

**ICND2**

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# Interconnecting Cisco Networking Devices, Part 2

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Version 2.0

**Course Guide**

Part Number: 97-3245-01



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# Course Management

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## Course Description

The *Interconnecting Cisco Networking Devices, Part 2* (ICND2) v2.0 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 becoming familiar with device management and Cisco licensing. ICND2 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). The learner will encounter more troubleshooting and more lab time than with the previous version of ICND2.

Full Title of Course	<i>Interconnecting Cisco Networking Devices, Part 2</i>
Course Acronym	ICND2
Course Version Number	2.0
New Course?	No
Replaces:	<i>Interconnecting Cisco Networking Devices, Part 2</i> v1.1

## Curricula

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

- Cisco CCNA® Routing and Switching
- Cisco CCDA®
- Cisco CCNA Security
- Cisco CCNA Voice
- Cisco CCNA Wireless
- Cisco CCNA Service Provider Operations (SP Operations)
- Cisco CCNP®

- Cisco CCDP®

## Course Goal and Objectives

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

- Operate a medium-sized LAN with multiple switches, supporting VLANs, trunking, and spanning tree
- Troubleshoot IP connectivity
- Configure and troubleshoot EIGRP in an IPv4 environment, and configure EIGRP for IPv6
- Configure and troubleshoot OSPF in an IPv4 environment, and configure OSPF for IPv6
- Define characteristics, functions, and components of a WAN
- Describe SNMP, syslog, and NetFlow, and manage Cisco device configurations, Cisco IOS images, and licenses

## Target Audiences

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

**Target audience:** Individuals seeking the *Cisco CCNA Routing and Switching* certification. The course is also appropriate for pre- 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 Software 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 that 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:

- Understand network fundamentals
- Implement local area networks
- Implement Internet connectivity
- Manage network device security
- Implement WAN connectivity
- Implement basic IPv6 connectivity

# Course Differences (Delta) Information

This section provides a summary of the most significant differences between the previous version, ICND2 v1.1, and this version, ICND2 v2.0.

## Executive Summary

### Overview

ICND2 v2.0 includes major updates and aligns to an updated blueprint. In comparison to the previous version, several topics have been moved from ICND2 to ICND1, while some new topics were added, such as Layer 3 redundancy protocols, Multiarea OSPF, OSPFv3, EIGRP for IPv6, NetFlow, and licensing. 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. In comparison to the previous course, there is more lab time and troubleshooting.

### 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)
Expand a small-sized, switched LAN to a medium-sized LAN with multiple switches, supporting VLANs, trunking, and spanning tree
Describe routing concepts as they apply to a medium-sized network and discuss considerations when implementing routing on the network
Configure, verify, and troubleshoot OSPF
Configure, verify, and troubleshoot EIGRP
Determine how to apply ACLs based on network requirements and configure, verify, and troubleshoot ACLs on a medium-sized network
Configure NAT or PAT on routers, explain IPv6 addressing, and configure IPv6 on a Cisco router
Identify and implement the appropriate WAN technology based on network requirements
Version 2.0 (Updated)
Operate a medium-sized LAN with multiple switches, supporting VLANs, trunking, and spanning tree
Troubleshoot IP connectivity
Configure and troubleshoot EIGRP in IPv4 environment, and configure EIGRP for IPv6
Configure and troubleshoot OSPF in IPv4 environment, and configure OSPF for IPv6
Define characteristics, functions, and components of a WAN
Describe SNMP, syslog, and NetFlow, and manage Cisco device configurations, Cisco IOS images, and licenses

## 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	Modified for the current version of the course
Module 1: Small Network Implementation	Module 1: Implementing Scalable Medium-Sized Networks	<p>Additions:</p> <ul style="list-style-type: none"> <li>• Troubleshooting VLAN Connectivity</li> <li>• Optimizing STP</li> <li>• Configuring EtherChannel</li> <li>• Understand Layer 3 Redundancy</li> </ul> <p>Deletions:</p> <ul style="list-style-type: none"> <li>• Theoretical introduction into the review lab</li> <li>• Review lab itself (repositioned and renamed)</li> </ul>
Module 2: Medium-Sized Switched Network Construction	Module 2: Troubleshooting Basic Connectivity	<p>Additions:</p> <ul style="list-style-type: none"> <li>• Troubleshooting IPv4 Network Connectivity</li> <li>• Troubleshooting IPv6 Network Connectivity</li> </ul> <p>Deletions:</p> <ul style="list-style-type: none"> <li>• Implementing VLANs and Trunks (repositioned and updated)</li> <li>• Optimizing Spanning Tree Performance (repositioned and updated)</li> <li>• Routing Between VLANs (moved to ICND1, but practically reviewed through <i>Review</i> and <i>ICND2 Superlab</i> labs).</li> <li>• Securing the Expanded Network (moved to ICND1, but practically reviewed through <i>Review</i> and <i>ICND2 Superlab</i> labs).</li> <li>• Troubleshooting Switched Networks (repositioned and updated)</li> </ul>
Module 3: Medium-Sized Routed Network Construction	Module 3: Implementing an EIGRP-Based Solution	<p>Additions:</p> <ul style="list-style-type: none"> <li>• Implementing EIGRP</li> <li>• Troubleshooting EIGRP</li> <li>• Implementing EIGRP for IPv6</li> </ul> <p>Deletions:</p> <ul style="list-style-type: none"> <li>• Implementing VLSM (moved to ICND1 and updated)</li> </ul>
Module 4: Single-Area OSPF Implementation	Module 4: Implementing a Scalable, Multiarea Network, OSPF-Based Solution	<p>Additions:</p> <ul style="list-style-type: none"> <li>• OSPF Overview</li> <li>• Multiarea OSPF IPv4 Implementation</li> <li>• Examining OSPFv3</li> </ul> <p>Deletions:</p> <ul style="list-style-type: none"> <li>• Implementing OSPF (repositioned and updated)</li> </ul>



Version 1.1 (Previous)	Version 2.0 (Updated)	Changes and Reason
Module 5: EIGRP Implementation	Module 5: Wide-Area Networks	<p>Additions:</p> <ul style="list-style-type: none"> <li>Understanding WAN Technologies</li> <li>Configuring Serial Encapsulation</li> <li>Establishing a Frame Relay WAN</li> <li>Introducing VPN Solutions</li> <li>Configuring GRE Tunnels</li> </ul> <p>Deletions:</p> <ul style="list-style-type: none"> <li>Implementing EIGRP (repositioned and updated)</li> <li>Troubleshooting EIGRP (repositioned and updated)</li> </ul>
Module 6: Access Control Lists	Module 6: Network Device Management	<p>Additions:</p> <ul style="list-style-type: none"> <li>SNMP and Syslog Basic Configuration</li> <li>Managing Cisco Devices</li> <li>Managing Cisco Devices and Licensing</li> </ul> <p>Deletions:</p> <ul style="list-style-type: none"> <li>Introducing ACL operation (moved to ICND1 and updated, but practically reviewed through some labs in ICND2)</li> <li>Configuring and Troubleshooting ACLs (moved to ICND1 and updated, but practically reviewed through some labs in ICND2)</li> </ul>
Module 7: Address Space Management		<p>Deletions:</p> <ul style="list-style-type: none"> <li>Scaling the Network with NAT and PAT (moved to ICND1 and updated)</li> <li>Transitioning to IPv6 (moved and updated)</li> </ul>
Module 8: LAN Extension into a WAN		<p>Deletions:</p> <ul style="list-style-type: none"> <li>Introducing VPN Solutions (updated and repositioned)</li> <li>Configuring PPP Encapsulation (updated and repositioned)</li> <li>Establishing a WAN Connection with Frame Relay (updated and repositioned)</li> <li>Troubleshooting Frame Relay WANs (removed, but indirectly covered in Verifying Frame Relay Configuration)</li> </ul>

## 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.

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
		<b>Lab or Other Activities</b>	Lab S1: Review
		<b>Lab or Other Objectives</b>	Configure Basic Settings, VLANs, Trunks, and Port Security on Switches Configure Inter-VLAN Routing Configure Internet Connectivity Configure WAN Connectivity, and Dynamic Routing Protocol
<b>Module 1</b>		<b>Module 1</b>	
<b>Lesson Titles</b>	Introducing the Review Lab	<b>Lesson Titles</b>	Troubleshooting VLAN Connectivity
<b>Lesson Objectives</b>	Describe the functions of the CLI Describe the configuration modes of the Cisco IOS Software Describe the help facilities available in the Cisco IOS Software Implement a basic switch and router configuration and ensure that it operates properly	<b>Lesson Objectives</b>	Describe VLANs Create and verify VLANs Describe trunks Configure and verify trunks Describe DTP Troubleshoot VLANs Troubleshoot trunks
<b>Lab or Other Activities</b>	Lab 1-1: Implementing a Small Network (Review Lab)	<b>Lab or Other Activities</b>	Lab 1-1: Troubleshooting VLANs and Trunks
<b>Lab or Other Objectives</b>	Return your workgroup switch and router to their default configurations Configure your workgroup switch and router with their proper identities and IP addressing Provide basic security with passwords and port security	<b>Lab or Other Objectives</b>	Troubleshoot VLAN Connectivity Troubleshoot Trunk Connectivity
		<b>Lesson Titles</b>	Building Redundant Switched Topologies
		<b>Lesson Objectives</b>	Describe problems that may arise in redundant switched topologies Describe the principles behind STP Describe variants of STP and the differences between them Explain how PVST+ improves on the concept of STP Describe how to use Cisco IOS Software commands to analyze the spanning-tree topology and verify the proper operation of STP Describe typical symptoms that are experienced during a major spanning- tree failure and how to recover from that failure Demonstrate how to configure and verify PortFast and BPDU guard
		<b>Lab or Other Activities</b>	Lab 1-2: Optimizing STP

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
		<b>Lab or Other Objectives</b>	Verify STP operation Influence root bridge selection Implement STP PortFast Implement STP BPDU guard
		<b>Lesson Titles</b>	Improving Redundant Switched Topologies with EtherChannel
		<b>Lesson Objectives</b>	Describe the idea behind EtherChannel technology Describe the advantages of EtherChannel technology Identify the two EtherChannel protocols and their modes Configure link aggregation using EtherChannel Explain what can go wrong with EtherChannel configurations
		<b>Lab or Other Activities</b>	Lab 1-3: Configuring EtherChannel
		<b>Lab or Other Objectives</b>	Configure EtherChannel Verify EtherChannel redundancy
		<b>Lesson Titles</b>	Understanding Layer 3 Redundancy
		<b>Lesson Objectives</b>	Describe routing issues in connection with redundancy Explain the router redundancy process and what happens when a failover occurs Identify HSRP and VRRP as Layer 3 redundancy protocols Describe the idea behind HSRP interface tracking Describe the idea behind HSRP load balancing Identify GLBP as a redundancy protocol
<b>Module 2</b>		<b>Module 2</b>	
<b>Lesson Titles</b>	Implementing VLANs and Trunks	<b>Lesson Titles</b>	Troubleshooting IPv4 Network Connectivity
<b>Lesson Objectives</b>	Define the purpose and function of VLANs on Cisco Catalyst switches Define the purpose and function of IEEE 802.1Q trunking on Cisco Catalyst switches Define the purpose and function of VTP on Cisco Catalyst switches List the steps that are required to configure a normal-range VLAN that uses VTP and 802.1Q trunking	<b>Lesson Objectives</b>	Show various components for troubleshooting IP connectivity Describe end-to-end connectivity troubleshooting tools Explain how to identify and fix physical connectivity issues Show how the current and desired path can be identified Describe how a misconfigured gateway affects connectivity Explain how a misconfigured name resolution entry affects network connectivity Explain how a misconfigured ACL affects network connectivity

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
<b>Lesson Titles</b>	Optimizing Spanning Tree Performance	<b>Lab or Other Activities</b>	Lab 2-1: Troubleshooting IP Connectivity
<b>Lesson Objectives</b>	Describe the methods that are used to create fast physical connections between switches in a redundant topology Identify the potential issues of a redundant switched topology Describe how spanning tree resolves issues of redundant switched networks Describe the operation of the STP Configure RSTP, including the root switch and a backup root switch	<b>Lab or Other Objectives</b>	Troubleshoot the default route Troubleshoot an ACL problem Troubleshoot default gateway Troubleshoot name resolution
<b>Lesson Titles</b>	Routing Between VLANs	<b>Lesson Titles</b>	Troubleshooting IPv6 Network Connectivity
<b>Lesson Objectives</b>	Describe the purpose of subinterfaces for inter-VLAN routing Configure inter-VLAN routing using 802.1Q and an external router	<b>Lesson Objectives</b>	Explain types of IPv6 unicast addresses Describe possible causes of failed IPv6 connectivity Describe usage of IPv6 end-to-end connectivity verification tools Explain how to identify IPv6 paths throughout the network Describe how to verify that the IPv6 default gateway is set correctly Identify how missing IPv6 name resolution mapping will influence network behavior Identify how ACLs can influence end-to-end-IPv6 connectivity
<b>Lesson Titles</b>	Securing the Expanded Network		
<b>Lesson Objectives</b>	Describe the security needs of the expanded network and the characteristics of an organizational security policy Describe how to secure switch devices, including securing access to the switch and switch protocols, and mitigating compromises that are launched through a switch		
<b>Lab or Other Activities</b>	Lab 2-1: Configuring Expanded Switched Networks		
<b>Lab or Other Objectives</b>	Configure the switch to participate in a VTP domain and configure the switch for transparent mode Configure trunking on a trunk port to provide access to a router on the network Configure separate VLANs for separate logical networks Enable RSTP and configure the root switch and backup root switch		

