CCNAX

Interconnecting Cisco Networking Devices: Accelerated

Version 2.0

Course Administration

Part Number: To be filled in later

CISCO

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Course Management

Course Description

The CCNA curriculum includes a third course, *Interconnecting Cisco Networking Devices: Accelerated* (CCNAX), a derivative works course consisting of ICND1 and ICND2 content in its entirety, but with the content merged into a single course. Overlapping content between ICND1 and ICND2 is eliminated and content is rearranged for the purpose of the course flow.

This course teaches learners how to install, operate, configure, and verify a basic IPv4 and IPv6 network, including configuring a LAN switch, configuring an IP router, identifying basic security threats, understanding redundant topologies, troubleshooting common network issues, connecting to a WAN, configuring EIGRP and OSPF in both IPv4 and IPv6, understanding wide-area network technologies, and getting familiar with device management and Cisco licensing. CCNAX v2.0 is augmented by a virtual classroom presentation, which has additional slides and interactions for instructor use. In addition to the classic hardware-based lab, Cisco will offer a new set of Cisco Learning Lab Classroom Labs. Learner will encounter more troubleshooting, and more lab time than with the previous version of CCNAX.

Full Title of Course	Interconnecting Cisco Networking Devices: Accelerated
Course Acronym	CCNAX
Course Version Number	2.0
New Course?	No
Replaces:	Interconnecting Cisco Networking Devices: Accelerated v1.1

Curricula

The course is used in the following curricula, certifications, or specializations:

- Cisco CCENT™
- Cisco CCNA Routing and Switching®
- Cisco CCDA®
- Cisco CCNA Security®
- Cisco CCNA Voice®

- Cisco CCNA Wireless®
- Cisco CCNA Service Provider Operations®
- Cisco CCNP®
- Cisco CCDP®

Course Goal and Objectives

Upon completing this course, you will be able to meet these objectives:

- Describe network fundamentals and build simple LANs
- Establish Internet connectivity
- Manage network device security
- Describe IPv6 basics
- Troubleshoot VLAN issues, explain how STP works, configure EtherChannel, and understand the idea behind Layer 3 redundancy
- Troubleshoot IP connectivity
- Define the characteristics, functions, and components of a WAN
- Configure and troubleshoot EIGRP in an IPv4 environment, and configure EIGRP for IPv6
- Configure, verify, and troubleshoot multi-area OSPF
- Describe SNMP, syslog and NetFlow, and manage Cisco device configurations, IOS images, and licenses

Target Audiences

This section specifies the primary and secondary target audiences of this course by job roles and notes the relevance to each job role.

Target Candidate: Individuals seeking the Cisco CCNA® Routing and Switching certification. The course is also appropriate for pre-sales and post-sales network engineers involved in the installation and support of enterprise branch office networks.

Key Job Tasks:

- **Configure**: Implement the identified solution by applying the planned implementation processes using Cisco IOS commands and applications in the correct order to the selected devices and portions of the network.
- **Verify**: Use the appropriate **show** and **debug** commands and applications to ensure that the solution was correctly implemented and is performing as desired.
- **Troubleshoot:** Use the appropriate **show** and **debug** commands and applications to identify the cause of basic level network issues and correctly implement a solution that ensures the network is performing as desired.
- **Job roles**: Entry Level Network Engineer, Network Administrator, Network Support Technician or Help Desk Technician.

Prerequisite Skills and Knowledge

The knowledge and skills that a learner must have before attending this course are as follows:

- Basic computer literacy

- Basic PC operating system navigation skills
- Basic Internet usage skills
- Basic IP address knowledge

ICND1/ICND2 to CCNAX Module Mapping

CCNAX v2.0 is a course that merges the ICND1 v2.0 and ICND2 v2.0 courses. The first three modules of CCNAX (*Building a Simple Network*, *Establishing Internet Connectivity*, *Managing Network Device Security*) are mapped from ICND1 without modifications. The fourth module of CCNAX is *Introducing IPv6*, taken from ICND1 and adapted by removing OSPFv3 discussion and configuration. The fifth module in CCNAX is called *Building a Medium-Sized Network* and merges the ICND1 module of the same name and the ICND2 module *Implementing Scalable Medium-Sized Switched Networks*. *Troubleshooting Basic Connectivity*, the sixth module, is copied from ICND2. The next three modules, *Wide-Area Networks*, *Implementing an EIGRP-Based Solution* and *Implementing a Scalable OSPF-Based Solution*, take modules of the same name from ICND2 and merge them with few basic concepts that were introduced in ICND1. The last module, *Network Device Management*, is taken from ICND2. *ICND1 Superlab*, *ICND2 Review Lab*, and *ICND2 Superlab* are not included in CCNAX v2.0.

	ICND1 v2.0		CCNAX v2.0
M1	Building a Simple Network	M1	Building a Simple Network
M1 L1	Exploring the Functions of Networking	M1 L1	Exploring the Functions of Networking
M1 L2	Understanding the Host-to-Host Communications Model	M1 L2	Understanding the Host-to-Host Communications Model
M1 L3	Introducing LANs	M1 L3	Introducing LANs
M1 L4	Operating Cisco IOS Software	M1 L4	Operating Cisco IOS Software
M1 L5	Starting a Switch	M1 L5	Starting a Switch
M1 L6	LAB Performing Switch Startup and Initial Configuration	M1 L6	LAB Performing Switch Startup and Initial Configuration
M1 L7	Understanding Ethernet and Switch Operation	M1 L7	Understanding Ethernet and Switch Operation
M1 L8	Troubleshooting Common Switch Media Issues	M1 L8	Troubleshooting Common Switch Media Issues
M1 L9	LAB Troubleshooting Switch Media Issues	M1 L9	LAB Troubleshooting Switch Media Issues
M2	Establishing Internet Connectivity	M2	Establishing Internet Connectivity
M2 L1	Understanding the TCP/IP Internet Layer	M2 L1	Understanding the TCP/IP Internet Layer
M2 L2	IP Addressing and Subnets	M2 L2	IP Addressing and Subnets
M2 L3	Understanding the TCP/IP Transport Layer	M2 L3	Understanding the TCP/IP Transport Layer
M2 L4	Exploring the Functions of Routing	M2 L4	Exploring the Functions of Routing

	ICND1 v2.0		CCNAX v2.0
M2 L5	Configuring a Cisco Router	M2 L5	Configuring a Cisco Router
M2 L6	LAB Performing Initial Router Setup and Configuration	M2 L6	LAB Performing Initial Router Setup and Configuration
M2 L7	Exploring the Packet-Delivery Process	M2 L7	Exploring the Packet-Delivery Process
M2 L8	Enabling Static Routing	M2 L8	Enabling Static Routing
M2 L9	Managing Traffic Using ACLs	M2 L9	Managing Traffic Using ACLs
M2 L10	Enabling Internet Connectivity	M2 L10	Enabling Internet Connectivity
M2 L11	LAB Connecting to the Internet	M2 L11	LAB Connecting to the Internet
M3	Managing Network Device Security	M3	Managing Network Device Security
M3 L1	Securing Administrative Access	M3 L1	Securing Administrative Access
M3 L2	LAB Enhancing the Security of the Initial Configuration	M3 L2	LAB Enhancing the Security of the Initial Configuration
M3 L3	Implementing Device Hardening	M3 L3	Implementing Device Hardening
M3 L4	LAB Device Hardening	M3 L4	LAB Device Hardening
M3 L5	Implementing Traffic Filtering with ACLs	M3 L5	Implementing Traffic Filtering with ACLs
M3 L6	LAB Filtering Traffic with ACLs	M3 L6	LAB Filtering Traffic with ACLs
M4	Building a Medium-Sized Network		
M4 L1	Implementing VLANs and Trunks		
M4 L2	Routing between VLANs		
M4 L3	LAB Configuring Expanded Switched Networks		
M4 L4	Using a Cisco Network Devices as a DHCP Server		
M4 L5	LAB Configuring DHCP Server		

	ICND1 v2.0		CCNAX v2.0
M4 L6	Introducing WAN Technologies		Merged into Understanding WAN Technologies
M4 L7	Introducing Dynamic Routing Protocols		Merged into Understanding EIGRP
M4 L8	Implementing OSPF		
M4 L9	LAB Implementing OSPF		
M5	Introducing IPv6	M4	Introducing IPv6
M5 L1	Introducing Basic IPv6	M4 L1	Introducing Basic IPv6
M5 L2	LAB Configure and Verify Basic IPv6	M4 L2	LAB Configure and Verify Basic IPv6
M5 L3	Understanding IPv6	M4 L3	Understanding IPv6
M5 L4	LAB Configure and Verify Stateless Autoconfiguration	M4 L4	LAB Configure and Verify Stateless Autoconfiguration
M5 L5	Configuring IPv6 Routing	M4 L5	Configuring IPv6 Routing (adapted)
M5 L6	LAB Configure and Verify IPv6 Routing	M4 L6	LAB Configure and Verify IPv6 Routing (adapted)
		M5	Building a Medium-Sized Network
		M5 L1	Implementing VLANs and Trunks
		M5 L2	Routing Between VLANs
		M5 L3	LAB Configuring Expanded Switched Networks
		M5 L4	Using a Cisco Network Devices as a DHCP Server
		M5 L5	LAB Configuring DHCP Server
M6	ICND1 Superlab		Removed
	ICND2 v2.0		
M1	Review of ICND1		Removed
M2	Implementing Scalable Medium-Sized Switched Networks		

	ICND1 v2.0		CCNAX v2.0
M2 L1	Troubleshooting VLAN Connectivity	M5 L6	Troubleshooting VLAN Connectivity
M2 L2	LAB Troubleshoot VLANs and Trunks	M5 L7	LAB Troubleshoot VLANs and Trunks
M2 L3	Building Redundant Switched Topologies	M5 L8	Building Redundant Switched Topologies
M2 L4	LAB Optimizing STP	M5 L9	LAB Optimizing STP
M2 L5	Improving Redundant Switched Topologies with Etherchannel	M5 L10	Improving Redundant Switched Topologies with Etherchannel
M2 L6	LAB Configuring EtherChannel	M5 L11	LAB Configuring EtherChannel
M2 L7	Understanding Layer 3 Redundancy	M5 L12	Understanding Layer 3 Redundancy
M3	Troubleshooting Basic Connectivity	M6	Troubleshooting Basic Connectivity
M3 L1	Troubleshooting Basic Connectivity	M6 L1	Troubleshooting Basic Connectivity
M3 L2	LAB Troubleshooting IP Connectivity	M6 L2	LAB Troubleshooting IP Connectivity
M3 L3	Troubleshooting IPv6 Network Connectivity	M6 L3	Troubleshooting IPv6 Network Connectivity
		M7	Wide-Area Networks
		M7 L1	Understanding WAN Technologies (merged)
		M7 L2	Configuring and Troubleshooting a Serial Encapsulation
		M7 L3	LAB Configuring a Serial Connection
		M7 L4	Establishing a WAN Connection using Frame Relay
		M7 L5	LAB Establishing a Frame Relay WAN
		M7 L6	Introducing VPN Solutions
		M7 L7	Configuring GRE Tunnels
		M7 L8	LAB Establishing a GRE Tunnel

	ICND1 v2.0		CCNAX v2.0
M4	Implementing an EIGRP-Based Solution	M8	Implementing an EIGRP-Based Solution
M4 L1	Implementing EIGRP	M8 L1	Implementing EIGRP (merged)
M4 L2	LAB Implementing EIGRP	M8 L2	LAB Implementing EIGRP
M4 L3	Troubleshooting EIGRP	M8 L3	Troubleshooting EIGRP
M4 L4	LAB Troubleshooting EIGRP	M8 L4	LAB Troubleshooting EIGRP
M4 L5	Implementing EIGRP for IPv6	M8 L5	Implementing EIGRP for IPv6
M4 L6	LAB Implementing EIGRP for IPv6	M8 L6	LAB Implementing EIGRP for IPv6
M5	Implementing a Scalable Multiarea Network OSPF-Based Solution	M9	Implementing a Scalable OSPF-Based Solution
		M9 L1	Implementing OSPF (merged)
		M9 L2	LAB Implementing OSPF
M5 L1	OSPF Overview		Merged into Implementing OSPF
M5 L2	Multiarea OSPF IPv4 Implementation	M9 L3	Multiarea OSPF IPv4 Implementation
M5 L3	LAB Configuring Multiarea OSPF	M9 L4	LAB Configuring Multiarea OSPF
M5 L4	Troubleshooting Multiarea OSPF	M9 L5	Troubleshooting Multiarea OSPF
M5 L5	LAB Troubleshooting Multiarea OSPF	M9 L6	LAB Troubleshooting Multiarea OSPF
M5 L6	Examining OSPFv3	M9 L7	Examining OSPFv3
M5 L7	LAB Configuring OSPF for IPv6	M9 L8	LAB Configuring OSPF for IPv6
M6	Wide-Area Networks		
M6 L1	Understanding WAN Technologies		
M6 L2	Configuring Serial Encapsulation		

	ICND1 v2.0		CCNAX v2.0
M6 L3	LAB Configuring and Troubleshooting a Serial Connection		
M6 L4	Establishing a WAN Connection using Frame Relay		
M6 L5	LAB Establishing a Frame Relay WAN		
M6 L6	Introducing VPN Solutions		
M6 L7	Configuring GRE Tunnels		
M6 L8	LAB Establishing a GRE Tunnel		
M7	Network Device Management	M10	Network Device Management
M7 L1	Configuring Network Devices to Support Network Management Protocols	M10L1	Configuring Network Devices to Support Network Management Protocols
M7 L2	LAB SNMP and Syslog Basic Configuration	M10L2	LAB SNMP and Syslog Basic Configuration
M7 L3	Paper Lab: Analyzing NetFlow Data	M10L3	Paper Lab: Analyzing NetFlow Data
M7 L4	Managing Cisco Devices	M10L4	Managing Cisco Devices
M7 L5	Licensing	M10L5	Licensing
M7 L6	LAB Managing Cisco Devices and Licensing	M10L6	LAB Managing Cisco Devices and Licensing
M8	ICND2 Superlab		Removed

Different colors indicate how content was merged and repositioned into CCNAX course.

Course Instruction Details

Instructor Certification Requirements

To teach this course, instructors must have attended the following training or completed the following requirements:

- New Instructor:

- – Certified Cisco Systems Instructor (CCSI) in good standing
- – Cisco CCNA R&S certified
- – Complete one of the following:
  - Attend the CCNAX v2.0 course
  - Attend the ICND1 v2.0 and ICND2 v2.0 courses
- Current CCNAX Instructor:
  - – Certified Cisco Systems Instructor (CCSI) in good standing
  - – Cisco CCNA R&S certified
  - – Complete one of the following:
    - Attend CCNAX v2.0 course
    - Attend ICND1 v2.0 and ICND2 v2.0 courses
    - Attend ICND1 v2.0 and ICND2 v2.0 train-the-trainer (TTT)
    - Attend ICND1 v2.0 and ICND2 v2.0 On-demand train-the-trainer (TTT)

Required Classroom Reference Materials

Required Item	Explanation and Notes
Student Guide	Available in hard copy or electronic version.
Lab Guide	Available in hard copy or electronic version.
Course Evaluation Form	Each learner should be encouraged to complete a standard online survey, with results reported in Metrics That Matter.
Course Administration Guide	Your reference for course delivery.
Instructor Slide Package	Contains materials for course delivery.
Other	

Required Classroom Environment

This information describes recommended class size and classroom setup:

- Room large enough for 16 learners, set up classroom-style with chairs and tables
- A projector capable of displaying slides
- Projection screen, as needed
- Whiteboard with surface area of 4 x 8 feet or greater
- Usable dry-erase pens in multiple colors
- Climate control
- Sufficient power for all equipment
- For local labs, rack and floor space to locate all equipment
- For remote lab delivery, access to the Internet for all learners and the instructor

Detailed Course Flow

An accelerated course typically delivers a given amount of content over a shorter period than normal. As opposed to a traditional five-day course flow schedule, the following table outlines approximately how long each module will take to deliver. The timing of each module does include the time that it will take to complete the corresponding labs, but does not include lunch or breaks. You may make adjustments based on the skills, knowledge, and preferences of the learners in attendance. The presentation of all topics is optional for noncertification offerings, but you are encouraged to use them because they are designed to reinforce the lesson concepts and ensure that learners apply some of the concepts.

CCNAX Module	Timing
Module 0: Course Introduction	0:30
Module 1: Building a Simple Network	6:00
Module 2: Establishing Internet Connectivity	7:30
Module 3: Managing Network Device Security	5:30
Module 4: Introducing IPv6	3:00
Module 5: Building a Medium-Sized Network	9:30
Module 6: Troubleshooting Basic Connectivity	2:00
Module 7: Wide-Area Networks	6:30
Module 8: Implementing an EIGRP-Based Solution	4:00
Module 9: Implementing a Scalable OSPF-Based Solution	5:00
Module 10: Network Device Management	3:30
Total	**53:00**

Course Evaluation

Evaluation Levels

The effectiveness of the course will be evaluated at these levels of the Kirkpatrick performance evaluation:

- **Level 1:** Reaction to the course
    - **Course effects:** End-of-module (or end-of-lesson) quizzes, lab solution assessments, and case study assessments will be administered by the instructor, and may include group discussions and individual queries.
    - **Course evaluation:** Each learner will be encouraged to complete a standard online survey, with results reported in Metrics That Matter.
- **Level 2:** Learning retained
    - **Course effects:** Certification exam pass rates and reliability studies will compare to the JTA job tasks.
    - **Course evaluation:** Certification exam pass rates and reliability studies will compare to the JTA job tasks.
- **Level 3:** Performance changes after the curriculum
    - **Curriculum effects:** Curriculum evaluation will be performed, including surveys and focus groups of students, instructors, and SMEs.
    - **Curriculum evaluation:** Curriculum evaluation will be performed, including surveys and focus groups of students, instructors, and SMEs.
- **Level 4:** Results on the job, after the curriculum
    - **Curriculum effects:** Voluntary, opt-in survey responses will be conducted and compared to the JTA and Claims and Component Skills.
    - **Curriculum evaluation:** Voluntary, opt-in survey responses will be conducted and compared to the JTA and Claims and Component Skills.

Course Outlines

High Level Course Outline

This subtopic provides an overview of how the course is organized. The course contains these components:

- Building a Simple Network
- Establishing Internet Connectivity
- Managing Network Device Security
- Introducing IPv6
- Building a Medium-Sized Network
- Troubleshooting Basic Connectivity
- Wide Area Networks
- Implementing an EIGRP-Based Solution
- Implementing a Scalable OSPF-Based Solution
- Network Device Management
- Lab 1-1: Performing Switch Startup and Initial Configuration
- Lab 1-2: Troubleshooting Switch Media Issues
- Lab 2-1: Performing Initial Router Setup and Configuration
- Lab 2-2: Connecting to the Internet
- Lab 3-1: Enhancing the Security of the Initial Configuration
- Lab 3-2: Device Hardening
- Lab 3-3: Filtering Traffic with ACLs
- Lab 4-1: Configure and Verify Basic IPv6
- Lab 4-2: Configure and Verify Stateless Autoconfiguration
- Lab 4-3: Configure and Verify IPv6 Routing
- Lab 5-1: Configuring Expanded Switched Networks
- Lab 5-2: Configuring DHCP Server

- Lab 5-3: Troubleshooting VLANs and Trunks
- Lab 5-4: Optimizing STP
- Lab 5-5: Configuring EtherChannel
- Lab 6-1: Troubleshooting IP Connectivity
- Lab 7-1: Configuring and Troubleshooting a Serial Connection
- Lab 7-2: Establishing a Frame Relay WAN
- Lab 7-3: Establishing a GRE Tunnel
- Lab 8-1: Implementing EIGRP
- Lab 8-2: Troubleshooting EIGRP
- Lab 8-3: Implementing EIGRP for IPv6
- Lab 9-1: Implementing OSPF
- Lab 9-2: Configuring Multiarea OSPF
- Lab 9-3: Troubleshooting Multiarea OSPF
- Lab 9-4: Configuring OSPF for IPv6
- Lab 10-1: SNMP and Syslog Basic Configuration
- Lab 10-2: Analyzing NetFlow Data
- Lab 10-3: Managing Cisco Devices and Licensing

Detailed Course Outline

This in-depth outline of the course structure lists each module, lesson, and topic.

Course Introduction

The Course Introduction provides learners with the course objectives and prerequisite learner skills and knowledge. The Course Introduction presents the course flow diagram and the icons that are used in the course illustrations and figures. This course component also describes the curriculum for this course, providing learners with the information that they need to make decisions regarding their specific learning path.

- Overview
- Course Goal and Objectives
- Course Flow
- Additional References
- Your Training Curriculum

Module 1: Building a Simple Network

Module Objective: Describe network fundamentals and build simple LANs

Lesson 1: Exploring the Functions of Networking

Lesson Objective: Identify the components of a computer network and describe their basic characteristics

This lesson includes these topics:

- What Is a Network?

- VC Challenge Question: Physical Components of a Network
- Physical Components of a Network
- VC Poll Question: Primary Function of a Router
- Interpreting a Network Diagram
- Impact of User Applications on the Network
- Characteristics of a Network
- Physical vs. Logical Topologies
- VC Interactivity: Logical Topologies
- VC Interactivity: Common Network Topologies
- Summary

Lesson 2: Understanding the Host-to-Host Communications Model

Lesson Objective: Understand the model of host-to-host communication

This lesson includes these topics:

- Introducing Host-to-Host Communications
- OSI Reference Model
- VC Challenge Question: Layered Models
- TCP/IP Protocol Suite
- VC Poll Question: Internet Layer
- Encapsulation and De-Encapsulation
- Peer-to-Peer Communications
- VC Interactivity: Layer Identification
- VC Discussion Question: Benefits of Using a Layered Model
- Summary

Lesson 3: Introducing LANs

Lesson Objective: Describe LANs and the role of switches within LANs

This lesson includes these topics:

- Local Area Networks
- VC Challenge Question: LANs vs. WANs
- LAN Components
- VC Interactivity: LAN Devices
- Need for Switches
- Switches
- Summary

Lesson 4: Operating Cisco IOS Software

Lesson Objective: Describe the features and functions of the Cisco IOS Software

This lesson includes these topics:

- Cisco IOS Software Features and Functions
- Cisco IOS CLI Functions
- User EXEC Mode
- Privileged EXEC Mode
- VC Interactivity: EXEC Mode Prompt
- Help Functions in the CLI
- CLI Error Messages
- Managing Cisco IOS Configurations
- VC Poll Question: Making Configuration Backups
- Improving the User Experience in the CLI
- VC Interactivity: Hot Keys and Shortcuts
- Summary

Lesson 5: Starting a Switch

Lesson Objective: Install a switch and perform the initial configuration

This lesson includes these topics:

- Switch Installation
- VC Challenge Question: Switch Booting
- Switch LED Indicators
- Connecting to a Console Port
- Basic Switch Configuration
  Instructor Note: Do not spend too much time explaining all the details regarding VLAN interface, IP address assignment, etc. Focus here is just overview of basic configuration commands.
- VC Interactivity: Port Configuration
- Verifying the Switch Initial Startup Status
- VC Poll Question: Switch Uptime
- VC Discussion Question: Incorrect IP Address
- Summary

Lab 1-1: Performing Switch Startup and Initial Configuration

Lab Objective: Restart the switch and verify the initial configuration messages

This lab includes these tasks:

- Task 1: Perform a Reload and Verify that the Switch Is Unconfigured
- Task 2: Configure the Switch with a Hostname and an IP Address
- Task 3: Explore Context-Sensitive Help
- Task 4: Improve the Usability of the CLI

Lesson 6: Understanding Ethernet and Switch Operation

Lesson Objective: Describe Ethernet as the network access layer of TCP/IP and describe the operation of switches

This lesson includes these topics:

- Ethernet LAN Connection Media
- Ethernet Frame Structure
- MAC Addresses
- VC Interactivity: Vendor-Assigned Part of the MAC Address
- Switching Operation
- VC Interactivity: Unicast Frame Processing
- VC Interactivity: Switching Process
- VC Interactivity: Forwarding
- Duplex Communication
- Configuring Duplex and Speed Options
- VC Interactivity: Full Duplex vs. Half Duplex
- Summary

Lesson 7: Troubleshooting Common Switch Media Issues

Lesson Objective: Identify and resolve common switched network issues

This lesson includes these topics:

- Common Troubleshooting Tools
- Media Issues
- Troubleshooting Switch Media Issues
- VC Poll Question: The show interface Command
- VC Interactivity: Troubleshooting Media Issues
- Port Issues
- Troubleshooting Port Issues
- VC Interactivity: Troubleshooting Speed and Duplex Issues
- Summary

Lab 1-2: Troubleshooting Switch Media Issues

Lab Objective: Follow troubleshooting guidelines to determine the source of connectivity problems between a computer and a switch, and fix them

This lab includes these tasks:

- Task 1: Lab Setup
- Task 2: Troubleshoot Connectivity Between Computer PC1 and Switch SW1
- Task 3: Troubleshoot Connectivity Between Switch SW1 and the Branch Router

Lesson 8: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 9: Module Self-Check

Lesson Objective:

This lesson includes these topics:

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Module 2: Establishing Internet Connectivity

Module Objective: Establish Internet connectivity

Lesson 1: Understanding the TCP/IP Internet Layer

Lesson Objective: Describe IPv4 and its addressing scheme

This lesson includes these topics:

- Internet Protocol
- IPv4 Address Representation
- IPv4 Header Address Fields
  Instructor Note: The IPv4 header has many fields, but at this point, students only need to know about the destination and source address. The whole header is displayed only so that students are made aware that it comprises more than those two fields.
- Decimal and Binary Systems
- Decimal-to-Binary Conversion
  Instructor Note: Focus of topic is to illustrate how conversion can be done. Students may use calculators to convert between decimal and binary numbers when performing calculations on their own.
- IP Address Classes
- Reserved IPv4 Addresses
- VC Interactivity: Reserved IPv4 Address
- Domain Name System
- Verifying the IPv4 Address of a Host
- VC Interactivity: The ipconfig command
- Summary

Lesson 2: Understanding IP Addressing and Subnets

Lesson Objective: Describe subnets, subnetting, and the role of subnet masks

This lesson includes these topics:

- VC Challenge Question: Subnetworking
- Subnets
- Subnet Masks

- Octet Values of a Subnet Mask
- VC Discussion Question: Number of Subnets
- Default Gateways
- Computing Usable Subnetworks and Hosts
- Applying Subnet Masks
- Determining the Network Addressing Scheme
- VC Interactivity: Host Address
- Example: Addressing Scheme
  Instructor Note: Network engineers rarely do subnetting by hand now. Students should understand how subnetting works so they will be able to use a usable IP address if they are given a subnet. You can also show them one of the many online subnet calculators.
- Variable-Length Subnet Mask
- VLSM Example
- VC Interactivity: Number of Bits Borrowed
- VC Interactivity: Subnet Mask
- VC Interactivity: Broadcast Address
- Summary

Lesson 3: Understanding the TCP/IP Transport Layer

Lesson Objective: Describe the TCP/IP transport layer

This lesson includes these topics:

- TCP/IP Transport Layer Functions
- Reliable vs. Best-Effort Transport
- TCP vs. UDP Analogy
- UDP Characteristics
- TCP Characteristics
- VC Interactivity: Reliable vs. Best-Effort Comparison
- TCP/IP Applications
- VC Interactivity: Port Numbers
- Summary

Lesson 4: Exploring the Functions of Routing

Lesson Objective: Describe the functions of routing in the network model

This lesson includes these topics:

- VC Challenge Question: Exploring the Functions of Routing
- Role of a Router
- Router Characteristics
- Router Functions
- VC Interactivity: Packet Forwarding

- Path Determination

- VC Interactivity: Path Determination

- Routing Table

- Types of Routes

- VC Poll Question: Which Route?

