ICND1

Interconnecting Cisco Networking Devices, Part 1

Version 2.0

Course Guide

CISCO

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Course Description

Interconnecting Cisco Networking Devices, Part 1 (ICND1) v2.0 is a five-day, instructor-led training course that teaches learners how to install, operate, configure, and verify a basic IPv4 and IPv6 network, including configuring a LAN switch, configuring an IP router, connecting to a WAN, and identifying basic security threats. ICND1 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 Learning Partner Cisco Learning labs (LP CLL). Optionally, this course can be followed by the *Interconnecting Cisco Networking Devices, Part 2* (ICND1) v2.0 course, which covers topics in more depth and teaches learners how to perform basic troubleshooting steps in enterprise branch office networks, preparing learners for Cisco CCNA certification.

Full Title of Course	Interconnecting Cisco Networking Devices, Part 1
Course Order Code	ICND1
Course Version Number	2.0
New Course?	No
Replaces	Interconnecting Cisco Networking Devices, Part 1 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

- Expand small- to medium-sized networks with WAN connectivity

- Describe IPv6 basics

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 candidates:** Individuals seeking the Cisco CCENT certification, or Cisco CCNA Routing and Switching certification. The course is also appropriate for support technicians involved in the basic installation, operation, and verification of LAN 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** commands and applications to ensure that the solution was correctly implemented and is performing as desired.

- **Job roles:** Entry-level network engineer, network administrator, network support technician, and 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

Course Differences (Delta) Information

This section provides a summary of the most significant differences between the previous version, ICND1 v1.1, and this version, ICND1 v2.0.

Executive Summary

Overview

ICND1 v2.0 includes major updates and aligns to an updated blueprint. Several topics have been moved from ICND2 into ICND1, while some topics, such as RIP and wireless, have been removed from this course. Course content has been adapted to Cisco IOS Software Release 15 and technically updated. All configuration commands are introduced through examples and supported with lab exercises. All labs are developed with new pod topology and newer networking gear.

Course Objectives

The table provides a comparison between the course objectives in version 1.1 and the updated course objectives in version 2.0.

Version 1.1 (Previous)
Describe how networks function, identifying major components, functions of network components, and the OSI reference model
Using the host-to-host packet delivery process, describe issues that are related to increasing traffic on an Ethernet LAN, and identify switched LAN technology solutions to Ethernet networking issues
Describe the reasons for extending the reach of a LAN, and the methods that can be used, with a focus on RF wireless access
Describe the reasons for connecting networks with routers, and how routed networks transmit data by using TCP/IP
Describe the function of WANs and the major devices of WANs, and configure PPP encapsulation, static and dynamic routing, and PAT and RIP routing
Use the CLI to discover neighbors on the network and manage router startup and configuration

Version 2.0 (Updated)
Describe network fundamentals and build simple LANs
Establish Internet connectivity
Manage network device security
Expand small- to medium-sized networks with WAN connectivity
Describe IPv6 basics

Module Content Comparison

The table provides a high-level summary of changes for each module.

Version 1.1 (Previous)	Version 2.0 (Updated)	Changes and Reason
Module 0: Course Introduction	Module 0: Course Introduction	No major changes
Module 1: Building a Simple Network	Module 1: Building a Simple Network	Additions: • Introducing LANs (renamed and updated) • Operating Cisco IOS Software (repositioned and updated) • Starting a Switch (repositioned and updated) • Understanding Ethernet and Switch Operation (renamed and updated) • Troubleshooting Common Switch Media Issues (repositioned and updated) Deletions: • Securing the Network • Understanding the TCP/IP Internet Layer (repositioned) • Understanding the TCP/IP Transport Layer (repositioned) • Exploring the Packet Delivery Process (repositioned)

Version 1.1 (Previous)	Version 2.0 (Updated)	Changes and Reason
Module 2: Ethernet LANs	Module 2: Establishing Internet Connectivity	Additions: • Understanding the TCP/IP Internet Layer (updated and repositioned) • IP Addressing and Subnets (updated and repositioned) • Understanding the TCP/IP Transport Layer (updated and repositioned) • Exploring the Functions of Routing (updated and repositioned) • Configuring a Cisco Router (updated and repositioned) • Exploring the Packet-Delivery Process (updated and repositioned) • Enable Static Routing (updated and repositioned) • Managing Traffic Using ACLs (updated and repositioned from ICND2) • Enabling Internet Connectivity (renamed, repositioned, and updated) Deletions: • Understanding the Challenges of Shared LANs • Solving Network Challenges with Switched LAN Technologies • Operating Cisco IOS Software (repositioned) • Starting a Switch (repositioned) • Understanding Switch Security (repositioned) • Maximizing the Benefits of Switching (repositioned and merged) • Troubleshooting Switch Issues (repositioned)
Module 3: Wireless LANs	Module 3: Managing Network Device Security	Additions: • Securing Administrative Access (updated and repositioned) • Implementing Device Hardening (updated, renamed, and repositioned) • Implementing Traffic Filtering with ACLs (updated and repositioned from ICND2) Deletion: • All of existing module 3 removed

Version 1.1 (Previous)	Version 2.0 (Updated)	Changes and Reason
Module 4: LAN Connections	Module 4: Building a Medium-Sized Network	Additions: • Implementing VLANs and Trunks (updated and repositioned from ICND2) • Routing Between VLANs (repositioned from ICND2) • Introducing WAN Technologies (updated and repositioned) • Introducing Dynamic Routing Protocols (updated and repositioned) • Implementing OSPF (updated and repositioned from ICND2) Deletions: • Exploring the Functions of Routing (repositioned) • Understanding Binary Basics (repositioned and merged) • Constructing a Network Addressing Scheme (repositioned and merged) • Starting a Cisco Router (renamed and repositioned) • Configuring a Cisco Router (repositioned) • Exploring the Packet Delivery Process (repositioned) • Understanding Cisco Router Security (repositioned and merged) • Using Cisco SDM • Accessing Remote Devices (repositioned, updated and renamed)

Version 1.1 (Previous)	Version 2.0 (Updated)	Changes and Reason
Module 5: WAN Connections	Module 5: Introducing IPv6	Additions: • Introducing Basic IPv6 (updated and repositioned from ICND2) • Understanding IPv6 (updated and repositioned from ICDN2) • Configuring IPv6 Routing Deletions • Understanding WAN Technologies (repositioned) • Enabling the Internet Connection (repositioned and renamed) • Enabling Static Routing (repositioned) • Configuring Serial Encapsulation (repositioned to ICND2) • Enabling RIP
Module 6: Network Environment Management		Deletions: • Discovering Neighbors on the Network (repositioned and merged) • Managing Cisco Router Startup and Configuration (repositioned and merged) • Managing Cisco Devices (repositioned and merged)

Lesson and Lab Objective Changes

This table lists the lessons, labs, and other activities deleted from the previous version and the lessons, labs, and other activities added in this updated version.

	Lessons, Labs, and Activities *Removed* from v1.1 (Previous)		Lessons, Labs, and Activities *Added* to v2.0 (Updated)
Module 1		**Module 1**	
Lesson Titles	Securing the Network	**Lab or Other Activities**	Lab 1-2: Troubleshooting Switch Media Issues
Lesson Objectives	Identify common threats to a network and threat-mitigation methods	**Lab or Other Objectives**	Follow troubleshooting guidelines to determine the source of connectivity problems between a computer and switch and fix them Follow troubleshooting guidelines to determine the source of connectivity problems between a router and switch and fix them
Lab or Other Activities	Lab 1-1: Using Windows Applications as Network Tools		

	Lessons, Labs, and Activities *Removed* from v1.1 (Previous)		Lessons, Labs, and Activities *Added* to v2.0 (Updated)
Lab or Other Objectives	Using the Windows command **ipconfig**, determine the current network addressing information of a PC Using the Windows command **ping**, determine test connectivity to the default gateway router Using the Windows command **arp –a**, view the ARP table of the local PC and determine the association between the IP address and the MAC address of the default gateway		
Lab or Other Activities	Lab 1-2: Observing the TCP Three-Way Handshake		
Lab or Other Objectives	Start the packet sniffer software application, to monitor the appropriate Ethernet interface for recording the packet flow Generate a TCP connection, using a web browser Observe the initial packets of the TCP flow, especially the SYN packet, SYN-ACK packet, and the ACK packet		
Lab or Other Activities	Lab 1-3: Observing Extended PC Network Information		
Lab or Other Objectives	Using the Windows **ipconfig /all** command, determine the IP addresses of the DNS servers that are available to your PC Using the IP address of one of the DNS servers from Task 1, test the connectivity to the DNS servers by using the Windows **ping** command Using the Windows **tracert /d** command, obtain the IP addresses of the routers that were traversed to reach the DNS server that was tested		
Module 2		**Module 2**	
Lesson Titles	Understanding the Challenges of Shared LANs	**Lesson Titles**	Managing Traffic Using ACLs
Lesson Objectives	Describe issues that are related to increasing traffic on an Ethernet LAN	**Lesson Objectives**	Describe the operation of ACLs and their applications in the network.
Lesson Titles	Solving Network Challenges with Switched LAN Technologies	**Lab or Other Activities**	Lab 2-2: Connecting to the Internet
Lesson Objectives	Identify switched LAN technology solutions to address Ethernet networking issues	**Lab or Other Objectives**	Configure a static default route Enable DHCP on a public interface Configure NAT using a pool Configure NAT with PAT

	Lessons, Labs, and Activities *Removed* from v1.1 (Previous)		Lessons, Labs, and Activities *Added* to v2.0 (Updated)
Lab or Other Activities	Lab 2-1: Connecting to Remote Lab Equipment		
Lab or Other Objectives	Connect to your assigned workgroup equipment using a console (terminal) server, so that switches and routers can be configured via the console ports Connect to your assigned workgroup equipment using the Cisco VPN Client software, so that your PC will be connected through an interface on your workgroup switch, which will allow the configuration of your workgroup router using a Cisco router and SDM.		
Module 3		**Module 3**	
Lesson Titles	Exploring Wireless Networking	**Lesson Titles**	Implementing Traffic Filtering with ACLs
Lesson Objectives	Describe the business drivers and standards that affect WLAN implementation	**Lesson Objectives**	Implement standard, extended, numbered, and named ACLs to filter traffic
Lesson Titles	Understanding WLAN Security	**Lab or Other Activities**	Lab 3-3: Filtering Traffic with ACLs
Lesson Objectives	Describe WLAN security issues and threat-mitigation methods Describe the factors that affect WLAN implementation	**Lab or Other Objectives**	Configure extended named ACLs Troubleshoot ACLs
Lesson Titles	Implementing a WLAN		
Lesson Objectives	Describe the factors that affect WLAN implementation		
Lesson Titles	VoIP Requirements		
Lesson Objectives	Describe the requirements of the implementation of VoIP		
Module 4		**Module 4**	
Lesson Titles	Using Cisco SDM	**Lesson Titles**	Implementing VLANs and Trunks
Lesson Objectives	Describe basic Cisco SDM features	**Lesson Objectives**	Implement and verify VLANs and trunking
Lab or Other Activities	Lab 4-1: Converting Decimal to Binary and Binary to Decimal	**Lesson Titles**	Routing Between VLANs
Lab or Other Objectives	Convert decimal numbers to binary Convert binary numbers to decimal	**Lesson Objectives**	Describe the application and configuration of inter-VLAN routing
Lab or Other Activities	Lab 4-2: Classifying Network Addressing	**Lesson Titles**	Implementing OSPF