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
<b>Lesson Titles</b>	Troubleshooting Switched Networks		
<b>Lesson Objectives</b>	Describe the basic steps that are used to troubleshoot a switched network Identify and resolve port connectivity issues Identify and resolve VLAN and trunking issues Identify and resolve VTP issues Identify and resolve STP issues		
<b>Lab or Other Activities</b>	Lab 2-2: Troubleshooting Switched Networks		
<b>Lab or Other Objectives</b>	Discover switched network connectivity issues, follow troubleshooting guidelines to ascertain switched connectivity problems, and re-establish switched network connectivity		
<b>Module 3</b>		<b>Module 3</b>	
<b>Lesson Titles</b>	Reviewing Routing Operations	<b>Lesson Titles</b>	Implementing EIGRP
<b>Lesson Objectives</b>	Describe the purpose and types of dynamic routing protocols Describe the operation and implementation of distance vector routing protocols Describe the operation and implementation of link-state routing protocols	<b>Lesson Objectives</b>	Describe the idea behind dynamic routing protocols Describe the purpose of administrative distance Describe EIGRP features Explain how EIGRP chooses the best path Describe the EIGRP composite metric Configure EIGRP Verify EIGRP configuration Explain load balancing with EIGRP
<b>Lesson Titles</b>	Implementing VLSM	<b>Lab or Other Activities</b>	Lab 3-1: Implementing EIGRP
<b>Lesson Objectives</b>	Describe subnet mask calculation Describe the purpose of a VLSM and calculate VLSM Describe the route summarization process and how routers manage route summarization	<b>Lab or Other Objectives</b>	Verify network connectivity Configure and verify basic EIGRP Investigate EIGRP neighbor events Remove OSPF routing
		<b>Lesson Titles</b>	Troubleshooting EIGRP
		<b>Lesson Objectives</b>	Describe the basic components of troubleshooting a network that is running EIGRP Identify and resolve EIGRP neighbor relationship issues Identify and resolve EIGRP routing table issues
		<b>Lab or Other Activities</b>	Lab 3-2: Troubleshooting EIGRP

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
		<b>Lab or Other Objectives</b>	Troubleshoot EIGRP neighbors Troubleshoot routing table issues
		<b>Lesson Titles</b>	Implementing EIGRP for IPv6
		<b>Lesson Objectives</b>	Describe how EIGRP is used for IPv6 Explain commands that are used for enabling EIGRP for IPv6 Present an example configuration of EIGRP for IPv6
		<b>Lab or Other Activities</b>	Lab 3-3: Implementing EIGRP for IPv6
		<b>Lab or Other Objectives</b>	Configure EIGRP for IPv6 and verify the configuration
<b>Module 4</b>		<b>Module 4</b>	
<b>Lesson Titles</b>	Implementing OSPF	<b>Lesson Titles</b>	OSPF Overview
<b>Lesson Objectives</b>	Describe the features of OSPF Describe how OSPF neighbor adjacencies are established Describe the SPF algorithm that OSPF uses Configure a single-area OSPF network Configure a loopback interface to be used as the router ID Verify a single-area OSPF network configuration Use the OSPF <b>debug</b> commands to troubleshoot OSPF Configure load balancing with OSPF Configure authentication for OSPF	<b>Lesson Objectives</b>	Explain the basic idea behind link-state protocols Describe the data structures that are used by link-state routing protocols Describe the OSPF metric Describe how OSPF neighbor adjacencies are established Describe how routers build and synchronize the link-state database Describe the two-tier hierarchy structure of OSPF, including the characteristics of transit areas and regular areas, as well as the terminology that is used
<b>Lab or Other Activities</b>	Lab 4-1: Implementing OSPF	<b>Lesson Titles</b>	Multiarea OSPF IPv4 Implementation
<b>Lab or Other Objectives</b>	Disable the LAN connections to the core Enable the serial connections on a workgroup router Configure OSPF on a workgroup router Configure plaintext authentication for OSPF Verify the correct operation and configuration of OSPF routing and OSPF plaintext authentication	<b>Lesson Objectives</b>	Explain the difference between single-area and multiarea OSPF Describe how OSPF implementation should be planned Configure multiarea OSPF Verify multiarea OSPF
<b>Lesson Titles</b>	Troubleshooting OSPF	<b>Lab or Other Activities</b>	Lab 4-1: Configuring Multiarea OSPF

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
Lesson Objectives	Describe the basic components of OSPF troubleshooting Identify and resolve errors with OSPF neighbor adjacencies Identify and resolve errors with OSPF routing tables Identify and resolve authentication problems	<b>Lab or Other Objectives</b>	Configure multiarea OSPF Verify multiarea OSPF configuration
<b>Lab or Other Activities</b>	Lab 4-2: Troubleshooting OSPF	<b>Lesson Titles</b>	Troubleshooting Multiarea OSPF
<b>Lab or Other Objectives</b>	Discover OSPF network connectivity issues and follow troubleshooting guidelines to isolate and fix OSPF connectivity problems	<b>Lesson Objectives</b>	Understand OSPF neighbor states Describe how to troubleshoot OSPF Troubleshoot OSPF neighbor issues Troubleshoot OSPF routing table issues Troubleshoot OSPF path selection issues
		<b>Lab or Other Activities</b>	Lab 4-2: Troubleshooting Multiarea OSPF
		<b>Lab or Other Objectives</b>	Troubleshoot OSPF neighbor issues Troubleshoot OSPF routing table issues
		<b>Lesson Titles</b>	Examining OSPFv3
		<b>Lesson Objectives</b>	Introduce OSPFv3 and describe how it is different from OSPF for IPv4 Configure OSPFv3 Verify OSPFv3 configuration
		<b>Lab or Other Activities</b>	Lab 4-3: Configuring OSPF for IPv6
		<b>Lab or Other Objectives</b>	Configure basic OSPF in an IPv6 network Verify OSPFv3 configuration
<b>Module 5</b>		<b>Module 5</b>	
<b>Lesson Titles</b>	Implementing EIGRP	<b>Lesson Titles</b>	Understanding WAN Technologies
<b>Lesson Objectives</b>	Describe the features of EIGRP Configure and verify EIGRP Configure load balancing with EIGRP Configure MD5 authentication with EIGRP	<b>Lesson Objectives</b>	Explain WAN technologies List the WAN devices and their function in a WAN environment Describe various options for WAN cabling List various Layer 2 WAN protocols Describe the major WAN communication link options
<b>Lab or Other Activities</b>	Lab 5-1: Implementing EIGRP	<b>Lesson Titles</b>	Configuring Serial Encapsulation

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
<b>Lab or Other Objectives</b>	Configure EIGRP on the router Configure MD5 authentication for EIGRP Verify the correct operation and configuration of EIGRP routing using <b>show</b> commands, and verify the correct operation and configuration of EIGRP MD5 authentication Debug the EIGRP neighbor processes	<b>Lesson Objectives</b>	Explain the idea behind serial links Explain the configuration of a serial interface Describe HDLC protocols Understand Point-to-Point protocol Configure a serial link with PPP encapsulation Describe PAP authentication
<b>Lesson Titles</b>	Troubleshooting EIGRP	<b>Lab or Other Activities</b>	Lab 5-1: Configuring and Troubleshooting a Serial Connection
<b>Lesson Objectives</b>	Describe the basic components of troubleshooting a network that is running EIGRP Identify and resolve EIGRP neighbor relationship issues Identify and resolve EIGRP routing table issues Identify and resolve EIGRP authentication	<b>Lab or Other Objectives</b>	Troubleshoot PPP encapsulation Configure and verify HDLC encapsulation
<b>Lab or Other Activities</b>	Lab 5-2: Troubleshooting EIGRP	<b>Lesson Titles</b>	Establishing a WAN Connection Using Frame Relay
<b>Lab or Other Objectives</b>	Discover EIGRP network connectivity issues and follow troubleshooting guidelines to isolate and fix EIGRP connectivity problems Test EIGRP network connectivity	<b>Lesson Objectives</b>	Describe Frame Relay Explain Frame Relay topologies Explain Frame Relay reachability issues Explain Frame Relay LMI signaling Explain Frame Relay address mappings Configure basic Frame Relay Explain what is the difference between Point-to-Point and Multipoint Frame Relay Configure Point-to-Point Frame Relay Configure Multipoint Frame Relay Verify Frame Relay operation
		<b>Lab or Other Activities</b>	Lab 5-2: Establishing a Frame Relay WAN
		<b>Lab or Other Objectives</b>	Configure and verify basic Frame Relay Configure and verify Frame Relay subinterfaces Remove the Frame Relay configuration
		<b>Lesson Titles</b>	Introducing VPN Solutions
		<b>Lesson Objectives</b>	Describe the purpose of VPNs List the two Cisco SSL VPN solutions Identify the role of IPsec
		<b>Lesson Titles</b>	Configuring GRE Tunnels



	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
		<b>Lesson Objectives</b>	Describe GRE tunneling Configure a GRE tunnel Verify a GRE tunnel
		<b>Lab or Other Activities</b>	Lab 5-3: Establishing a GRE Tunnel
		<b>Lab or Other Objectives</b>	Configure and verify a GRE tunnel Configure and verify OSPF over a GRE tunnel
<b>Module 6</b>		<b>Module 6</b>	
<b>Lesson Titles</b>	Introducing ACL Operation	<b>Lesson Titles</b>	Configuring Network Devices to Support Network Management Protocols
<b>Lesson Objectives</b>	Explain the purpose of ACLs and give examples of when to use them Explain how inbound and outbound ACLs operate Describe numbered and named, standard and extended IPv4 ACLs Describe time-based, reflexive, and dynamic extended ACLs Use wildcard masking to create IPv4 ACLs	<b>Lesson Objectives</b>	Describe how network devices can be managed and monitored Describe managing of Cisco devices Explain licensing
<b>Lesson Titles</b>	Configuring and Troubleshooting ACLs	<b>Lab or Other Activities</b>	Lab 6-1: SNMP and Syslog Basic Configuration
<b>Lesson Objectives</b>	Configure and verify numbered standard IPv4 ACLs Configure and verify numbered extended IPv4 ACLs Configure and verify both standard and extended named IPv4 ACLs Identify and resolve common ACL configuration errors	<b>Lab or Other Objectives</b>	Configure SNMP client Configure syslog client
<b>Lab or Other Activities</b>	Lab 6-1: Implementing and Troubleshooting ACLs	<b>Lab or Other Activities</b>	Lab 6-2: Analyzing NetFlow Data
<b>Lab or Other Objectives</b>	Create an IP extended access list to block Telnet traffic, apply it to an interface, and verify its operation Create an IP extended ACL to block TFTP requests from a workgroup Troubleshoot to isolate and resolve an ACL problem	<b>Lab or Other Objectives</b>	Analyze NetFlow data
		<b>Lesson Titles</b>	Managing Cisco Devices

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
		<b>Lesson Objectives</b>	<p>Describe major internal components of a Cisco router</p> <p>Describe functions of ROM memory in a Cisco router</p> <p>Describe the sequence of events that occurs during a router bootup</p> <p>Describe how to display the boot information in the configuration register</p> <p>Describe how to change the boot information in the configuration register</p> <p>Describe the process of locating the Cisco IOS image</p> <p>Describe the process of loading the Cisco IOS image</p> <p>Describe the process of loading the Cisco IOS configuration files</p> <p>Describe the file systems that are used by a Cisco router</p> <p>Describe why it is important to create backup of Cisco IOS Software images and configuration files</p> <p>Describe how to decipher Cisco IOS image filenames</p> <p>Describe how to create a backup of Cisco IOS image to a TFTP server</p> <p>Describe how to upgrade a Cisco IOS router from a TFTP server</p> <p>Describe the configuration files and their location</p> <p>Describe how to perform a password recovery on a Cisco router</p>
		<b>Lesson Titles</b>	Licensing
		<b>Lesson Objectives</b>	<p>Understand the idea behind Cisco IOS image licensing</p> <p>Explain how the current version of the license can be identified</p> <p>Explain how to install a permanent license</p> <p>Explain how to install an evaluation license</p> <p>Explain how to back up a license</p> <p>Explain how to uninstall a license</p>
		<b>Lab or Other Activities</b>	Lab 6-3: Managing Cisco Devices and Licensing
		<b>Lab or Other Objectives</b>	<p>Do a password recovery on a router</p> <p>Back up a Cisco IOS image</p> <p>Manage a configuration file</p> <p>Verify licensing</p>
<b>Module 7</b>			
<b>Lesson Titles</b>	Scaling the Network with NAT and PAT		

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
<b>Lesson Objectives</b>	Describe the features and benefits of NAT and PAT Describe how to translate inside source addresses by using static and dynamic translation and how to configure NAT Configure PAT by overloading an inside global address Identify and resolve issues with the NAT translation table Identify and resolve issues with using the correct translation entry		
<b>Lesson Titles</b>	Lab 7-1: Configuring NAT and PAT		
<b>Lesson Objectives</b>	Configure inside and outside NAT interfaces and an IP ACL to permit hosts to use PAT Use <b>show</b> commands to verify the NAT configuration		
<b>Lesson Titles</b>	Transitioning to IPv6		
<b>Lesson Objectives</b>	Explain the need for IPv6 Describe the IPv6 address format Explain the methods that are used to assign an IPv6 address Configure IPv6 with RIPng through an IPv4 network Explain how IPv6 affects common routing protocols and the modifications necessary to make these protocols Explain how to enable IPv6 DNS support on a router Explain transition strategies for implementing IPv6		
<b>Lab or Other Activities</b>	Lab 7-2: Implementing IPv6		
<b>Lab or Other Objectives</b>	Determine how to allocate IPv6 addresses for the assigned routers, given an IPv6 numbering scheme and a prefix Configure router interfaces for IPv6 and assign addresses Configure RIP to support IPv6 and IPv6 addresses Configure and verify a dual-stack router configuration		
<b>Module 8</b>			
<b>Lesson Titles</b>	Introducing VPN Solutions		

