineers, support engineers, systems engineers or network technicians.

### **PREREQUISITES:**

- The knowledge and skills that a learner must have before attending this curriculum are as follows:
- Describing network fundamentals
- Establishing Internet and WAN connectivity (IPv4 and IPv6)
- Managing network device security Operating a medium-sized LAN with multiple switches, supporting VLANs, trunking, and spanning tree
- Troubleshooting IP connectivity (IPv4 and IPv6) Configuring and troubleshooting EIGRP and OSPF (IPv4 and IPv6)
- Configuring devices for SNMP, syslog, and NetFlow access
- Managing Cisco device configurations, Cisco IOS images, and licenses
- It is highly recommended that this course be taken after the following Cisco courses:
- Interconnecting Cisco Networking Devices v2.0, Part 1 (ICND1 v2.0) and Part 2 (ICND2 v2.0), or
- Interconnecting Cisco Networking Devices: Accelerated version 2.0 (CCNAX v2.0)

**COURSE OBJECTIVES:**

After completion of this course, students will be able to...

- Describe the hierarchical campus structure, basic switch operation, use of SDM templates, PoE, and LLDP
- Implement VLANs, trunks, explain VTP, implement DHCP in IPv4 and IPv6 environments, and configure port aggregation
- Implement and optimize STP mechanism that best suits your network - PVSTP+, RPVSTP+, or MSTP
- Configure routing on a multilayer switch
- Configure NTP, SNMP, IP SLA, and port mirroring, and verify StackWise and VSS operation
- Implement first hop redundancy in IPv4 and IPv6 environments
- Secure the campus network according to recommended practices

**COURSE OUTLINE:****Module 1: Basic Concepts and Network Design****Lesson 1: Analyzing Campus Network Structure**

- Hierarchical Network Design
- Layers in the Hierarchical Model
- Building Cisco Enterprise Campus Architecture
- Access Layer
- Distribution Layer
- Core Layer
- Is a Core Layer Needed?
- Types of Cisco Switches
- Routed vs. Switched Campus Architectur

**Lesson 2: Comparing Layer 2 and Multilayer Switches**

- Layer 2 Switch Operation
- Multilayer Switch Operation
- Frame Rewrite
- CAM and TCAM
- **Discovery 1: Investigating the CAM**
- Distributed Hardware Forwarding
- Cisco Switching Methods
- Route Caching
- Topology-Based Switching

**Lesson 3: Using Cisco SDM Templates**

- What Are SDM Templates?
- SDM Template Types
- Changing the SDM Template
- Choosing the Correct Template

#### **Lesson 4: Implementing LLDP**

- LLDP Introduction
- Enabling LLDP
- Discovering Neighbors Using LLDP
- **Challenge Lab 1: Network Discovery**

#### **Lesson 5: Implementing PoE**

- PoE Components
- PoE Standards
- PoE Negotiation
- Configuring and Verifying PoE
- The Need for PoE

### **Module 2: Campus Network Architecture**

#### **Lesson 1: Implementing VLANs and Trunks**

- **Discovery 2: Configuring VLANs and Trunks**
- The Native VLAN
- Switch Port Mode Interactions
- Deploying VLANs
- End-to-End vs. Local VLANs
- Voice VLAN Overview
- Voice VLAN Configuration
- Switch Configuration for Wireless Network Support

#### **Lesson 2: Introducing VTP**

- The Role of VTP
- VTP Modes
- **Discovery 3: VTP Operation**
- VTP Versions
- Default VTP Configuration
- Overwriting VTP Configuration
- VTP Configuration Recommendation

#### **Lesson 3: Implementing DHCP**

- DHCP Overview
- **Discovery 4: Exploring DHCP**
- DHCP Relay
- DHCP Options
- **Challenge Lab 2: Configure DHCP**

#### **Lesson 4: Implementing DHCP for IPv6**

- Stateless Autoconfiguration Overview
- DHCPv6 Overview
- DHCPv6 Operation
- Stateless DHCPv6 Overview
- **Discovery 5: Obtaining IPv6 Addresses Dynamically**
- DHCPv6 Relay Agent
- **Challenge Lab 3: Configure DHCPv6**

#### **Lesson 5: Configuring Layer 2 Port Aggregation**

- The Need for EtherChannel
- EtherChannel Mode Interactions
- Layer 2 EtherChannel Configuration Guidelines
- **Discovery 6: EtherChannel Configuration and Load Balancing**
- EtherChannel Load-Balancing Options
- EtherChannel Load-Balancing Operation
- EtherChannel Guard
- **Challenge Lab 4: Configure EtherChannel**