- Dynamic Routing Protocols
  Instructor Note: Distance vector routing and link state routing are only briefly mentioned. Avoid explaining details in this topic; it is only an introduction.

- Summary

Lesson 5: Configuring a Cisco Router

Lesson Objective: Implement basic configuration on a Cisco router

This lesson includes these topics:

- VC Challenge Question: Startup Procedure

- Initial Router Startup

- Initial Router Setup

- VC Discussion Question: Entering Global Configuration Mode

- Configuring Router Interfaces

- VC Interactivity: Configuring an Interface

- Configuring the Cisco Router IP Address

- Verifying Interface Configuration and Status

- VC Poll Question: Show Interfaces

- Exploring Connected Devices

- VC Challenge Question: Neighbor Discovery

- Cisco Discovery Protocol

- Discovering Neighbors Using Cisco Discovery Protocol

- VC Interactivity: Cisco Discovery Protocol Verification Commands

- VC Interactivity: Determine Interface with Cisco Discovery Protocol

- Summary

Lab 2-1: Performing Initial Router Setup and Configuration

Lab Objective: Observe the router boot procedure and perform basic router configuration

This lab includes these tasks:

- Task 1: Inspect the Router Hardware and Software

- Task 2: Create the Initial Router Configuration

- Task 3: Improve the Usability of the CLI

- Task 4: Discover Connected Neighbors with Cisco Discovery Protocol

Lesson 6: Exploring the Packet Delivery Process

Lesson Objective: Understand host-to-host communications across switches and routers

This lesson includes these topics:

- VC Challenge Question: Packet Delivery Process
- Layer 2 Addressing
  Instructor Note: The figures refer to Layer 2 and Layer 3 of the OSI model, not the TCP/IP model.
- Layer 3 Addressing
  Instructor Note: This figure refers to Layer 2 and Layer 3 of the OSI model, not the TCP/IP model.
- Address Resolution Protocol
- Host-to-Host Packet Delivery
- Role of a Switch in Packet Delivery
- VC Interactivity: Unknown Address
- VC Interactivity: Routing Process
- Summary

Lesson 7: Enabling Static Routing

Lesson Objective: Describe the operation, benefits, and limitations of static routing

This lesson includes these topics:

- Routing Operations
- Static and Dynamic Routing Comparison
- When to Use Static Routing
- VC Interactivity: Static and Dynamic Routes
- Static Route Configuration
- Default Routes
- Static Route Configuration Verification
- VC Interactivity: Static Route Configuration
- Summary

Lesson 8: Managing Traffic Using ACLs

Lesson Objective: Describe the operation of ACLs and their applications in the network

This lesson includes these topics:

- Using ACLs
  Instructor Note: Do not go into the details regarding different actions that can be taken. Traffic classification and traffic filtering should not be discussed at this point.
- ACL Operation
- ACL Wildcard Masking
- Wildcard Bit Mask Abbreviations
- VC Interactivity: ACL Wildcard Mask
- VC Interactivity: Wildcard Mask Unique Match

- Types of ACLs

- VC Interactivity: ACL Number

- Testing an IP Packet Against a Numbered Standard Access List

- Basic Configuration of Numbered Standard IPv4 ACLs
  Instructor Note: This topic does not go into applying ACLs.

- Summary

Lesson 9: Enabling Internet Connectivity

Lesson Objective: Configure Internet access using DHCP clients, NAT, and PAT on Cisco routers

This lesson includes these topics:

- The Demarcation Point

- VC Challenge Question: DHCP

- Dynamic Host Configuration Protocol

- Options for Configuring a Provider-Assigned IP Address

- Configuring a Static Provider-Assigned IP Address

- Configuring a DHCP Client

- Public vs. Private IPv4 Addresses

- VC Interactivity: Public vs. Private IP Addresses

- Introducing NAT

- Types of Addresses in NAT

- VC Interactivity: NAT Address Type

- Types of NAT

- Understanding Static NAT

- Configuring Static NAT

- Verifying Static NAT Configuration

- Understanding Dynamic NAT

- Configuring Dynamic NAT

- Verifying Dynamic NAT Configuration

- VC Interactivity: Address Translation

- Understanding PAT

- Configuring PAT

- Verifying PAT Configuration

- VC Interactivity: Address Translation—Web Server

- Troubleshooting NAT

- Troubleshooting NAT Case Study

- VC Discussion Question: show ip nat translations

- Summary

Lab 2-2: Connecting to the Internet

Lab Objective: Establish Internet connectivity by enabling static routing, DHCP, and NAT

This lab includes these tasks:

- Task 1: Configure a Manual IP Address and Static Default Route
- Task 2: Configure a DHCP-Obtained IP Address
- Task 3: Configure NAT
- Task 4: Configure NAT with PAT

Lesson 10: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 11: Module Self-Check

Lesson Objective:

This lesson includes these topics:

-

Module 3: Managing Network Device Security

Module Objective: Manage network device security

Lesson 1: Securing Administrative Access

Lesson Objective: Implement a basic security configuration

This lesson includes these topics:

- Network Device Security Overview
- Securing Access to Privileged EXEC Mode
- VC Interactivity: Access to Privileged EXEC Mode
- VC Interactivity: Securing Privileged EXEC Mode
- Securing Console Access
- Securing Remote Access
- Enabling Remote Access Connectivity
- VC Challenge Question: ACLs
- Limiting Remote Access with ACLs
- External Authentication Options
- Configuring the Login Banner
- Summary

Lab 3-1: Enhancing the Security of the Initial Configuration

Lab Objective: Increase the security of the initial switch and router configuration

This lab includes these tasks:

- Task 1: Add Password Protection
- Task 2: Enable SSH Remote Access
- Task 3: Limit Remote Access to Selected Network Addresses
- Task 4: Configure a Login Banner

Lesson 2: Implementing Device Hardening

Lesson Objective: Implement basic steps to harden network devices

This lesson includes these topics:

- Securing Unused Ports
- VC Interactivity: Securing Unused Ports
- Port Security
- Port Security Configuration
- Port Security Verification
- VC Interactivity: Port Security Configuration
- Disabling Unused Services
- VC Interactivity: Disabling Unused Services
- Network Time Protocol
- Configuring NTP
- Verifying NTP
- VC Interactivity: Network Time Protocol
- Summary

Lab 3-2: Device Hardening

Lab Objective: Perform security device hardening on a router and switch

This lab includes these tasks:

- Task 1: Disable Unused Ports
- Task 2: Configure Port Security on a Switch
- Task 3: Disable Unused Services
- Task 4: Configure NTP

Lesson 3: Implementing Traffic Filtering with ACLs

Lesson Objective: Implement standard, extended, numbered, and named ACLs to filter traffic

This lesson includes these topics:

- VC Challenge Question: Traffic Filtering
- Using ACLs to Filter Network Traffic
- ACL Operation
- VC Interactivity: Inbound ACLs
- Applying ACLs to Interfaces

- VC Poll Question: Number of ACLs
- The Need for Extended ACLs
- Configuring Numbered, Extended IPv4 ACLs
- VC Interactivity: Extended ACL Example
- Configuring Named ACLs
- VC Interactivity: Named ACL Example
- ACL Configuration Guidelines
- VC Interactivity: ACL Position
- Monitoring ACLs
- VC Interactivity: ACL Configuration Example
- Troubleshooting Common ACL Errors
- VC Discussion Question: Find Mistakes
- Summary

Lab 3-3: Filtering Traffic with ACLs

Lab Objective: Configure traffic filtering by using ACLs

This lab includes these tasks:

- Task 1: Configure an ACL
- Task 2: Lab Setup
- Task 3: Troubleshoot an ACL

Lesson 4: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 5: Module Self-Check

Lesson Objective:

This lesson includes these topics:

-

Module 4: Introducing IPv6

Module Objective: Describe IPv6 basics

Lesson 1: Introducing Basic IPv6

Lesson Objective: Describe IPv6 main features, addresses, and basic configuration

This lesson includes these topics:

- VC Challenge Question: Why implement IPv6
- IPv4 Addressing Exhaustion Workarounds
- IPv6 Features

- IPv6 Addresses
- IPv6 Unicast Addresses
- IPv6 Addresses Allocation
- VC Interactivity: IPv6 Address
- Basic IPv6 Connectivity
- Summary

Lab 4-1: Configure and Verify Basic IPv6

Lab Objective: Enable IPv6 support on a router and perform basic configuration

This lab includes these tasks:

- Task 1: Enable IPv6 on the Router

Lesson 2: Understanding IPv6

Lesson Objective: Describe IPv6 operations

This lesson includes these topics:

- IPv6 Header Changes and Benefits
- VC Poll Question: Dropped IPv4 Header Fields
- ICMPv6
- Neighbor Discovery
- VC Poll Question: Neighbor Discovery Functions
- Stateless Autoconfiguration
- VC Poll Question: Stateless Autoconfiguration Command
- Summary

Lab 4-2: Configure and Verify Stateless Autoconfiguration

Lab Objective: Configure and verify stateless autoconfiguration

This lab includes these tasks:

- Task 1: Enable Stateless Autoconfiguration on the Router

Lesson 3: Configuring IPv6 Routing

Lesson Objective: Identify routing protocols for IPv6

This lesson includes these topics:

- Overview
- Routing for IPv6
- Static Routing
- VC Poll Question: Static Route Command
- Summary

Lab 4-3: Configure and Verify IPv6 Routing

Lab Objective: Configure and verify IPv6 routing by enabling static routing

This lab includes these tasks:

- Task 1: Task: Enable IPv6 Static Routing

Lesson 4: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 5: Module Self-Check

Lesson Objective:

This lesson includes these topics:

-

Module 5: Building a Medium-Sized Network

Module Objective: Implement and verify VLANs and trunking

Lesson 1: Implementing VLANs and Trunks

Lesson Objective: Implement and verify VLANs and trunking

This lesson includes these topics:

- Overview
- VC Challenge Question: VLANs
- Issues in a Poorly Designed Network
- VLAN Introduction
- VC Interactivity: Use of VLANs
- VC Interactivity: Hierarchical Addressing
- Trunking with 802.1Q
- VC Interactivity: VLANs over Multiple Switches
- Creating a VLAN
- Assigning a Port to a VLAN
- Configuring an 802.1Q Trunk
- VLAN Design Considerations
- Summary

Lesson 2: Routing Between VLANs

Lesson Objective: Describe the application and configuration of inter-VLAN routing

This lesson includes these topics:

- Purpose of Inter-VLAN Routing
- Options for Inter-VLAN Routing
- VC Discussion Question: Inter-VLAN Routing
- Configuring a Router with a Trunk Link

- Summary

Lab 5-1: Configuring Expanded Switched Networks

Lab Objective: Configure the network to support VLAN segmentation

This lab includes these tasks:

- Task 1: Configure a VLAN
- Task 2: Configure the Link Between Switches as a Trunk
- Task 3: Configure a Trunk Link on the Router

Lesson 3: Using a Cisco Network Device as a DHCP Server

Lesson Objective: Configure a Cisco IOS DHCPv4 server on a Cisco router and switch

This lesson includes these topics:

- VC Challenge Question: DHCP
- Need for a DHCP Server
- Understanding DHCP
  Instructor Note: This topic focuses on DHCP address allocation. Students should already be familiar with general DHCP properties and other DHCP allocation methods.
- VC Interactivity: DHCP Messages
- Configuring a DHCP Server
- VC Interactivity: DHCP Parameters
- Monitoring DHCP Server Functions
- DHCP Relay Agent
  Instructor Note: The scope of the topic is to explain only what needs to be done in the Branch office to support a centralized DHCP solution. The centralized DHCP solution is just briefly reviewed and not discussed in detail.
- VC Interactivity: DHCP
- Summary

Lab 5-2: Configuring DHCP Server

Lab Objective: Configure and troubleshoot the DHCP server

This lab includes these tasks:

- Task 1: Configure DHCP Pools
- Task 2: Exclude Specific IP Addresses from DHCP Pools
- Task 3: Configure DHCP Relay Agent
- Task 4: Manually Assign IP Addresses

Lesson 4: Troubleshooting VLAN Connectivity

Lesson Objective: Troubleshoot VLAN connectivity

This lesson includes these topics:

- Overview

- Dynamic Trunking Protocol
- VC Poll Question: DTP
- VLAN Troubleshooting
- VC Poll Question: VLAN Troubleshooting
- Trunk Troubleshooting
- VC Poll Question: Trunk Troubleshooting
- Summary

Lab 5-3: Troubleshooting VLANs and Trunks

Lab Objective: Explore various trouble tickets related to VLANs and trunks, identify the problems that they present, and correct the problems.

This lab includes these tasks:

- Task 1: Troubleshoot VLAN Connectivity
- Task 2: Troubleshoot Trunk Connectivity Between the Switches

Lesson 5: Building Redundant Switched Topologies

Lesson Objective: Explain how STP works

This lesson includes these topics:

- VC Challenge Question: STP
- Issues in Redundant Topologies
- Spanning-Tree Operation
- VC Interactivity: Spanning-Tree Operation
- VC Poll Question: Spanning-Tree Root Bridge Election
- VC Poll Question: Spanning-Tree Root Ports
- VC Poll Question: Spanning-Tree Designated Ports
- Types of Spanning-Tree Protocols
- Per VLAN Spanning Tree Plus
- Modifying the Bridge ID
- VC Poll Question: Root Port Selection
- VC Interactivity: Types of STP
- VC Discussion Question: Preventing Loops
- Analyzing the STP Topology
- VC Interactivity: Root Bridge
- Spanning-Tree Failure Consequences
- VC Poll Question: Loop
- PortFast and BPDU Guard
- Summary

Lab 5-4: Optimizing STP

Lab Objective: Optimize STP

This lab includes these tasks:

- Task 1: Verify STP Operation
- Task 2: Influence Root Bridge Selection
- Task 3: Implement STP PortFast
- Task 4: Implement STP BPDU Guard

Lesson 6: Improving Redundant Switched Topologies with EtherChannel

Lesson Objective: Configure link aggregation using EtherChannel

This lesson includes these topics:

- The Need for EtherChannel
- Advantages of EtherChannel
- VC Interactivity: EtherChannel
- EtherChannel Protocols
- VC Interactivity: EtherChannel Protocols
- Configuring EtherChannel
- VC Poll Question: Configuring EtherChannel
- Verifying EtherChannel
- Summary

Lab 5-5: Configuring EtherChannel

Lab Objective: Configure and verify EtherChannel

This lab includes these tasks:

- Task 1: Configure EtherChannel
- Task 2: Verify EtherChannel Redundancy

Lesson 7: Understanding Layer 3 Redundancy

Lesson Objective: Describe the purpose of Layer 3 redundancy protocols

This lesson includes these topics:

- The Need for Default Gateway Redundancy
- Default Gateway Redundancy
- HSRP
- HSRP Interface Tracking
- HSRP Load Balancing
- VC Interactivity: HSRP Terminology
- VC Poll Question: HSRP vs. VRRP
- VC Poll Question: Verify HSRP

- Gateway Load Balancing Protocol
- Summary

Lesson 8: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 9: Module Self-Check

Lesson Objective:

This lesson includes these topics:

-

Module 6: Troubleshooting Basic Connectivity

Module Objective: Troubleshoot IP connectivity

Lesson 1: Troubleshooting IPv4 Network Connectivity

Lesson Objective: Troubleshoot end-to-end connectivity in an IPv4 network

This lesson includes these topics:

- Components of Troubleshooting End-to-End Connectivity
- Verification of End-to-End Connectivity
- VC Interactivity: Verify Connectivity
- Verification of Physical Connectivity Issue
- Identification of Current and Desired Path
- Default Gateway Issues
- VC Poll Question: Verify a Default Route
- Name Resolution Issues
- ACL Issues
- Summary

Lab 6-1: Troubleshooting IP Connectivity

Lab Objective: Explore different trouble tickets regarding IP connectivity, identify these problems, and correct them.

This lab includes these tasks:

- Task 1: Troubleshoot the Default Route
- Task 2: Troubleshoot an ACL
- Task 3: Troubleshoot the Default Gateway and Name Resolution Settings

Lesson 2: Troubleshooting IPv6 Network Connectivity

Lesson Objective: Troubleshoot connectivity in an IPv6 network

This lesson includes these topics:

- Troubleshooting End-to-End IPv6 Connectivity
- Verification of End-to-End IPv6 Connectivity
- VC Poll Question: Verify Transport Layer Connectivity
- Identification of Current and Desired IPv6 Path
- Default Gateway Issues in IPv6
- Name Resolution Issues in IPv6
- ACL Issues in IPv6
- VC Interactivity: Verify the Current IPv6 Path
- Summary

Lesson 3: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 4: Module Self-Check

Lesson Objective:

This lesson includes these topics:

-

Module 7: Wide Area Networks

Module Objective: Define characteristics, functions and components of a WAN

Lesson 1: Understanding WAN Technologies

Lesson Objective:

This lesson includes these topics:
- VC Challenge Question: WANs
- Introducing WANs
- WANs vs. LANs
- VC Interactivity: WAN Bandwidth
- WAN Devices
- VC Interactivity: WAN Devices
- Role of Routers in WANs
- Serial WAN Cabling
- WAN Layer 2 Protocols
- VC Interactivity: WAN Encapsulation Protocols
- WAN Link Options
- Summary

Lesson 2: Configuring Serial Encapsulation

Lesson Objective: Configure a serial connection

This lesson includes these topics:

- Point-to-Point Connectivity
- Configuring a Point-to-Point Link
- Serial Communication Links
- Configuration of a Serial Interface
- HDLC Protocol
- Point-to-Point Protocol
- VC Challenge Question: Using PPP for WANs
- VC Interactivity: PPP Session Establishment
- PPP Configuration
- PPP Authentication: PAP
- PPP Authentication: CHAP
- Configuring CHAP for PPP Authentication
- Verifying CHAP Configuration
- VC Poll Question: Describe CHAP
- Troubleshooting Serial Connections
- Summary

Lab 7-1: Configuring and Troubleshooting a Serial Connection

Lab Objective: Configure and troubleshoot serial connection

This lab includes these tasks:

- Task 1: Troubleshoot PPP
- Task 2: Enable HDLC Encapsulation

Lesson 3: Establishing a WAN Connection Using Frame Relay

Lesson Objective: Describe Frame Relay

This lesson includes these topics:

- Understanding Frame Relay
- VC Interactivity: Frame Relay Terminology
- Frame Relay Topologies
- VC Interactivity: WAN Topologies
- Frame Relay Reachability Issues
- Frame Relay Signaling
- Frame Relay Address Mappings
- VC Interactivity: Inverse ARP
- Configuring Frame Relay

- Point-to-Point vs. Multipoint
- Configuring Point-to-Point Frame Relay
- Configuring Multipoint Frame Relay
- VC Interactivity: Frame Relay Subinterfaces Configuration
- Verifying Frame Relay Configuration
- VC Interactivity: Frame Relay Verification
- Summary

Lab 7-2: Establishing a Frame Relay WAN

Lab Objective: Configure Frame Relay

This lab includes these tasks:

- Task 1: Configure and Verify Basic Frame Relay
- Task 2: Configure and Verify Frame Relay Subinterfaces
- Task 3: Remove Frame Relay Configuration

Lesson 4: Introducing VPN Solutions

Lesson Objective: Describe VPN solutions

This lesson includes these topics:

- VPNs and Their Benefits
- VC Interactivity: VPN Benefits
- Cisco SSL VPN Solutions
- VC Discussion: Site-to-Site VPNs vs. VPN Benefits
- Introducing IPsec
- Summary

Lesson 5: Configuring GRE Tunnels

Lesson Objective: Configure GRE tunnels

This lesson includes these topics:

- GRE Tunnel Overview
- VC Poll Question: GRE Tunnel
- GRE Tunnel Configuration
- GRE Tunnel Verification
- VC Poll Question: GRE Tunnel Verification
- Summary

Lab 7-3: Establishing a GRE Tunnel

Lab Objective: Implement a GRE Tunnel

This lab includes these tasks:

- Task 1: Configure and Verify a GRE Tunnel

Lesson 6: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 7: Module Self-Check

Lesson Objective:

This lesson includes these topics:

-

Module 8: Implementing an EIGRP-Based Solution

Module Objective: Configure and troubleshoot EIGRP in an IPv4 environment, and configure EIGRP for IPv6

Lesson 1: Implementing EIGRP

Lesson Objective: Introduce dynamic routing protocols, EIGRP, and its basic configuration

This lesson includes these topics:

- Purpose of Dynamic Routing Protocols
- VC Poll Question: Dynamic Routing Protocols
- Interior and Exterior Routing Protocols
- VC Poll Question: Exterior Gateway Protocols
- Distance Vector and Link-State Routing Protocols
- Administrative Distance
- EIGRP Features
- VC Interactivity: EIGRP Routing
- EIGRP Path Selection
- EIGRP Metric
- VC Interactivity: Path Selection
- EIGRP Configuration
- Verification of EIGRP Configuration
- VC Interactivity: EIGRP Configuration
- VC Poll Question: EIGRP Commands
- Load Balancing with EIGRP
- Summary