	<b>Lessons, Labs, and Activities Removed from v1.1 (Previous)</b>		<b>Lessons, Labs, and Activities Added to v2.0 (Updated)</b>
Lesson Objectives	Define a VPN solution and its benefits Define the different types of and uses for VPNs Describe the hardware and software components of VPN Describe IPsec and its components Describe how encryption, integrity, and authentication are applied to the IPsec protocol suite		
Lesson Titles	Introducing VPN Solutions		
Lesson Objectives	Describe the types of encapsulation that are available on Cisco routers Describe the features and functionality of PPP Configure and verify PPP		
Lesson Titles	Establishing a WAN Connection with Frame Relay		
Lesson Objectives	Describe the features and functions of Frame Relay Configure Frame Relay Verify that Frame Relay is functioning as configured		
Lab or Other Activities	Lab 8-1: Establishing a Frame Relay WAN		
Lab or Other Objectives	Configure a serial interface to use Frame Relay encapsulation Verify the Frame Relay connection using <b>show</b> and <b>ping</b> commands Configure a router subinterface and associate it with a specific DLCI		
Lesson Titles	Troubleshooting Frame Relay WANs		
	Describe the basic steps that are used to troubleshoot a Frame Relay WAN Identify and resolve the most common Frame Relay connectivity issues		
Lab or Other Activities	Lab 8-2: Troubleshooting Frame Relay WANs		
Lab or Other Objectives	Discover Frame Relay network connectivity issues and follow troubleshooting guidelines to determine and fix Frame Relay connectivity problems		

	Lessons, Labs, and Activities Removed from v1.1 (Previous)		Lessons, Labs, and Activities Added to v2.0 (Updated)
		<b>Lab or Other Activities</b>	Lab S2: ICND2 Superlab
		<b>Lab or Other Objectives</b>	Secure router and configure Inter-VLAN routing Configure basic settings, VLANs and trunks on switch Configure EtherChannel Configure port security Configure SSH on a router Configure DHCP server Configure stateless autoconfiguration Configure PPP encapsulation Configure dynamic routing protocol Troubleshoot IP access control list

## 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.

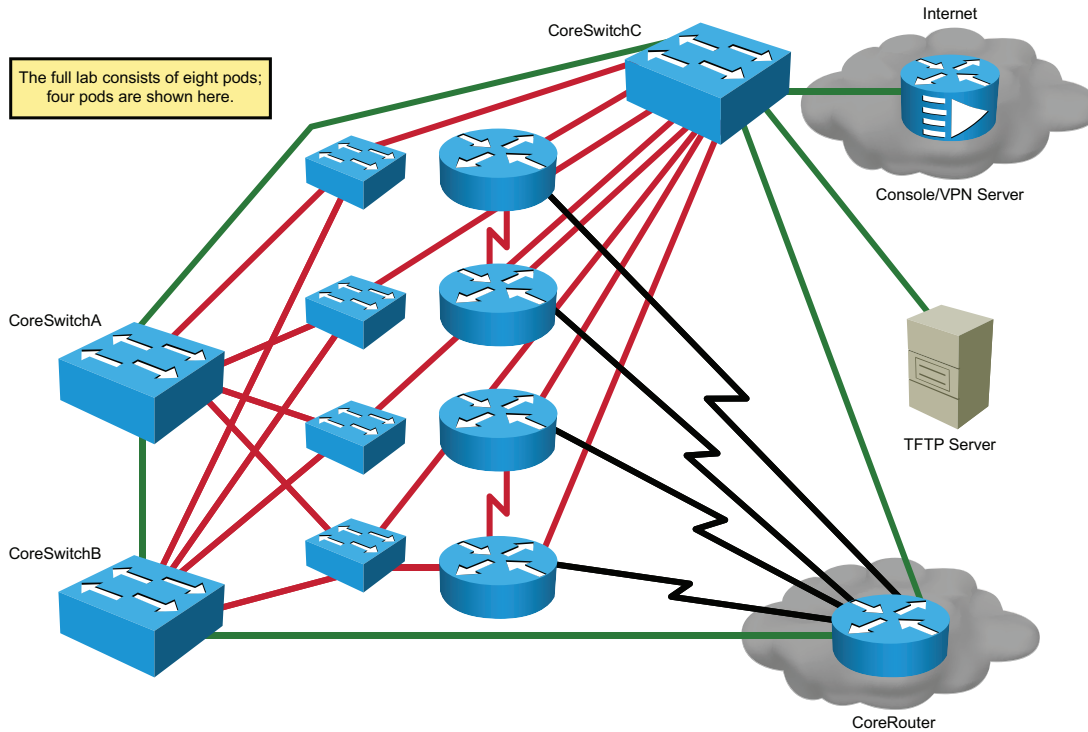
Version 1.1 (Previous)	Version 2.0 (Updated)
Pod equipment:	Pod equipment:
WS-2960-24TT-L	WS-C2960-24TT-L
	WS-C2960-24-S
CISCO2811	CISCO2901 (Qty: 2)
HWIC-2T	HWIC-1T (Qty: 2)
CAB-SS-X21MT	CAB-SS-2626x
CAB-SS-X21FC	
PC with Microsoft Windows	PC with Microsoft Windows (Qty: 2)
Ethernet cables	Ethernet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

Version 1.1 (Previous)	Version 2.0 (Updated)
NM-32A	
CAB-OCTALASYNC	
Common server	

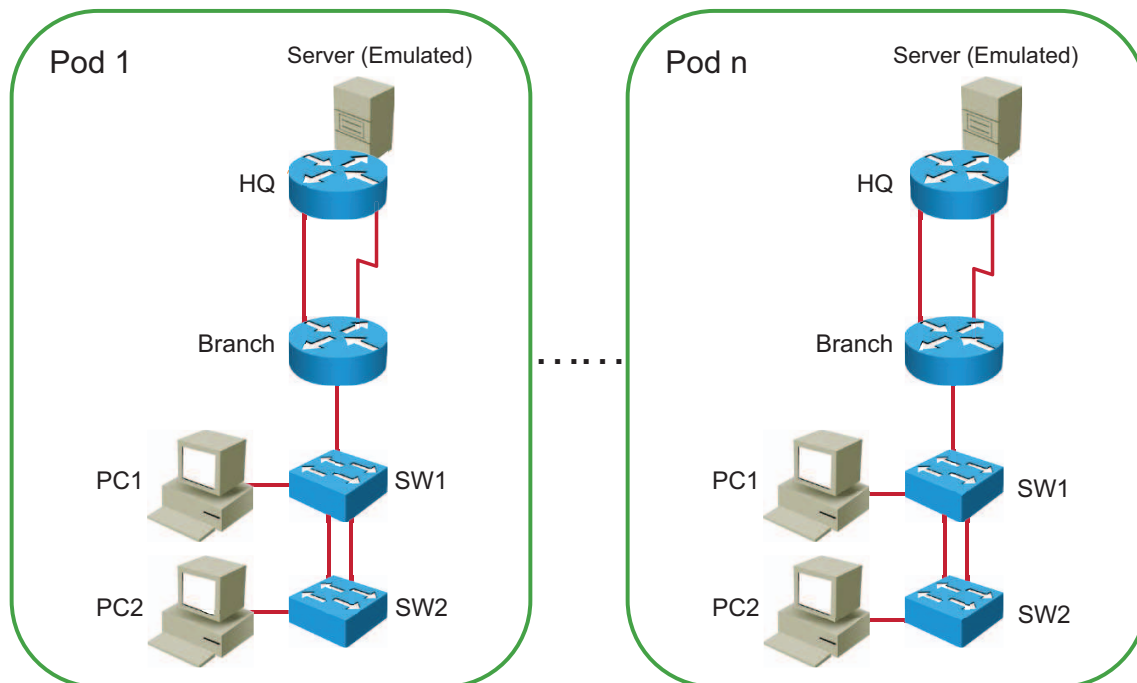
## Lab Topology Changes

These figures provide a comparison of the lab topologies.

ICND1 and ICND2—Combined Lab Topology



ICND2 v1.1 (Previous)



ICND2 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 ICND2 v2.0 course
- Current ICND2 instructor:
  - Certified Cisco Systems Instructor (CCSI) in good standing
  - Cisco CCNA R&S certified
  - Attend the ICND2 v2.0 course or attend ICND2 v2.0 train-the-trainer (TTT) or view ICND2 v2.0 on-demand 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: Implementing Scalable Medium-Sized Networks		
	9:00–9:30	Course Introduction
	9:30–12:00	Lab S1: Review
	12:00–1:00	Lunch
	1:00–1:30	Lab S1: Review (Cont.)
	1:30–2:00	Module 1: Implementing Scalable Medium-Sized Networks Lesson 1-1: Troubleshooting VLAN Connectivity
	2:00–2:30	Lab 1-1: Troubleshooting VLANs and Trunks
	2:30–2:45	Break
	2:45–3:45	Lesson 1-2: Building Redundant Switched Topologies
	3:45–4:30	Lab 1-2: Optimizing STP
	4:30–5:00	Lesson 1-3: Improving Redundant Switched Topologies with EtherChannel
	5:00	Day ends



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**Day 2: Implementing Scalable Medium-Sized Networks, Troubleshooting Basic Connectivity, Implementing an EIGRP-Based Solution**

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	9:00–9:20	Review of Day 1
	9:20–9:40	Lab 1-3: Configuring EtherChannel
	9:40–10:10	Lesson 1-4 Understanding Layer 3 Redundancy
	10:10–10:25	Break
	10:25–11:10	Module 2: Troubleshooting Basic Connectivity Lesson 2-1: Troubleshooting IPv4 Network Connectivity Lesson 2-1: Troubleshooting IPv4 Network
	11:10–12:00	Lab 2-1: Troubleshooting IP Connectivity
	12:00–1:00	Lunch
	1:00–1:30	Lesson 2-2: Troubleshooting IPv6 Network Connectivity
	1:30–2:50	Module 3: Implementing an EIGRP-Based Solution Lesson 3-1: Implementing EIGRP Lesson 3-1: Implementing EIGRP
	2:50–3:05	Break
	3:05–3:50	Lab 3-1: Implementing EIGRP for IPv6
	3:50–4:20	Lesson 3-2: Troubleshooting EIGRP
	4:20–5:00	Lab 3-2: Troubleshooting EIGRP
	5:00	Day ends

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**Day 3: Implementing an EIGRP-Based Solution, Implementing a Scalable, Multiarea Network, OSPF-Based Solution, WANs**

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	9:00–9:20	Review of Day 2
	9:20–9:50	Lesson 3-3: Implementing EIGRP for IPv6
	9:50–10:05	Break
	10:05–10:35	Lab 3-3: Implementing EIGRP for IPv6
	10:35–11:00	Module 4: Implementing a Scalable, Multiarea Network, OSPF-Based Solution Lesson 4-1: OSPF Overview

	11:00–11:30	Lesson 4-2: Multiarea OSPF IPv4 Implementation
	11:30–12:00	Lab 4-1: Configuring Multiarea OSPF
	12:00–1:00	Lunch
	1:00–1:35	Lesson 4-3: Troubleshooting Multiarea OSPF
	1:35–3:05	Lab 4-2: Troubleshooting Multiarea OSPF
	3:05–3:20	Break
	3:20–3:50	Lesson 4-4: Examining OSPFv3
	3:50–4:30	Lab 4-3: Configuring OSPF for IPv6
	4:30–5:00	Module 5: Wide-Area Networks Lesson 5-1: Understanding WAN Technologies  Lesson 5-1: Understanding WAN Technologies
	5:00	Day ends

#### Day 4: Wide-Area Networks

	9:00–9:20	Review of Day 3
	9:20–10:30	Lesson 5-2: Configuring Serial Encapsulation
	10:30–10:45	Break
	10:45–12:00	Lab 5-1: Configuring and Troubleshooting a Serial Connection
	12:00–1:00	Lunch
	1:00–2:00	Lesson 5-3: Establishing a WAN Connection Using Frame Relay
	2:00–3:30	Lab 5-2: Establishing a Frame Relay WAN
	3:30–3:45	Break
	3:45–4:10	Lesson 5-4: Introducing VPN Solutions
	4:10–4:30	Lesson 5-5: Configuring GRE Tunnels
	4:30–5:00	Lab 5-3: Establishing a GRE Tunnel
	5:00	Day ends

#### Day 5: Network Device Management

	9:00–9:20	Review of Day 4
	9:20–10:10	Module 6: Network Device Management Lesson 6-1: Configuring Network Devices to Support Network Management Protocols Lesson 6-1: Configuring Network Devices to Support Network Management Protocols
	10:10–10:25	Break
	10:25–11:00	Lab 6-1: SNMP and Syslog Basic Configuration
	11:00–11:20	Paper Lab 6-2: Analyzing NetFlow Data
	11:20–12:00	Lesson 6-2: Managing Cisco Devices
	12:00–1:00	Lunch
	1:00–1:15	Lesson 6-3: Licensing
	1:15–2:15	Lab 6-3: Managing Cisco Devices and Licensing
	2:15–2:30	Break
	2:30–5:00	Lab S2: ICND2 Superlab
	5:00	Day ends