### **Module 3: Spanning Tree Implementation**

#### **Lesson 1: Implementing RSTP**

- STP Overview
- STP Standards
- STP Operation Bridge Protocol Data Units
- Root Bridge Election
- Root Port Election
- Designated Port Election
- STP Port States
- Per VLAN Spanning Tree
- **Discovery 7: Discovering and Modifying STP Behavior**
- RSTP Port Roles
- Comparison of RSTP and STP Port States
- STP Topology Changes
- RSTP Topology Changes
- RSTP Link Types
- **Challenge Lab 5: Implement RSTP**

#### **Lesson 2: Implementing STP Stability Mechanisms**

- Cisco STP Toolkit
- UplinkFast
- BackboneFast
- PortFast
- Securing a PortFast Interface with BPDU guard
- Disabling STP with BPDU filter
- **Discovery 8: Root Guard**
- The Problem with Unidirectional Links
- Loop Guard Overview
- Loop Guard Configuration
- Loop Guard Verification
- UDLD Overview
- UDLD Configuration
- Comparing Loop Guard with UDLD
- UDLD Recommended Practices
- STP Stability Mechanism Recommendations
- Flex Links
- **Challenge Lab 6: Improve STP Configuration**

### **Lesson 3: Implementing MST**

- Introducing MST
- MST Regions
- STP Instances with MST
- Extended System ID for MST
- **Discovery 9: Configuring MST**
- Configuring MST Path Cost
- Configuring MST Port Priority
- MST Protocol Migration
- MST Recommended Practices
- **Challenge Lab 7: Configure MST**

## **Module 4: Inter-VLAN Routing**

### **Lesson 1: Implementing Inter-VLAN Routing Using a Router**

- Inter-VLAN Routing Using an External Router
- **Discovery 10: Routing with an External Router**
- External Router: Advantages and Disadvantages
- **Challenge Lab 8: Configure Routing Between VLANs with a Router**

### **Lesson 2: Configuring a Switch to Route**

- Switch Virtual Interfaces
- Routed Switch Ports
- **Discovery 11: Routing on a Multilayer Switch**
- SVI autostate exclude Command
- SVI Configuration Checklist
- Layer 2 EtherChannel vs. Layer 3 EtherChannel
- Layer 3 EtherChannel Configuration
- **Challenge Lab 9: Configure Routing on a Multilayer Switch**

## **Module 5: High-Availability Networks**

### **Lesson 1: Configuring Network Time Protocol**

- The Need for Accurate Time
- Configuring the System Clock Manually
- Network Time Protocol
- NTP Modes
- **Discovery 12: NTP Configuration**
- Securing NTP
- NTP Source Address
- NTP Versions
- NTP in an IPv6 Environment
- Simple Network Time Protocol
- SNTP Configuration
- **Challenge Lab 10: Configure NTP**



### **Lesson 2: Implementing SNMP Version 3**

- SNMP Overview
- SNMP Versions
- SNMP Recommendations
- SNMPv3 Configuration
- Verifying the SNMPv3 Configuration

### **Lesson 3: Implementing the Cisco IOS IP SLA**

- Cisco IOS IP SLA Introduction
- IP SLA Source and Responder
- **Discovery 13: IP SLA Echo Configuration**
- IP SLA Operation with Responder
- IP SLA Responder Time Stamps
- Configuring Authentication for the IP SLA
- Configuration Example: UDP Jitter
- **Challenge Lab 11: Configure Network Monitoring Using the Cisco IOS IP SLA**

### **Lesson 4: Implementing Port Mirroring for Monitoring Support**

- What Is SPAN?
- SPAN Terminology
- Remote SPAN
- Local SPAN Configuration
- Verifying the Local SPAN Configuration
- RSPAN Configuration
- Verifying the RSPAN Configuration

### **Lesson 5: Verifying Switch Virtualization**

- The Need for Logical Switching Architectures
- What Is StackWise?
- StackWise Benefits
- Verifying StackWise
- Redundant Switch Supervisors
- Supervisor Redundancy Modes
- What Is VSS?
- VSS Benefits
- Verifying VSS

## **Module 6: First Hop Redundancy Protocol Implementation**

### **Lesson 1: Configuring Layer 3 Redundancy with HSRP**

- The Need for First-Hop Redundancy
- The Idea Behind the First-Hop Redundancy Process
- **Discovery 14: Configuring and Tuning HSRP**
- HSRP State Transition
- HSRP and STP
- Load Sharing with HSRP
- The Need for Interface Tracking with HSRP
- HSRP Interface Tracking
- HSRP and Object Tracking

- HSRP Authentication
- HSRP Timers
- HSRP Versions
- **Challenge Lab 12: Configure HSRP with Load Balancing**

#### **Lesson 2: Configuring Layer 3 Redundancy with VRRP**

- About VRRP
- **Discovery 15: Configure VRRP and Spot the Differences from HSRP**
- Tracking and VRRP
- VRRP Interface-Tracking Configuration
- **Challenge Lab 13: Configure VRRP with Load Balancing**