Lab 8-1: Implementing EIGRP

Lab Objective: Configure EIGRP and investigate EIGRP neighbor events

This lab includes these tasks:

- Task 1: Configure and Verify EIGRP

- Task 2: Investigate Neighbor Events
- Task 3: Configure and Verify EIGRP over a GRE Tunnel

Lesson 2: Troubleshooting EIGRP

Lesson Objective: Troubleshoot EIGRP

This lesson includes these topics:

- VC Challenge Question: Enabling EIGRP
- Components of Troubleshooting EIGRP
- Troubleshooting EIGRP Neighbor Issues
- VC Interactivity: Passive Interface
- Troubleshooting EIGRP Routing Table Issues
- VC Challenge Question: The Network Statement
- Summary

Lab 8-2: Troubleshooting EIGRP

Lab Objective: Explore different trouble tickets regarding EIGRP, identify these problems, and correct them

This lab includes these tasks:

- Task 1: Troubleshoot Basic Connectivity
- Task 2: Troubleshoot EIGRP Neighbors
- Task 3: Troubleshoot Routing Table Issues

Lesson 3: Implementing EIGRP for IPv6

Lesson Objective: Describe the implementation of EIGRP for IPv6

This lesson includes these topics:

- EIGRP for IPv6
- VC Challenge Question: EIGRP Commands
- EIGRP for IPv6 Commands
- EIGRP for IPv6 Configuration Example
- Summary

Lab 8-3: Implementing EIGRP for IPv6

Lab Objective: Configure EIGRP for IPv6 and verify the configuration

This lab includes these tasks:

- Task 1: Enable IPv6 on the Interfaces
- Task 2: Enable IPv6 EIGRP

Lesson 4: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 5: Module Self-Check

Lesson Objective:

This lesson includes these topics:

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Module 9: Implementing a Scalable OSPF-Based Solution

Module Objective: Configure, verify and troubleshoot multi-area OSPF

Lesson 1: Implementing OSPF

Lesson Objective: Describe the operation and configuration of single-area OSPF

This lesson includes these topics:

• Link-State Routing Protocol Overview

• Link-State Routing Protocol Data Structures

• VC Poll Question: Link-State Data Structures

• Introducing OSPF

• Establishing OSPF Neighbor Adjacencies

• SPF Algorithm

• VC Interactivity: SPF Algorithm

• Building a Link-State Database

• OSPF Area Structure

• VC Interactivity: OSPF Area Structure

• Router ID

• Configuring Single-Area OSPF

• VC Interactivity: OSPF Configuration

• Verifying OSPF Configuration

• Summary

Lab 9-1: Implementing OSPF

Lab Objective: Configure OSPF on a router to dynamically exchange routes with core site

This lab includes these tasks:

• Task 1: Configure OSPF

Lesson 2: Multiarea OSPF IPv4 Implementation

Lesson Objective: Describe how to implement a multiarea OSPF

This lesson includes these topics:

• Single-Area vs. Multiarea OSPF

• Planning for the Implementation of OSPF

• VC Interactivity: Multiarea OSPF

• Multiarea OSPF Configuration

- Multiarea OSPF Verification
- VC Poll Question: Multiarea OSPF Configuration
- Summary

Lab 9-2: Configuring Multiarea OSPF

Lab Objective: Configure a simple multiarea OSPF network

This lab includes these tasks:

- Task 1: Configure Multiarea OSPF
- Task 2: Verify Multiarea OSPF

Lesson 3: Troubleshooting Multiarea OSPF

Lesson Objective: Troubleshoot multiarea OSPF

This lesson includes these topics:

- OSPF Neighbor States
- Components of Troubleshooting OSPF
- VC Interactivity: OSPF Neighbor States
- Troubleshooting OSPF Neighbor Issues
- Troubleshooting OSPF Routing Table Issues
- VC Poll Question: Troubleshooting OSPF
- Troubleshooting OSPF Path Selection
- Summary

Lab 9-3: Troubleshooting Multiarea OSPF

Lab Objective: Configure the SNMP client

This lab includes these tasks:

- Task 1: Troubleshoot OSPF Neighbor Issues
- Task 2: Troubleshoot OSPF Routing Table Issues

Lesson 4: Examining OSPFv3

Lesson Objective: Describe how to implement OSPF in an IPv6 network

This lesson includes these topics:

- OSPFv3 Key Characteristics
- VC Poll Question: OSPFv3 and OSPFv2 Similarities
- OSPFv3 Configuration
- VC Poll Question: OSPFv3 Commands
- OSPFv3 Configuration Verification
- Summary

Lab 9-4: Configuring OSPF for IPv6

Lab Objective: Configure basic OSPF in an IPv6 network

This lab includes these tasks:

- Task 1: Enable OSPFv3

Lesson 5: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 6: Module Self-Check

Lesson Objective:

This lesson includes these topics:

-

Module 10: Network Device Management

Module Objective: Describe SNMP, syslog, and NetFlow, and manage Cisco device configurations, Cisco IOS images, and licenses

Lesson 1: Configuring Network Devices to Support Network Management Protocols

Lesson Objective: Describe how network devices can be managed and monitored

This lesson includes these topics:

- SNMP Overview
- SNMP Versions
- Obtaining Data from an SNMP Agent
- SNMP Configuration
- VC Poll Question: SNMP Configuration
- Syslog Overview
- Syslog Message Format
- Syslog Configuration
- VC Poll Question: Syslog
- NetFlow Overview
- NetFlow Architecture
- Netflow Configuration
- VC Poll Question: Management Protocols
- Summary

Lab 10-1: SNMP and Syslog Basic Configuration

Lab Objective: Configure the SNMP client

This lab includes these tasks:

- Task 1: Configure Router for SNMP Access
- Task 2: Configure Router for Syslog

Lab 10-2: Analyzing NetFlow Data

Lab Objective: Analyze data that is captured by the NetFlow collector

This lab includes these tasks:

- Task 1: Analyze Netflow Data

Lesson 2: Managing Cisco Devices

Lesson Objective: Describe the management of Cisco devices

This lesson includes these topics:

- Router Internal Components Overview
- ROM Functions
- VC Interactivity: Router Internal Components
- Stages of the Router Power-On Boot Sequence
- VC Poll Question: Cisco Router Bootup Process
- Configuration Register
- Changing the Configuration Register
- Locating Cisco IOS Image Files
- Loading Cisco IOS Image Files
- VC Interactivity: Router Boot Process
- Loading Cisco IOS Configuration Files
- VC Interactivity: Cisco IOS Software EXEC Commands
- Cisco IOS Integrated File System and Devices
- Managing Cisco IOS Images
- Deciphering Cisco IOS Image Filenames
- VC Interactivity: System File Images
- Creating the Cisco IOS Image Backup
- Upgrading Cisco IOS Images
- VC Poll Question: Cisco IOS Copy Command
- Managing Device Configuration Files
- VC Interactivity: Copy Configuration into RAM
- Password Recovery
- VC Interactivity: Password Recovery
- Summary

Lesson 3: Licensing

Lesson Objective: Understand licensing under Cisco IOS 15

This lesson includes these topics:

- Licensing Overview
- VC Poll Question: Technology Package Licenses

- Licensing Verification
- Permanent License Installation
- Evaluation License Installation
- VC Poll Question: License Installation
- Backing up the License
- Uninstalling the License
- Summary

Lab 10-3: Managing Cisco Devices and Licensing

Lab Objective: Do a password recovery, manage device IOS image, configuration and verify the license

This lab includes these tasks:

- Task 1: Lab Setup
- Task 2: Router Password Recovery
- Task 3: Backing up an IOS Image
- Task 4: Manage Configuration File
- Task 5: Verify Licensing

Lesson 4: Module Summary

Lesson Objective:

This lesson includes these topics:

- References

Lesson 5: Module Self-Check

Lesson Objective:

This lesson includes these topics:

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Lab Setup

General Information

CCNAX labs are available in two editions: classic physical (that is, hardware-based) and Cisco Partner Learning Labs (PLL). The PLL offers a virtual practice lab bundle that can be used in place of the classic hardware-based labs. Learners are provided with hands-on Cisco IOS Software lab practice for both routing and core switching that mirror the topologies used in the ILT course. The lab guides for the PLL labs are available in both PDF format and though the PLL GUI. The PLL labs are delivered though Cisco Learning Labs portal. The student needs only a PC and Internet access. This removes the need for a training partner to provide hardware and access to that hardware.

CCNAX labs are built around new common topology. The amount of equipment in individual pods has been increased to improve the learning experience and better resemble a simplified branch office network that is connected to a central office.

Labs in the first module have the student enable connectivity between network devices within the branch office. In the second module, the student configures everything that is needed to connect the branch office to the Internet. Once the router is connected to the simulated Internet network, it is important to improve device security, which is the theme of the labs in the third module. The fourth module introduces students to IPv6 networks, so they configure the branch office with IPv6 addressing together with static routing. In the fifth module, the students make their network more scalable by implementing VLANs, inter-VLAN routing, DHCP servers, and EtherChannel. The sixth module presents the students with common network issues that they need to resolve. In the seventh module, students configure a serial link between the branch and headquarters, they configure Frame Relay, and they also setup a GRE tunnel between the two sites. The eigth module, concerning EIGRP, has three labs. The first lab has the students configuring basic EIGRP on the branch router while the headquarters side is pre-configured. The next lab introduces trouble tickets they need to resolve. The third lab instructs the students to configure the branch router with EIGRP for IPv6. Again, the headquarters router is pre-configured. The labs in the ninth, OSPF module, follow the same flow as the EIGRP labs. In the last module, students configure the router on the branch side as an SNMP and syslog node, are presented with NetFlow analyzer outputs that they need to interpret, and manage Cisco device IOS images and configurations.

A solution is provided at the end of the Lab Guide for each lab exercise. The instructor should reference the Course Administration Guide and employ the Lab Guide to mentor learners during labs, maximizing their hands-on experience.

For ILT classes with hardware labs, two students per pod are recommended. When class is delivered using Cisco Partner Learning Labs, one student per pod is recommended.

The instructor will assign a pod to each learner, who will access the equipment from the student PC. Every learning partner will provide its own access details or Cisco Partner Learning Labs access credentials.

Laboratory Topology (Delivery)

The CCNAX v2.0 course reinforces the theoretical knowledge gained during the delivery, primarily through the use of labs.

Laboratory Topology

CCNAX v2.0 labs are designed as individual pods. Each pod consists of two routers, two switches, and two PCs. Since each pod is independent, it does not connect to a common backbone topology.

Lab Topology Diagram (Backbone Pod View)
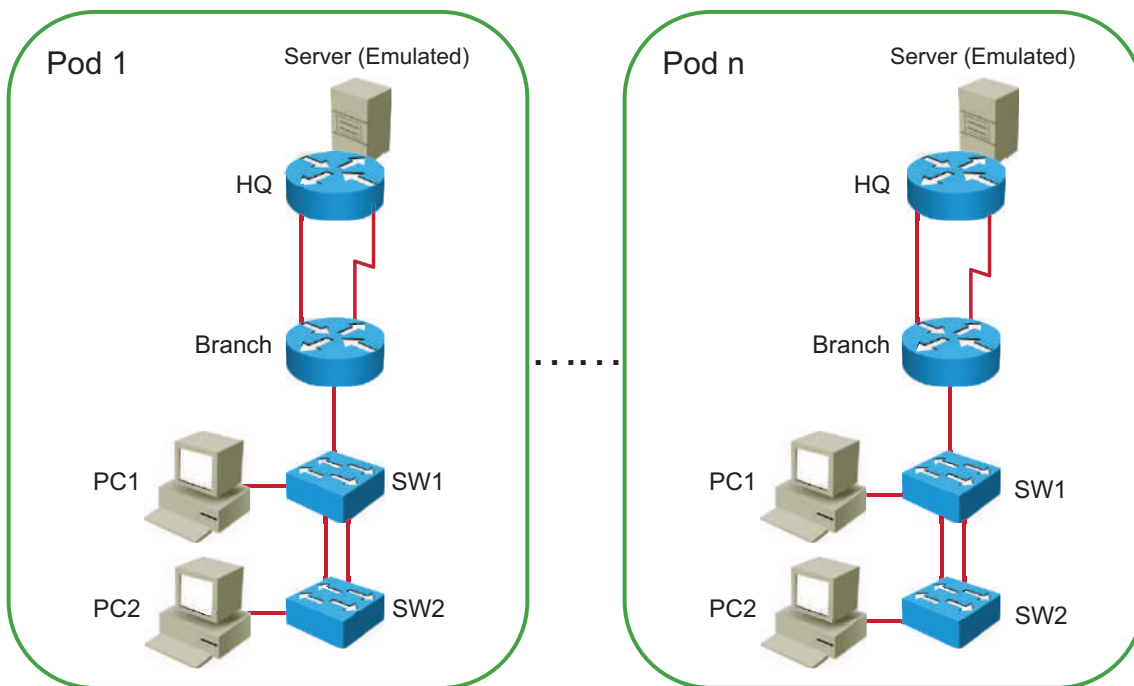
Lab Topology Diagram (Student Pod View)
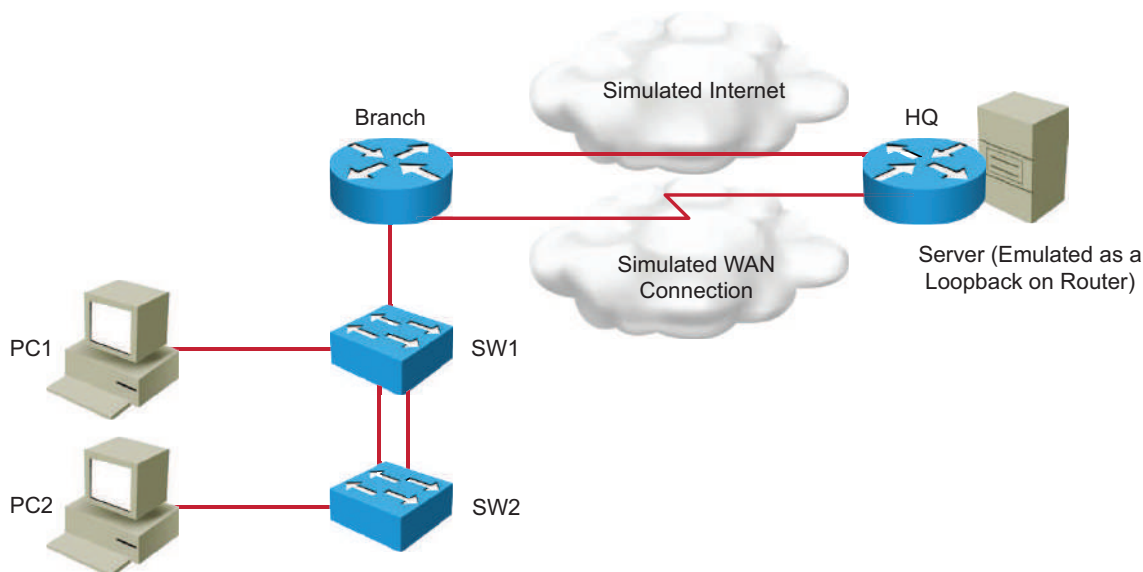
Physical Laboratory Equipment

These tables list the recommended equipment per pod to support the physical lab activities.

Learner Pod Equipment

Description	Mfr.	Part Number	Total Qty.
Cisco 2901 Integrated Services Router	Cisco	CISCO2901	2
Catalyst 2960 Series Switch	Cisco	WS-C2960-24TT-L	1
Catalyst 2960 Series Switch	Cisco	WS-C2960-24-S	1
1-port serial WIC	Cisco	HWIC-1T	2
Serial cable	Generic	CAB-SS-2626x	1
Ethernet RJ-45 straight-through cable	Generic	N/A	3
Ethernet RJ-45 crossover cable	Generic	N/A	3
Microsoft Windows PC	Generic	N/A	2

Physical Laboratory Software List

Description	Mfr.	Part Number	Total Qty.
c2900-universalk9-mz.SPA.152-4.M1.bin	Cisco		2 (1 per device)
c2960-lanbasek9-mz.150-1.SE3.bin	Cisco		1
c2960-lanlitek9-mz.150-1.SE3.bin	Cisco		1

Physical Laboratory Workstation Configuration

These instructions describe how to set up workstations for the physical lab environment.

Step 1

A Windows-based PC is required.

Step 2

Install PuTTY terminal emulation software from the instructor CD, and provide a shortcut on the desktop.

Step 3

Install Cisco TFTP Server software from the instructor CD, and provide a shortcut on the desktop.

Step 4

Install HiliSoft MIB Browser software from the instructor CD, and provide a shortcut on the desktop.

Step 5

Install Kiwi Syslog Daemon software from the instructor CD, and provide a shortcut on the desktop.

Initial Physical Laboratory Build

This topic contains information required to interconnect physical laboratory equipment.
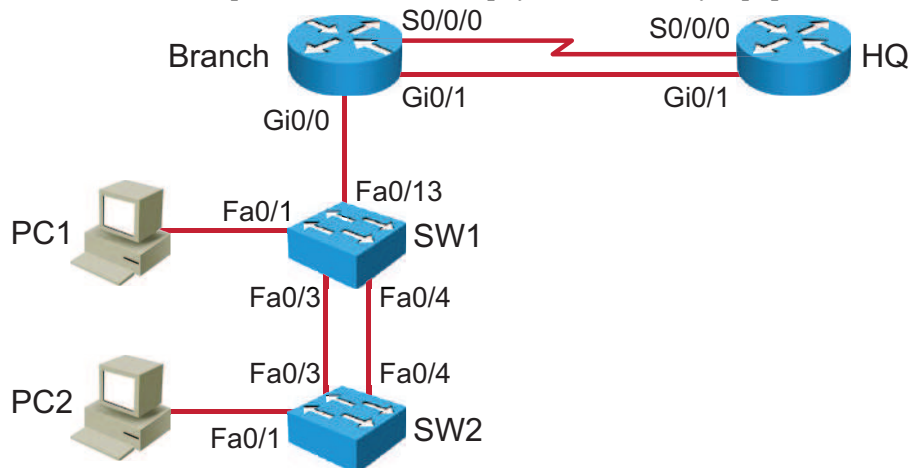
Physical Topology Overview

The table describes the cabling of an individual physical pod.

Device Name	Interface	Remote Device	Interface	Remarks	
HQ	Gi0/1	Branch	Gi0/1	XO	
	S0/0/0	Branch	S0/0/0	DCE	
Branch	Gi0/1	HQ	Gi0/1	XO	
	Gi0/0	SW1	Fa0/13	ST	
	S0/0/0	HQ	S0/0/0	DTE	
SW1	Fa0/1	PC1		ST	
	Fa0/3	SW2	Fa0/3	XO	
	Fa0/4	SW2	Fa0/4	XO	
	Fa0/13	Branch	Gi0/0	ST	
SW2	Fa0/1	PC2		ST	
	Fa0/3	SW1	Fa0/3	XO	
	Fa0/4	SW1	Fa0/4	XO	

Note   ST = UTP straight-through, XO = UTP crossover

Note   It is advisable to choose switches SW1 and SW2 so that SW1 has the lower MAC address.

General Physical Laboratory Setup

This topic details the procedure to set up and configure the physical lab equipment at the beginning of each class.

The table describes which configuration files need to be copied to flash memory before the beginning of each class. The next topic covers each individual lab, its setup procedures, when you need to load configuration files from flash memory, and under what conditions you can skip this step.

Device	Configuration Files to Copy
HQ	INIT_Tshoot_SW_Media_HQ.cfg INIT_Connecting_Internet_HQ.cfg INIT_Enhance_Init_Config_HQ.cfg INIT_Device_Hardening_HQ.cfg INIT_Filtering_w_ACLs_HQ.cfg INIT_Configure_Expanded_SW_Net_HQ.cfg INIT_Configure_DHCP_SRV_HQ.cfg INIT_Implement_OSPF_HQ.cfg INIT_Configure_IPv6_HQ.cfg INIT_Configure_Stateless_Autoconfig_HQ.cfg INIT_Configure_IPv6_Routing_HQ.cfg INIT_VLANs_and_Trunks_HQ.cfg INIT_STP_HQ.cfg INIT_EtherChannel_HQ.cfg INIT_IP_Conn_HQ.cfg INIT_Implement_EIGRP_HQ.cfg INIT_Tshoot_EIGRP_HQ.cfg INIT_EIGRP_for_IPv6_HQ.cfg INIT_Config_OSPF_HQ.cfg INIT_Tshoot_OSPF_HQ.cfg INIT_OSPF_for_IPv6_HQ.cfg INIT_Serial_HQ.cfg INIT_Frame_Relay_HQ.cfg INIT_GRE_Tunnel_HQ.cfg INIT_SNMP_and_Syslog_HQ.cfg INIT_Managing_and_Licensing_HQ.cfg
Branch	INIT_Tshoot_SW_Media_Branch.cfg INIT_Router_Setup_Branch.cfg INIT_Connecting_Internet_Branch.cfg INIT_Enhance_Init_Config_Branch.cfg INIT_Device_Hardening_Branch.cfg INIT_Filtering_w_ACLs_Branch.cfg TSHOOT_Filtering_w_ACLs_Branch.cfg INIT_Configure_Expanded_SW_Net_Branch.cfg INIT_Configure_DHCP_SRV_Branch.cfg INIT_Implement_OSPF_Branch.cfg INIT_Configure_IPv6_Branch.cfg INIT_Configure_Stateless_Autoconfig_Branch.cfg INIT_Configure_IPv6_Routing_Branch.cfg INIT_VLANs_and_Trunks_Branch.cfg INIT_STP_HQ.cfg INIT_EtherChannel_Branch.cfg INIT_IP_Conn_Branch.cfg INIT_Implement_EIGRP_Branch.cfg INIT_Tshoot_EIGRP_Branch.cfg INIT_EIGRP_for_IPv6_Branch.cfg INIT_Config_OSPF_Branch.cfg INIT_Tshoot_OSPF_Branch.cfg INIT_OSPF_for_IPv6_Branch.cfg INIT_Serial_Branch.cfg INIT_Frame_Relay_Branch.cfg INIT_GRE_Tunnel_Branch.cfg INIT_SNMP_and_Syslog_Branch.cfg INIT_Managing_and_Licensing_Branch.cfg

Device	Configuration Files to Copy
SW1	INIT_SW_StartupSW1.cfg
	INIT_Tshoot_SW_Media_SW1.cfg
	TSHOOT_Tshoot_SW_Media_SW1.cfg
	INIT_Router_Setup_SW1.cfg
	INIT_Connecting_Internet_SW1.cfg
	INIT_Enhance_Init_Config_SW1.cfg
	INIT_Device_Hardening_SW1.cfg
	INIT_Filtering_w_ACLs_SW1.cfg
	INIT_Configure_Expanded_SW_Net_SW1.cfg
	INIT_Configure_DHCP_SRV_SW1.cfg
	INIT_Implement_OSPF_SW1.cfg
	INIT_VLANs_and_Trunks_SW1.cfg
	INIT_STP_SW1.cfg
	INIT_EtherChannel_SW1.cfg
	INIT_IP_Conn_SW1.cfg
	INIT_Implement_EIGRP_SW1.cfg
	INIT_Tshoot_EIGRP_SW1.cfg
	INIT_EIGRP_for_IPv6_SW1.cfg
	INIT_Config_OSPF_SW1.cfg
	INIT_Tshoot_OSPF_SW1.cfg
	INIT_OSPF_for_IPv6_SW1.cfg
	INIT_Serial_SW1.cfg
	INIT_Frame_Relay_SW1.cfg
	INIT_GRE_Tunnel_SW1.cfg
	INIT_SNMP_and_Syslog_SW1.cfg
	INIT_Managing_and_Licensing_SW1.cfg
SW2	INIT_Connecting_Internet_SW2.cfg
	INIT_Filtering_w_ACLs_SW2.cfg
	INIT_Configure_Expanded_SW_Net_SW2.cfg
	INIT_Configure_DHCP_SRV_SW2.cfg
	INIT_Implement_OSPF_SW2.cfg
	INIT_VLANs_and_Trunks_SW2.cfg
	INIT_STP_SW2.cfg
	INIT_EtherChannel_SW2.cfg
	INIT_IP_Conn_SW2.cfg
	INIT_Implement_EIGRP_SW1.cfg
	INIT_Tshoot_EIGRP_SW2.cfg
	INIT_EIGRP_for_IPv6_SW2.cfg
	INIT_Config_OSPF_SW2.cfg
	INIT_Tshoot_OSPF_SW2.cfg
	INIT_OSPF_for_IPv6_SW2.cf
	INIT_Serial_SW2.cfg
	INIT_Frame_Relay_SW2.cfg
	INIT_GRE_Tunnel_SW2.cfg
	INIT_SNMP_and_Syslog_SW2.cfg
	INIT_Managing_and_Licensing_SW2.cfg

Lab Details

This topic presents lab details for the instructor in the order they appear in this course.