# Course Evaluation

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## 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

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## High-Level Course Outline

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

- Review
- Implementing Scalable Medium-Sized Networks
- Troubleshooting Basic Connectivity
- Implementing an EIGRP-Based Solution
- Implementing a Scalable, Multiarea Network, OSPF-Based Solution
- Wide-Area Networks
- Network Device Management
- ICND2 Superlab
- Lab S-1: Review
- Lab 1-1: Troubleshooting VLANs and Trunks
- Lab 1-2: Optimizing STP
- Lab 1-3: Configuring EtherChannel
- Lab 2-1: Troubleshooting IP Connectivity
- Lab 3-1: Implementing EIGRP
- Lab 3-2: Troubleshooting EIGRP
- Lab 3-3: Implementing EIGRP for IPv6
- Lab 4-1: Configuring Multiarea OSPF
- Lab 4-2: Troubleshooting Multiarea OSPF
- Lab 4-3: Configuring OSPF for IPv6
- Lab 5-1: Configuring and Troubleshooting a Serial Connection
- Lab 5-2: Establishing a Frame Relay WAN
- Lab 5-3: Establishing a GRE Tunnel

- Lab 6-1: SNMP and Syslog Basic Configuration
- Lab 6-2: Analyzing NetFlow Data
- Lab 6-3: Managing Cisco Devices and Licensing
- Lab S-2: ICND2 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 S: Review

Module Objective: Consolidate ICND1 knowledge by configuring a simple network

#### Lab S-1: Review

Lab Objective: Consolidate 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

### Module 1: Implementing Scalable Medium-Sized Networks

Module Objective: Operate a medium-sized LAN with multiple switches, supporting VLANs, trunking, and spanning tree

#### Lesson 1: Troubleshooting VLAN Connectivity

Lesson Objective: Troubleshoot VLAN connectivity

This lesson includes these topics:

- VLAN Overview
- Creating VLANs
- Trunk Operation



- Configuring Trunks
- Dynamic Trunking Protocol
- VLAN Troubleshooting
- Trunk Troubleshooting
- Summary

### **Lab 1-1: 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 2: Building Redundant Switched Topologies**

Lesson Objective: Explain how STP works

This lesson includes these topics:

- Issues in Redundant Topologies
- Spanning-Tree Operation
- Types of Spanning-Tree Protocols
- Per VLAN Spanning Tree Plus
- Modifying the Bridge ID
- Analyzing the STP Topology
- Spanning-Tree Failure Consequences
- PortFast and BPDU Guard
- Summary

### **Lab 1-2: 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 3: 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

- EtherChannel Protocols
- Configuring EtherChannel
- Verifying EtherChannel
- Summary

### **Lab 1-3: Configuring EtherChannel**

Lab Objective: Configure and verify EtherChannel

This lab includes these tasks:

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

### **Lesson 4: 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
- Gateway Load Balancing Protocol
- Summary

### **Lesson 5: Module Summary**

This lesson includes these topics:

- References

### **Lesson 6: Module Self-Check**

## **Module 2: 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
- Verification of Physical Connectivity Issue
- Identification of Current and Desired Path
- Default Gateway Issues
- Name Resolution Issues

- ACL Issues
- Summary

### **Lab 2-1: 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:

- IPv6 Unicast Addresses
- Troubleshooting End-to-End IPv6 Connectivity
- Verification of End-to-End IPv6 Connectivity
- Identification of Current and Desired IPv6 Path
- Default Gateway Issues in IPv6
- Name Resolution Issues in IPv6
- ACL Issues in IPv6
- Summary

### **Lesson 3: Module Summary**

This lesson includes these topics:

- References

### **Lesson 4: Module Self-Check**

## **Module 3: 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:

- Dynamic Routing Protocols
- Administrative Distance
- EIGRP Features
- EIGRP Path Selection
- EIGRP Metric

- EIGRP Configuration
- Verification of EIGRP Configuration
- Load Balancing with EIGRP
- Summary

### **Lab 3-1: Implementing EIGRP**

Lab Objective: Configure EIGRP and investigate EIGRP neighbor events

This lab includes these tasks:

- Task 1: Verify Connectivity to Remote Network
- Task 2: Configure and Verify EIGRP
- Task 3: Investigate Neighbor Events
- Task 4: Disable OSPF Routing Process

### **Lesson 2: Troubleshooting EIGRP**

Lesson Objective: Troubleshoot EIGRP

This lesson includes these topics:

- Components of Troubleshooting EIGRP
- Troubleshooting EIGRP Neighbor Issues
- Troubleshooting EIGRP Routing Table Issues
- Summary

### **Lab 3-2: 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: Troubleshooting EIGRP Neighbors
- Task 3: Troubleshooting 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
- EIGRP for IPv6 Commands
- EIGRP for IPv6 Configuration Example
- Summary

### **Lab 3-3: 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**

This lesson includes these topics:

- References

#### **Lesson 5: Module Self-Check**

## **Module 4: Implementing a Scalable, Multiarea Network, OSPF-Based Solution**

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

#### **Lesson 1: OSPF Overview**

Lesson Objective: Describe the basic components and terms of OSPF

This lesson includes these topics:

- Link-State Routing Protocol Overview
- Link-State Routing Protocol Data Structures
- OSPF Metric
- Establishing OSPF Neighbor Adjacencies
- Building a Link-State Database
- OSPF Area Structure
- Summary

#### **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
- Multiarea OSPF Configuration
- Multiarea OSPF Verification
- Summary

#### **Lab 4-1: 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
- Troubleshooting OSPF Neighbor Issues
- Troubleshooting OSPF Routing Table Issues
- Troubleshooting OSPF Path Selection
- Summary

### **Lab 4-2: 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
- OSPFv3 Configuration
- OSPFv3 Configuration Verification
- Summary

### **Lab 4-3: Configuring OSPF for IPv6**

Lab Objective: Implement OSPF in an IPv6 network

This lab includes these tasks:

- Task 1: Enable OSPFv3

### **Lesson 5: Module Summary**

This lesson includes these topics:

- References

### **Lesson 6: Module Self-Check**

## **Module 5: 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:

- Introduction to WAN Technologies
- WAN Devices
- Serial WAN Cabling

- WAN Layer 2 Protocols
- WAN Link Options
- Summary

## **Lesson 2: Configuring Serial Encapsulation**

Lesson Objective: Configure a serial connection

This lesson includes these topics:

- Serial Communication Links
- Configuration of a Serial Interface
- HDLC Protocol
- Point-to-Point Protocol
- PPP Configuration
- PPP Authentication: PAP
- PPP Authentication: CHAP
- Configuring CHAP for PPP Authentication
- Verifying CHAP Configuration
- Troubleshooting Serial Connections
- Summary

## **Lab 5-1: 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 technology and its basic configuration

This lesson includes these topics:

- Understanding Frame Relay
- Frame Relay Topologies
- Frame Relay Reachability Issues
- Frame Relay Signaling
- Frame Relay Address Mappings
- Configuring Frame Relay
- Point-to-Point vs. Multipoint
- Configuring Point-to-Point Frame Relay
- Configuring Multipoint Frame Relay
- Verifying Frame Relay Configuration

- Summary

### **Lab 5-2: 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
- Cisco SSL VPN Solutions
- Introducing IPsec
- Summary

### **Lesson 5: Configuring GRE Tunnels**

Lesson Objective: Configure GRE tunnels

This lesson includes these topics:

- GRE Tunnel Overview
- GRE Tunnel Configuration
- GRE Tunnel Verification
- Summary

### **Lab 5-3: Establishing a GRE Tunnel**

Lab Objective: Implement a GRE tunnel

This lab includes these tasks:

- Task 1: Configure and Verify a GRE Tunnel
- Task 2: Configure and Verify OSPF over a GRE Tunnel

### **Lesson 6: Module Summary**

This lesson includes these topics:

- References

### **Lesson 7: Module Self-Check**

## **Module 6: 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
- Syslog Overview
- Syslog Message Format
- Syslog Configuration
- NetFlow Overview
- NetFlow Architecture
- NetFlow Configuration
- Summary

### **Lab 6-1: 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 6-2: 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
- Stages of the Router Power-On Boot Sequence
- Configuration Register
- Changing the Configuration Register
- Locating Cisco IOS Image Files
- Loading Cisco IOS Image Files
- Loading Cisco IOS Configuration Files
- Cisco IOS Integrated File System and Devices

- Managing Cisco IOS Images
- Deciphering Cisco IOS Image Filenames
- Creating the Cisco IOS Image Backup
- Upgrading Cisco IOS Images
- Managing Device Configuration Files
- Password Recovery
- Summary

### **Lesson 3: Licensing**

Lesson Objective: Understand licensing under Cisco IOS 15

This lesson includes these topics:

- Licensing Overview
- Licensing Verification
- Permanent License Installation
- Evaluation License Installation
- Backing up the License
- Uninstalling the License
- Summary

### **Lab 6-3: Managing Cisco Devices and Licensing**

Lab Objective: Perform a password recovery, back up a Cisco IOS device image, manage a configuration file, 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 a Configuration File
- Task 5: Verify Licensing

### **Lesson 4: Module Summary**

This lesson includes these topics:

- References

### **Lesson 5: Module Self-Check**

## **Module S: ICND2 Superlab**

Module Objective:

### **Lab S-2: ICND2 Superlab**

Lab Objective: Put knowledge that is acquired through the whole CCNA course to the test

This lab includes these tasks:

- Task 1: Secure Router and Configure Inter-VLAN Routing
- Task 2: Configure Basic Settings, VLANs, and Trunks on Switch
- Task 3: Troubleshoot EtherChannel
- Task 4: Port Security (Trouble Ticket)
- Task 5: Enable SSH Access on the Branch Router
- Task 6: Configure DHCP Server
- Task 7: Stateless Autoconfiguration on the PC
- Task 8: Configure PPP Encapsulation
- Task 9: Configure Dynamic Routing Protocol
- Task 10: Configure the OSPFv3 Routing Protocol
- Task 11: Troubleshoot the IP Access Control List (Trouble Ticket)



# Lab Setup

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## General Information

ICND2 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 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 through the Learning Partner 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.

ICND2 labs are built around a new common topology, which is shared with the ICND1 course. 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.

During the review module, students become familiar with the lab topology and consolidate basic networking knowledge, such as configuring VLANs and trunks, implementing port security, setting up inter-VLAN routing, configuring WAN connectivity, and implementing OSPF. In this lab, the students configure only the Branch side of the topology. The labs "Troubleshoot VLANs and Trunks," "Optimize STP," and "Configure EtherChannel" deal with configuring the two switches in the Branch LAN. The lab "Troubleshooting IP Connectivity" introduces common issues that impede end-to-end connectivity between PC1 and the server on the HQ side. The server is simulated using a loopback interface on the HQ router.

In the lab "Implementing EIGRP," the students configure basic EIGRP on the Branch router, while the HQ side is preconfigured. The next lab, "Troubleshooting EIGRP," introduces trouble tickets that students need to resolve. The lab "Implementing EIGRP for IPv6" instructs the student on how to configure the Branch router with EIGRP for IPv6. Again, the HQ router is preconfigured. The multiarea OSPF labs ("Configuring Multiarea OSPF," "Troubleshooting Multiarea OSPF," and "Configuring OSPF for IPv6") follow the same flow as EIGRP labs. In the "Configuring and Troubleshooting a Serial Connection" lab, the WAN link interfaces are configured with PPP, and there is a connection issue that the students need to solve. The "Establishing a Frame Relay WAN" lab instructs the student on how to convert the HQ router into a Frame Relay switch. The student does not need to know the details of how a Frame Relay switch functions or the configuration of such a device. It is important for the student to understand that, for this lab, the role of the HQ changes—it becomes a service provider cloud. At the end of the lab, the students remove the Frame Relay configuration. In the lab "Establishing a GRE Tunnel," the students configure a tunnel between the Branch and the HQ router over the Gigabit Ethernet link.

During the "SNMP and Syslog Basic Configuration" lab, students configure the Branch router as an SNMP and syslog node. Students gather data using a syslog server and MIB browser on PC1. During the "Managing Cisco Devices and Licensing" lab, students receive hands-on experience about these two topics using the Branch router. Students are presented outputs from the NetFlow Analyzer tool and they need to interpret these during the "Analyzing NetFlow Data" lab. In the last lab, "ICND2 Superlab," students configure their network from the start to finish. In that way, and with a few trouble tickets, the students test the knowledge that they acquired throughout the course.

Lab configurations are sequential, which means that configurations that students perform in a lab will be the same at the start of the second lab. In that way, the students become familiar with the network in their pods, as they would with a real-life network. There are some exceptions, however. After the review lab, a part of the configuration on the devices is dropped (for example, passwords), so that the students can quickly advance through the numerous labs in this course. Troubleshooting labs take the configuration of the previous lab, break it, and instruct the students to fix it. However, because this is still a basic course, students are led through troubleshooting tasks with extensive instructions.

A solution is provided at the end of the Lab Guide for each lab exercise. The instructor should reference the Course 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 LP CLL labs, an individual pod per 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 Learning Partner Cisco Learning Labs access credentials.