	Lessons, Labs, and Activities *Removed* from v1.1 (Previous)		Lessons, Labs, and Activities *Added* to v2.0 (Updated)
Lab or Other Objectives	Convert decimal IP addresses to binary numbers Convert binary numbers to IP addresses Identify classes of IP addresses Identify valid and invalid host IP addresses	**Lesson Objectives**	Describe the operation and configuration of single-area OSPF
Lab or Other Activities	Lab 4-3: Computing Usable Subnetworks and Hosts	**Lab or Other Activities**	Lab 4-1: Configuring Expanded Switched Networks
Lab or Other Objectives	Determine the number of bits that are required to create different subnets Determine the maximum number of host addresses that are available in a given subnet	**Lab or Other Objectives**	Configure VLANs Configure trunking Configure router with a trunk link
Lab or Other Activities	Lab 4-4: Calculating Subnet Masks	**Lab or Other Activities**	Lab 4-3: Implementing OSPF
Lab or Other Objectives	Given a network address, determine the number of possible network addresses and the binary subnet mask to use Given a network IP address and subnet mask, determine the range of subnet addresses Identify the host addresses that can be assigned to a subnet and the associated broadcast addresses	**Lab or Other Objectives**	Configure a WAN interface Configure OSPF
Lab or Other Activities	Lab 4-8: Using Cisco SDM to Configure DHCP Server Function		
Lab or Other Objectives	Use Cisco SDM to configure a DHCP pool of addresses Use Cisco SDM to verify that at least one DHCP client has received an address from the pool that was just created Use Cisco IOS commands to locate the switch port through which the DHCP client is attached to your workgroup switch		
Lab or Other Activities	Lab 4-9: Managing Remote Access Sessions		
Lab or Other Objectives	Initiate, suspend, resume, and close a Telnet session from a Cisco router or switch Initiate, suspend, resume, and close an SSH session from a Cisco router or switch		
Module 5		**Module 5**	
Lesson Titles	Configuring Serial Encapsulation	**Lesson Titles**	Introducing Basic IPv6

	Lessons, Labs, and Activities *Removed* from v1.1 (Previous)		Lessons, Labs, and Activities *Added* to v2.0 (Updated)
Lesson Objectives	Configure and verify serial ports using HDLC and PPP encapsulation	**Lesson Objectives**	Describe IPv6 main features, address and basic configuration
Lesson Titles	Enabling RIP	**Lesson Titles**	Understanding IPv6
Lesson Objectives	Configure and verify RIP routing	**Lesson Objectives**	Describe IPv6 operations
Lab or Other Activities	Lab 5-2: Connecting to the Main Office	**Lesson Titles**	Configuring IPv6 Routing
Lab or Other Objectives	Configure your serial interface to use PPP Configure a static route to a given IP network, which can be reached via the serial interface	**Lesson Objectives**	Identify routing protocols for IPv6
Lab or Other Activities	Lab 5-3: Enabling Dynamic Routing to the Main Office	**Lab or Other Activities**	Lab 5-1: Configure and Verify Basic IPv6
Lab or Other Objectives	Configure RIP on your workgroup router Verify that RIP is operating Remove the unnecessary static route to an adjacent network	**Lab or Other Objectives**	Enable IPv6 support on router and perform basic configuration
		Lab or Other Activities	Lab 5-2: Configure and Verify Stateless Autoconfiguration
		Lab or Other Objectives	Configure and verify stateless autoconfiguration
		Lab or Other Activities	Lab 5-3: Configure and Verify IPv6 Routing
		Lab or Other Objectives	Configure and verify IPv6 routing by enabling static routing and OSPFv3
Module 6			
Lab or Other Activities	Lab 6-2: Managing Router Startup Options	**Lab or Other Activities**	Lab 6-1: ICND1 Superlab
Lab or Other Objectives	Display the configuration register, modify it to a specified value, and return it to its original value Validate by inspection of output whether a displayed configuration is from the running configuration or the startup configuration in the startup configuration file Modify the sequence of a Cisco IOS file that is loaded at startup, using a sequenced list of boot system commands Observe a reload and verify which of the boot statements was processed to obtain the running Cisco IOS binary file	**Lab or Other Objectives**	Configure basic settings, VLANs, trunks, and port security on the Cisco switch Configure inter-VLAN routing Configure Internet connectivity Configure WAN connectivity and dynamic routing protocol Configure IPv6 connectivity in a LAN Configure OSPFv3 routing protocol

	Lessons, Labs, and Activities *Removed* from v1.1 (Previous)		Lessons, Labs, and Activities *Added* to v2.0 (Updated)
Lab or Other Activities	Lab 6-3: Managing Cisco Devices		
Lab or Other Objectives	Save your running configuration on a remote TFTP server Upload and download configuration files Copy and delete files to local flash memory. Ensure that the router is lightly loaded before using debugging commands Turn debugging on and off		
Lab or Other Activities	Lab 6-4: Confirming the Reconfiguration of the Branch Network		
Lab or Other Objectives	Complete the configuration of your assigned workgroup switch, using information that is provided in the checklist Complete the configuration of your workgroup router using information that is provided in the checklists See the route that is indicated in the visual objective after enabling dynamic routing on your workgroup router Perform tests to validate that your final configuration meets the new topology information		

Lab Equipment Changes

This table provides a comparison of the lab equipment. ICND1 v2.0, ICND2 v2.0, and 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, pods do not connect to a common backbone topology.

Version 1.1 (Previous)	Version 2.0 (Updated)
Pod equipment:	Pod equipment:
WS-2960-24TT-L	WS-C2960-24TT-L
	WS-C2960-24-S
CISCO2811	CISCO2901 (Qty: 2)
HWIC-2T	HWIC-1T (Qty: 2)
CAB-SS-X21MT	CAB-SS-2626x
CAB-SS-X21FC	
PC with Microsoft Windows	PC with Microsoft Windows (Qty: 2)
Ethernet cables	Ethernet cables
Common equipment:	

Version 1.1 (Previous)	Version 2.0 (Updated)
WS-2960-24TT-L (Qty: 3)	
CISCO 2811 (core router)	
HWIC-4A/S	
CAB-SS-X21FC	
HWIC-2T	
CAB-SS-X21MT	
CAB-SS-X21FC	
CISCO 2811 (console/VPN server)	
NM-32A	
CAB-OCTALASYNC	
Common server	

Lab Topology Changes

These figures provide a comparison of the lab topologies.

ICND1 and ICND2—Combined Lab Topology

ICND1 v1.1 (Previous)
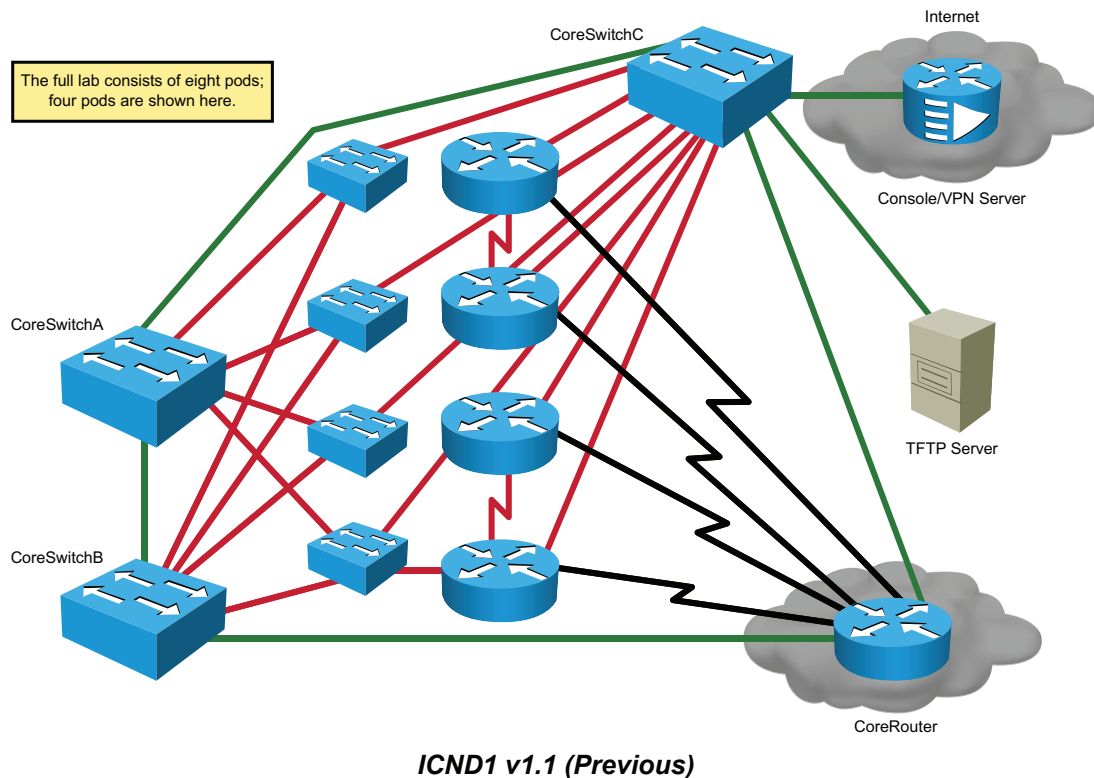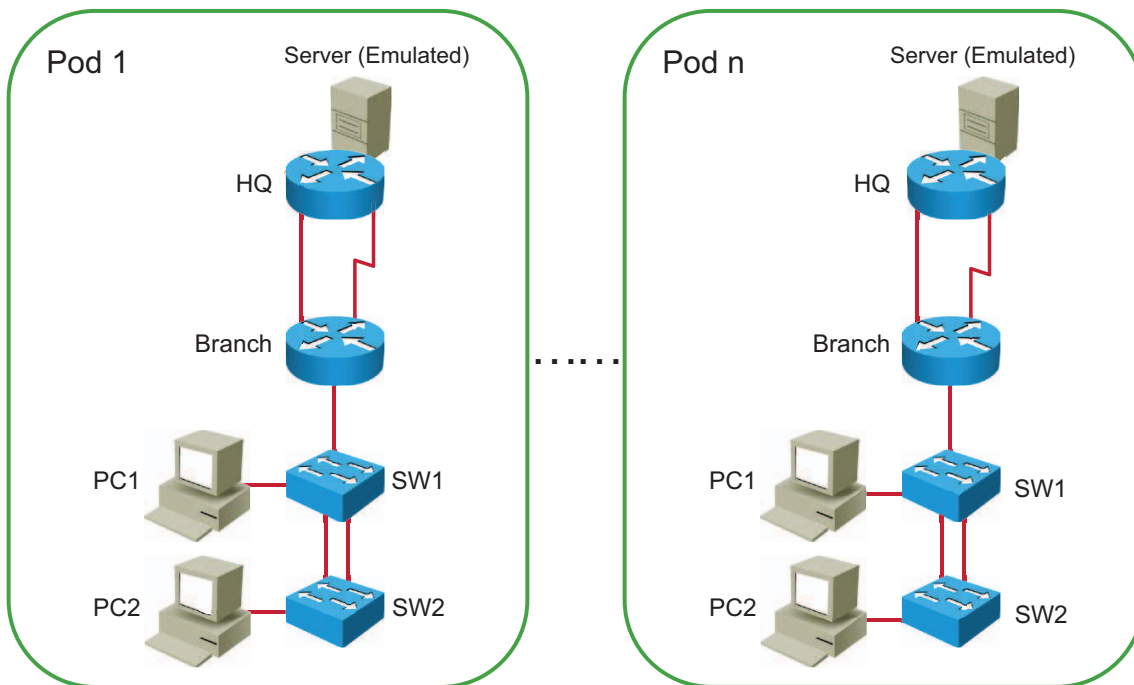
ICND1 v2.0 (Updated)