Lab 1-1: Performing Switch Startup and Initial Configuration

This topic details the lab activity for Lab 1-1: Performing Switch Startup and Initial Configuration.
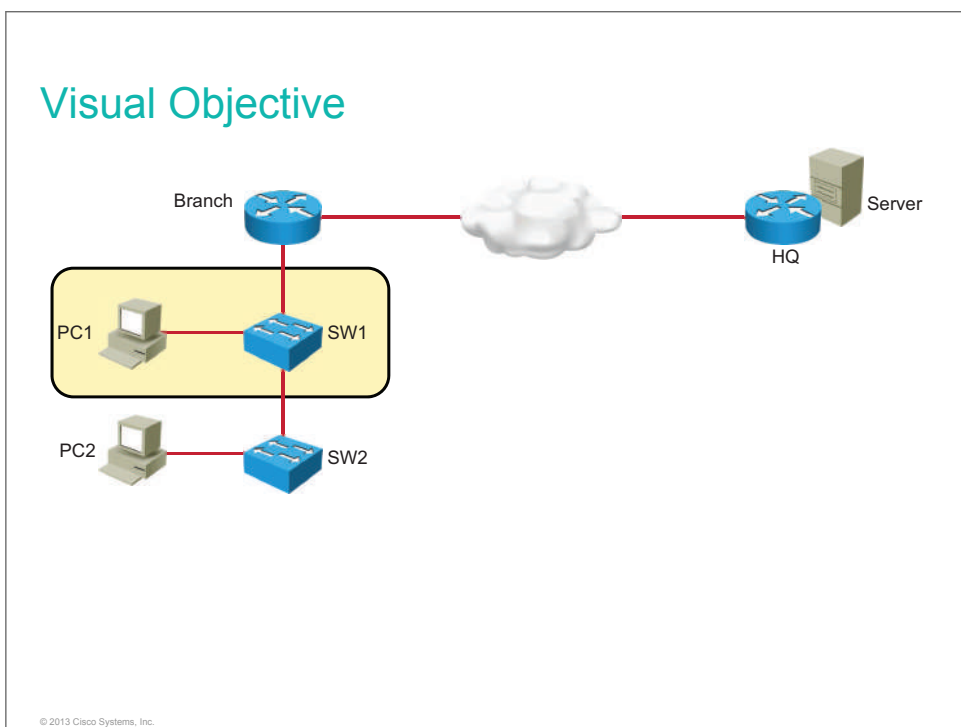
Objectives

In this activity, you will observe the switch boot procedure and perform basic switch configuration. After you have completed this activity, you will be able to meet these objectives:

- Restart the switch and verify the initial configuration messages
- Complete the initial configuration of the Cisco Catalyst switch
- Explore context-sensitive help
- Improve the usability of the CLI

Visual Objective

The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Perform switch startup and initial configuration.

PC1

SW1

Setup

The lab requires a Microsoft Windows PC and a Cisco switch, connected by an Ethernet cable. The switch configuration must be empty. Alternatively, you can load startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
SW1	INIT_SW_StartupSW 1.cfg	Copy and load the configuration file

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

Assign learners to their workgroups.

Draw learner attention to the Job Aids section at the beginning of the lab. Explain that there are solutions for every lab exercise within the Lab Guide. However, make it clear that learners will get the most out of this course if they try to complete the lab tasks by looking up the information that they need in the Student Guide rather than copying it from the solution.

Lab 1-2: Troubleshooting Switch Media Issues

This topic details the lab activity for Lab 1-2: Troubleshooting Switch Media Issues.

Objectives

In this activity, you will use troubleshooting guidelines to isolate and correct switch media issues. After completing this activity, you will be able to meet these objectives:

- Follow troubleshooting guidelines to determine the source of connectivity problems between a computer and a switch, and fix them
- Follow troubleshooting guidelines to determine the source of connectivity problems between a router and a switch, and fix them

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

Branch

PC1

SW1

PC2

SW2

Server

HQ

Detailed Visual Objective

Branch

Troubleshooting Task 2

Troubleshooting Task 1

PC1

SW1
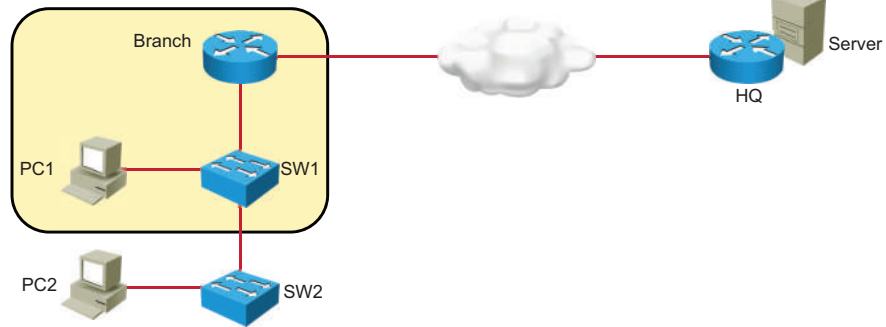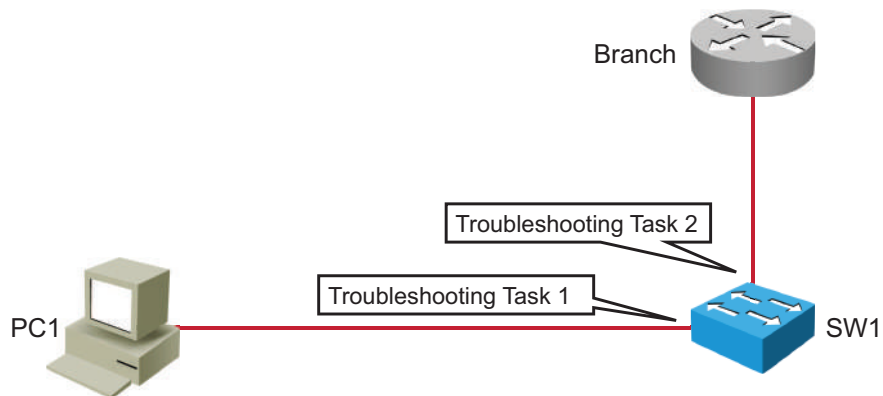
Setup

This lab builds on the previous lab. If students have completed the previous exercises, the configurations on computer PC1 and on switch SW1 are the same as the startup configuration that is described in the table below. Make sure that the troubleshooting configuration is loaded in flash on switch SW1. The Branch router is introduced into the topology and the startup configuration must be loaded on it as described below. Alternatively, you can load the startup configuration as described in the table for all devices.

Device	Configuration File to Install	Configuration Instructions
SW1	INIT_Tshoot_SW_Media_SW1.cfg	Copy and load the configuration file
SW1	TSHOOT_Tshoot_SW_Media_SW1.cfg	Copy configuration file to flash
Branch	INIT_Tshoot_SW_Media_Branch.cfg	Copy and load the configuration file

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

This lab exposes two common problems that will hinder or break connectivity: an interface being administratively down and a duplex mismatch. However, be aware that students at this point do not have the knowledge for extended troubleshooting. It is only important at this step to reinforce the knowledge that they gained from previous lessons and that they get the feeling of how to work with Cisco equipment.

In Task 1, "Troubleshoot Connectivity Between Computer PC1 and Switch SW1," connectivity between the PC and switch is not successful because interface FastEthernet 0/1 is in the shutdown state.

In Task 2, "Troubleshoot Connectivity Between Switch SW1 and the Branch Router," connectivity between the switch and the Branch router is problematic because of misconfigured duplex settings on the switch port FastEthernet 0/13.

Lab 2-1: Performing Initial Router Setup and Configuration

This topic details the lab activity for Lab 2-1: Performing Initial Router Setup and Configuration.

Objectives

In this activity, you will observe the router boot procedure and perform basic router configuration. After completing this activity, you will be able to meet these objectives:

- Inspect router hardware and software

- Perform initial router configuration

- Improve the usability of the CLI

- Use Cisco Discovery Protocol to discover how devices are interconnected
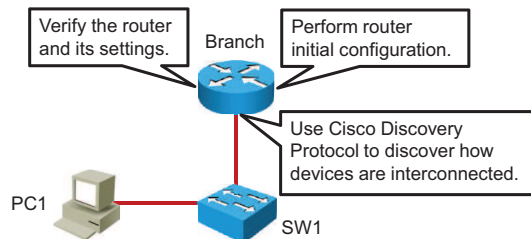
Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

Detailed Visual Objective

Verify the router and its settings.

Branch

Perform router initial configuration.

Use Cisco Discovery Protocol to discover how devices are interconnected.

PC1

SW1
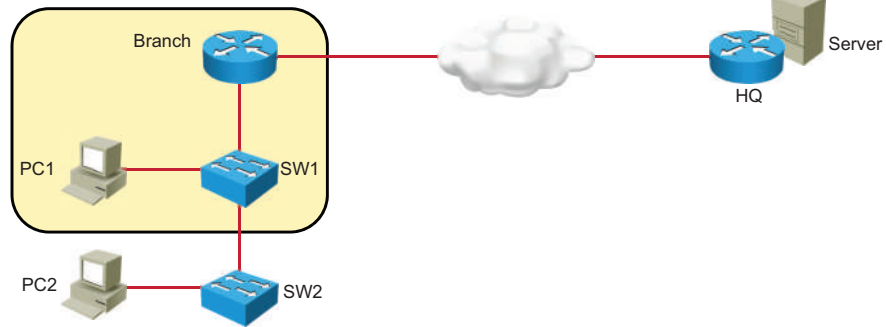
Setup

This lab builds on the previous lab. If students have completed the previous exercise, there is no need to load the startup configuration on the switch SW1. The table describes how to set up lab configurations for other devices in the lab.

Device	Configuration File to Install	Configuration Instructions
Branch	INIT_Router_Setup_Branch.cfg	Copy and load the configuration
SW1	INIT_Router_Setup_SW1.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

After the router is reloaded without a configuration file, Cisco IOS Software occasionally displays error messages similar to these:

```
%Error opening tftp://255.255.255.255/network-confg (Socket error)
%Error opening tftp://255.255.255.255/cisconet.cfg (Socket error)
```

These error messages are related to the default service configuration option built into Cisco IOS Software, which attempts to access the service configuration files from a network TFTP server. In order to disable this feature, issue the **no service config** global command and save the configuration. Alternatively, you can reload a device after saving the configuration.

Lab 2-2: Connecting to the Internet

This topic details the lab activity for Lab 2-2: Connecting to the Internet.

Objectives

In this activity, you will establish Internet connectivity by enabling static routing, DHCP, and NAT. After completing this activity, you will be able to meet these objectives:

*   Configure a static default route

*   Enable DHCP on a public interface

*   Configure NAT using a pool

*   Configure NAT with PAT

Visual Objective
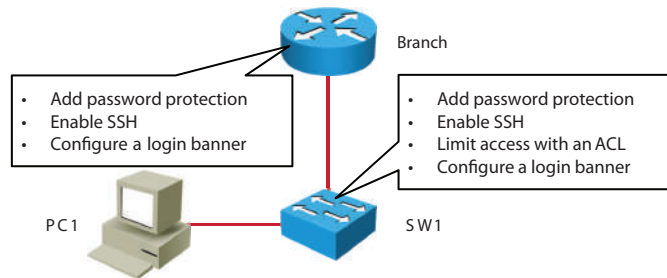
The figure illustrates what you will accomplish in this activity.

Visual Objective

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Detailed Visual Objective

Configure NAT with PAT.

Branch

Outside

Internet

HQ

Server

Inside

Configure static and DHCP-obtained IP addresses.

PC1

SW1

PC2
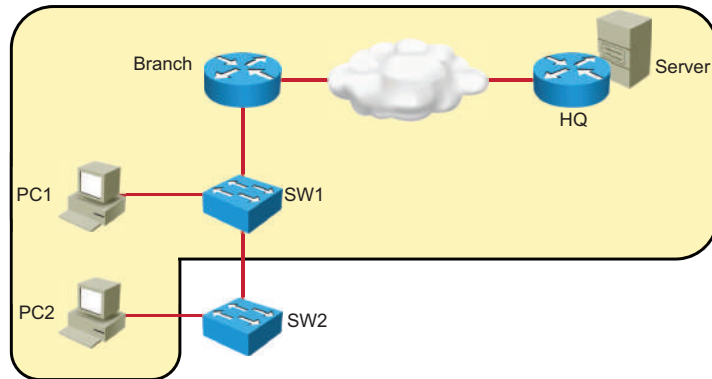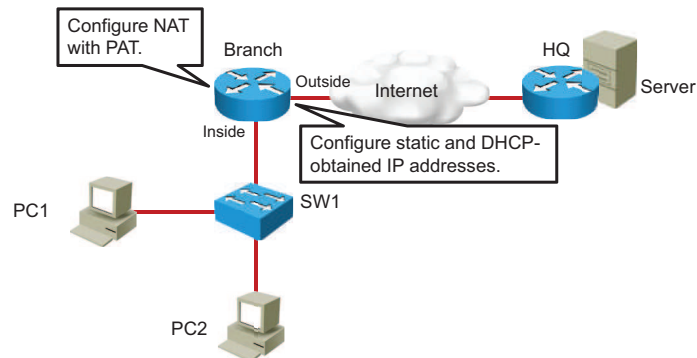
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Setup

This lab builds on the previous lab. If students have completed the previous exercise, there is no need to load the startup configurations on router Branch and switch SW1. The table describes how to set up lab configurations for other devices in the lab.

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_Connecting_Internet_HQ.cfg	Copy and load the configuration
Branch	INIT_Connecting_Internet_Branch.cfg	Copy and load the configuration
SW1	INIT_Connecting_Internet_SW1.cfg	Copy and load the configuration
ŞW2	INIT_Connecting_Internet_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

When enabling an interface as NAT inside interface, a router will block for approximately 1 minute.

Lab 3-1: Enhancing the Security of the Initial Configuration

This topic details the lab activity for Lab 3-1: Enhancing the Security of the Initial Configuration.

Objectives

Securing administrative access to devices is crucial because you do not want unauthorized users to have access to your network devices. In this lab, you will increase the security of the initial switch and router configuration. After you have completed this activity, you will be able to meet these objectives:

* Configure passwords on a router and switch
* Configure and limit remote access to SSH
* Configure an ACL to limit remote access
* Configure the login banner

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

Branch

Server

HQ

PC1

SW1

PC2

SW2

Detailed Visual Objective

Branch

- Add password protection
- Enable SSH
- Configure a login banner

- Add password protection
- Enable SSH
- Limit access with an ACL
- Configure a login banner

PC1

SW1

Setup

This lab builds on the previous lab. If students have completed the previous exercise, there is no need to load the startup configurations. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
Headquarters	INIT_Enhance_Init_Config_HQ.cfg	Copy and load the configuration
Branch	INIT_Enhance_Init_Config_Branch.cfg	Copy and load the configuration
SW1	INIT_Enhance_Init_Config_SW1.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 3-2: Device Hardening

This topic details the lab activity for Lab 3-2: Device Hardening.

Objectives

Device hardening is crucial to increasing security in the network. In this lab, you will perform security device hardening on a router and switch. After you have completed this activity, you will be able to meet these objectives:

- Disable unused ports
- Configure port security on a switch
- Disable unused services
- Configure NTP

Visual Objective

The figure illustrates what you will accomplish in this activity.

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Visual Objective

Branch

Server

HQ

PC1

SW1

PC2

SW2

Detailed Visual Objective

Configure NTP
client and server

Branch

HQ

Outside

Internet

Server

Inside

NTP server

PC1

SW1

• Disable unused ports
• Configure port security
• Disable Cisco Discovery Protocol
• Configure NTP client
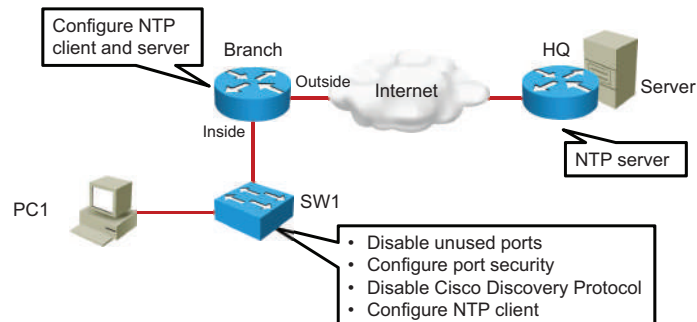
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Setup

This lab builds on the previous lab. If students have completed the previous exercise, there is no need to load the startup configurations. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
Headquarters	INIT_Device_Hardening_HQ.cfg	Copy and load the configuration
Branch	INIT_Device_Hardening_Branch.cfg	Copy and load the configuration
SW1	INIT_Device_Hardening_SW1.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 3-3: Filtering Traffic with ACLs

This topic details the lab activity for Lab 3-3: Filtering Traffic with ACLs.

Objectives

A common mechanism for filtering traffic is ACLs, which enable you to allow, limit, or restrict access to a network resource. In this lab, you will configure traffic filtering using ACLs. After you have completed this activity, you will be able to meet these objectives:

- Configure extended, named ACLs
- Troubleshoot ACLs

Visual Objective
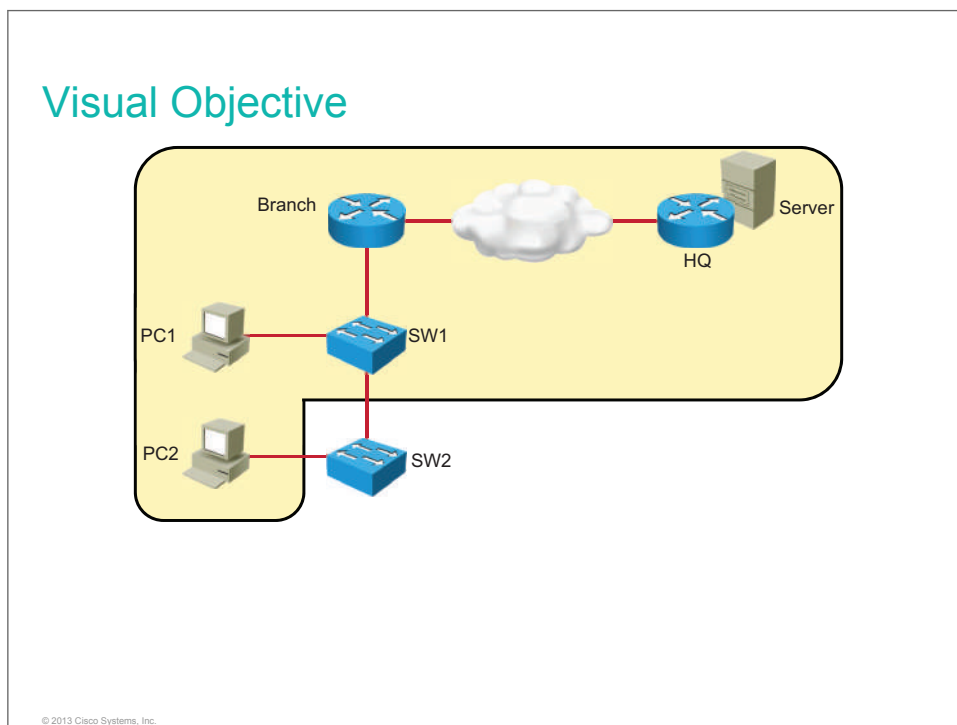
The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

All Other Traffic Allowed

Telnet Allowed

Configure ACL
Troubleshoot ACL

Branch

HQ

Server

Internet

SW1

PC1

Telnet Blocked

All Other Traffic Allowed

PC2

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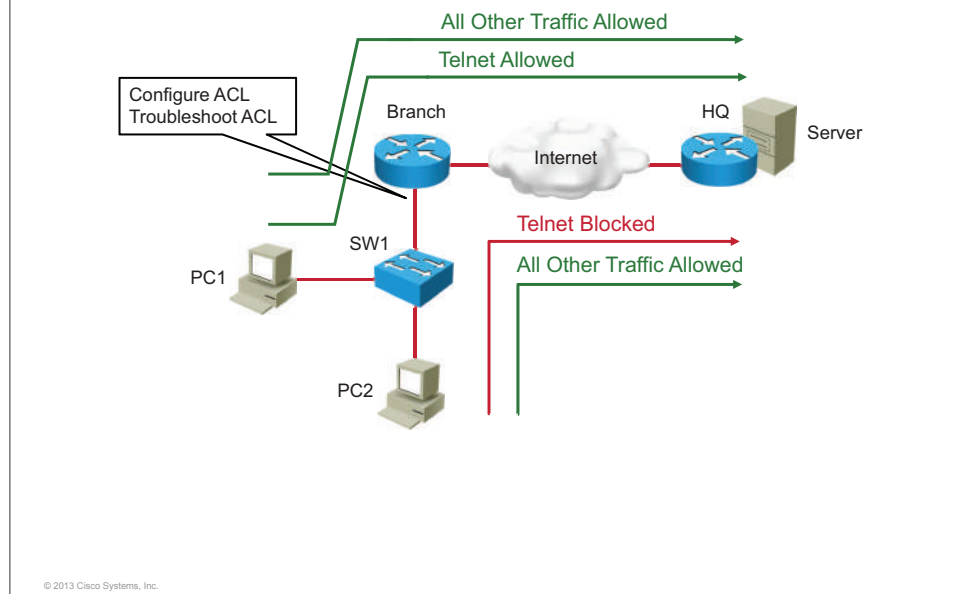
Setup

This lab builds on the previous lab. If students have completed the previous exercise, there is no need to load the startup configurations. But you need to make sure the troubleshooting file is copied to router Branch. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
Branch	TSHOOT_Filtering_w_ACLs_Branch.cfg	Copy configuration file to flash
Branch	INIT_Filtering_w_ACLs_Branch.cfg	Copy and load the configuration
Headquarters	INIT_Filtering_w_ACLs_HQ.cfg	Copy and load the configuration
SW1	INIT_Filtering_w_ACLs_SW1.cfg	Copy and load the configuration
SW2	INIT_Filtering_w_ACLs_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

In Task 2, "Troubleshoot an ACL," Telnet traffic from PC2 to the server is allowed because an ACL has been applied on interface GigabitEthernet 0/0 in the wrong direction. Additionally, the ACL includes two statements,10 and 20, that are incorrect and need to be removed.

Lab 4-1: Configure and Verify Basic IPv6

This topic details the lab activity for Lab 4-1: Configure and Verify Basic IPv6.