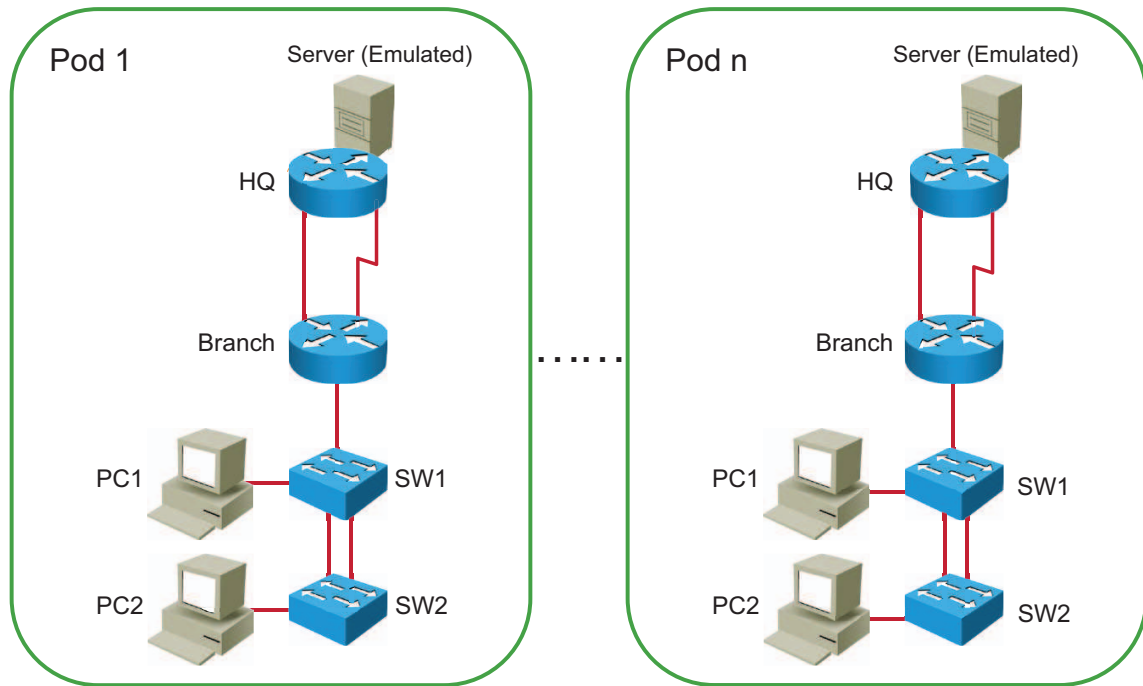
## Laboratory Topology (Delivery)

The *Interconnecting Cisco Networking Devices, Part 2* (ICND2) v2.0 course reinforces the theoretical knowledge gained during the delivery, primarily through the use of labs.

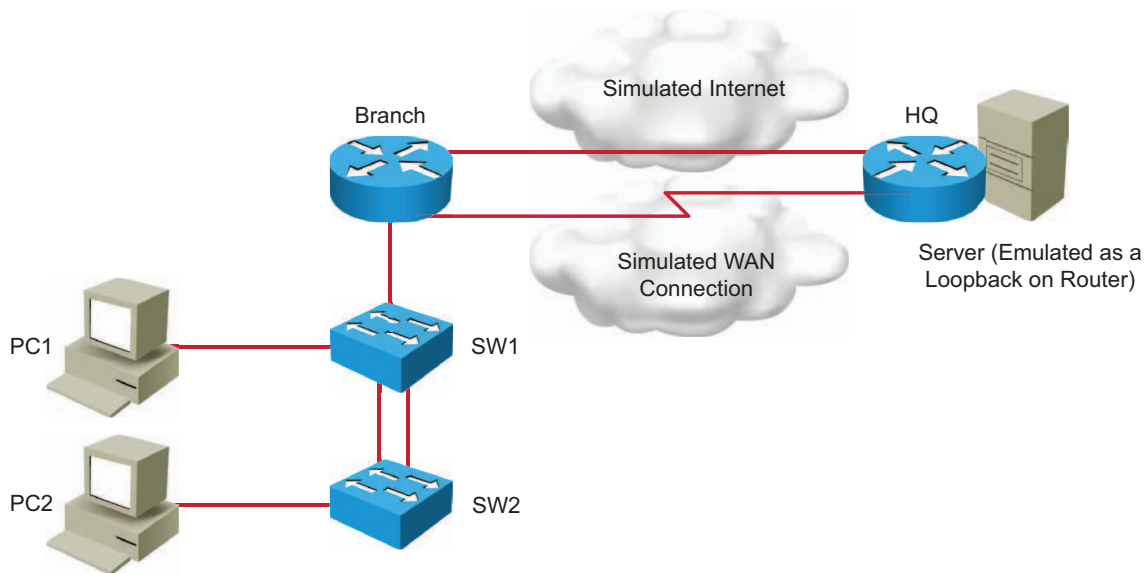
## Laboratory Topology

ICND2 v2.0 labs are designed as individual pods. Each pod consists of two routers, two switches, and two PCs. Because each pod is independent, it does not connect to the 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.

Description	Mfr.	Part Number	Total Qty.
<b>Learner Pod Equipment</b>			
Cisco 2901 Integrated Services Router	Cisco	CISCO2901	2
Catalyst 2960 Series Switch	Cisco	WS-C2960-24TT-L	1

Description	Mfr.	Part Number	Total Qty.
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 Cross-Over 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.



# LP CLL Workstation Configuration

## Supported platforms:

Microsoft Windows® XP (32-bit), Windows Server® 2003 (32-bit), Windows Server 2008 (32-bit), Windows Vista® (32-bit), Windows 7 (32-bit and 64-bit), Mac OS X v10.6 or higher

## System requirements:

2.33-GHz or faster x86-compatible processor for computers, Intel® Atom™ 1.6-GHz or faster processor for Netbooks, 128-MB RAM, 128-MB graphics memory

## Supported browsers:

- Mozilla Firefox 4.0 and above (recommended)
- Internet Explorer 7.0 and above
- Google Chrome
- Safari 5.0 and above (for Mac users only)
- Opera 11

## Software requirements:

- Adobe Flash Player, version 10.2.152.26 or higher
- Windows users should download the Cisco Terminal Application. A link to this free application is located at the top of the window in the Cisco Learning Labs portal. It includes a modified version of the PuTTY Telnet client that will correctly title the Telnet windows. This program will also make the necessary registry changes to the Windows operating system to permit Telnet operations from the web browser. Mac computers have a default Telnet application (Terminal) that can be used with the Cisco Learning Labs.

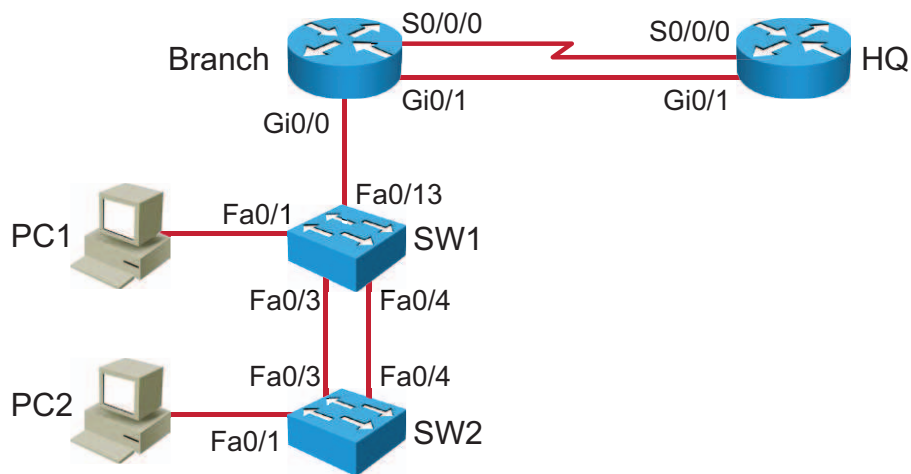
**Network requirements:** Any network that you are using to access the labs must permit the following TCP ports:

- Port 80 (HTTP)
- Port 8080 (HTTP)
- Port 443 (HTTPS)
- Higher-numbered TCP ports, 30,000 and above

For further information, see FAQ at <http://cisco.com/go/learninglabs>.

## 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_ICND1_Review_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 INIT_ICND2_Superlab_HQ.cfg
Branch	INIT_ICND1_Review_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 INIT_ICND2_Superlab_Branch.cfg

Device	Configuration Files to Copy
SW1	INIT_ICND1_Review_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 INIT_ICND2_Superlab_SW1.cfg
SW2	INIT_ICND1_Review_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 INIT_ICND2_Superlab_SW2.cfg

## Lab Details

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

### Lab S-1: Review

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

#### Objectives

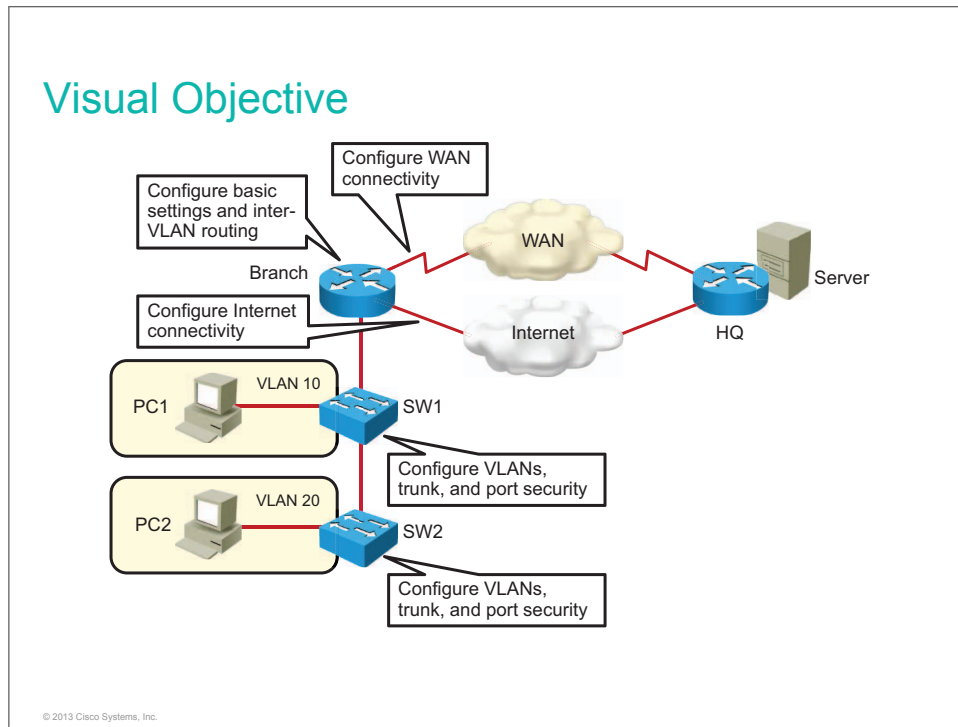
In this lab, you will consolidate the knowledge that you gained in ICND1 by configuring a simple network. After completing this activity, you will be able to meet these objectives:

- Configure basic settings, VLANs, trunks, and port security on switches
- Configure inter-VLAN routing
- Configure Internet connectivity
- Configure WAN connectivity and a dynamic routing protocol

#### Visual Objective

The figure illustrates what you will accomplish in this activity.

## Visual Objective



### Setup

Students will be configuring switch SW1, switch SW2, and the Branch router.

The table lists configurations that need to be loaded at the beginning of 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_ICND1_Review_HQ.cfg	Copy and load the configuration
Branch	INIT_ICND1_Review_Branch.cfg	Copy and load the configuration
SW1	INIT_ICND1_Review_SW1.cfg	Copy and load the configuration
SW2	INIT_ICND1_Review_SW2.cfg	Copy and load the configuration

This configuration file should be preloaded to the flash memory of the device.

### Additional Setup Notes

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

## Common Issues

When students configure port security on SW1 and SW2, they might run into trouble because they are doing remote labs. In those types of environments, there might be switches between PCs and pod switches that are sending out BPDUs. If they configure port security as restrict, they would be notified about violations. If there is no connectivity between PCs and other devices, they might need to use the **shutdown** and then the **no shutdown** commands on the switch port that connects to the PC.

## 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.

This is the review lab of ICND1 material. Since some students might have attended that course a while ago (and some might not have even attended ICND1 at all), this review lab is a great tool for the instructor to gauge the level of student knowledge.

The interface types that the students are most familiar with are probably Fast Ethernet and Gigabit Ethernet. In the task, Configure WAN Connectivity and Dynamic Routing Protocol, the students will configure an IP address on the serial interface of the Branch router. The Lab Guide explains to them that for a basic implementation, a serial connection will work with no additional configuration. In more complex implementations, there are a few optional settings. The HQ router already has a configuration in place on the serial link.

## Lab 1-1: Troubleshooting VLANs and Trunks

This topic details the lab activity for Lab 1-1: Troubleshooting VLANs and Trunks.