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
  - Attend the ICND1 v2.0 course
- Current ICND1 Instructor:
  - Certified Cisco Systems Instructor (CCSI) in good standing
  - Cisco CCNA R&S certified
  - Attend the ICND1 v2.0 course or attend ICND1 v2.0 train-the-trainer (TTT) or view ICND1 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.

Required Item	Explanation and Notes
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

The course schedule specifies the recommended teaching time for each lesson, lab, and activity. Optionally, indicate breaks and starting and ending times for each day.

Day 1: Course Introduction, Building a Simple Network		
	9:00–9:30 (0900–0930)	Course Introduction
	9:30–10:00 (0930–1000)	Module 1: Building a Simple Network Lesson 1-1: Exploring the Functions of Networking
	10:00–10:20 (1000–1020)	Lesson 1-2: Understanding the Host-to-Host Communications Model
	10:20–10:40 (1020–1040)	Lesson 1-3: Introducing LANs
	10:40–10:55 (1040–1055)	Break
	10:55–11:25 (1055–1125)	Lesson 1-4: Operating Cisco IOS Software
	11:25–12:00 1125–1200)	Lesson 1-5: Starting a Switch
	12:00–1:00 (1200–1300)	Lunch

	1:00–2:30 (1300–1430)	Lab 1-1: Performing Switch Startup
	2:30–3:25 (1430–1425)	Lesson 1-6: Understanding Ethernet and Switch Operation
	3:25–3:40 (1425–1540)	Break
	3:40–4:10 (1540–1610)	Lesson 1-7: Troubleshooting Common Switch Media Issues
	4:10–5:00 (1610–1700)	Lab 1-2: Troubleshooting Switch Media Issues
	5:00 (1700)	Day ends

Day 2: Establishing Internet Connectivity

	9:00–9:20 (0900–0920)	Review of Day 1
	9:20–9:50 (0920–0950)	Module 2: Establishing Internet Connectivity Lesson 2-1: Understanding the TCP/IP Internet Layer
	09:50–10:40 (0950–1040)	Lesson 2-2: IP Addressing and Subnets
	10:40–10:55 (1040–1055)	Break
	10:55–11:15 (1055–1115)	Lesson 2-3: Understanding the TCP/IP Transport Layer
	11:15–11:40 (1115–1140)	Lesson 2-4: Exploring the Functions of Routing
	11:40–12:00 (1140–1200)	Lesson 2-5: Configuring a Cisco Router
	12:00–1:00 (1200–1300)	Lunch
	1:00–1:50 (1300–1350)	Lab 2-1: Performing Initial Router Setup and Configuration
	1:50–2:45 (1350–1425)	Lesson 2-6: Exploring the Packet-Delivery Process
	2:45–3:00 (1425–1500)	Break
	3:00–3:25 (1500–1525)	Lesson 2-7: Enabling Static Routing
	3:25–4:00 (1525–1600)	Lesson 2-8: Managing Traffic Using ACLs
	4:00–5:00 (1600–1700)	Lesson 2-9: Enabling Internet Connectivity

	5:00 (1700)	Day ends

Day 3: Managing Network Device Security

	9:00–9:20 (0900–0920)	Review of Day 2
	9:20–10:50 (0920–1050)	Lab 2-2: Connecting to the Internet
	10:50–11:05 (1050–1105)	Break
	11:05–12:00 (1105–1200)	Module 3: Managing Network Device Security Lesson 3-1: Securing Administrative Access
	12:00–1:00 (1200–1300)	Lunch
	1:00–1:50 (1300–1350)	Lab 3-1: Enhancing the Security of the Initial Configuration
	1:50–2:35 (1350–1435)	Lesson 3-2: Implementing Device Hardening
	2:35–2:50 (1435–1450)	Break
	2:50–4:00 (1450–1600)	Lab 3-2: Device Hardening
	4:00–5:00 (1600–1700)	Lesson 3-3: Implementing Traffic Filtering with ACLs
	5:00 (1700)	Day ends

Day 4: Building a Medium-Sized Network

	09:00–9:20 (0900–0920)	Review of Day 3
	9:20–10:10 (0920–1010)	Lab 3-3: Filtering Traffic with ACLs
	10:10–11:00 (1010–1100)	Module 4: Building a Medium-Sized Network Lesson 4-1: Implementing VLANs and Trunks
	11:00–11:15 (1100–1115)	Break
	11:15–12:00 (1115–1200)	Lesson 4-2: Routing Between VLANs
	12:00–1:00 (1200–1300)	Lunch
	1:00–1:50 (1300–1350)	Lab 4-1: Configuring Expanded Switched Networks

	1:50–2:20 (1350–1420)	Lesson 4-3: Using a Cisco Network Device as a DHCP Server
	2:20–3:05 (1420–1505)	Lab 4-2: Configuring a DHCP Server
	3:05–3:20 (1505–1530)	Break
	3:20–3:40 (1530–1540)	Lesson 4-4: Introducing WAN Technologies
	3:40–4:00 (1540–1600)	Lesson 4-5: Introducing Dynamic Routing Protocols
	4:00–4:30 (1600–1630)	Lesson 4-6: Implementing OSPF
	4:30–5:00 (1630–1700)	Lab 4-3: Implementing OSPF
	5:00 (1700)	Day ends

Day 5: Introducing IPv6

	09:00–09:20 (0900–0920)	Review of Day 4
	09:20–10:00 (0920–1000)	Module 5: Introducing IPv6 Lesson 5-1: Introducing basic IPv6
	10:00–10:30 (1000–1030)	Lab 5-1: Configure and Verify Basic IPv6
	10:30–10:45 (1030–1045)	Break
	10:45–11:05 (1045–1105)	Lesson 5-2: Understanding IPv6
	11:05–11:30 (1105–1130)	Lab 5-2: Configure and Verify Stateless Autoconfiguration
	11:30–12:00 (1130–1200)	Lesson 5-3: Configuring IPv6 Routing
	12:00–1:00 (1200–1300)	Lunch
	1:00–1:40 (1300–1330)	Lab 5-3: Configure and Verify IPv6 Routing
	1:40–5:00 (1340–1700)	Lab: ICND1 Superlab
	5:00 (1700)	Day ends

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
- Building a Medium-Sized Network
- Introducing IPv6
- ICND1 Superlab
- 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: Configuring Expanded Switched Networks
- Lab 4-2: Configuring DHCP Server
- Lab 4-3: Implementing OSPF
- Lab 5-1: Configure and Verify Basic IPv6
- Lab 5-2: Configure and Verify Stateless Autoconfiguration
- Lab 5-3: Configure and Verify IPv6 Routing
- Lab S-1: ICND1 Superlab

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?

- Physical Components of a Network

- Interpreting a Network Diagram

- Impact of User Applications on the Network

- Characteristics of a Network

- Physical vs. Logical 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

- TCP/IP Protocol Suite

- Encapsulation and De-Encapsulation

- Peer-to-Peer Communications

- Summary

Lesson 3: Introducing LANs

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

This lesson includes these topics:

- Local Area Networks

- LAN Components

- 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

- Help Functions in the CLI

- CLI Error Messages

- Managing Cisco IOS Configurations

- Improving the User Experience in the CLI

- Summary

Lesson 5: Starting a Switch

Lesson Objective: Install a switch and perform the initial configuration

This lesson includes these topics:

- Switch Installation

- 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.

- Verifying the Switch Initial Startup Status

- 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
- Switching Operation
- Duplex Communication
- Configuring Duplex and Speed Options
- 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
- Port Issues
- Troubleshooting Port 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

This lesson includes these topics:

- References

Lesson 9: Module Self-Check

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

- Domain Name System

- Verifying the IPv4 Address of a Host

- Summary

Lesson 2: Understanding IP Addressing and Subnets

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

This lesson includes these topics:

- Subnets

- Subnet Masks

- Octet Values of a Subnet Mask

- Default Gateways

- Computing Usable Subnetworks and Hosts

- Applying Subnet Masks

- Determining the Network Addressing Scheme

- 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

- 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

- TCP/IP Applications

- Summary

Lesson 4: Exploring the Functions of Routing

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

This lesson includes these topics:

- Role of a Router

- Router Characteristics

- Router Functions

- Path Determination

- Routing Table

- Types of Routes

- 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:

- Initial Router Startup

- Initial Router Setup

- Configuring Router Interfaces

- Configuring the Cisco Router IP Address

- Verifying Interface Configuration and Status

- Exploring Connected Devices

- Cisco Discovery Protocol

- Discovering Neighbors Using 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:

- 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
- 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
- Static Route Configuration
- Default Routes
- Static Route Configuration Verification
- 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
- Types of ACLs
- 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
- 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
- Introducing NAT
- Types of Addresses in NAT
- Types of NAT
- Understanding Static NAT
- Configuring Static NAT
- Verifying Static NAT Configuration
- Understanding Dynamic NAT
- Configuring Dynamic NAT
- Verifying Dynamic NAT Configuration
- Understanding PAT
- Configuring PAT
- Verifying PAT Configuration
- Troubleshooting NAT
- Troubleshooting NAT Case Study
- 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

This lesson includes these topics:

- References

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
- Securing Console Access
- Securing Remote Access
- Enabling Remote Access Connectivity
- 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
- Port Security
- Port Security Configuration
- Port Security Verification
- Disabling Unused Services
- Network Time Protocol
- Configuring NTP
- Verifying NTP
- 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:

- Using ACLs to Filter Network Traffic
- ACL Operation
- Applying ACLs to Interfaces
- The Need for Extended ACLs
- Configuring Numbered, Extended IPv4 ACLs
- Configuring Named ACLs
- ACL Configuration Guidelines
- Monitoring ACLs
- Troubleshooting Common ACL Errors
- 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

This lesson includes these topics:

- References

Lesson 5: Module Self-Check

Module 4: Building a Medium-Sized Network

Module Objective: Expand a small network to a medium-sized network with WAN connectivity

Lesson 1: Implementing VLANs and Trunks

Lesson Objective: Implement and verify VLANs and trunking

This lesson includes these topics:

- Issues in a Poorly Designed Network
- VLAN Introduction
- Trunking with 802.1Q
- Creating a VLAN
- Assigning a Port to a VLAN
- Configuring an 802.1Q Trunk
- VLAN Design Considerations
- Physical Redundancy in a LAN
- 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
- Configuring a Router with a Trunk Link
- Summary

Lab 4-1: 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:

- 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.
- Configuring a DHCP Server
- 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.
- Summary

Lab 4-2: 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: Introducing WAN Technologies

Lesson Objective: Describe WANs and list major technologies

This lesson includes these topics:

- Introducing WANs
- WANs vs. LANs
- Role of Routers in WANs
- WAN Communication Link Options
- Point-to-Point Connectivity
- Configuring a Point-to-Point Link
- Summary

Lesson 5: Introducing Dynamic Routing Protocols

Lesson Objective: Describe the need for and purpose of dynamic routing protocols

This lesson includes these topics:

- Purpose of Dynamic Routing Protocols
- Interior and Exterior Routing Protocols
- Distance Vector and Link-State Routing Protocols
- Understanding Link-State Routing Protocols
- Summary

Lesson 6: Implementing OSPF

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

This lesson includes these topics:

- Introducing OSPF
- OSPF Adjacencies
- SPF Algorithm
- Router ID
- Configuring Single-Area OSPF
- Verifying OSPF Configuration
- Summary

Lab 4-3: Implementing OSPF

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

This lab includes these tasks:

- Task 1: Connect the Router to the WAN
- Task 2: Configure OSPF

Lesson 7: Module Summary

Lesson 8: Module Self-Check

Module 5: 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:

- IPv4 Addressing Exhaustion Workarounds
- IPv6 Features
- IPv6 Addresses
- IPv6 Unicast Addresses
- IPv6 Addresses Allocation
- Basic IPv6 Connectivity
- Summary

Lab 5-1: 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
- ICMPv6
- Neighbor Discovery
- Stateless Autoconfiguration
- Summary

Lab 5-2: 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:

- Routing for IPv6
- Static Routing
- OSPFv3
- Summary

Lab 5-3: Configure and Verify IPv6 Routing

Lab Objective: Configure and verify IPv6 routing by enabling static routing and OSPFv3

This lab includes these tasks:

- Task 1: Enable IPv6 Static Routing
- Task 2: Enable OSPFv3

Lesson 4: Module Summary

This lesson includes these topics:

- References

Lesson 5: Module Self-Check

Module S: ICND1 Superlab

Module Objective:

Lab S-1: ICND1 Superlab

Lab Objective: Reinforce ICND1 knowledge by configuring a simple network

This lab includes these tasks:

- Task 1: Configure Basic Settings, VLANs, Trunks, and Port Security on Switches
- Task 2: Configure Inter-VLAN Routing
- Task 3: Configure Internet Connectivity
- Task 4: Configure WAN Connectivity and a Dynamic Routing Protocol
- Task 5: Configure IPv6 Connectivity in the LAN
- Task 6: Configure the OSPFv3 Routing Protocol

Lab Setup

General Information

ICND1 labs are available in two editions: classic physical (that is, hardware-based) and Learning Partner Cisco Learning Labs (LP CLL). The LP CLL 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 mirrors the topologies that are used in the instructor-led training course. The lab guides for the LP CLL labs are available in both PDF format and through the LP CLL GUI. The LP CLL labs are delivered though the Learning Partner Cisco Learning Labs portal. The student needs only a PC and Internet access. This delivery method removes the need for a training partner to provide hardware and access to that hardware.

ICND1 labs are built around new common topology, which is shared with the ICND2 course. The amount of equipment in individual pods has been increased to improve the learning experience and better resemble a simplified branch office network, connected to the central office.

ICND1 labs introduce equipment to the student step-by-step, aligned with the course content according to the following scenario. Labs in the first module start with a single switch, which enables connectivity between network devices within the branch office. The second module introduces a router to the topology, which enables students to configure everything needed to connect the branch office to the Internet. After the router is connected to the simulated Internet network, it is very important to improve device security, which is the theme of labs in the third module. To satisfy the growth of the branch office, labs in the fourth module introduce another switch in the topology. The connectivity of the branch router is upgraded with a WAN link, which enables the branch office to connect with the central office. The last module introduces IPv6 connectivity within the branch office and also toward the central office. The concluding lab activity is an ICND1 superlab, in which students pull together all the knowledge and skills gathered through the course.

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 the instructor-led training class with hardware labs, two students per pod are recommended. When the class is delivered using Cisco LP CLLs, an individual pod for each student 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 LP CLL access credentials.

Laboratory Topology (Delivery)

The *Interconnecting Cisco Networking Devices, Part 1* (ICND1) v2.0 course reinforces the theoretical knowledge gained during delivery, primarily through the use of labs.
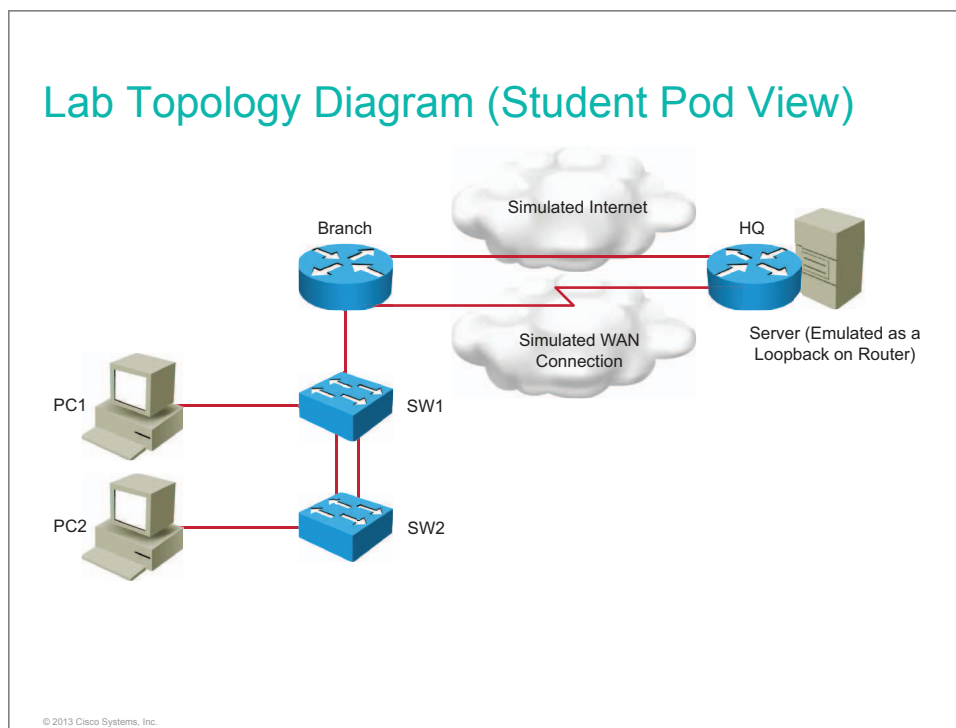
Laboratory Topology

ICND1 v2.0 labs are designed as individual pods. Each pod consists of two routers, two switches, and two PCs. Since each pod is independent, pods do not connect to a common backbone topology.

Lab Topology Diagram (Backbone Pod View)

Lab Topology Diagram (Student Pod View)
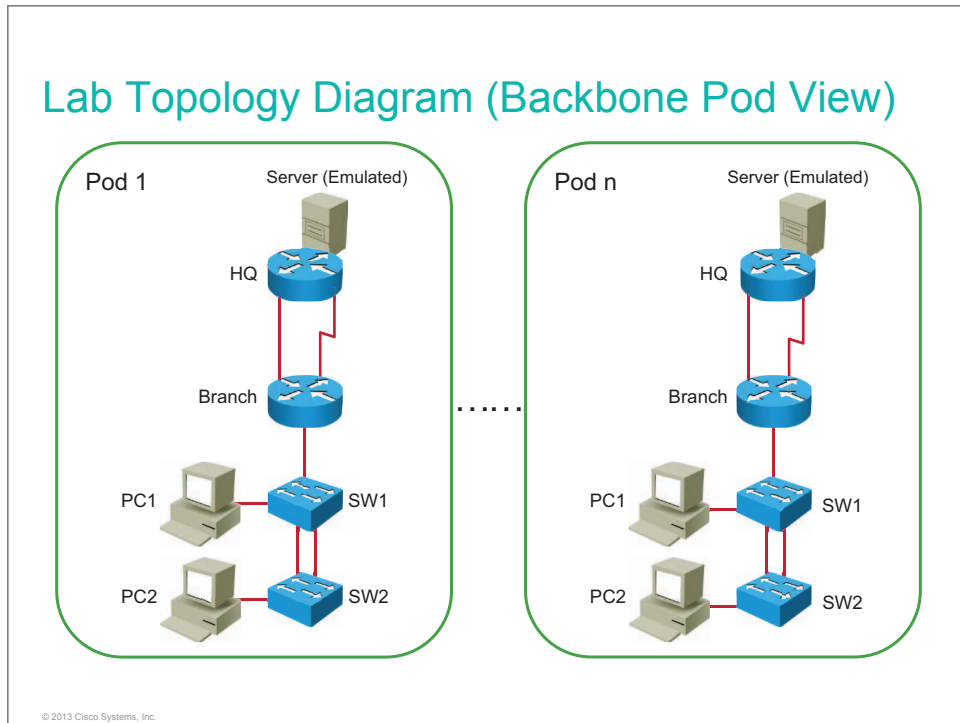
Lab Topology Diagram (Student Pod View)