Objectives

In this activity, you will enable IPv6 globally and manually configure an IPv6 address on the interface. After completing this lab activity, you will be able to meet this objective:

- Enable IPv6 support on a router and perform basic configuration

Visual Objective

The figure illustrates what you will accomplish in this activity.
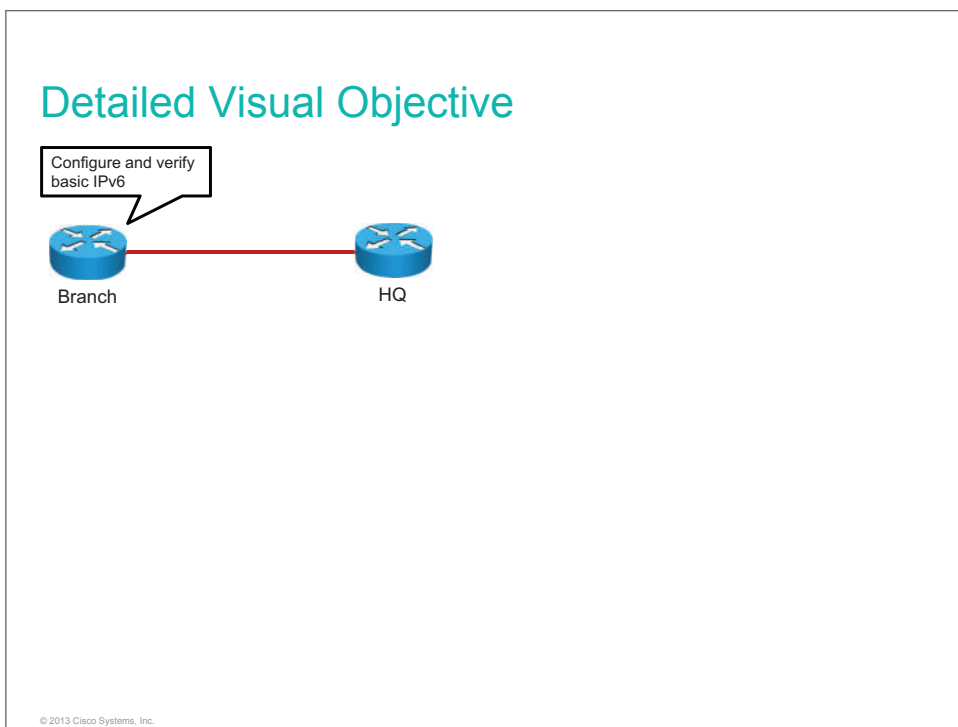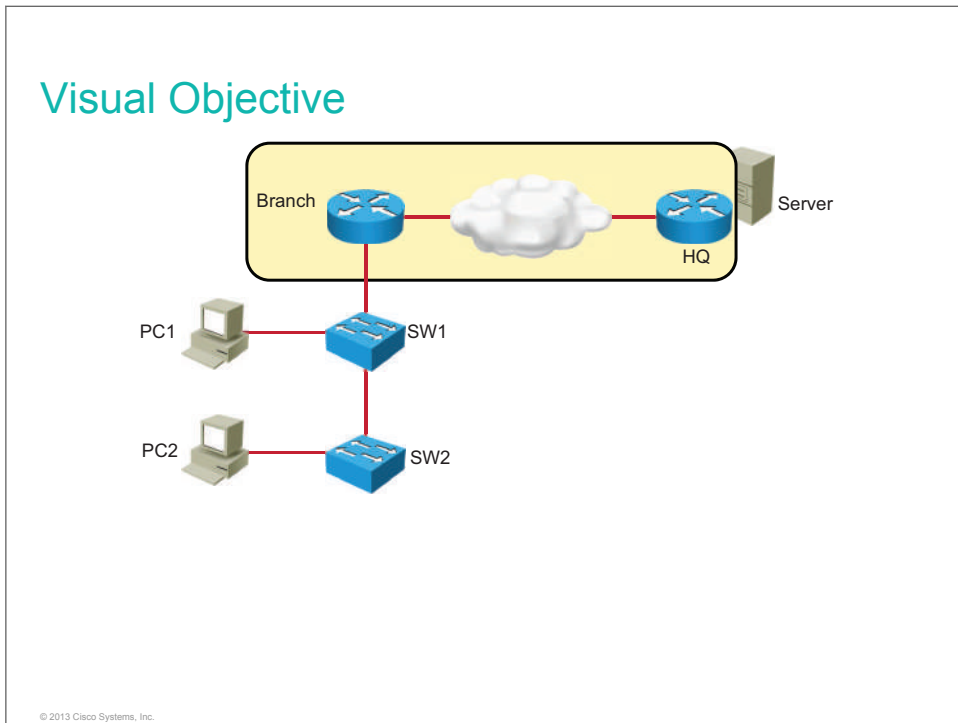
Setup

This lab builds on the previous lab. If students have completed the previous exercise, there is no need to load the startup configurations. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
Branch	INIT_Configure_IPv6_Branch.cfg	Copy and load the configuration
Headquarters	INIT_Configure_IPv6_HQ.cfg	Copy and load the configuration

These configuration files should be preloaded to the flash memory of the devices.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

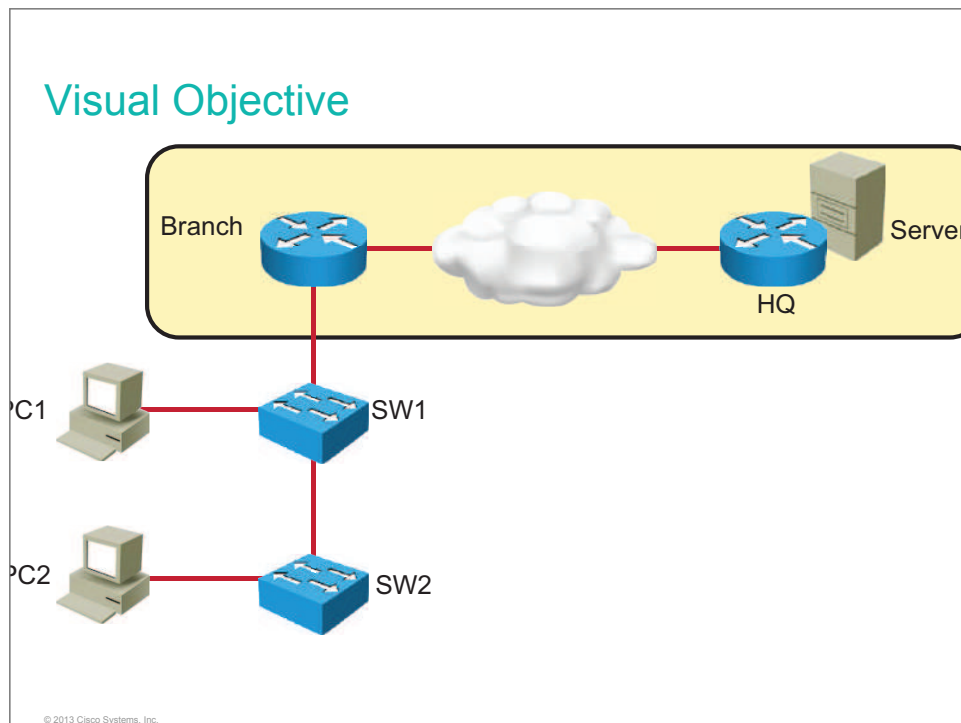No instructor notes are necessary.

Lab 4-2: Configure and Verify Stateless Autoconfiguration

This topic details the lab activity for Lab 4-2: Configure and Verify Stateless Autoconfiguration.

Objectives

- Configure and verify stateless autoconfiguration

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

Branch

Server

HQ

PC1 — SW1

PC2 — SW2

Detailed Visual Objective

Enable and verify IPv6
stateless autoconfiguration

Branch

HQ
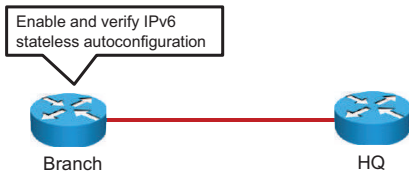
Setup

This lab builds on the previous lab. If students have completed the previous exercise, there is no need to load the startup configurations. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
Branch	INIT_Configure_Stateless_Autoconfig_Branch.cfg	Copy and load the configuration
Headquarters	INIT_Configure_Stateless_Autoconfig_HQ.cfg	Copy and load the configuration

These configuration files should be preloaded to the flash memory of the devices.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 4-3: Configure and Verify IPv6 Routing

This topic details the lab activity for Lab 4-3: Configure and Verify IPv6 Routing.

Objectives

- Configure and verify IPv6 routing by enabling static routing

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

Configure IPv6 default route

IPv6

Gi0/1

Branch   HQ

2001:DB8:D1A5:C900::2/64   2001:DB8:AC10:100::/64
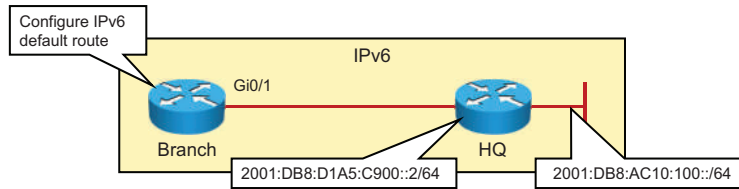
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Setup

The table describes how to set up lab configurations with equipment for this lab.

Device	Configuration File to Install	Configuration Instructions
Branch	INIT_Configure and Verify IPv6 Routing_Branch.cfg	Copy the configuration file to the device.
HQ	INIT_Configure and Verify IPv6 Routing_HQ.cfg	Copy the configuration file to the device.

These configuration files should be preloaded to devices' flash memory.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 5-1: Configuring Expanded Switched Networks

This topic details the lab activity for Lab 5-1: Configuring Expanded Switched Networks.

Objectives

In this lab, you will configure two switches to meet specified VLAN requirements. After completing this activity, you will be able to meet these objectives:

- Configure VLANs
- Configure trunking
- Configure router with a trunk link

Visual Objective
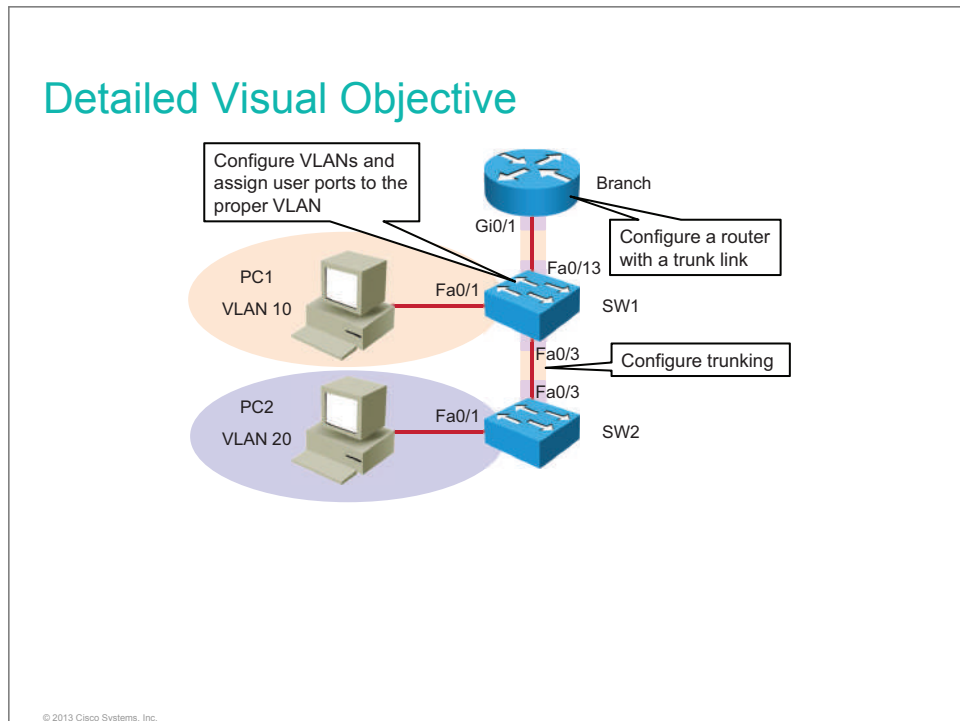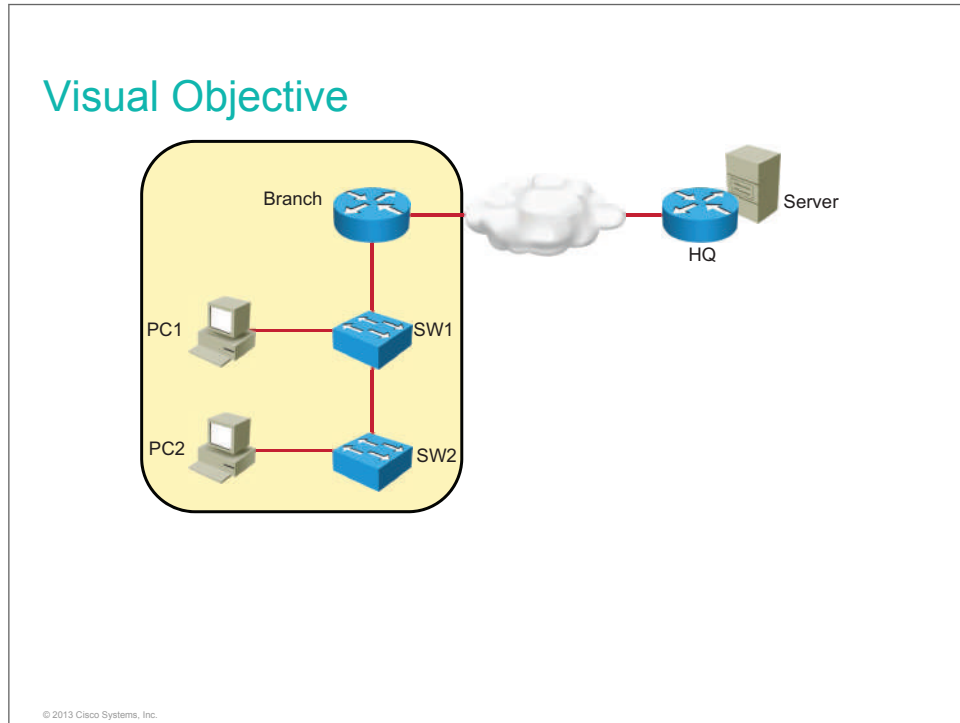
The figure illustrates what you will accomplish in this activity.

Visual Objective

Branch — HQ — Server
PC1 — SW1
PC2 — SW2

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Detailed Visual Objective

Configure VLANs and assign user ports to the proper VLAN

Branch

Gi0/1

Configure a router with a trunk link

Fa0/13

PC1
VLAN 10
Fa0/1
SW1

Fa0/3
Configure trunking
Fa0/3

PC2
VLAN 20
Fa0/1
SW2

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Setup

This lab builds on the previous lab. If students have completed the previous exercise, there is no need to load the startup configurations. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
Headquarters	INIT_Configure_Expanded_SW_Net _HQ.cfg	Copy and load the configuration
Branch	INIT_Configure_Expanded_SW_Net _Branch.cfg	Copy and load the configuration
SW1	INIT_Configure_Expanded_SW_Net _SW1.cfg	Copy and load the configuration
SW2	INIT_Configure_Expanded_SW_Net _SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 5-2: Configuring DHCP Server

This topic details the lab activity for Lab 5-2: Configuring DHCP Server.

Objectives

In this lab, you will assign IP addresses to network devices using DHCP. After completing this activity, you will be able to meet these objectives:

- Configure a DHCP server
- Exclude specific IP addresses from DHCP pools
- Configure a DHCP relay agent

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective
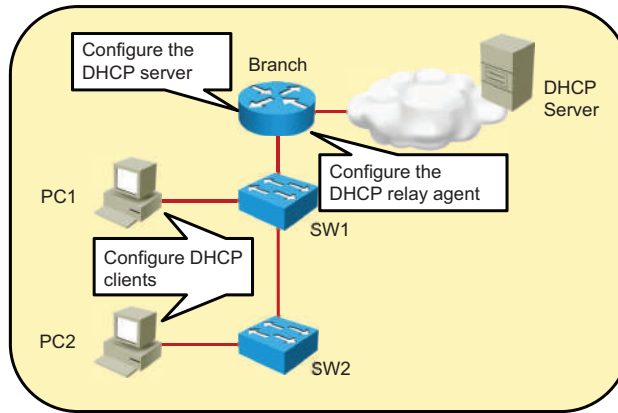
Setup

This lab builds on the previous lab. If students have completed the previous exercise, there is no need to load the startup configurations. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
Headquarters	INIT_Configure_DHCP_SRV_HQ.cfg	Copy and load the configuration
Branch	INIT_Configure_DHCP_SRV_Branch.cfg	Copy and load the configuration
SW1	INIT_Configure_DHCP_SRV_SW1.cfg	Copy and load the configuration
SW2	INIT_Configure_DHCP_SRV_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 5-3: Troubleshooting VLANs and Trunks

This topic details the lab activity for Lab 5-3: Troubleshooting VLANs and Trunks.

Objectives

In this lab, you will explore various trouble tickets related to VLANs and trunks, identify the problems that they present, and correct the problems. After completing this activity, you will be able to meet these objectives:
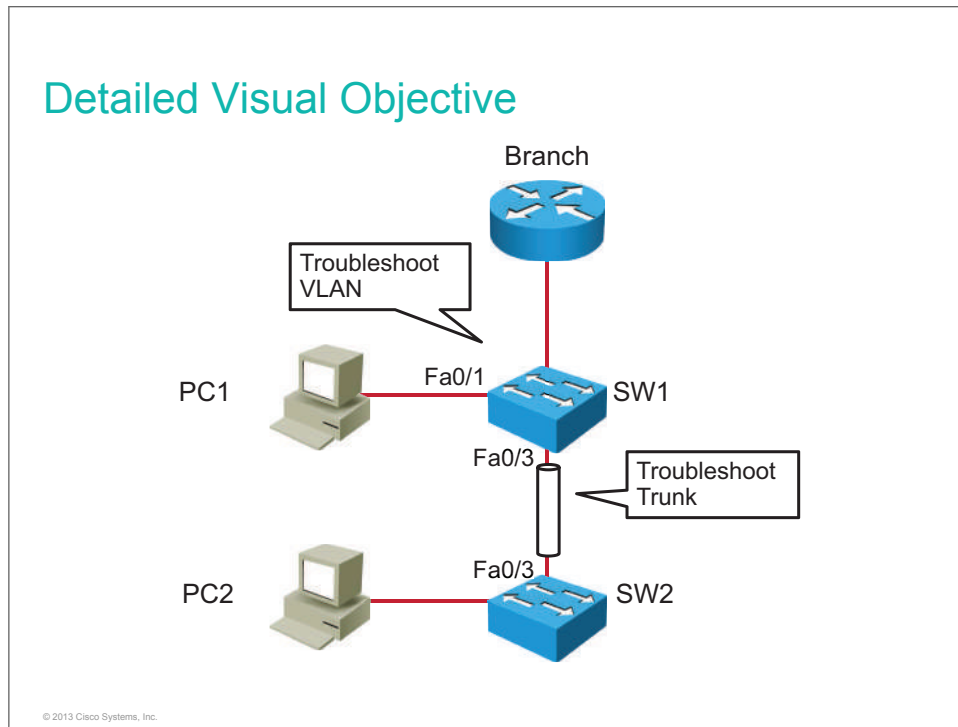
*   Troubleshoot VLAN connectivity
*   Troubleshoot trunk connectivity

Visual Objective

The figure illustrates what you will accomplish in this activity.
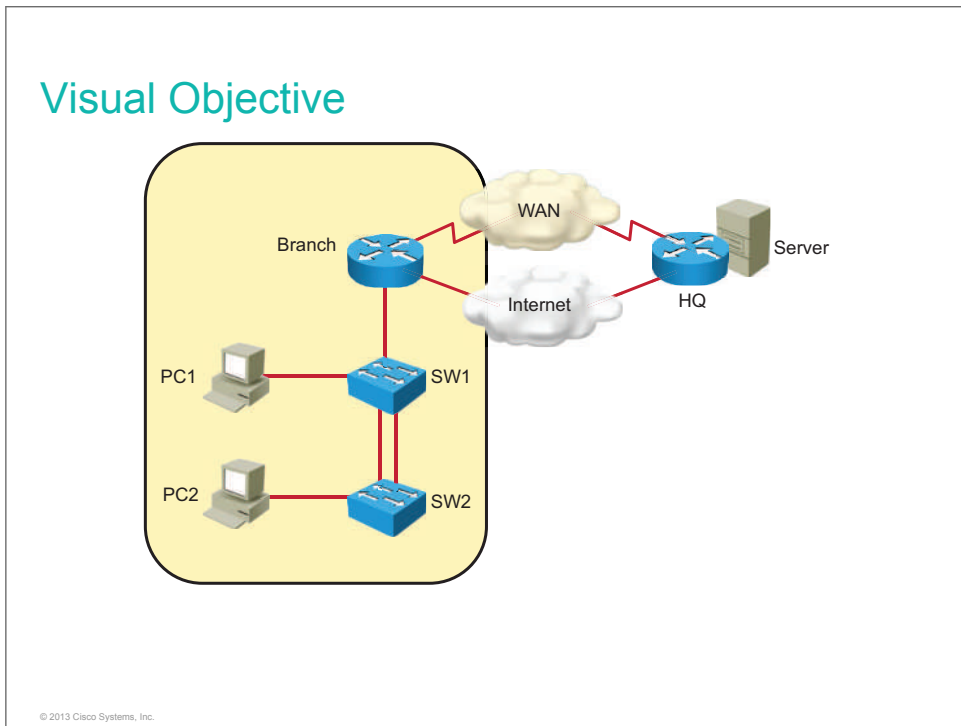
Detailed Visual Objective

Setup

The table lists configuration files that are required to create trouble tickets in this lab. Alternatively the students can be instructed to replace the configuration files with the files specified in the table (use **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_VLANs_and_Trunks_HQ.cfg	Copy and load the configuration
Branch	INIT_VLANs_and_Trunks_Branch.cfg	Copy and load the configuration
SW1	INIT_VLANs_and_Trunks_SW1.cfg	Copy and load the configuration
SW2	INIT_VLANs_and_Trunks_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

In Task 1: Troubleshoot VLAN Connectivity, the issue is that VLAN 10 was deleted from SW1. PC1 is connected to a port that belongs to VLAN 10, but membership is inactive. To solve this problem, the students need to create VLAN 10 on SW1.

In Task 2: Troubleshoot Trunk Connectivity Between the Switches, the trunk between switches is not functional because both sides are configured with *dynamic auto* DTP mode. Students are instructed to fix the issue by configuring both sides of the link as trunk. After the trunk becomes operational, students are informed about native VLAN mismatch. The solution to this problem is to configure the native VLAN on both switches to be VLAN 1.

Lab 5-4: Optimizing STP

This topic details the lab activity for Lab 5-4: Optimizing STP.

Objectives

In this lab, you will optimize STP:

- Verify STP operation
- Influence root bridge selection
- Implement STP PortFast
- Implement STP BPDU guard

Visual Objective
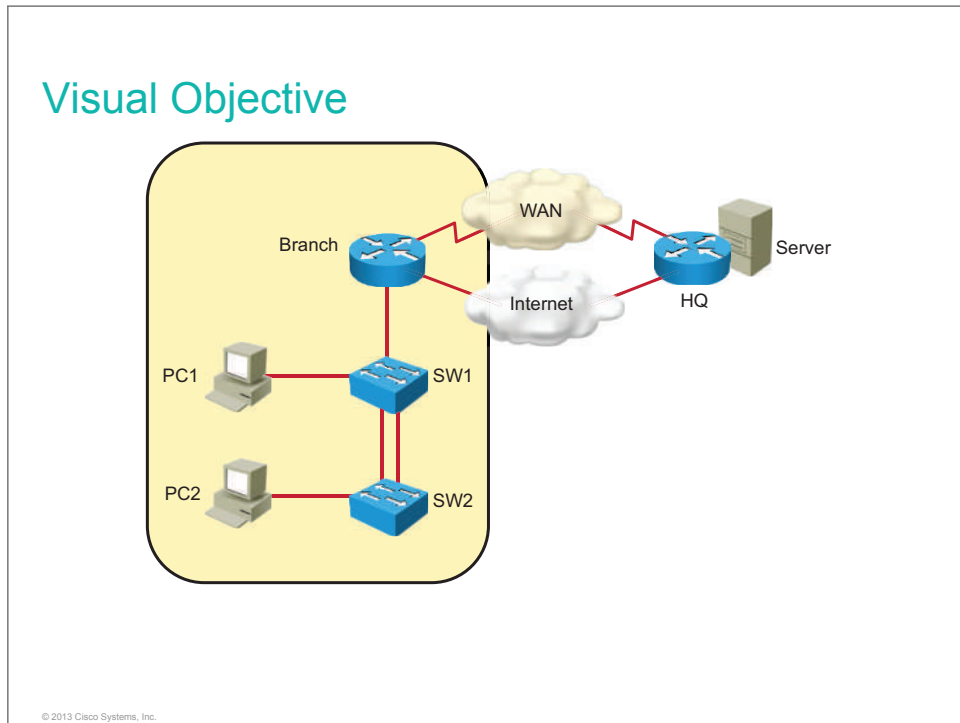
The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Setup

This lab builds on the previous lab. If students have successfully completed the previous exercise, there is no need to load the startup configurations.

The table describes how to set up the lab configurations for the equipment for this lab. The students can be instructed to replace the configuration files with the files specified in the table (use the **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_STP_HQ.cfg	Copy and load the configuration
Branch	INIT_STP_Branch.cfg	Copy and load the configuration
SW1	INIT_STP_SW1.cfg	Copy and load the configuration
SW2	INIT_STP_SW2.cfg	Copy and load the configuration

The lab text is written as if SW1 is the root bridge. That will only be true if SW1 has a lower MAC address than SW2. The student is alerted during the lab that the roles might be reversed, but it would be better to make sure that SW1 is the switch with the lower MAC address.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

In Task 4: Implement STP BPDU Guard, students implement BPDU guard on a port that is connected to another switch. This is done for testing purposes, so that port goes into error-disabled state. Make it clear that this is not done in a real-life situation.