### Objectives

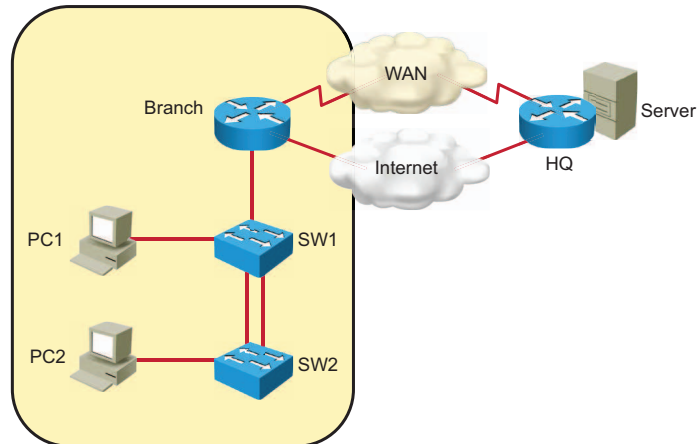
In this lab, you will explore various trouble tickets related to VLANs and trunks, identify the problems that they present, and correct the problems:

- Troubleshooting VLAN connectivity
- Troubleshoot trunk connectivity

### Visual Objective

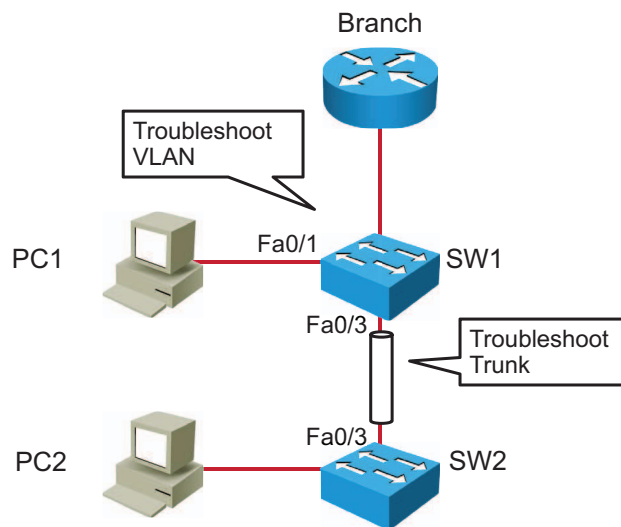
The figure illustrates what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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### 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 the **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 the 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 1-2: Optimizing STP

This topic details the lab activity for Lab 1-2: Optimizing STP.

### Objectives

In this lab, you will optimize STP. When you have completed this activity, you will be able to meet these objectives:

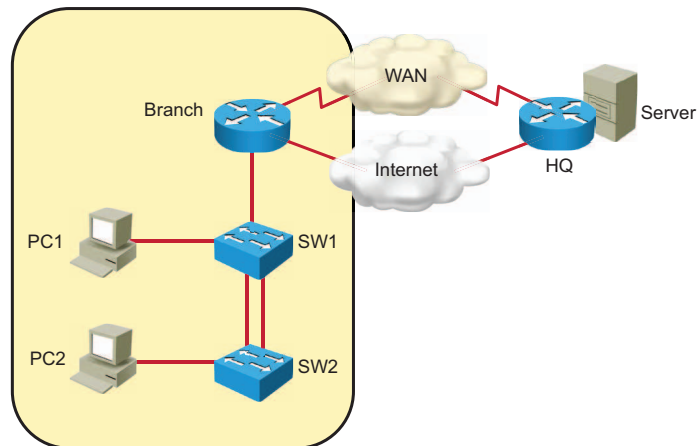
- Verify STP operation
- Influence root bridge selection
- Implement STP PortFast
- Implement STP BPDU guard

### Visual Objective

The figure illustrates what you will accomplish in this activity.

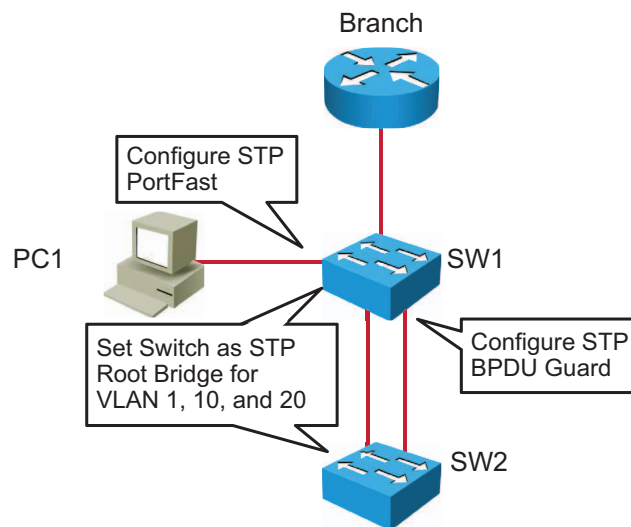


## Visual Objective



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## Detailed Visual Objective



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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_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.

### Instructor Notes

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 1-3: Configuring EtherChannel

This topic details the lab activity for Lab 1-3: Configuring EtherChannel.

### Objectives

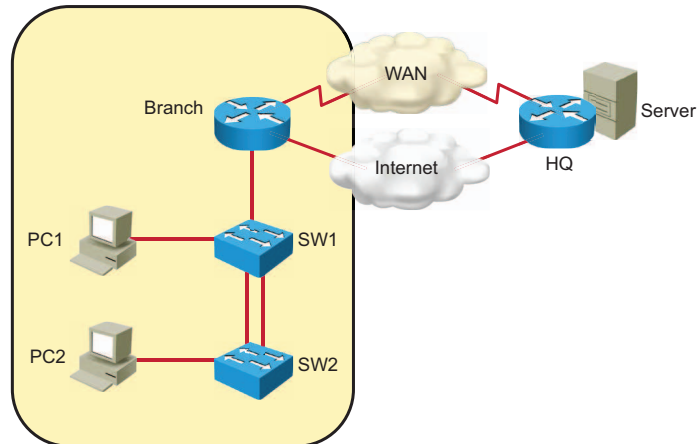
In this lab, you will become familiar with EtherChannel technology. When you have completed this activity, you will be able to meet these objectives:

- Configure EtherChannel
- Verify EtherChannel redundancy

### Visual Objective

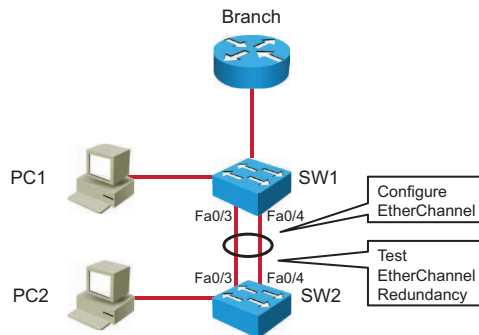
The figure illustrates what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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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 2-1: Troubleshooting IP Connectivity

This topic details the lab activity for Lab 2-1: Troubleshooting IP Connectivity.

### Objectives

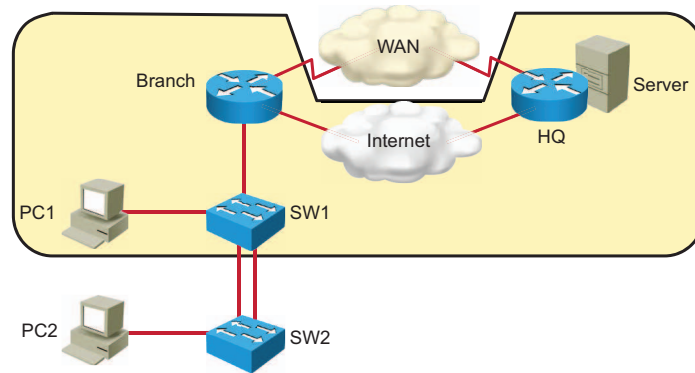
In this activity, you will explore various trouble tickets related to IP connectivity, identify the problems, and correct them. After completing this activity, you will be able to meet these objectives:

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

### Visual Objective

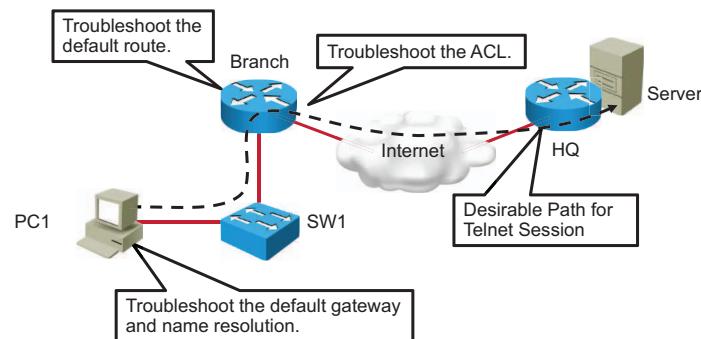
The figure illustrates what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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### 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 3-1: Implementing EIGRP

This topic details the lab activity for Lab 3-1: Implementing EIGRP.

### Objectives

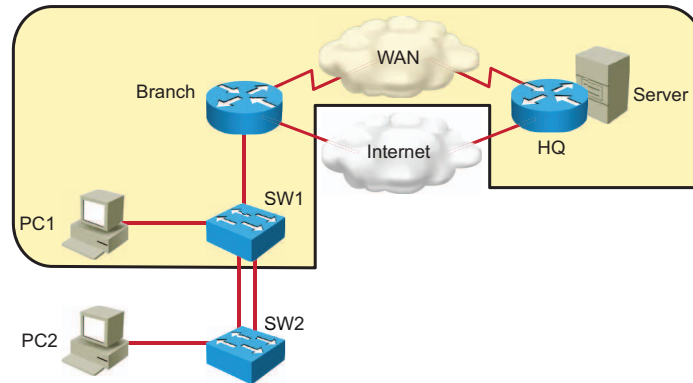
In this activity, you will configure EIGRP and investigate EIGRP neighbor events. After completing this activity, you will be able to meet these objectives:

- Verify network connectivity
- Configure and verify basic EIGRP
- Investigate EIGRP neighbor events
- Remove OSPF routing

### Visual Objective

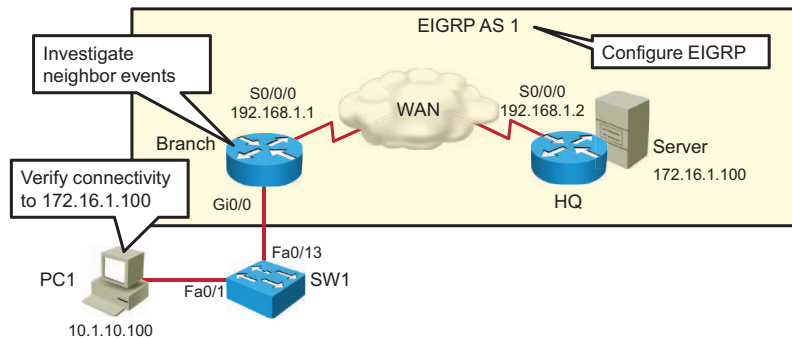
The figure illustrates what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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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_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 3-2: Troubleshooting EIGRP

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

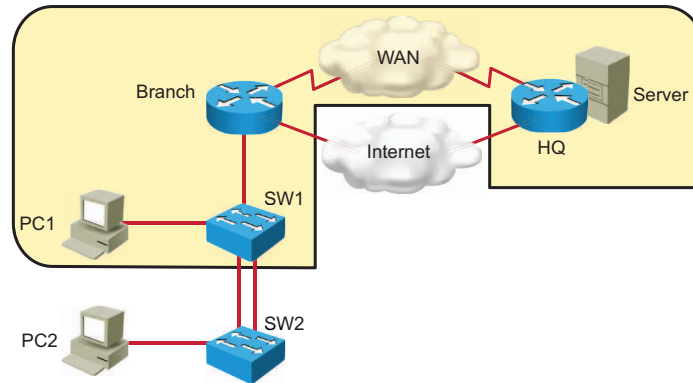
- Troubleshoot EIGRP neighbors
- Troubleshoot routing table issues

### Visual Objective

The figure illustrates what you will accomplish in this activity.

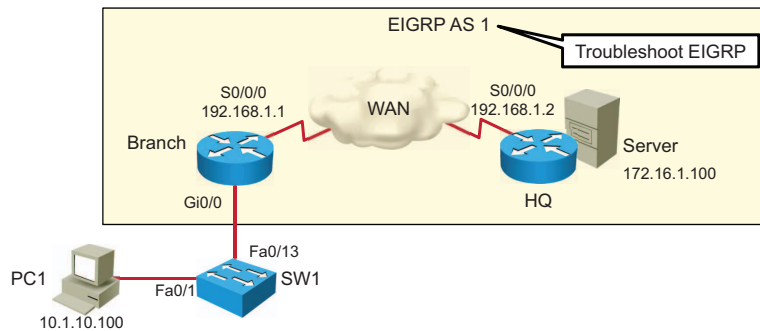


## Visual Objective



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## Detailed Visual Objective



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### 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_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 nonpassive 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 3-3: Implementing EIGRP for IPv6

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

### Objectives

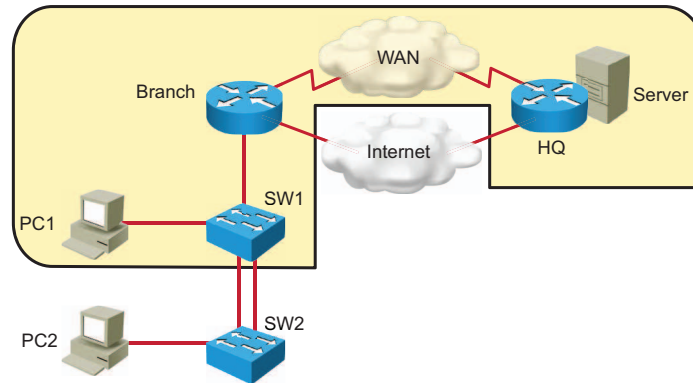
In this activity, you will configure and verify EIGRP for IPv6. After completing this lab activity, you will be able to meet this objective:

- Enable IPv6 routing and configure an IPv6 address on an interface
- Enable EIGRP for IPv6

### Visual Objective

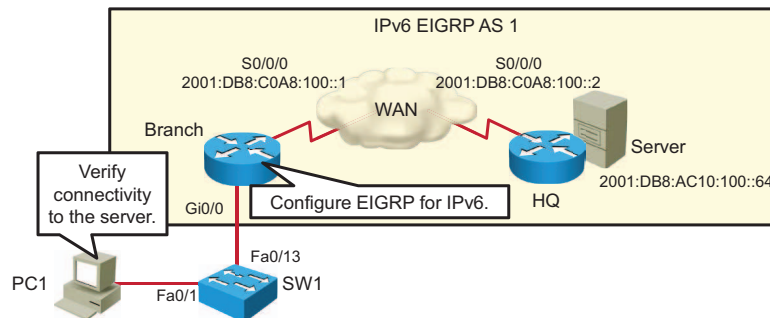
The figure illustrates what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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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_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.