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.
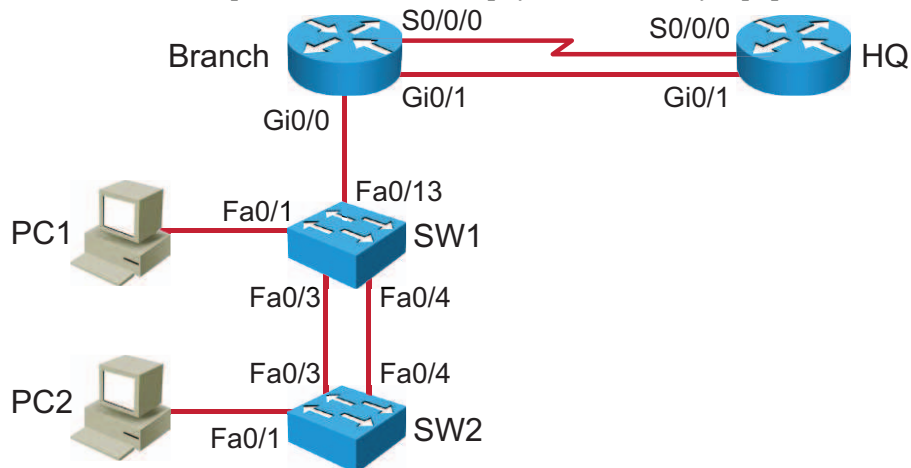
Physical Topology Overview

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_Superlab_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_Superlab_Branch.cfg
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_Superlab_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_Superlab_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.
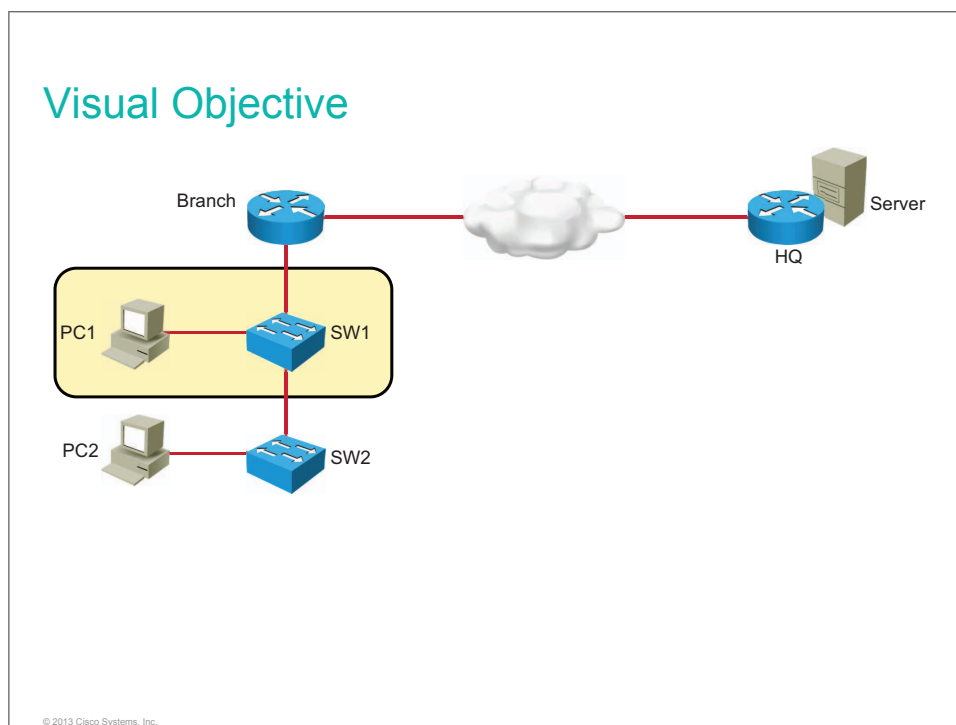
Objectives

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

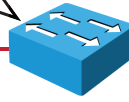The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Perform switch startup and initial configuration.

PC1

SW1

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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 the 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.
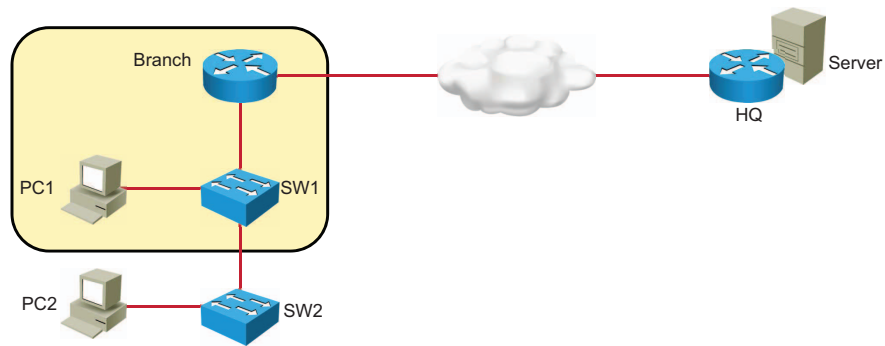
Objectives

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
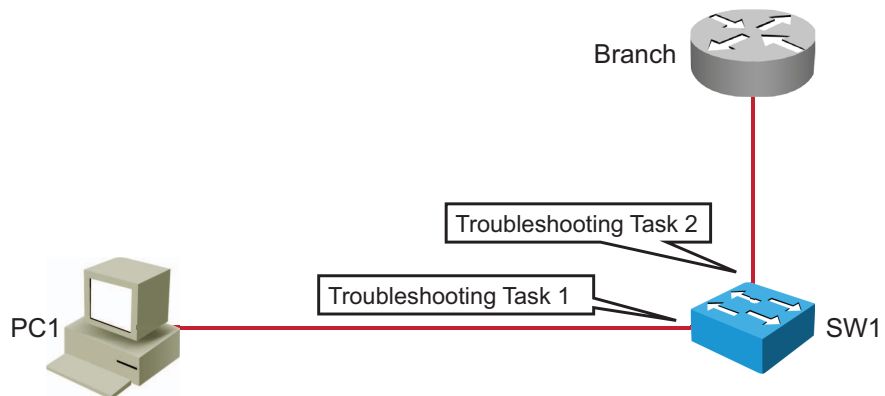
Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

Branch

Server

HQ

PC1

SW1

PC2

SW2

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.
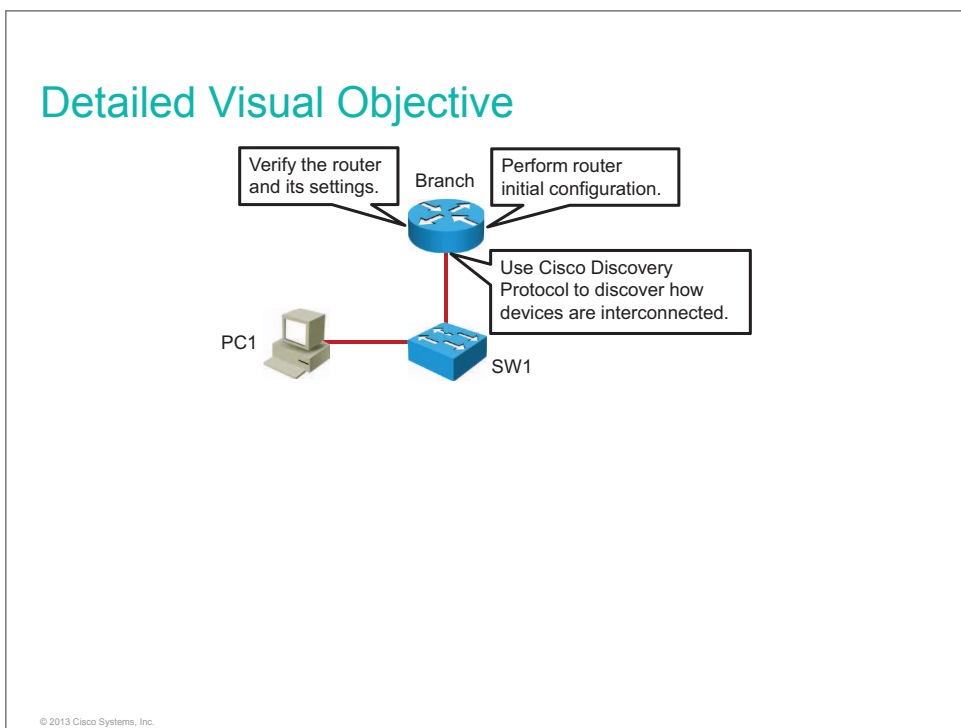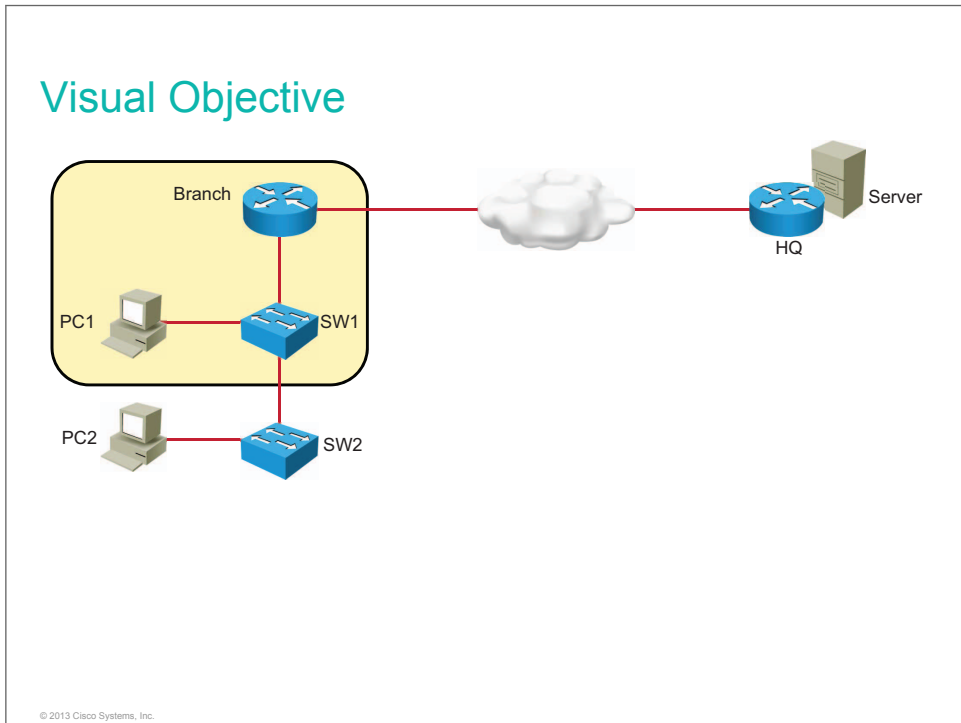
Objectives

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

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.
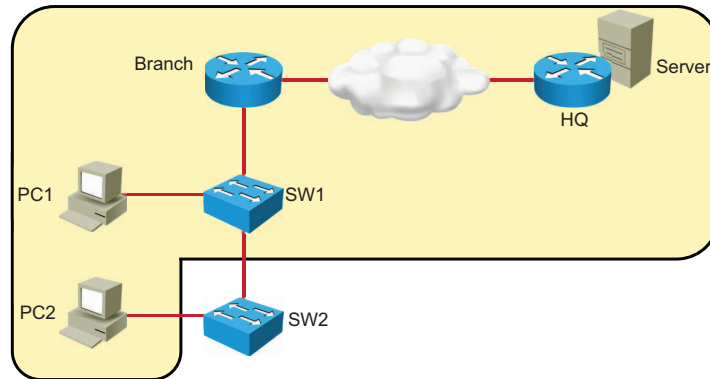
Objectives

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
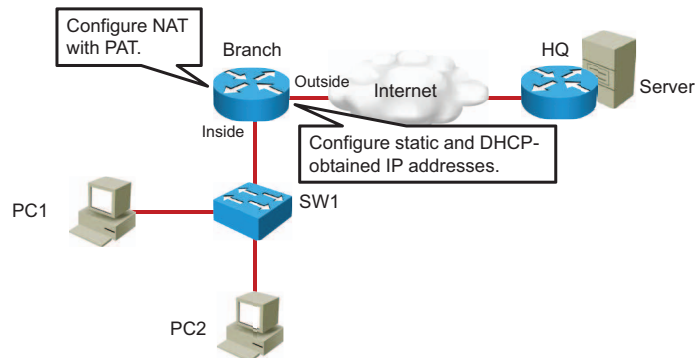* Configure NAT using a pool
* Configure NAT with PAT

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.