Lab 5-5: Configuring EtherChannel

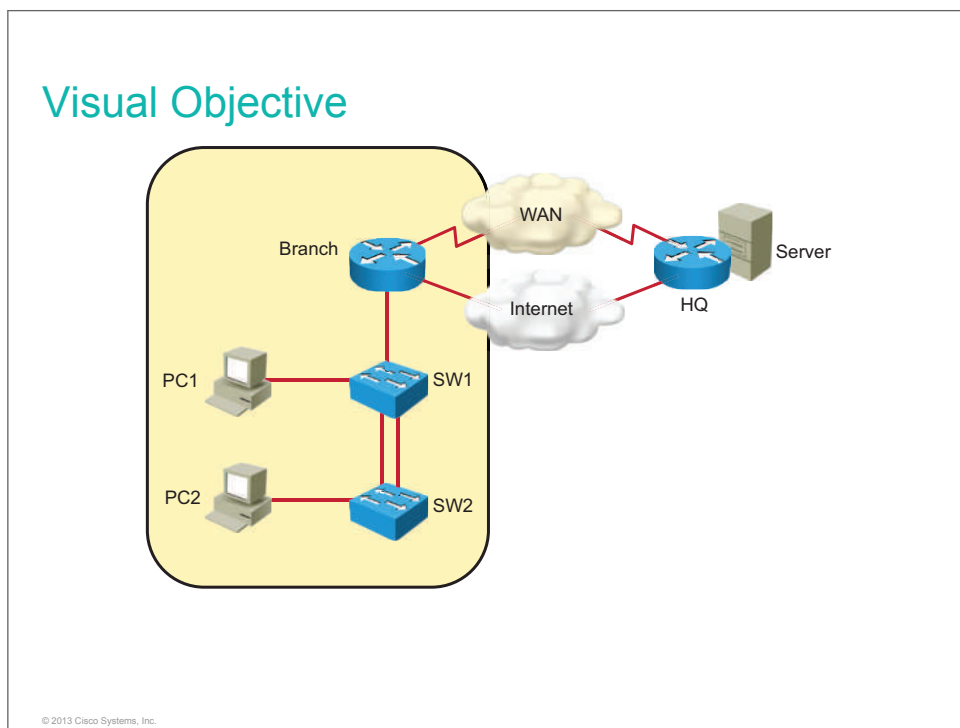This topic details the lab activity for Lab 5-5: Configuring EtherChannel.

Objectives

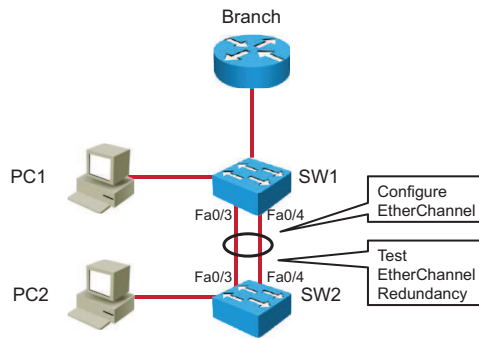In this lab, you will become familiar with EtherChannel technology:

- Configure EtherChannel
- Verify EtherChannel redundancy

Visual Objective

The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Branch

PC1 — SW1

Fa0/3 | Fa0/4 — Configure EtherChannel

Fa0/3 | Fa0/4 — Test EtherChannel Redundancy

PC2 — SW2

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Setup

This lab builds on the previous lab. If students have successfully completed the previous exercise, there is no need to load the startup configurations.

The table describes how to set up the lab configurations for the equipment for this lab. The students can be instructed to replace the configuration files with the files specified in the table (use the **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_EtherChannel_HQ.cfg	Copy and load the configuration
Branch	INIT_EtherChannel_Branch.cfg	Copy and load the configuration
SW1	INIT_EtherChannel_SW1.cfg	Copy and load the configuration
SW2	INIT_EtherChannel_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 6-1: Troubleshooting IP Connectivity

This topic details the lab activity for Lab 6-1: Troubleshooting IP Connectivity.

Objectives

In this activity, you will explore various trouble tickets related to IP connectivity, identifying the problems and correcting them. After completing this activity, you will be able to meet these objectives:

- Troubleshoot the default route
- Troubleshoot an ACL problem
- Troubleshoot the default gateway
- Troubleshoot name resolution

Visual Objective
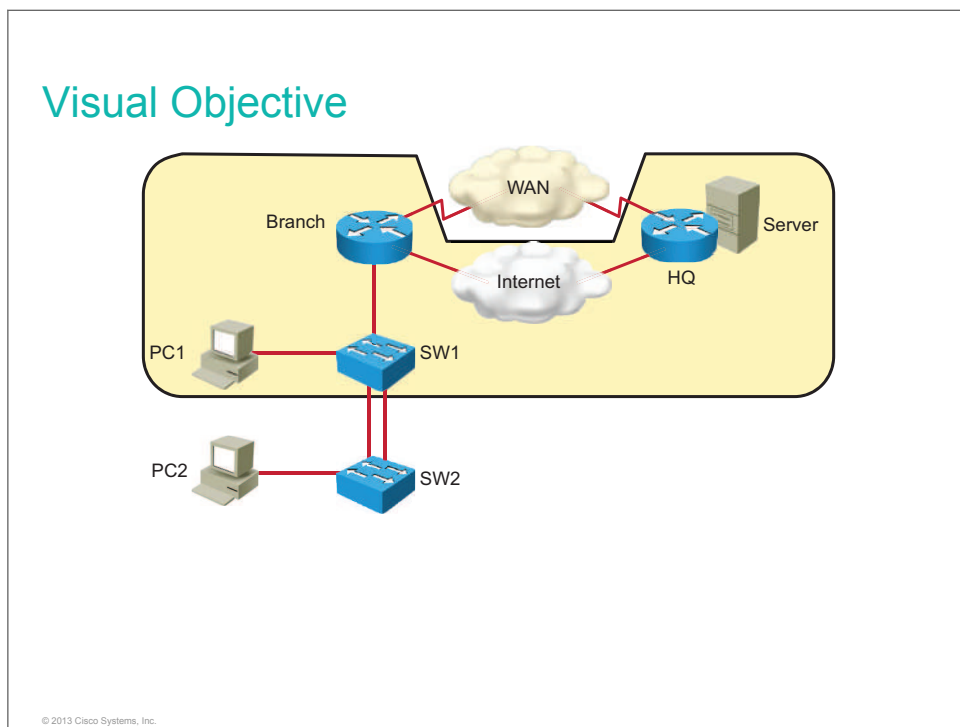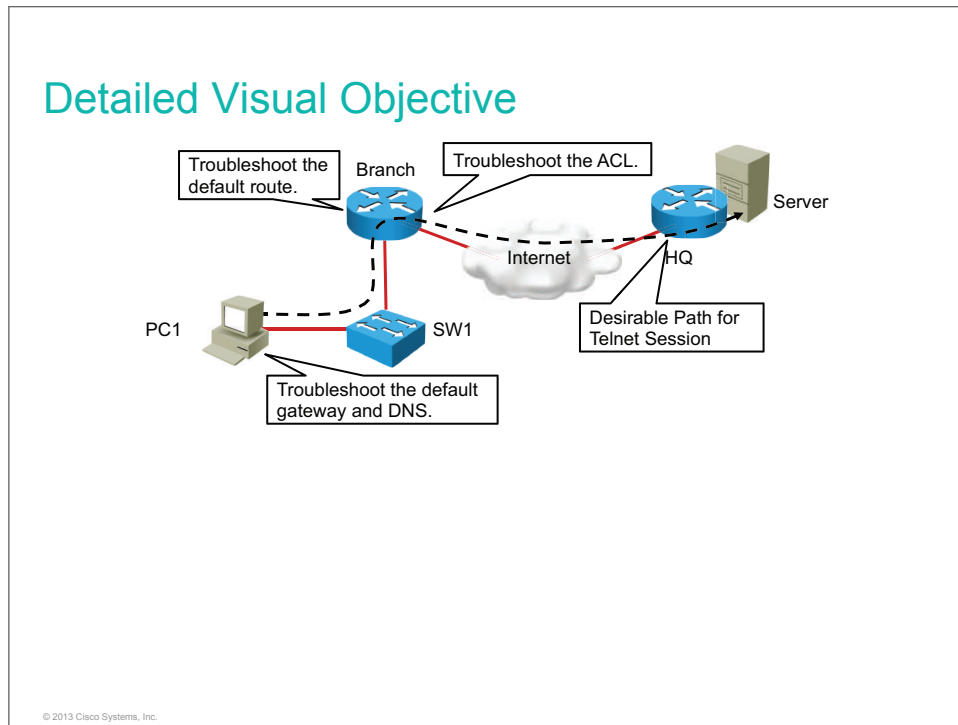
The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Setup

The table lists configuration files that are required to create trouble tickets in this lab. The students can be instructed to replace the configuration files with the files specified in the table (use the **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_IP_Conn_HQ.cfg	Copy and load the configuration
Branch	INIT_IP_Conn_Branch.cfg	Copy and load the configuration
SW1	INIT_IP_Conn_SW1.cfg	Copy and load the configuration
SW2	INIT_IP_Conn_SW2.cfg	Copy and load the configuration

On PC1, change the default gateway to 10.1.10.10.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

When the students intend to modify the access list named Outbound-ACL, they might not be aware that the access list name is case-sensitive. Therefore, they might create a new access list instead of editing the existing one.

Instructor Notes

In Task 1: Troubleshoot the Default Route, the SW1 switch does not have connectivity to the server at 172.16.1.100 because there is a default route missing on the Branch router. Students configure a default route pointing to the IP on the HQ GigabitEthernet0/1 to solve this issue.

In Task 2: Troubleshoot an ACL, PC1 cannot access the server at 172.16.1.100 through Telnet or HTTP because of the access list Outbound-ACL on the Branch router that implicitly denies this kind of traffic. The students can solve the issue by modifying the access list so that it permits Telnet and HTTP traffic from any source to any destination. More advanced students, waiting for others to catch up, can write a more specific access list, one that will permit HTTP and Telnet traffic only between VLAN 10 users and the server at 172.16.1.100. Also, more advanced students, waiting for others to catch up, can modify Outbound-ACL to allow traceroute traffic.

Lab 7-1: Configuring and Troubleshooting a Serial Connection

This topic details the lab activity for Lab 7-1: Configuring and Troubleshooting a Serial Connection.
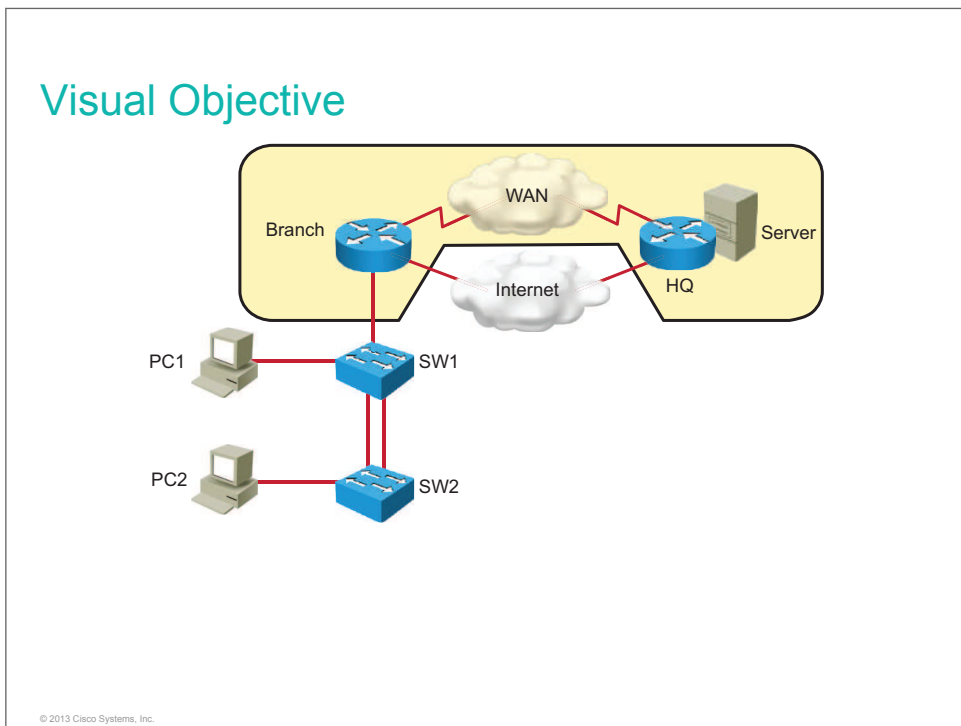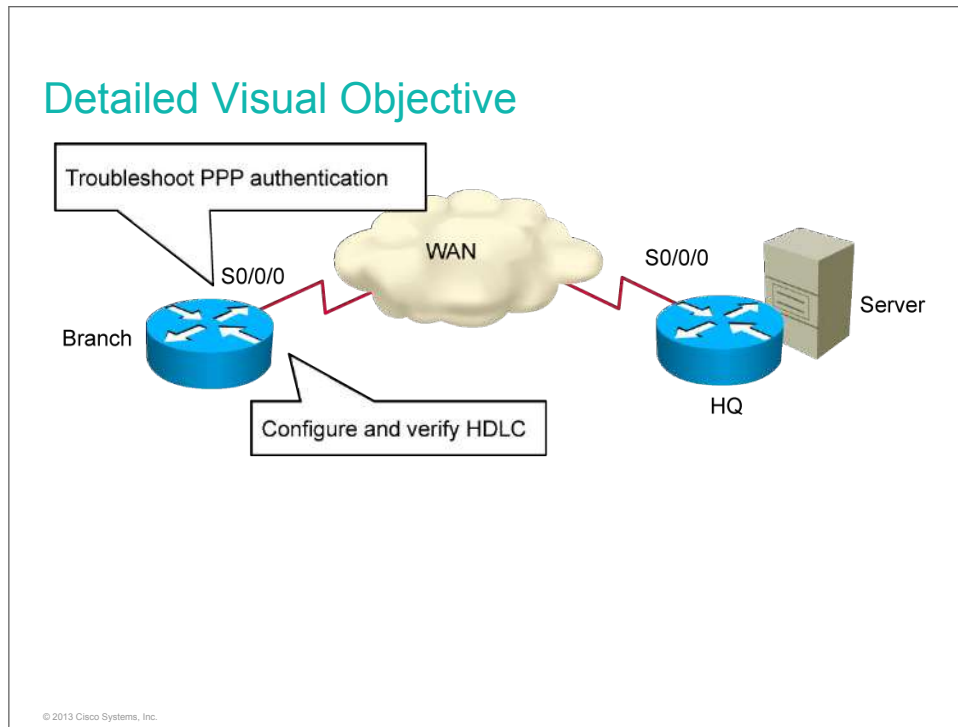
Objectives

In this activity, you will identify and correct connectivity problems that are caused by misconfigured PPP encapsulation. Then, you will change the encapsulation from PPP to HDLC. After you have completed this activity, you will be able to meet these objectives:

- Troubleshoot PPP encapsulation
- Configure and verify HDLC encapsulation

Visual Objective

The figure illustrates what you will accomplish in this activity.

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Detailed Visual Objective

Troubleshoot PPP authentication

WAN

S0/0/0

S0/0/0

Server

Branch

HQ

Configure and verify HDLC

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Setup

Since this is a troubleshooting lab, students are first required to copy new configurations to devices to create troubleshooting tickets. These configuration files should be preloaded to the flash memory of the devices.

The table lists configuration files that are required to create trouble tickets in this lab.

Device	Configuration File to Install	Configuration Instructions
Branch	TSHOOT_Serial_Connection_Branch.cfg	Copy the configuration file to the device flash memory.
HQ	TSHOOT_Serial_Connection_HQ.cfg	Copy the configuration file to the device flash memory.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 7-2: Establishing a Frame Relay WAN

This topic details the lab activity for Lab 7-2: Establishing a Frame Relay WAN.

Objectives

In this activity, you will configure basic Frame Relay. After completing this activity, you will be able to meet these objectives:

- Configure and verify basic Frame Relay
- Configure and verify Frame Relay subinterfaces
- Remove the Frame Relay configuration

Visual Objective

The figure illustrates what you will accomplish in this activity.
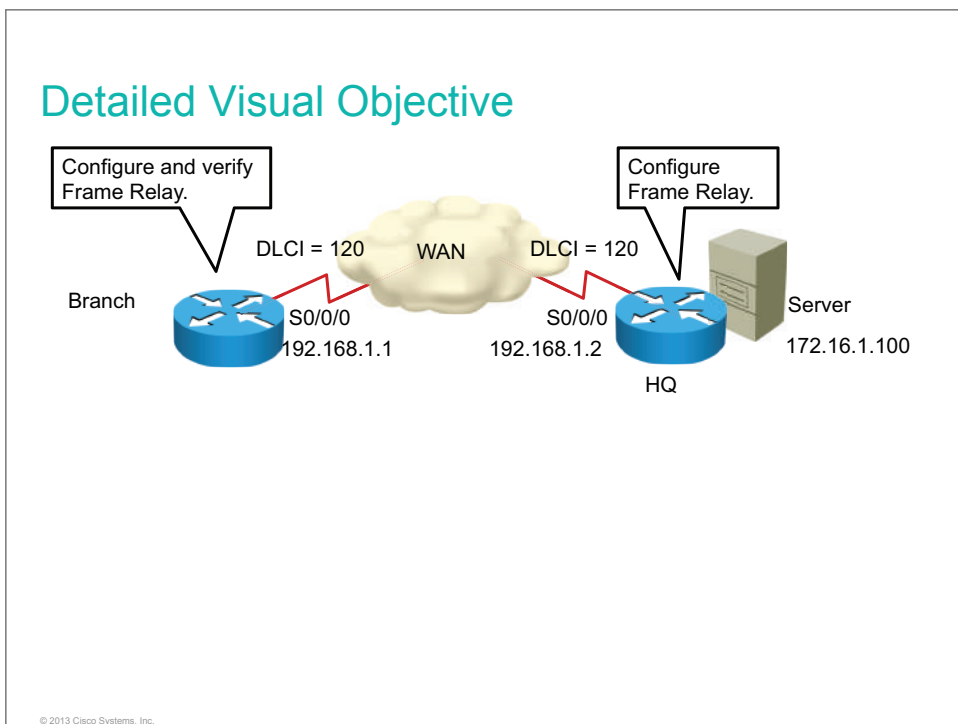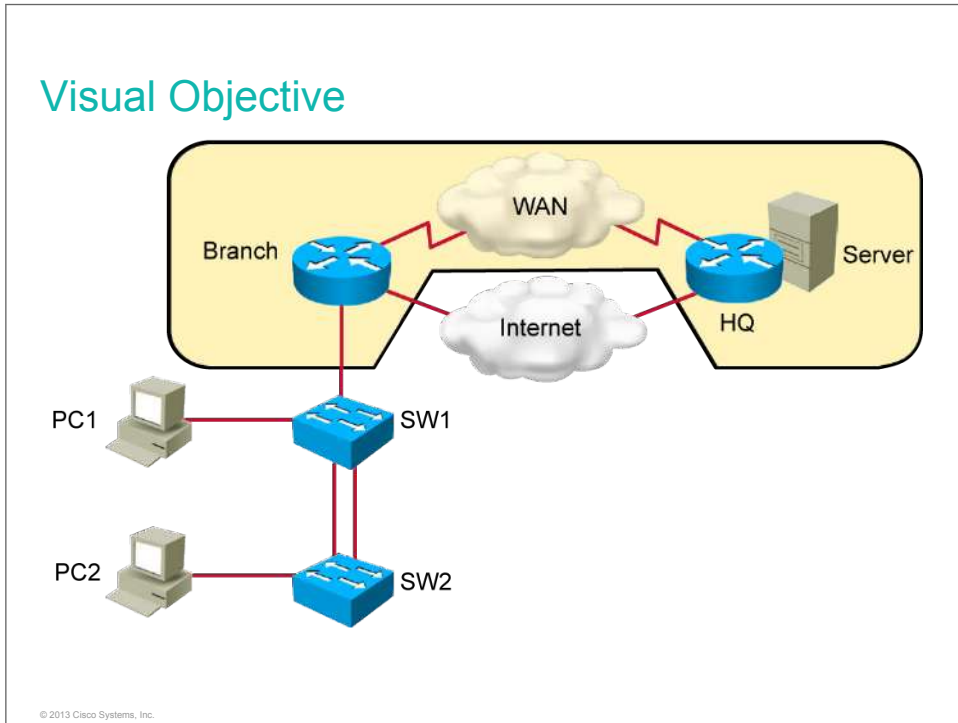
Setup

The table describes how to set up the lab configurations for the equipment for this lab.

Device	Configuration File to Install	Configuration Instructions
Branch	INIT_Establishing_Frame_Relay_WAN_Branch.cfg	Copy the configuration file to the device.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

Students are instructed to copy a configuration to the HQ router that enables it to act as a frame relay switch. If students fail to perform that step, they will not be able to finish the lab.

Instructor Notes

In this lab, the students are required to copy a configuration to the HQ router. This configuration is required to configure the HQ router to act as Frame Relay switch and router at the same time. It is not possible to preconfigure these commands during the course setup, because some of the commands are not available on the router until encapsulation is set to Frame Relay on the interface.

Lab 7-3: Establishing a GRE Tunnel

This topic details the lab activity for Lab 7-3: Establishing a GRE Tunnel.
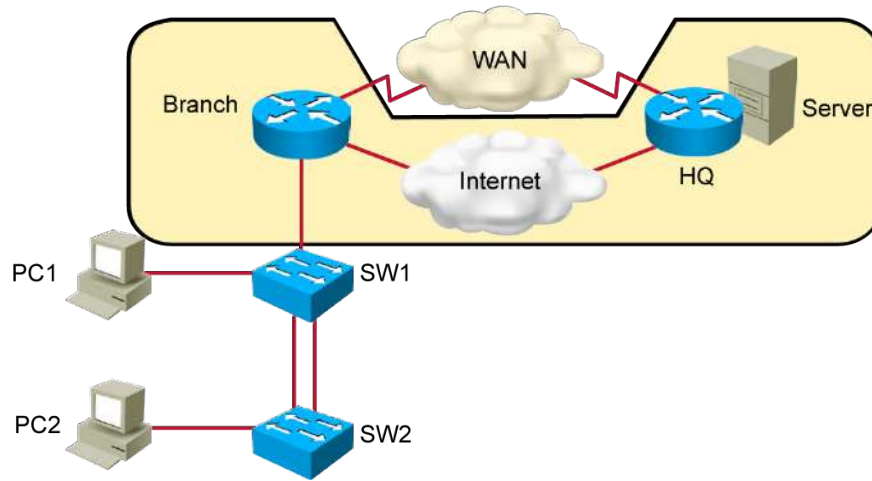
Objectives

In this activity, you will implement a GRE tunnel. After completing this activity, you will be able to meet this objective:

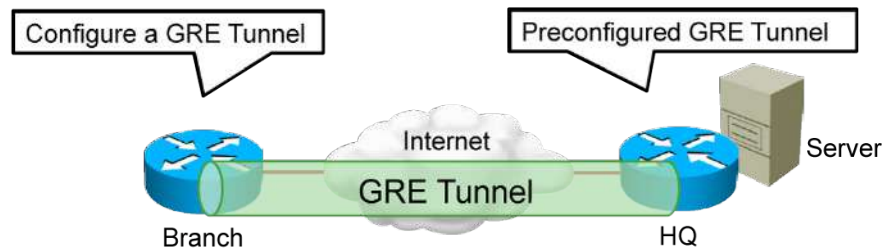- Configure and verify a GRE tunnel

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

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Detailed Visual Objective

Configure a GRE Tunnel

Preconfigured GRE Tunnel

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Setup

The table describes how to set up the lab configurations for the equipment for this lab.