### Instructor Notes

No instructor notes are necessary.

## Lab 4-1: Configuring Multiarea OSPF

This topic details the lab activity for Lab 4-1: Configuring Multiarea OSPF .

### Objectives

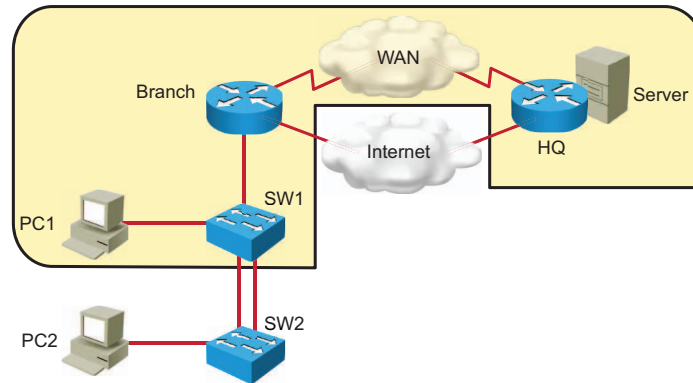
In this activity, you will remove the EIGRP routing protocol and replace it with multiarea OSPF. After completing this activity, you will be able to meet these objectives:

- Configure multiarea OSPF
- Verify multiarea OSPF configuration

### Visual Objective

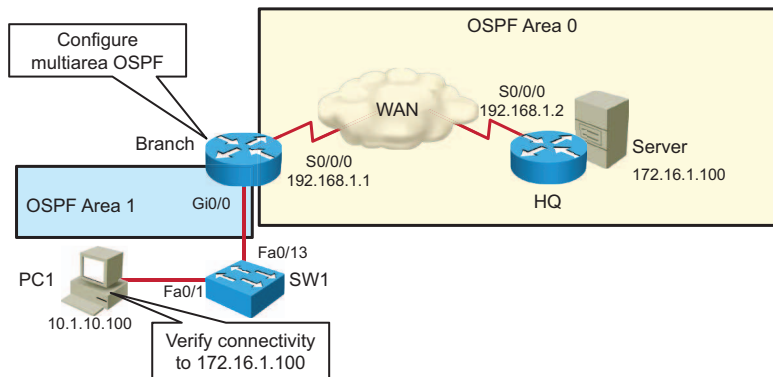
The figure illustrates what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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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 that are specified in the table (use the **configure replace configuration** command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_Config_OSPF_HQ.cfg	Copy and load the configuration
Branch	INIT_Config_OSPF_Branch.cfg	Copy and load the configuration
SW1	INIT_Config_OSPF_SW1.cfg	Copy and load the configuration
SW2	INIT_Config_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

No instructor notes are necessary.

## Lab 4-2: Troubleshooting Multiarea OSPF

This topic details the lab activity for Lab 4-2: Troubleshooting Multiarea OSPF.

### Objectives

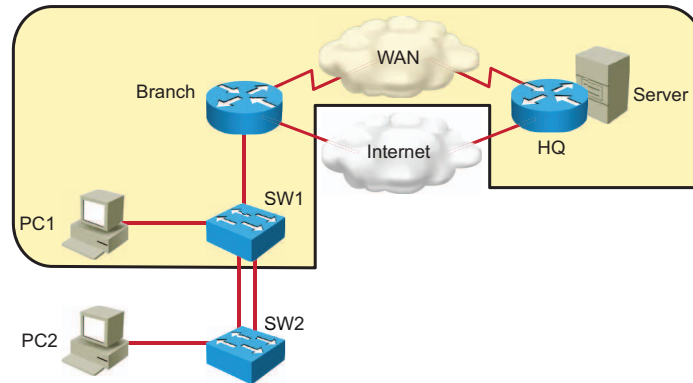
In this lab, you will be presented with two multiarea OSPF troubleshooting tickets. After this lab activity, you will be able to meet these objectives:

- Troubleshoot OSPF neighbor issues
- Troubleshoot OSPF routing table issues

### Visual Objective

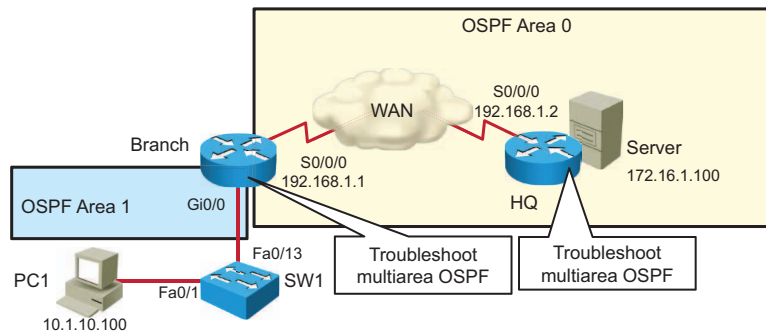
The figure illustrates what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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### 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
HQ	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 HQ 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 HQ 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 HQ router is advertising an incorrect network. The student can correct this connectivity problem by removing the incorrect **network** statement on the HQ router and replacing it with a correct one.

## Lab 4-3: Configuring OSPF for IPv6

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

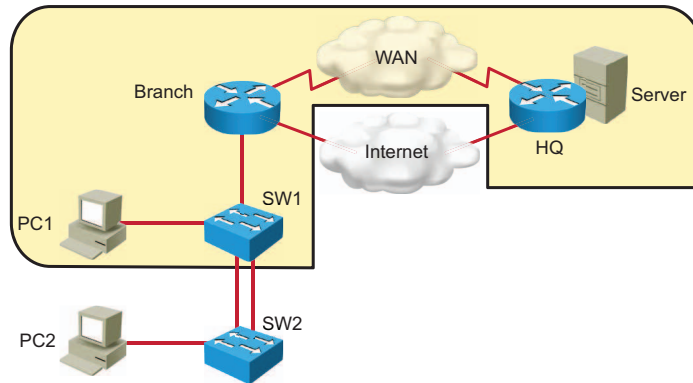
- Configure basic OSPF in an IPv6 network
- Verify the OSPFv3 configuration

### Visual Objective

The figure illustrates what you will accomplish in this activity.

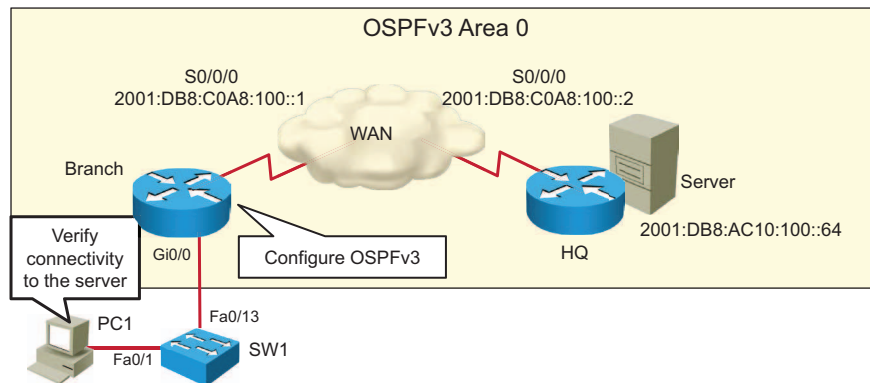


## Visual Objective



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## Detailed Visual Objective



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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 that are specified in the table (use the **configure replace** *configuration* command).

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 that are found in this lab.

### Instructor Notes

No instructor notes are necessary.

## Lab 5-1: Configuring and Troubleshooting a Serial Connection

This topic details the lab activity for Lab 5-1: Configuring and Troubleshooting a Serial Connection.

### Objectives

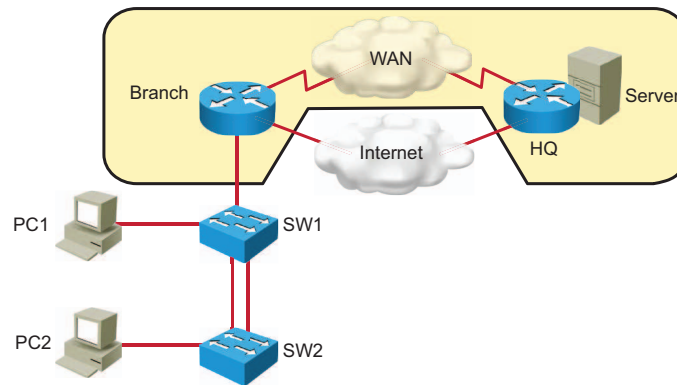
In this activity, you will first identify connectivity issues due to misconfigured PPP encapsulation and correct them. In the second part, you will change the encapsulation from PPP to HDLC. After completing this activity, you will be able to meet these objectives:

- Troubleshoot PPP encapsulation
- Configure and verify HDLC encapsulation

### Visual Objective

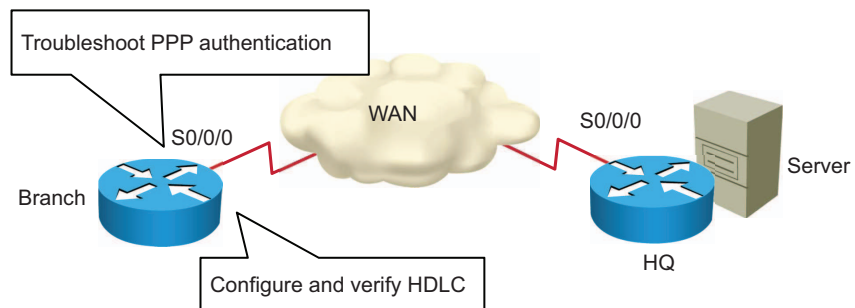
The figures illustrate what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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### 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
HQ	INIT_Serial_HQ.cfg	Copy and load the configuration
Branch	INIT_Serial_Branch.cfg	Copy and load the configuration
SW1	INIT_Serial_SW1.cfg	Copy and load the configuration
SW2	INIT_Serial_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 5-2: Establishing a Frame Relay WAN

This topic details the lab activity for Lab 5-2: Establishing a Frame Relay WAN.

### Objectives

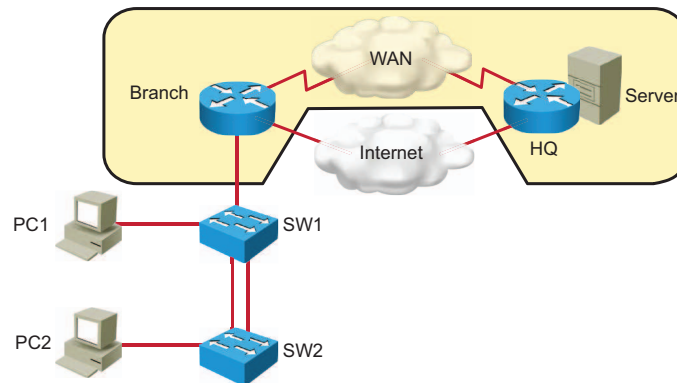
In this activity, you will configure basic Frame Relay. After completing this activity, you will be able to meet these objectives:

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

### Visual Objective

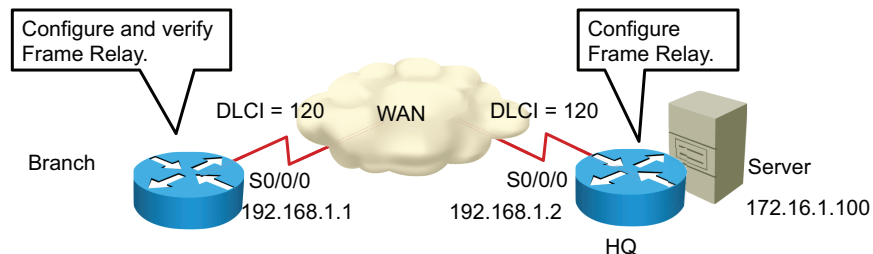
The figure illustrates what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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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 that are specified in the table (use the **configure replace** *configuration* command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_Frame_Relay_HQ.cfg	Copy and load the configuration
Branch	INIT_Frame_Relay_Branch.cfg	Copy and load the configuration
SW1	INIT_Frame_Relay_SW1.cfg	Copy and load the configuration
SW2	INIT_Frame_Relay_SW2.cfg	Copy and load the configuration

### Additional Setup Notes

No additional setup is needed for this lab.

### Common Issues

Students are instructed to copy a piece of configuration to the HQ router that enables it to act as a Frame Relay switch. If students fail to do this 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 a 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 5-3: Establishing a GRE Tunnel

This topic details the lab activity for Lab 5-3: Establishing a GRE Tunnel.