Configure static and DHCP-obtained IP addresses.

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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.
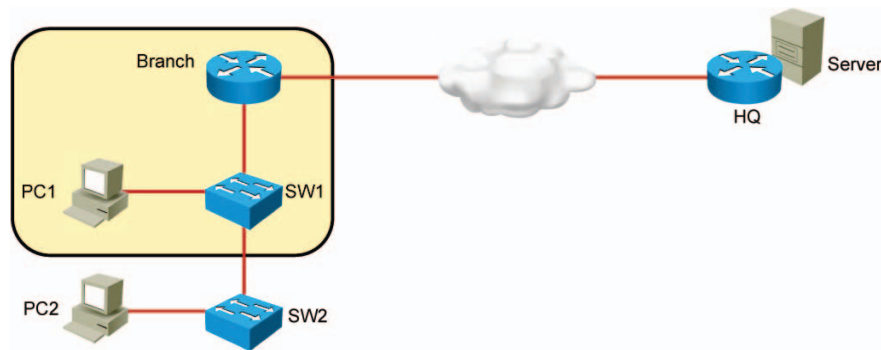
Objectives

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
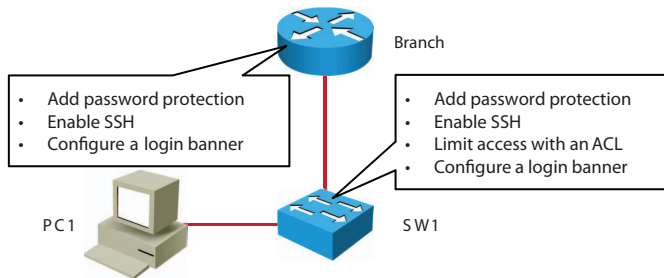- Configure the login banner

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

Detailed Visual Objective

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

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

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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_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

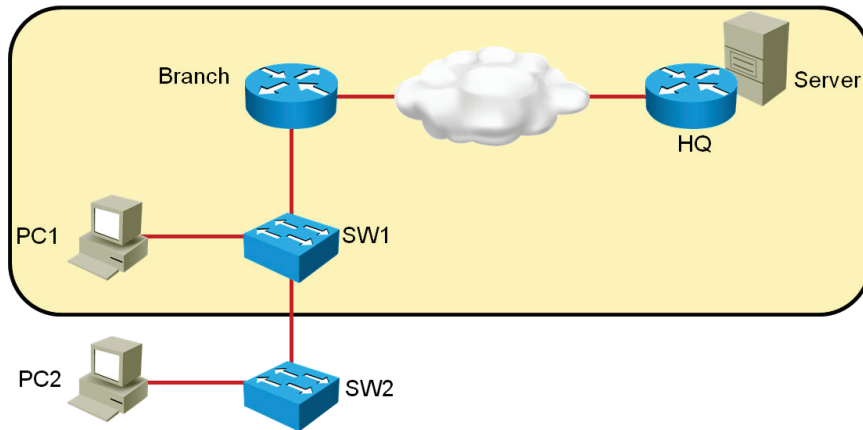This topic details the lab activity for Lab 3-2: Device Hardening.

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
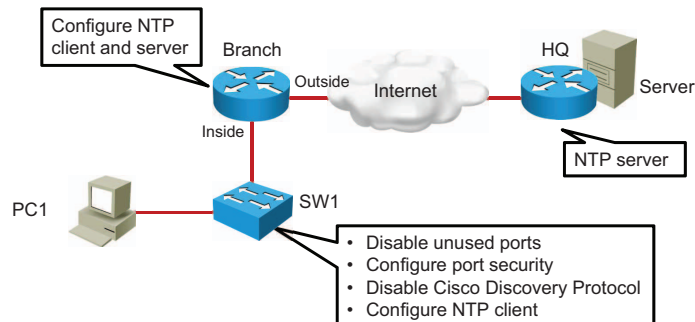- Configure NTP

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

Branch

Server

HQ

PC1 — SW1

PC2 — SW2

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Detailed Visual Objective

Configure NTP client and server

Branch

Outside

Internet

HQ

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

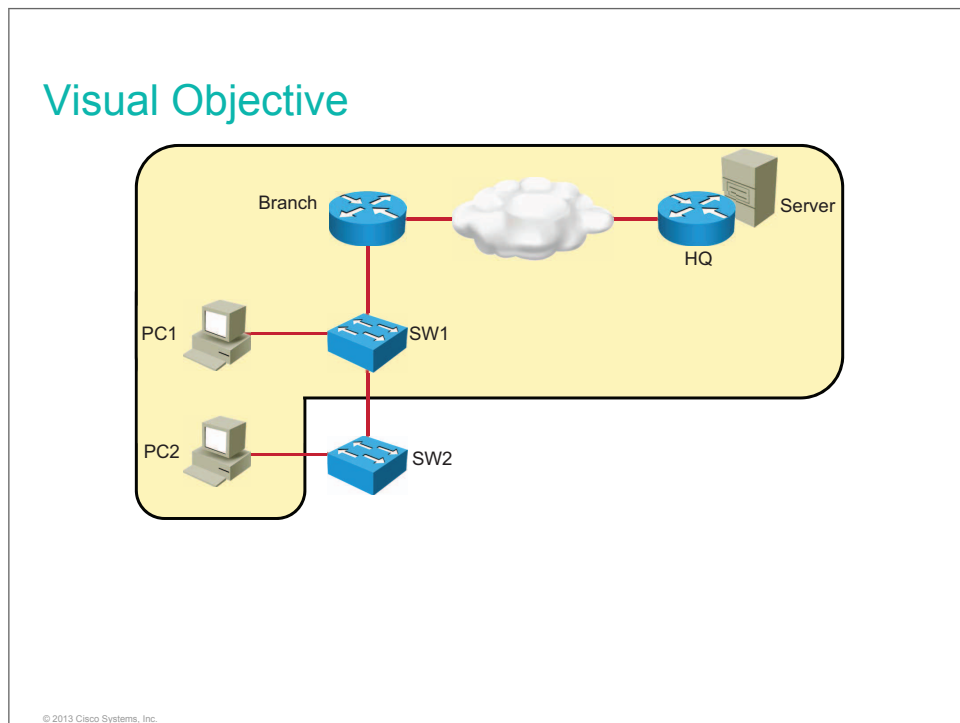This topic details the lab activity for Lab 3-3: Filtering Traffic with ACLs.
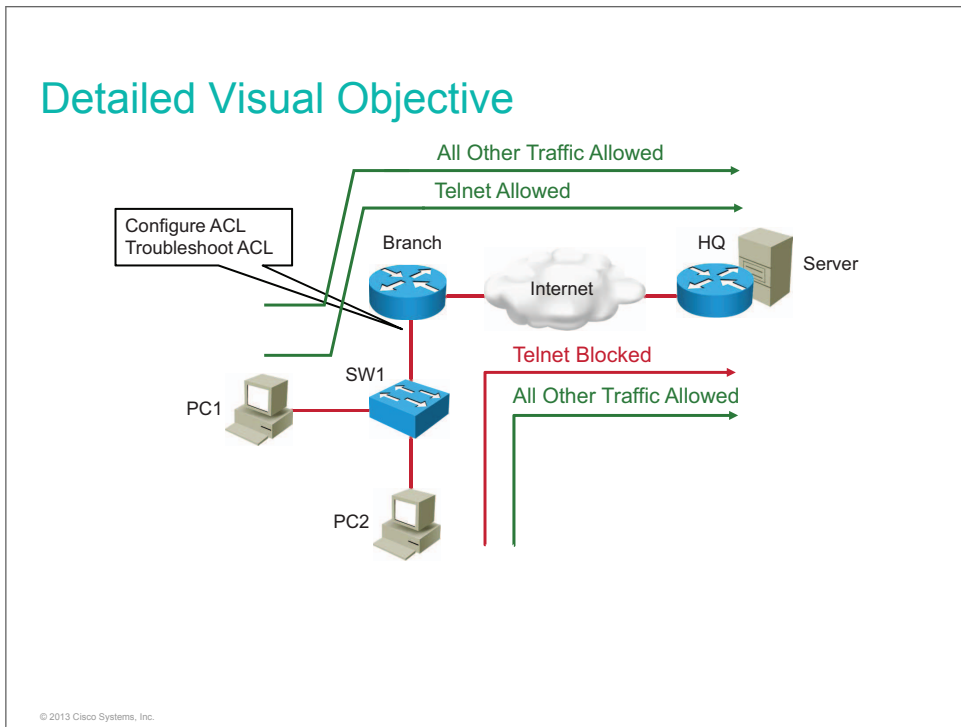
Objectives

A common mechanism for filtering traffic is the use of 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

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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: Configuring Expanded Switched Networks

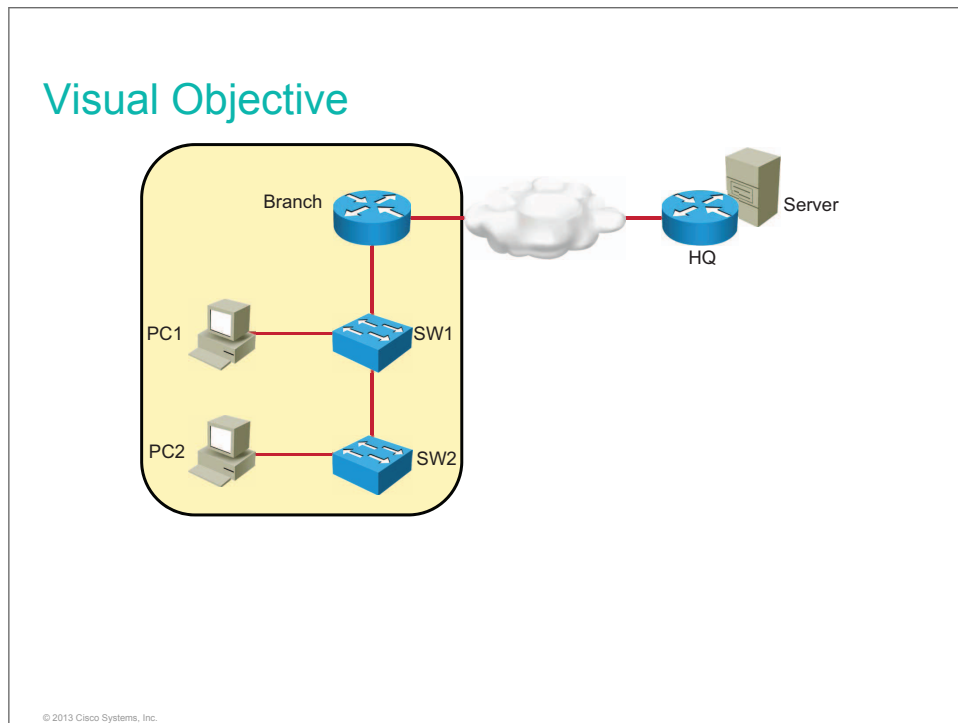This topic details the lab activity for Lab 4-1: Configuring Expanded Switched Networks.