Device	Configuration File to Install	Configuration Instructions
Branch	INIT_Establishing_GRE_Tunnel_Branch.cfg	Copy the configuration file to the device.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 8-1: Implementing EIGRP

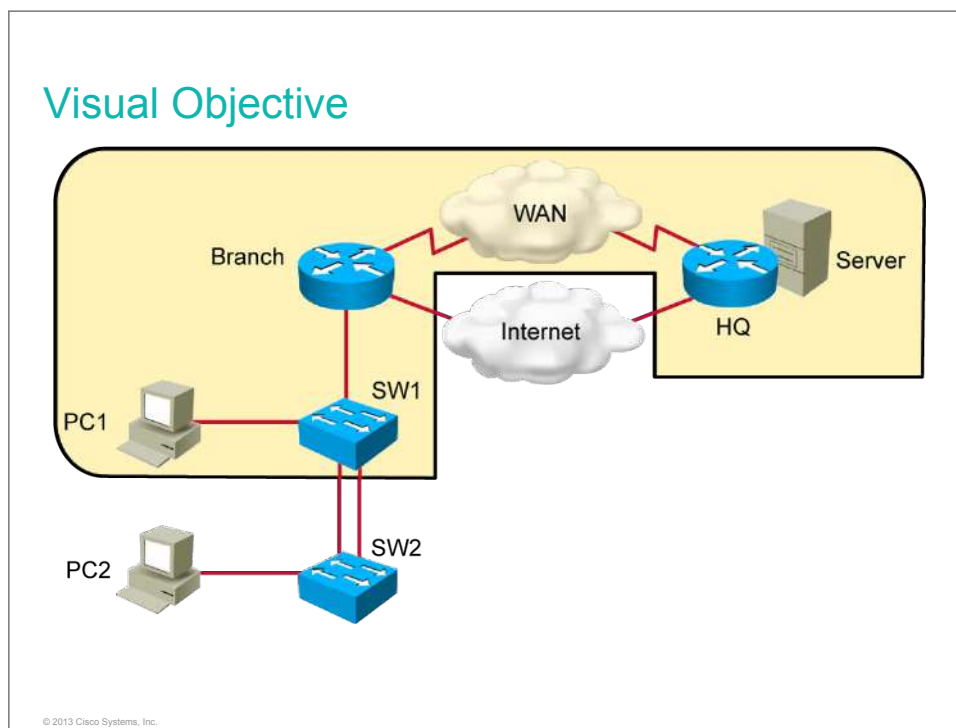This topic details the lab activity for Lab 8-1: Implementing EIGRP.

Objectives

In this activity, you will configure EIGRP, investigate EIGRP neighbor events, and enable EIGRP over GRE tunnel. After completing this activity, you will be able to meet these objectives:
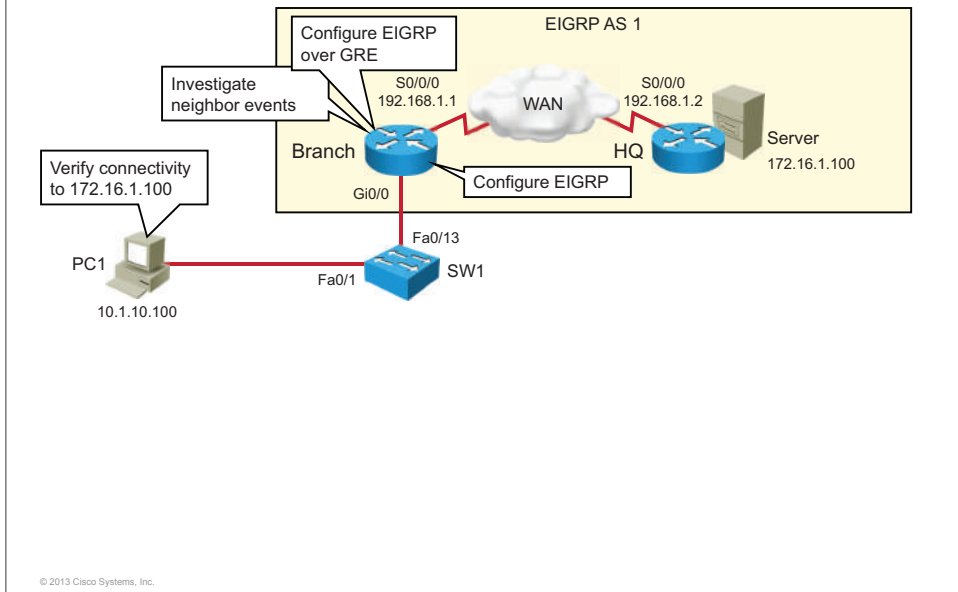
•   Configure and verify basic EIGRP

•   Investigate EIGRP neighbor events

•   Configure and verify EIGRP over GRE tunnel

Visual Objective

The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Setup

This lab builds on the previous lab. If students have successfully completed the previous exercise, there is no need to load the startup configurations.

The table describes how to set up the lab configurations for the equipment for this lab. The students can be instructed to replace the configuration files with the files specified in the table (use the **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_Implement_EIGRP_HQ.cfg	Copy and load the configuration
Branch	INIT_Implement_EIGRP_Branch.cfg	Copy and load the configuration
SW1	INIT_Implement_EIGRP_SW1.cfg	Copy and load the configuration
SW2	INIT_Implement_EIGRP_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 8-2: Troubleshooting EIGRP

This topic details the lab activity for Lab 8-2: Troubleshooting EIGRP.
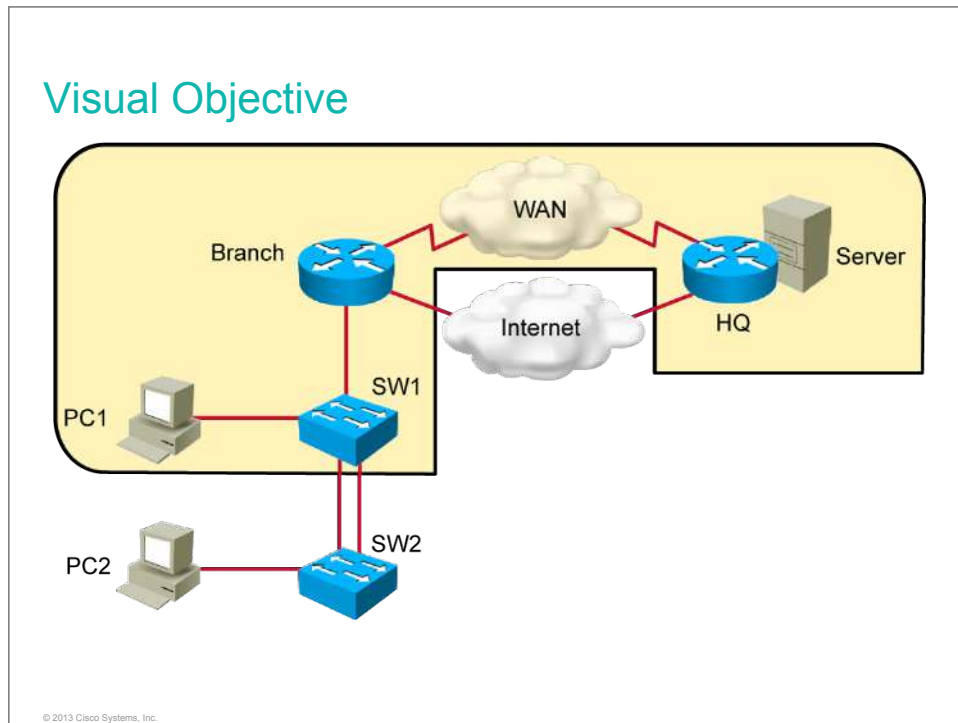
Objectives

In this activity, you will troubleshoot connectivity problems that are related to EIGRP. After completing this activity, you will be able to meet these objectives:
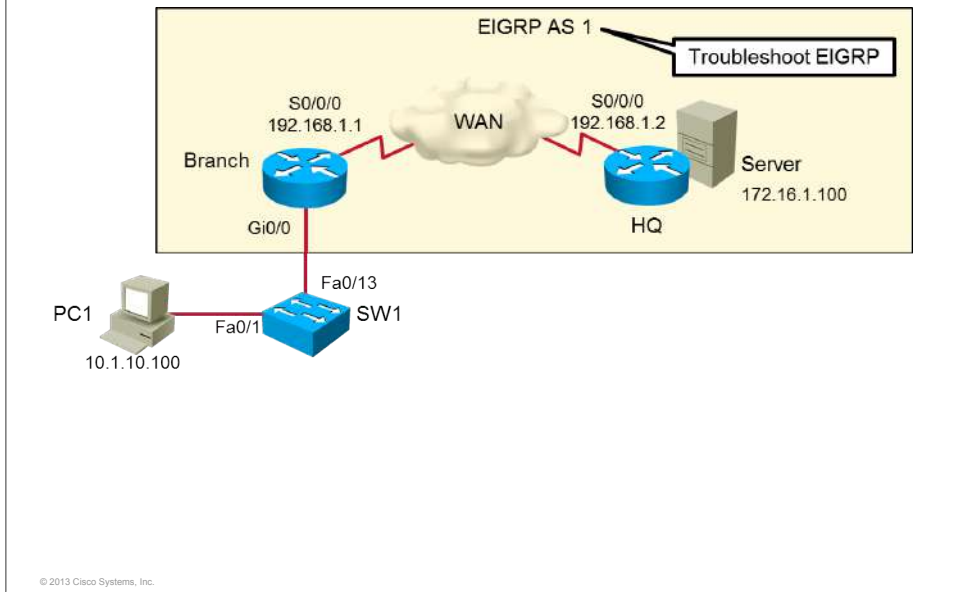
- Troubleshoot EIGRP neighbors
- Troubleshoot routing table issues

Visual Objective

The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Setup

The table lists configuration files that are required to create trouble tickets in this lab. The students can be instructed to replace the configuration files with the files specified in the table (use **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_Tshoot_EIGRP_HQ.cfg	Copy and load the configuration
Branch	INIT_Tshoot_EIGRP_Branch.cfg	Copy and load the configuration
SW1	INIT_Tshoot_EIGRP_SW1.cfg	Copy and load the configuration
SW2	INIT_Tshoot_EIGRP_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

In Task 1: Troubleshoot Basic Connectivity, the Branch router is not able to reach the HQ router because Serial 0/0/0 on the Branch side is shut down. Students solve this issue by bringing up the interface with the **no shutdown** command.

In Task 2: Troubleshooting EIGRP Neighbors, Branch and HQ are not becoming EIGRP neighbors because Serial 0/0/0 on the Branch side is configured as passive. Students solve this issue by configuring Serial 0/0/0 as a non-passive under the EIGRP routing process with AS 1.

In Task 3: Troubleshooting Routing Table Issues, PC1 does not get an answer from the server at 172.16.1.100, because the Branch router is missing **network** statements for the LAN behind the Branch router. The students resolve the connectivity issue by configuring correct network statements on the Branch router under the EIGRP router process with AS 1.

Lab 8-3: Implementing EIGRP for IPv6

This topic details the lab activity for Lab 8-3: Implementing EIGRP for IPv6.
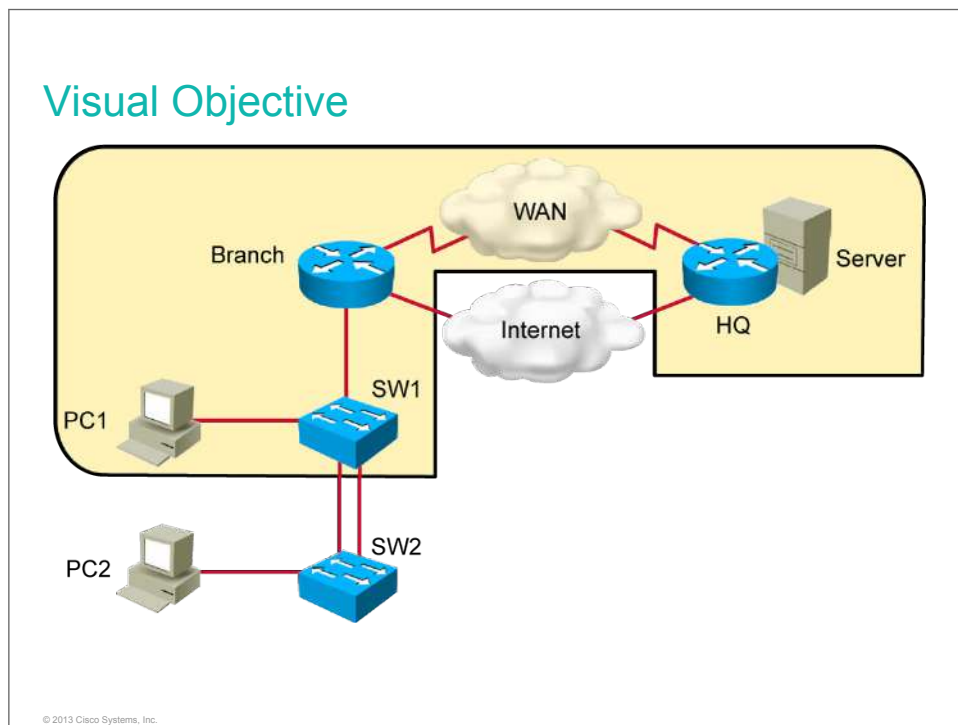
Objectives

In this activity, you will configure and verify EIGRP for IPv6. After completing this lab activity, you will be able to meet this objective:
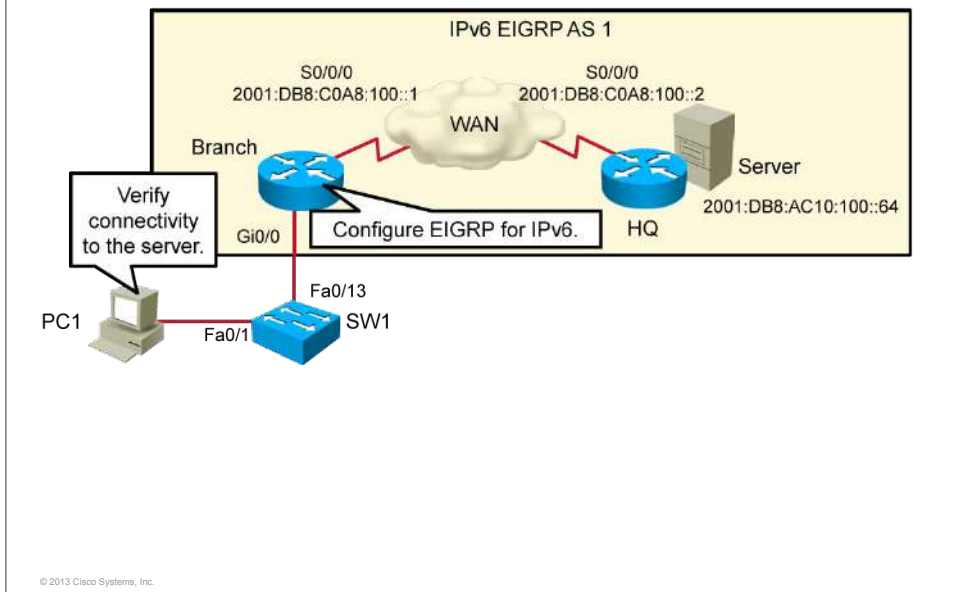
• Configure EIGRP for IPv6 and verify the configuration

Visual Objective

The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

IPv6 EIGRP AS 1

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Setup

This lab builds on the previous lab. If students have successfully completed the previous exercise, there is no need to load the startup configurations.

The table describes how to set up the lab configurations for the equipment for this lab. The students can be instructed to replace the configuration files with the files specified in the table (use **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_EIGRP_for_IPv6 _HQ.cfg	Copy and load the configuration
Branch	INIT_EIGRP_for_IPv6 _Branch.cfg	Copy and load the configuration
SW1	INIT_EIGRP_for_IPv6 _SW1.cfg	Copy and load the configuration
SW2	INIT_EIGRP_for_IPv6 _SW2.cfg	Copy and load the configuration

These configuration files should be preloaded to the flash memory of the devices.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Lab 9-1: Implementing OSPF

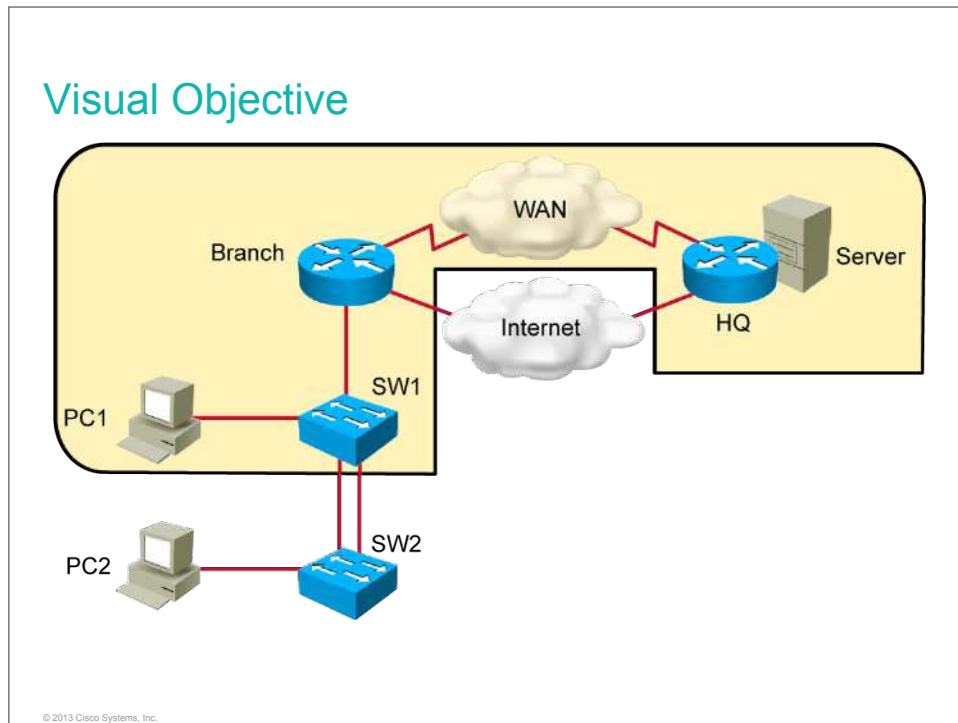This topic details the lab activity for Lab 9-1: Implementing OSPF.

Objectives

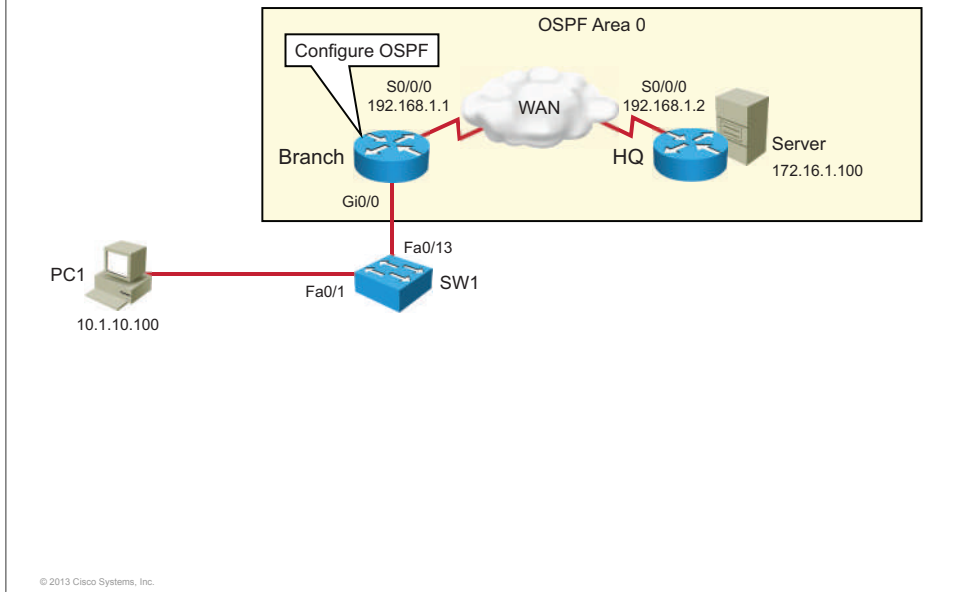After completing this activity, you will be able to meet this objective:

• Configure OSPF

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

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Detailed Visual Objective

OSPF Area 0

Configure OSPF

S0/0/0
192.168.1.1

WAN

S0/0/0
192.168.1.2

Branch

HQ

Server
172.16.1.100

Gi0/0

PC1

Fa0/13

Fa0/1   SW1

10.1.10.100

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Setup

This lab builds on the previous lab. If students have completed the previous exercise, you only need to load a new configuration on the HQ router.

You can also load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_Implement_OSPF_HQ.cfg	Copy and load the configuration
Branch	INIT_Implement_OSPF_Branch.cfg	Copy and load the configuration
SW1	INIT_Implement_OSPF_SW1.cfg	Copy and load the configuration
SW2	INIT_Implement_OSPF_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 9-2: Configuring Multiarea OSPF

This topic details the lab activity for Lab 9-2: Configuring Multiarea OSPF .
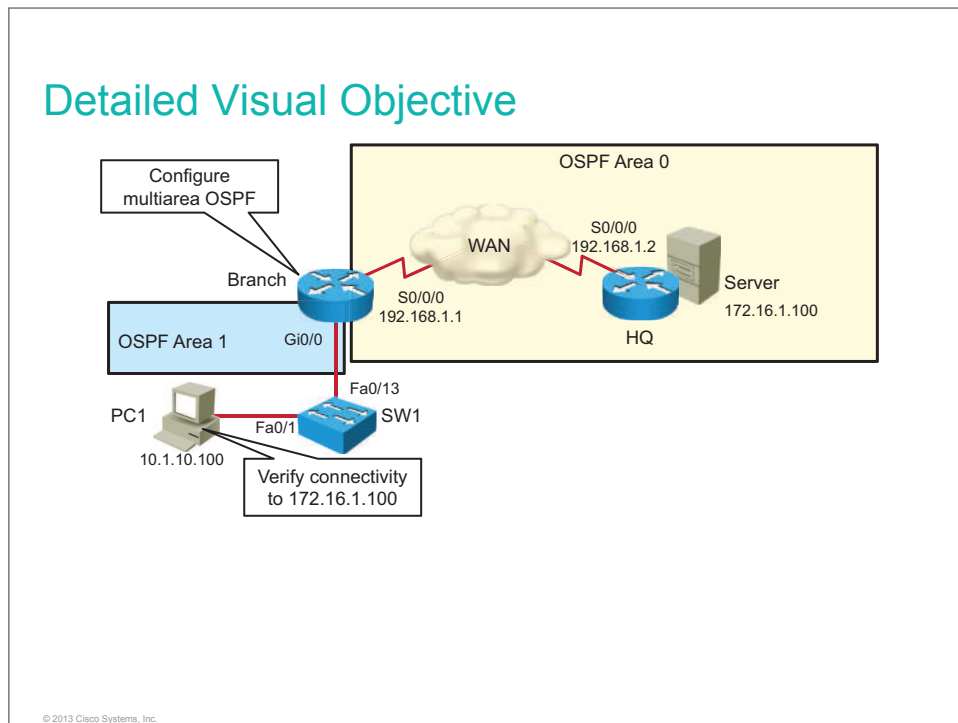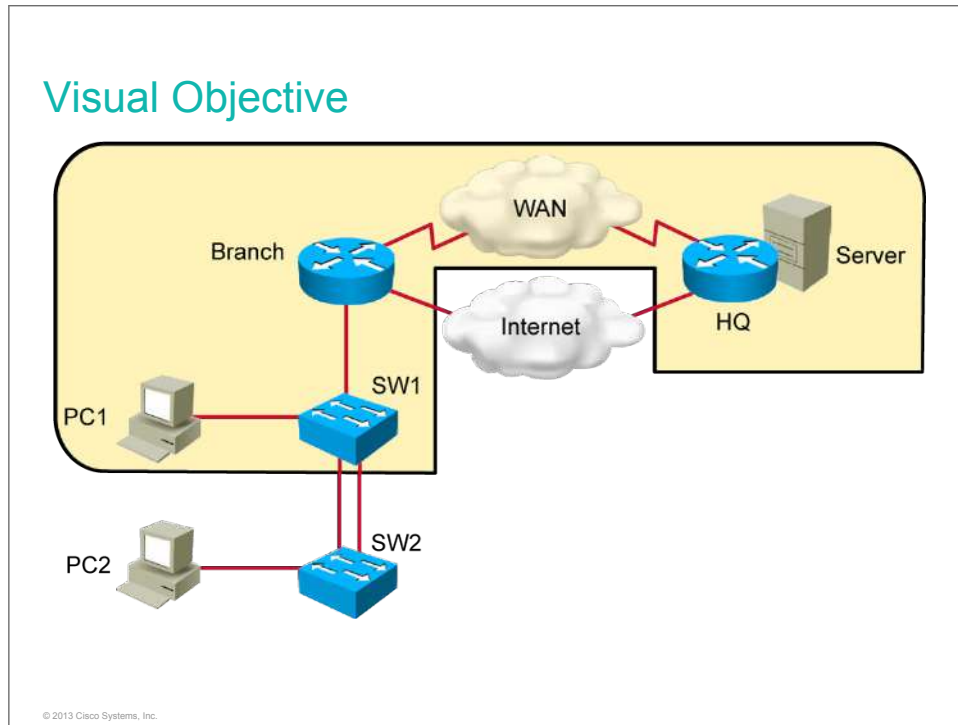
Objectives

After completing this activity, you will be able to meet these objectives:

* Configure multiarea OSPF

- Verify multiarea OSPF configuration

Visual Objective

The figure illustrates what you will accomplish in this activity.