### Objectives

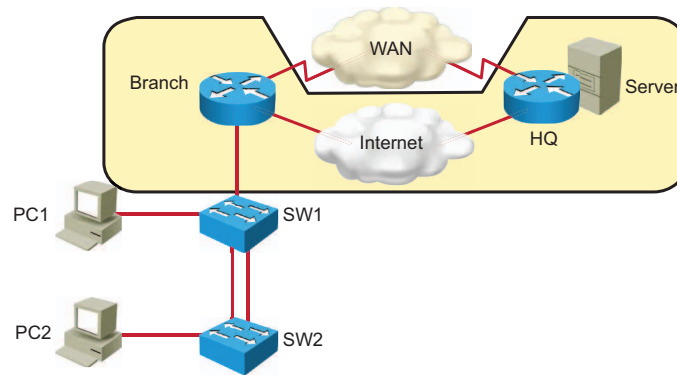
In this activity, you will implement a GRE tunnel. After completing this activity, you will be able to meet these objectives:

- Configure and verify a GRE tunnel
- Configure and verify OSPF over a GRE tunnel

### Visual Objective

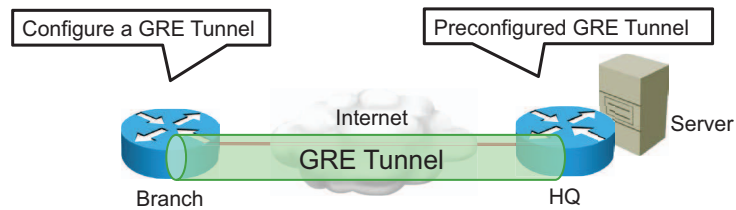
The figure illustrates what you will accomplish in this activity.

## Visual Objective



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## Detailed Visual Objective



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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 that are specified in the table (use the **configure replace configuration** command).

Device	Configuration File to Install	Configuration Instructions
HQ	INIT_GRE_Tunnel_HQ.cfg	Copy and load the configuration
Branch	INIT_GRE_Tunnel_Branch.cfg	Copy and load the configuration
SW1	INIT_GRE_Tunnel_SW1.cfg	Copy and load the configuration
SW2	INIT_GRE_Tunnel_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 6-1: SNMP and Syslog Basic Configuration

This topic details the lab activity for Lab 6-1: 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:

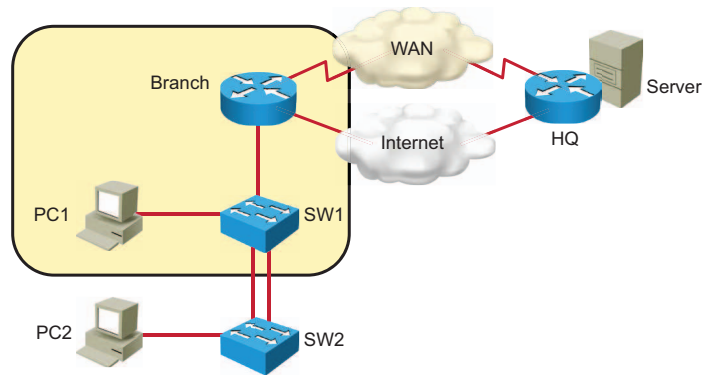
- Configure the SNMP client
- Configure the syslog client

### Visual Objective

The figure illustrates what you will accomplish in this activity.

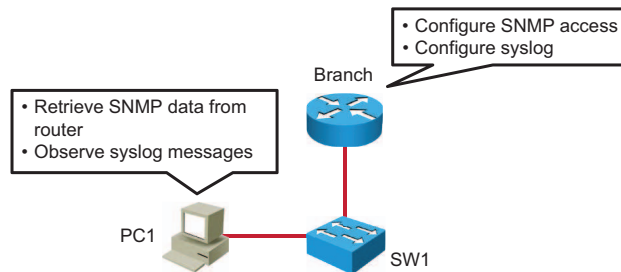


## Visual Objective



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## Detailed Visual Objective



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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 that are specified in the table (use the **configure replace configuration** command).

Device	Configuration File to Install	Configuration Instructions
HQ	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 6-2: Analyzing NetFlow Data

This topic details the lab activity for Lab 6-2: 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 NetFlow 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 6-3: Managing Cisco Devices and Licensing

This topic details the lab activity for Lab 6-3: Managing Cisco Devices and Licensing.

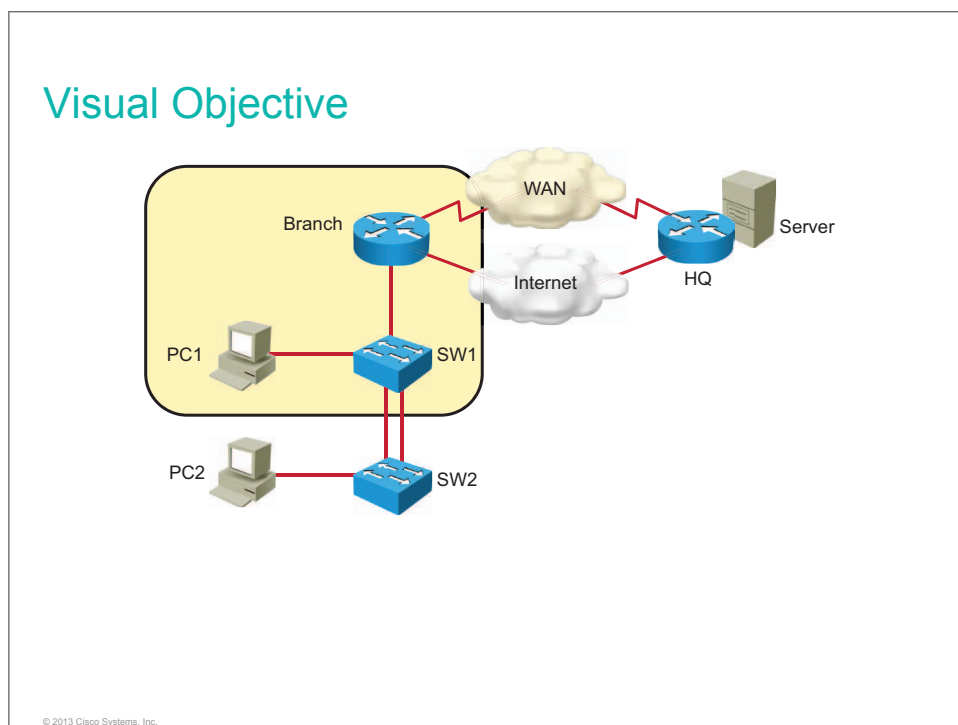
### Objectives

In this lab, you will do 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:

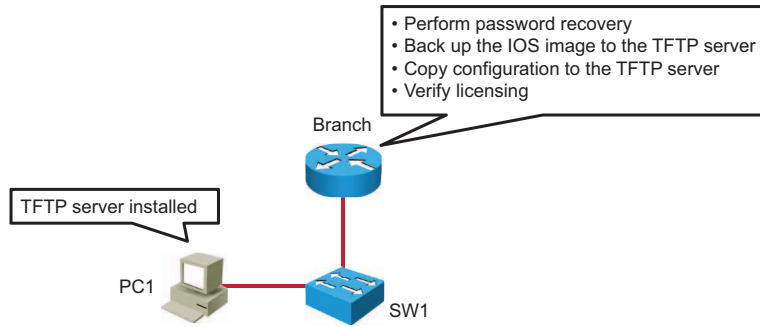
- Perform a password recovery on a router
- Back up a Cisco IOS image
- Manage a configuration file
- Verify licensing

### 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 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
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 that are found in this lab.

## Instructor Notes

How the power cycle is done depends on the lab setup:

- If you are using remote labs, lab provider might have the option to power-cycle the router via the web interface.
- If you are using local physical equipment, switch off the router and switch it on again.
- If none of the above options are available, enter privileged mode by using the enable password "forget" and reload the router using the **reload** command.

It depends on the application you are using to access lab equipment for how to send the break sequence to the router. The most common break key sequence is **Break**, **Ctrl-Break**, **Alt-B**.

## Lab S-2: ICND2 Superlab

This topic details the lab activity for Lab S-2: ICND2 Superlab.

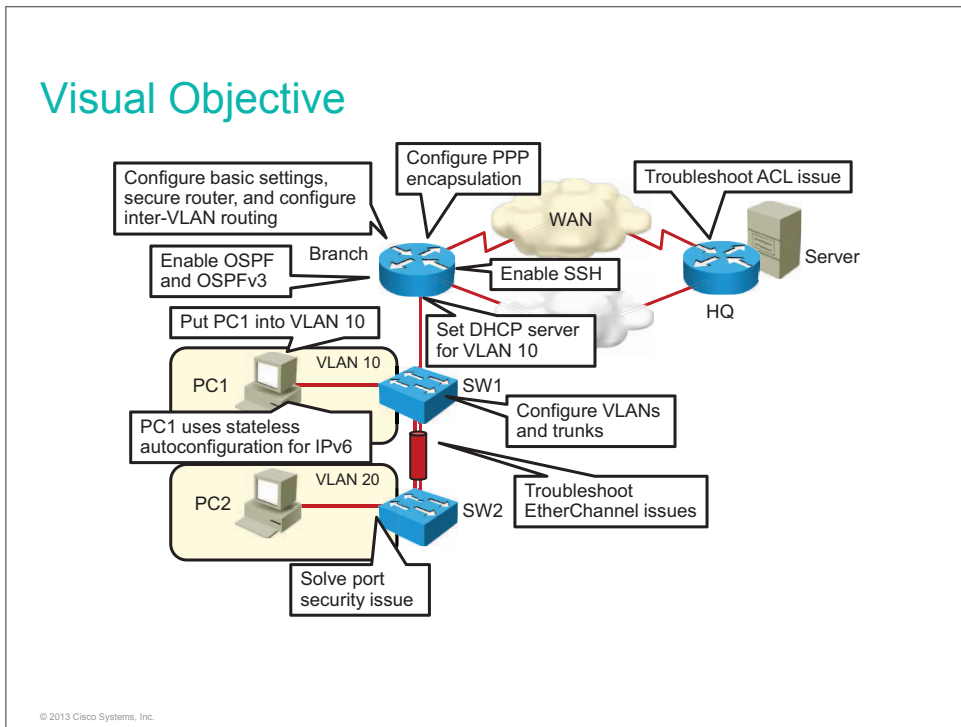
### Objectives

In this lab, you will reinforce the knowledge that you acquired through this course. You will be presented with a mix of configuration and troubleshooting tasks:

- Secure a router and configure inter-VLAN routing
- Configure basic settings, VLANs, and trunks on a switch
- Configure EtherChannel
- Configure port security
- Configure SSH on a router
- Configure a DHCP server
- Configure stateless autoconfiguration
- Configure PPP encapsulation
- Configure dynamic routing protocol
- Troubleshoot an IP access control list

### Visual Objective

The figure illustrates what you will accomplish in this activity.



## 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
HQ	INIT_ICND2_Superlab_HQ.cfg	Copy and load the configuration
Branch	INIT_ICND2_Superlab_Branch.cfg	Copy and load the configuration
SW1	INIT_ICND2_Superlab_SW1.cfg	Copy and load the configuration
SW2	INIT_ICND2_Superlab_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 4: Troubleshoot EtherChannel, the grouping of the two links between workgroup switches is not successful because of the mismatch of negotiation protocol modes (one side is PaGP, and the other side is LACP). To resolve this issue, students configure SW1 as active (LACP) to match the mode on SW2.

In Task 5: Port Security (Trouble Ticket), PC2 does not have connectivity because port FastEthernet0/1 on SW1 has an incorrect MAC address that is specified for port security. Students solve this issue by removing the current MAC configuration and replacing it with the MAC address of PC2.

In Task 12: Troubleshoot the IP Access Control List (Trouble Ticket), PC2 is not able to ping 172.16.1.100. Students resolve this ticket by editing the *denyPING* access list on the HQ router to permit ICMP echos from PC2 to the server at 172.16.1.100.





# Glossary

Term	Definition
ACL	access control list. A list kept by routers to control access to or from the router for a number of services (for example, to prevent packets with a certain IP address from leaving a particular interface on the router).
EIGRP	Enhanced Interior Gateway Routing Protocol. Advanced version of IGRP developed by Cisco. Provides superior convergence properties and operating efficiency, and combines the advantages of link-state protocols with those of distance vector protocols.
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GRE	Generic Routing Encapsulation. Tunneling protocol that was developed by Cisco and that can encapsulate a variety of protocol packet types inside IP tunnels. This process creates a virtual point-to-point link to Cisco routers at remote points over an IP network.
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.
MIB	Management Information Base. Database of network management information that is used and maintained by a network management protocol, such as SNMP or CMIP. The value of a MIB object can be changed or retrieved using SNMP or CMIP commands, usually through a GUI network management system. MIB objects are organized in a tree structure that includes public (standard) and private (proprietary) branches.
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NAT	Network Address Translation. Mechanism for reducing the need for globally unique IP addresses. NAT allows an organization with addresses that are not globally unique to connect to the Internet by translating those addresses into globally routable address space. Also known as Network Address Translator.

Term	Definition
OSPF	Open Shortest Path First. Link-state, hierarchical IGP routing algorithm proposed as a successor to RIP in the Internet community. OSPF features include least-cost routing, multipath routing, and load balancing. OSPF was derived from an early version of the IS-IS protocol.
PAT	port address translation. Translation method that allows the user to conserve addresses in the global address pool by allowing source ports in TCP connections or UDP conversations to be translated. Different local addresses then map to the same global address, with port translation providing the necessary uniqueness. When translation is required, the new port number is picked out of the same range as the original following the convention of Berkeley Standard Distribution (SD).
SME	subject matter expert. A work role description.
SNMP	Simple Network Management Protocol. Network management protocol used almost exclusively in TCP/IP networks. SNMP provides a means to monitor and control network devices, and to manage configurations, statistics collection, performance, and security.
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STP	shielded twisted-pair. Two-pair wiring medium used in a variety of network implementations. STP cabling has a layer of shielded insulation to reduce EMI.