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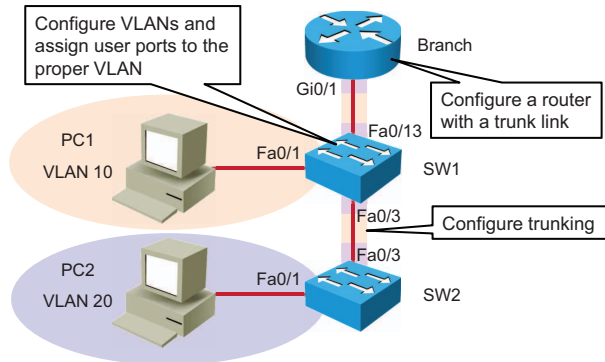
- Configure VLANs
- Configure trunking
- Configure router with a trunk link

Visual Objective

The figure illustrates what you will accomplish in this activity.

Detailed Visual Objective

Configure VLANs and assign user ports to the proper VLAN

Branch

Gi0/1

Fa0/13

Configure a router with a trunk link

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 4-2: Configuring DHCP Server

This topic details the lab activity for Lab 4-2: Configuring DHCP Server.
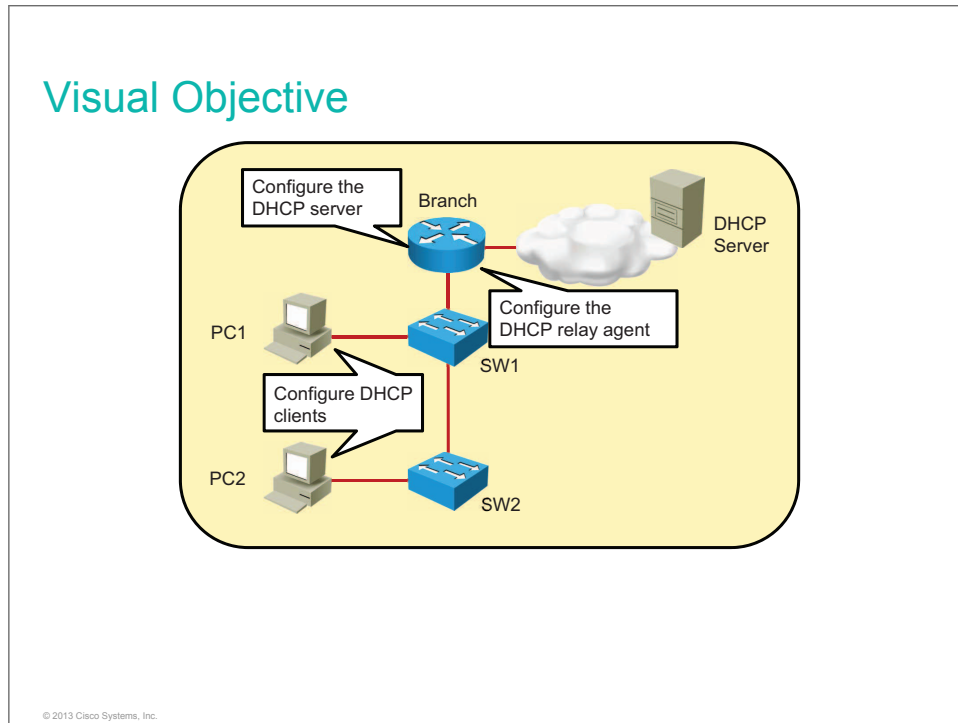
Objectives

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.

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 4-3: Implementing OSPF

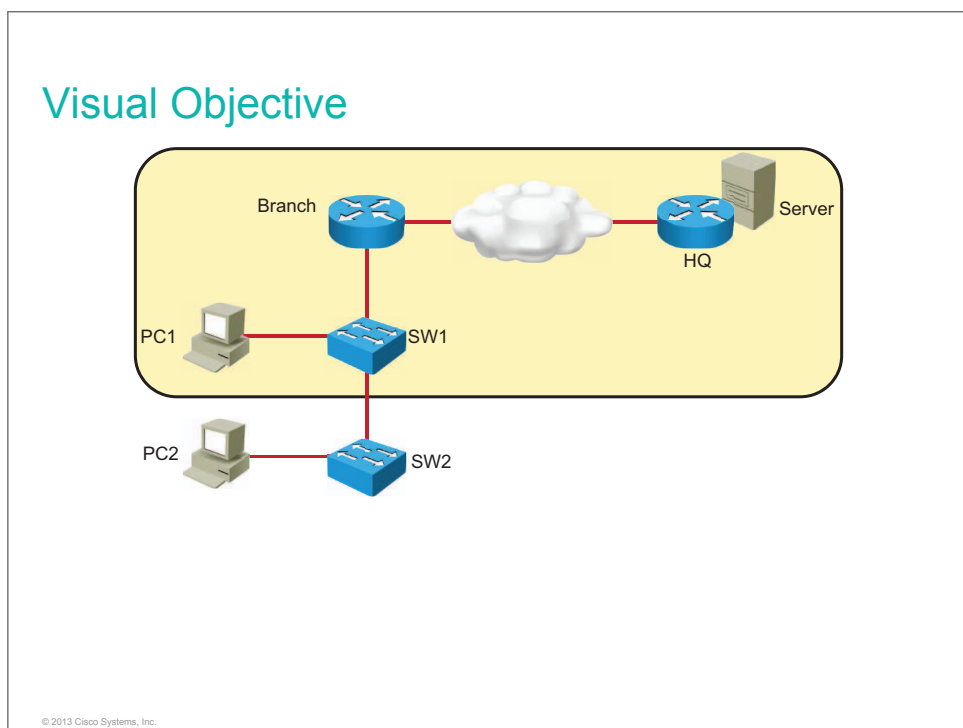This topic details the lab activity for Lab 4-3: Implementing OSPF.

Objectives

After completing this activity, you will be able to meet these objectives:
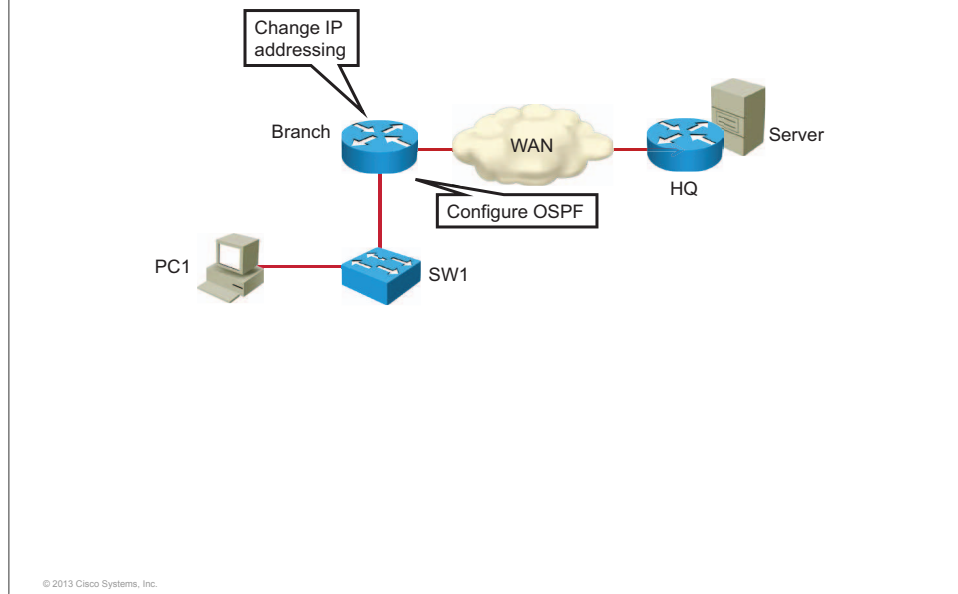
* Configure a WAN interface
* Configure OSPF

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

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Detailed Visual Objective

Change IP addressing

Branch

WAN

Server

HQ

Configure OSPF

PC1

SW1

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Setup

This lab builds on the previous lab. If students have completed the previous exercise, you only need to load the new configuration on the Headquarters router. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
Headquarters	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 in this lab.

Common Issues

There are no common issues in this lab.

Instructor Notes

No instructor notes are necessary.