Setup

The table describes how to set up the lab configurations for the equipment for this lab.

Device	Configuration File to Install	Configuration Instructions
Branch	INIT_Configuring_Multiarea_OSPF_Branch.cfg	Copy the configuration file to the device.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 9-3: Troubleshooting Multiarea OSPF

This topic details the lab activity for Lab 9-3: Troubleshooting Multiarea OSPF.
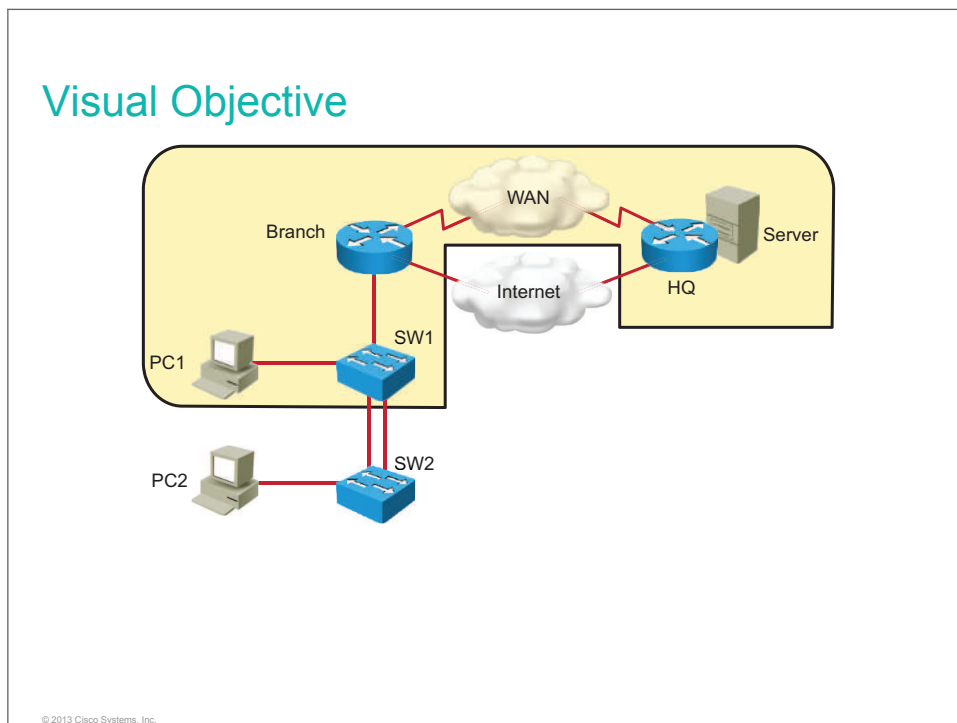
Objectives

In this lab, you will be presented with two multiarea OSPF troubleshooting tickets. After this lab activity, you will be able to meet these objectives:
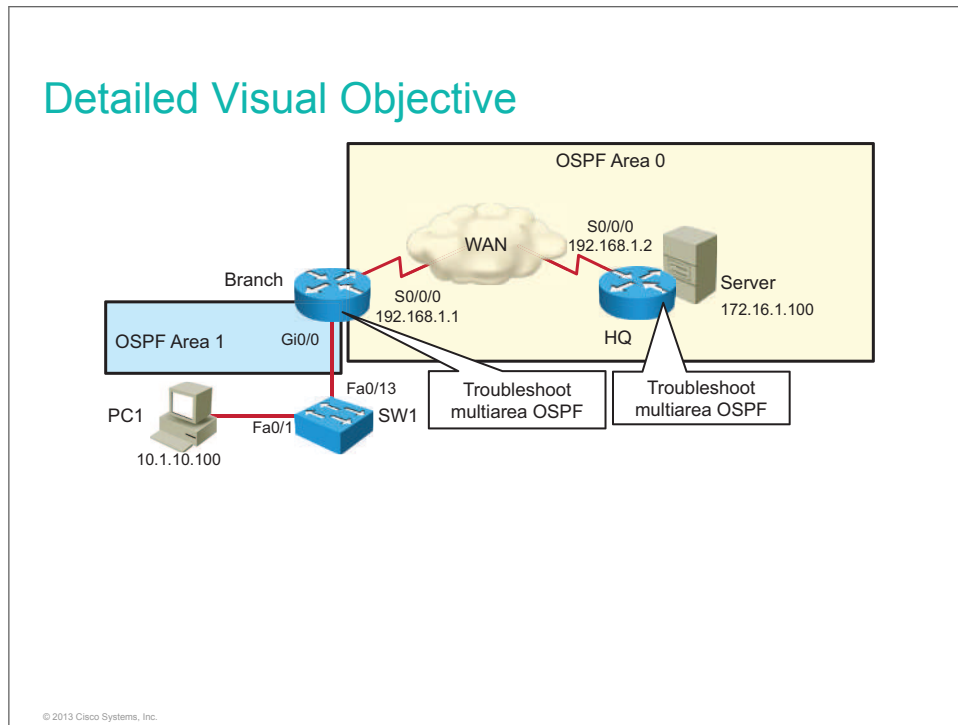
- Troubleshoot OSPF neighbor issues
- Troubleshoot OSPF routing table issues

Visual Objective

The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Setup

The table lists configuration files that are required to create trouble tickets in this lab. The students can be instructed to replace the configuration files with the files that are specified in the table (use the **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
Headquarters	INIT_Tshoot_OSPF_ HQ.cfg	Copy and load the configuration
Branch	INIT_Tshoot_OSPF_ Branch.cfg	Copy and load the configuration
SW1	INIT_Tshoot_OSPF_ SW1.cfg	Copy and load the configuration
SW2	INIT_Tshoot_OSPF_ SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues that are found in this lab.

Instructor Notes

In Task 1: Troubleshoot OSPF Neighbor Issues, routers are not becoming neighbors because the Branch router is configured with the **passive-interface default** command and because the Headquarters router has the Serial 0/0/0 interface in OSPF Area 1 instead of in Area 0. The students solve these two problems by configuring Serial0/0/0 as a nonpassive interface and modifying the OSPF **network** statement on the Headquarters router so that the Serial 0/0/0 interface is in Area 0.

In Task 2: Troubleshoot OSPF Routing Table Issues, the Branch router does not have connectivity to the server at 172.16.1.100 because the Headquarters router is advertising an incorrect network. The student can correct this connectivity problem by removing the incorrect **network** statement on the Headquarters router and replacing it with a correct one.

Lab 9-4: Configuring OSPF for IPv6

This topic details the lab activity for Lab 9-4: Configuring OSPF for IPv6.
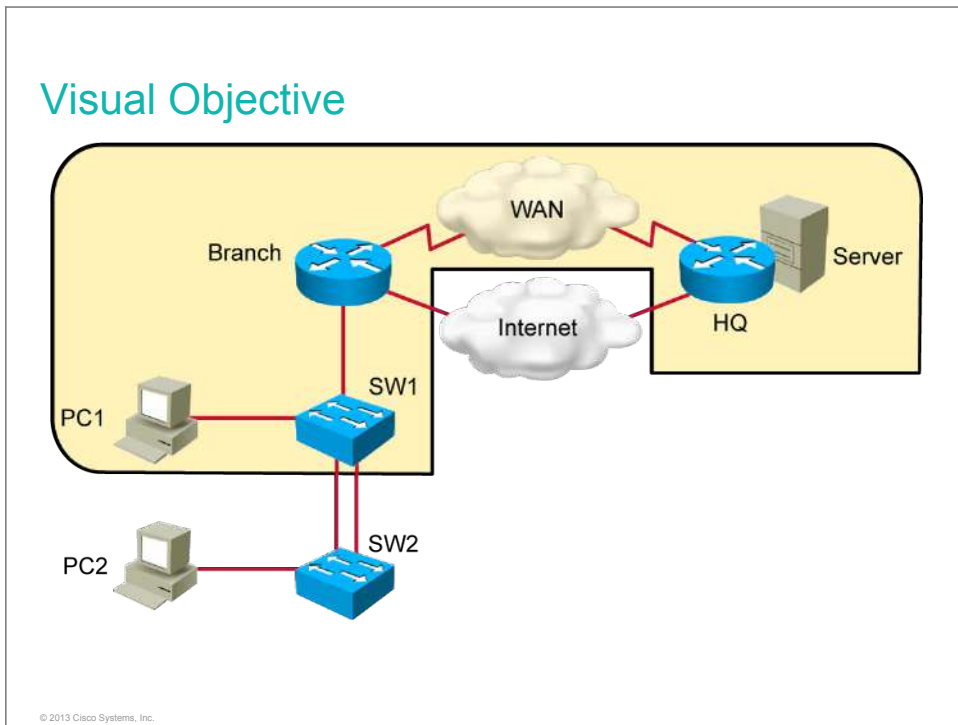
Objectives

In this lab, you will remove EIGRP for IPv6 and replace it with the OSPFv3 routing protocol. After this lab activity, you will be able to meet these objectives:
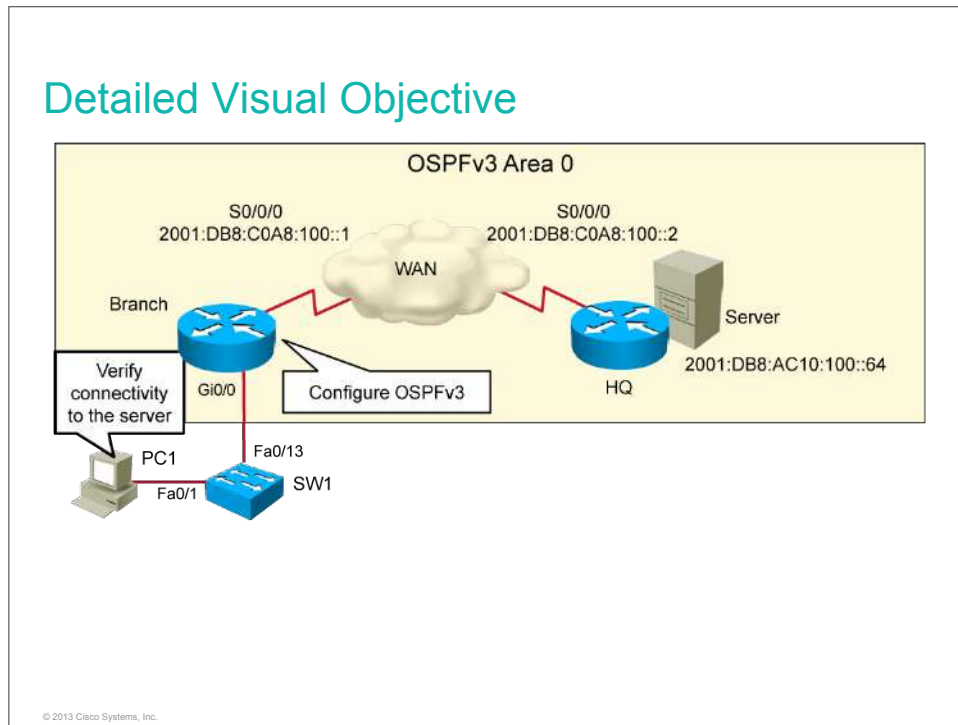
- Configure basic OSPF in an IPv6 network
- Verify OSPFv3 configuration

Visual Objective

The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

OSPFv3 Area 0

Branch

S0/0/0
2001:DB8:C0A8:100::1

WAN

S0/0/0
2001:DB8:C0A8:100::2

Server

2001:DB8:AC10:100::64

HQ

Configure OSPFv3

Verify connectivity to the server

PC1

Gi0/0

Fa0/13

SW1

Fa0/1

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Setup

The table describes how to set up lab configurations with equipment for this lab.

Device	Configuration File to Install	Configuration Instructions
Branch	INIT_OSPF_for_IPv6 _Branch.cfg	Copy and load the configuration
HQ	INIT_OSPF_for_IPv6 _HQ.cfg	Copy and load the configuration
SW1	INIT_OSPF_for_IPv6 _SW1.cfg	Copy and load the configuration
SW2	INIT_OSPF_for_IPv6 _SW2.cfg	Copy and load the configuration

These configuration files should be preloaded to the flash memory of the devices.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 10-1: SNMP and Syslog Basic Configuration

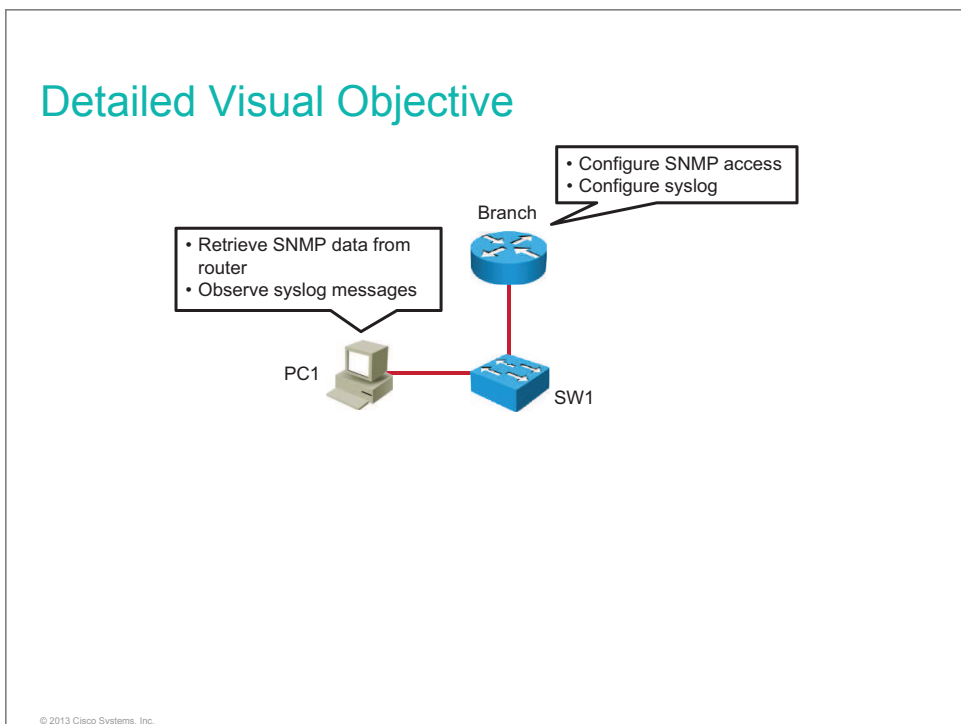This topic details the lab activity for Lab 10-1: SNMP and Syslog Basic Configuration.
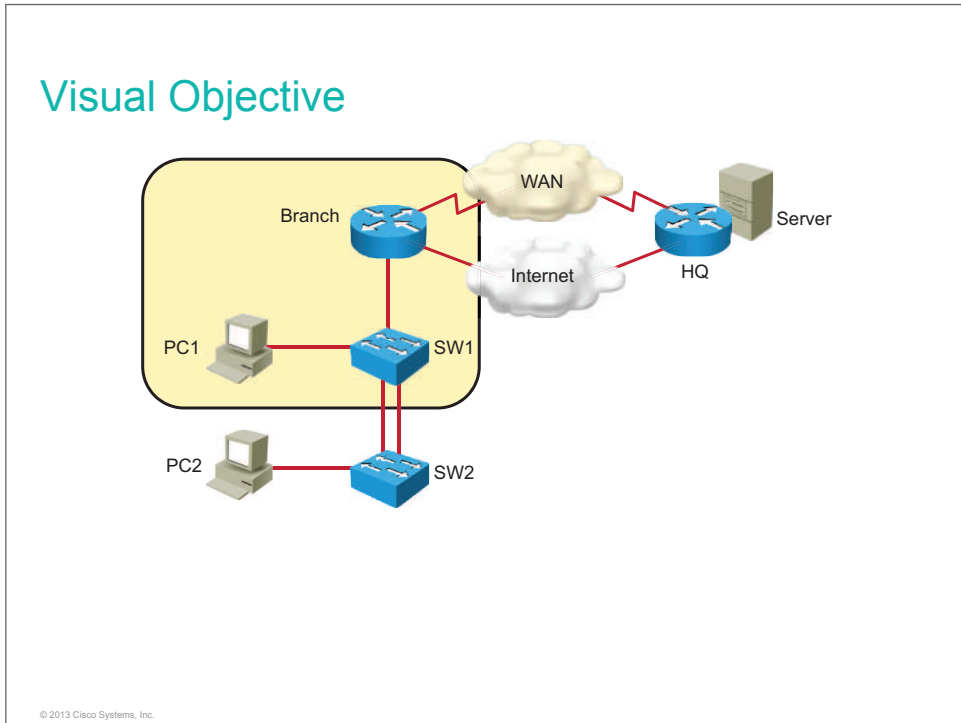
Objectives

In this activity, you will configure the Branch router as an SNMP and syslog client. After completing this activity, you will be able to meet these objectives:

- Configure the SNMP client
- Configure the syslog client

Visual Objective

The figure illustrates what you will accomplish in this activity.

Setup

This lab builds on the previous lab. If students have successfully completed the previous exercise, there is no need to load the startup configurations.

The table describes how to set up the lab configurations for the equipment for this lab. The students can be instructed to replace the configuration files with the files that are specified in the table (use the **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
Headquarters	INIT_SNMP_and_Syslog_HQ.cfg	Copy and load the configuration
Branch	INIT_SNMP_and_Syslog_Branch.cfg	Copy and load the configuration
SW1	INIT_SNMP_and_Syslog_SW1.cfg	Copy and load the configuration
SW2	INIT_SNMP_and_Syslog_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues that are found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 10-2: Analyzing NetFlow Data

This topic details the lab activity for Lab 10-2: Analyzing NetFlow Data.

Objectives

In this activity, you will look at outputs from a NetFlow analyzer and answer questions about them. After completing this activity, you will be able to meet this objective:

• Analyze data that is captured by the NetFlow collector

Visual Objective

There is no visual objective for this lab.

Setup

There is no setup that is needed for this lab. This is a paper lab where students are presented with printouts from a NetwFlow Analyzer and asked to interpret them.

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues that are found in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 10-3: Managing Cisco Devices and Licensing

This topic details the lab activity for Lab 10-3: Managing Cisco Devices and Licensing.
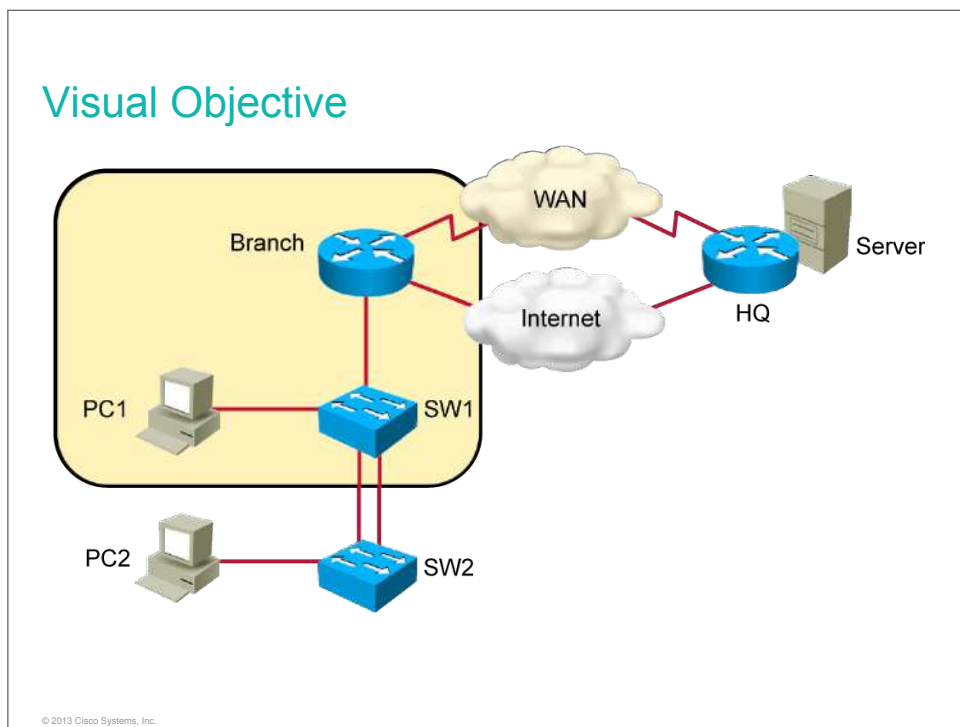
Objectives

In this lab, you will perform a password recovery, manage Cisco IOS image and configuration files, and verify licensing. After completing this activity, you will be able to meet these objectives:
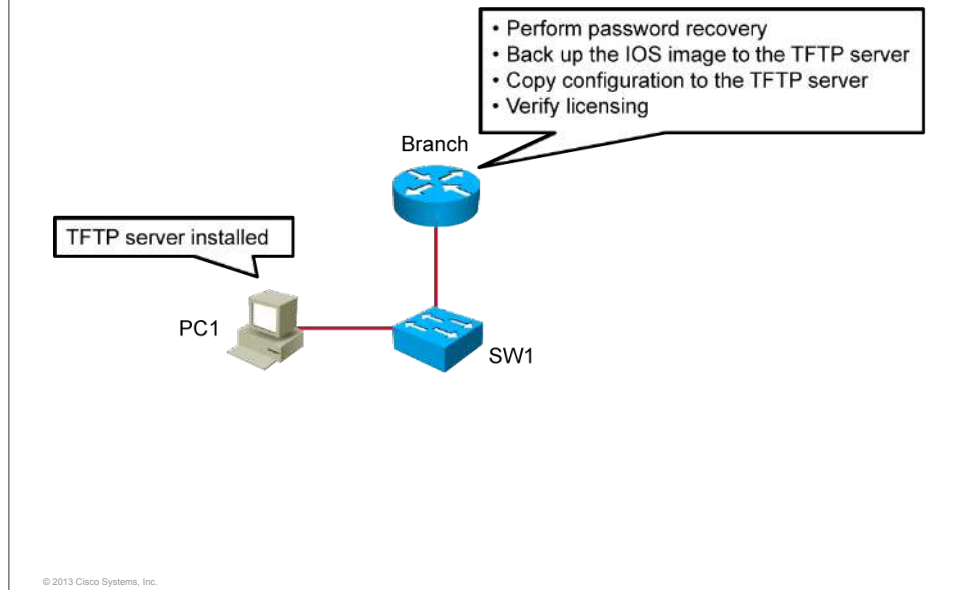
- Perform a password recovery on a router
- Back up an IOS image
- Manage configuration filea
- Verify licensing

Visual Objective

The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Branch
- Perform password recovery
- Back up the IOS image to the TFTP server
- Copy configuration to the TFTP server
- Verify licensing

TFTP server installed

PC1

SW1

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Setup

This lab builds on the previous lab. If students have successfully completed the previous exercise, there is no need to load the startup configurations.

The table describes how to set up the lab configurations for the equipment for this lab. The students can be instructed to replace the configuration files with the files specified in the table (use the **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_Managing_and_Licensing_HQ.cfg	Copy and load the configuration
Branch	INIT_Managing_and_Licensing_Branch.cfg	Copy and load the configuration
SW1	INIT_Managing_and_Licensing_SW1.cfg	Copy and load the configuration
SW2	INIT_Managing_and_Licensing_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab.

Common Issues

There are no common issues found in this lab.

Instructor Notes

The power cycle is performed differently depending on the lab setup:

- If you are using remote labs, the lab provider might have the option to power cycle the router via a web interface

- If you are using local physical equipment, switch off the router and switch it on again.

- If neither of the above options is available, enter privilege mode by using the enable password **forget** and reload the router using the **reload** command