#### **Lesson 3: Configuring Layer 3 Redundancy with GLBP**

- Introducing GLBP
- GLBP vs. HSRP
- GLBP States
- **Discovery 16: Configure GLBP**
- GLBP Load-Balancing Options
- GLBP Authentication
- GLBP and STP
- Tracking and GLBP
- **Challenge Lab 14: Implement GLBP**

#### **Lesson 4: Configuring First Hop Redundancy Protocol for IPv6**

- IPv6 Native First-Hop Redundancy
- Why FHRP in IPv6?
- HSRP for IPv6
- GLBP for IPv6
- **Challenge Lab 15: Configure HSRP for IPv6**

### **Module 7: Campus Network Security**

#### **Lesson 1: Implementing Port Security**

- Overview of Switch Security Issues
- Recommended Practices for Switch Security
- Unauthorized Access by Rogue Devices
- Switch Attack Categories
- MAC Flooding Attack
- Introducing Port Security
- **Discovery 17: Port Security**
- Port Error Conditions
- Error-Disabled Port Automatic Recovery
- Port Access Lists
- Configure Port Access Lists
- **Challenge Lab 16: Control Network Access with Port Security**

**Lesson 2: Implementing Storm Control**

- Storm Control
- Configuring Storm Control
- Verifying Storm Control Behavior

**Lesson 3: Implementing Access to External Authentication**

- AAA Framework Overview
- Benefits of AAA Usage
- Authentication Options
- RADIUS and TACACS+
- Enabling AAA and Configuring a Local User for Fallback
- Configuring RADIUS for Console and vty Access
- Configuring TACACS+ for Console and vty Access
- Configuring Authorization and Accounting
- Limitations of TACACS+ and RADIUS
- Identity-Based Networking
- IEEE 802.1X Port-Based Authentication
- IEEE 802.1X Configuration Checklist

**Lesson 4: Mitigating Spoofing Attacks**

- DHCP Spoofing Attacks
- DHCP Snooping
- DHCP Snooping Configuration
- IP Source Guard
- IP Source Guard Configuration
- ARP Spoofing
- Dynamic ARP Inspection
- DAI Configuration

**Lesson 5: Securing VLAN Trunks**

- Switch Spoofing
- Protecting Against Switch Spoofing
- VLAN Hopping
- Protecting Against VLAN Hopping
- VLAN Access Lists
- VACL Interaction with ACL and PACL
- Configuring VACLs

**Lesson 6: Configuring PVLANS**

- The Need for PVLANS
- Introduction to PVLANS
- PVLAN Port Types
- PVLAN Configuration
- PVLAN Verification
- PVLANS Across Multiple Switches
- Protected Port Feature

**Lesson 7: Module Summary**



**Lab Outline:**

There are 2 different types of labs being used to aid learning. **Discovery labs** are instructor guided labs through which students explore new topics in an interactive way. **Challenge labs** are designed to test students understanding of the topics being taught and to provide vital hands-on practice.

**labs:**

- Discovery 1: Investigating the CAM
- Discovery 2: Configuring VLANs and Trunks
- Discovery 3: VTP Operation
- Discovery 4: Exploring DHCP
- Discovery 5: Obtaining IPv6 Addresses Dynamically
- Discovery 6: EtherChannel Configuration and Load Balancing
- Discovery 7: Discovering and Modifying STP Behavior
- Discovery 8: Root Guard
- Discovery 9: Configuring MST
- Discovery 10: Routing with an External Router
- Discovery 11: Routing on a Multilayer Switch
- Discovery 12: NTP Configuration
- Discovery 13: IP SLA Echo Configuration
- Discovery 14: Configuring and Tuning HSRP
- Discovery 15: Configure VRRP and Spot the Differences from HSRP
- Discovery 16: Configure GLBP
- Discovery 17: Port Security
  
- Challenge 1: Network Discovery
- Challenge 2: Configure DHCP
- Challenge 3: Configure DHCPv6
- Challenge 4: Configure EtherChannel
- Challenge 5: Implement RSTP
- Challenge 6: Improve STP Configuration
- Challenge 7: Configure MST
- Challenge 8: Configure Routing Between VLANs with a Router
- Challenge 9: Configure Routing on a Multilayer Switch
- Challenge 10: Configure NTP
- Challenge 11: Configure Network Monitoring Using the Cisco IOS IP SLA
- Challenge 12: Configure HSRP with Load Balancing
- Challenge 13: Configure VRRP with Load Balancing
- Challenge 14: Implement GLBP
- Challenge 15: Configure HSRP for IPv6
- Challenge 16: Control Network Access with Port Security

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