Lab 5-1: Configure and Verify Basic IPv6

This topic details the lab activity for Lab 5-1: Configure and Verify Basic IPv6.
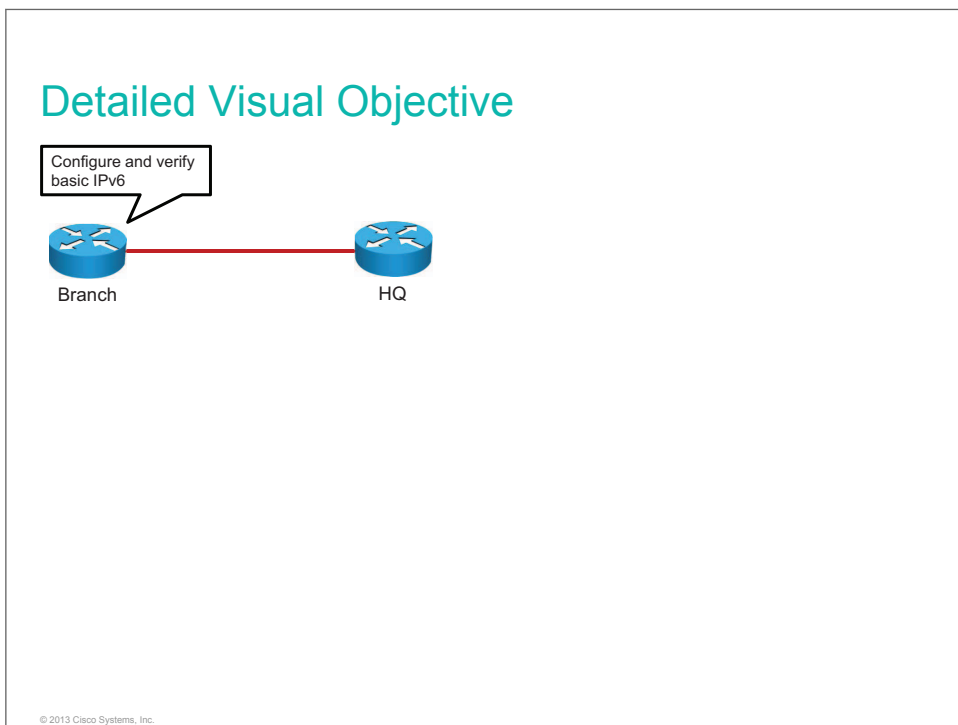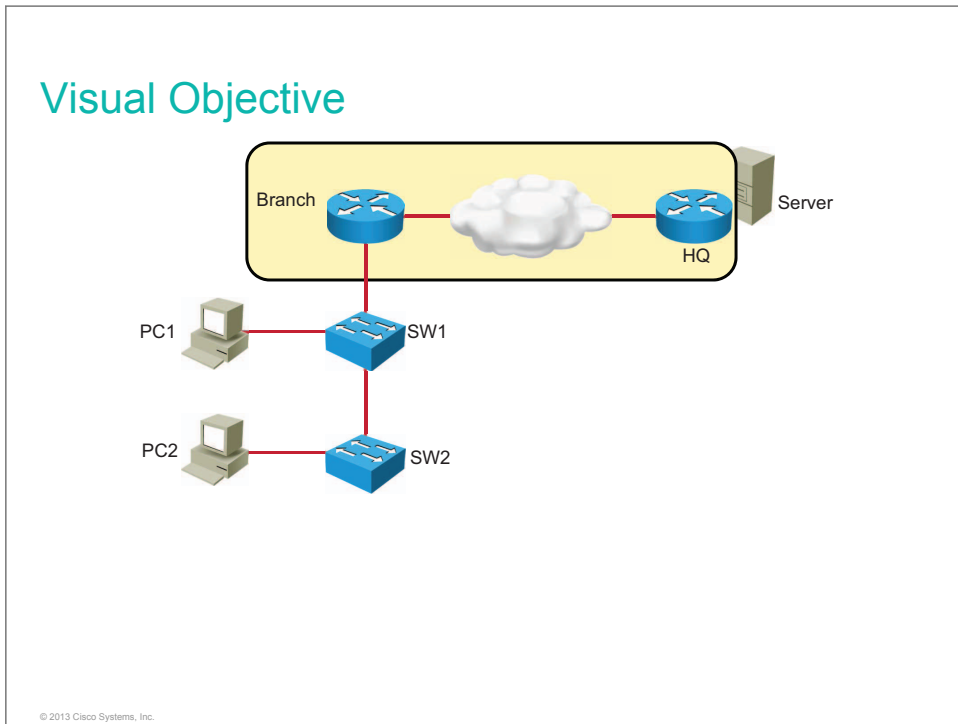
Objectives

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.

Visual Objective

Branch
Server
HQ
PC1   SW1
PC2   SW2

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Detailed Visual Objective

Configure and verify basic IPv6

Branch   HQ

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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
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 5-2: Configure and Verify Stateless Autoconfiguration

This topic details the lab activity for Lab 5-2: Configure and Verify Stateless Autoconfiguration.
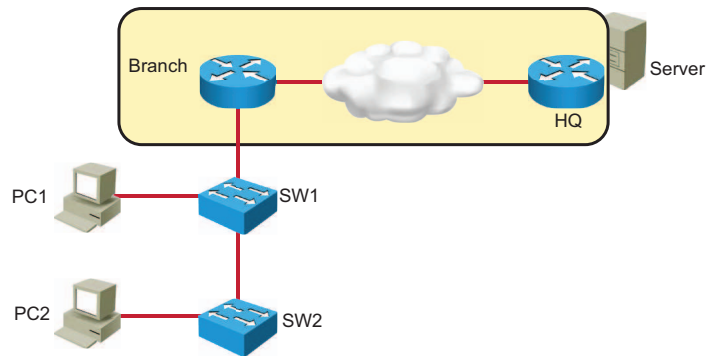
Objectives

In this activity, you will enable stateless autoconfiguration. After completing this lab activity, you will be able to meet this objective:

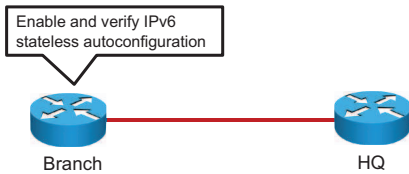• Configure and verify stateless autoconfiguration

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

Detailed Visual Objective

Enable and verify IPv6 stateless autoconfiguration

Branch   HQ

© 2013 Cisco Systems, Inc.

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 5-3: Configure and Verify IPv6 Routing

This topic details the lab activity for Lab 5-3: Configure and Verify IPv6 Routing.
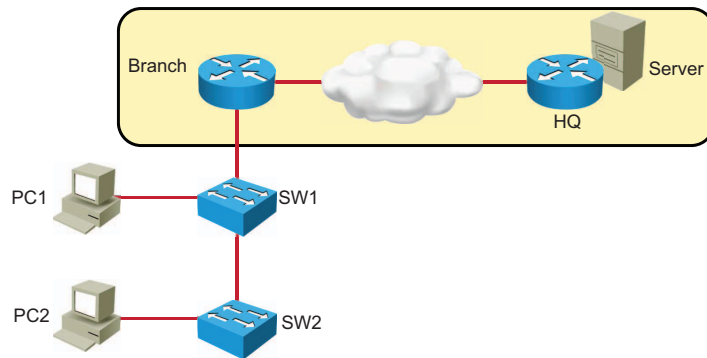
Objectives

In this activity, you will configure and verify IPv6 routing by enabling static routing and OSPFv3. After completing this lab activity, you will be able to meet these objectives:

- Enable and verify static routing
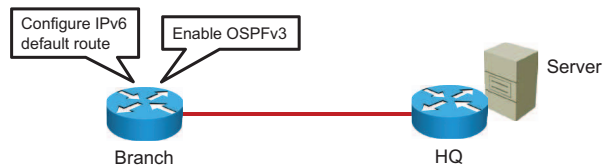
- Enable and verify OSPFv3

Visual Objective

The figure illustrates what you will accomplish in this activity.

Visual Objective

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Detailed Visual Objective

Configure IPv6 default route

Enable OSPFv3

Branch

HQ

Server

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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 configuration. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
Branch	INIT_Configure_IPv6_Routing_Branch.cfg	Copy and load the configuration
HQ	IINIT_Configure_IPv6_Routing_HQ.cfg	Copy and load the configuration

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

Additional Setup Notes

There are no additional setup notes.

Common Issues

There are no common issues in this lab.

Instructor Notes

No instructor notes are necessary.

Lab S-1: ICND1 Superlab

This topic details the lab activity for Lab S-1: ICND1 Superlab.

Objectives

In this activity, you will repeat what you have learned throughout the course. After completing this activity, you will be able to meet these objectives:

- Configure basic settings, VLANs, trunks, and port security on the Cisco switch

- Configure inter-VLAN routing

- Configure Internet connectivity

- Configure WAN connectivity and dynamic routing protocol

- Configure IPv6 connectivity in a LAN

- Configure the OSPFv3 routing protocol

Visual Objective

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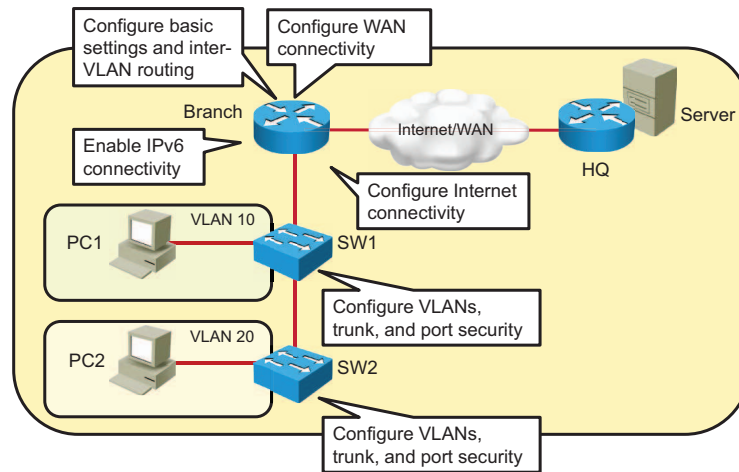
Setup

This lab builds on the previous lab. If students have completed the previous exercise, you only need to load the new configuration on the HQ router. Alternatively, you can load the startup configuration as described in the table.

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_Superlab_HQ.cfg	Copy and load the configuration
Branch	INIT_Superlab_Branch.cfg	Copy and load the configuration
SW1	INIT_Superlab_SW1.cfg	Copy and load the configuration
SW2	INIT_Superlab_SW2.cfg	Copy and load the configuration

Additional Setup Notes

No additional setup is needed for this lab because the existing configurations are deleted from lab devices at the beginning of the lab.

Common Issues

There are no common issues in this lab.

Instructor Notes

After the router is reloaded without the 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 that is built into Cisco IOS Software, which attempts to access the service configuration files from a network TFTP server. To disable this feature, issue the **no service config** global command and save the configuration. Alternatively, you can also reload a device after saving the configuration.

In the port security section of the lab, it is important that the students first change the port security violation to protect, then to set up the allowed MAC address, and to enable port security last. The reason for this is that in remote lab environments, PCs may be connected to SW1 and SW2 via another switch, which sends management traffic to SW1 and SW2. This management traffic comes from another switch using the switch MAC address, which can cause security violations on SW1 and SW2 because only one MAC address is allowed by default. Because the port security violation action is set to "shutdown" by default, the ports on SW1 and SW2 will shut down.

Glossary

Term	Definition
IPv4	IP version 4. Internet Protocol version 4 is the fourth version in the development of the IP and the first version of the protocol to be widely deployed. Along with IPv6, IPv4 is at the core of standards-based internetworking methods of the Internet. IPv4 is still used to route most traffic across the Internet. IPv4 is a connectionless protocol for use on packet-switched link layer networks (for example, Ethernet). It operates on a best-effort delivery model in that it does not guarantee delivery and does not assure proper sequencing or avoidance of duplicate delivery.
IPv6	IP version 6. Replacement for the current version of IP (version 4). IPv6 includes support for flow ID in the packet header, which can be used to identify flows. Formerly called IPng (next generation).
JTA	job task analysis. A process of examining a specific job to identify all the duties and tasks that are performed by the job incumbent at a given skill level.
RIP	Routing Information Protocol. IGP supplied with UNIX BSD systems. The most common IGP in the Internet. RIP uses hop count as a routing metric.
SME	subject matter expert. A work role description.