Chapter 15: Advanced Networks

IT Essentials: PC Hardware and Software v4.0

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Purpose of this Presentation

To provide to instructors an overview of Chapter 15:

- List of chapter objectives
- Overview of the chapter contents, including
  - student worksheets
  - student labs
  - student activities
  - some potential student misconceptions
- Reflection/Activities for instructors to complete to prepare to teach
- Additional resources

Chapter 15 Objectives

- 15.1 Identify potential safety hazards and implement proper safety procedures related to networks
- 15.2 Design a network based on the customer's needs
- 15.3 Determine the components for your customer's network
- 15.4 Implement the customer's network
- 15.5 Upgrade the customer's network
- 15.6 Describe installation, configuration and management of a simple mail server
- 15.7 Describe preventive maintenance procedures for networks
- 15.8 Troubleshoot the network

Chapter 15 Worksheets, Activities, Labs

- 15.2.2 Worksheet: Protocols
- 15.3.2 Worksheet: ISP Connections
- 15.3.4 Activity: Network Devices
- 15.4.2a Lab: Browser Configuration
- 15.4.2b Lab: Network Resource Sharing
- 15.5.1 Lab: Wireless NIC Installation
- 15.5.2 Lab: Wireless Router Installation
- 15.5.3 Lab: Wireless NIC Connection Test
- 15.8.3 Lab: Network Problem
- 15.8.3 Lab: Remote Tech Network Problem

Introduction

- To meet the expectations and needs of customers and network users, a technician must be familiar with networking technologies.
- A technician must understand the basics of how a network is designed and why some components affect the flow of data on a network.
- Topics included in this chapter are:

  Advanced networking topics, including network design, network component upgrades, and email server installations

  Basic networking topics such as safety, network components, and preventive maintenance

  Troubleshooting advanced network situations

Safety Procedures

- Wear clothing that will help protect you from unexpected or toxic materials you may encounter when pulling cable through ceilings and walls.

  For example, wear long pants, long-sleeved shirts, sturdy shoes that cover your feet, gloves, and safety glasses.

- Consider safety issues when using a ladder.
- Follow safety rules when working with cables.
- Use common sense when you take care of any problems. Call another person to assist you if need help.

Fiber-Optic Safety

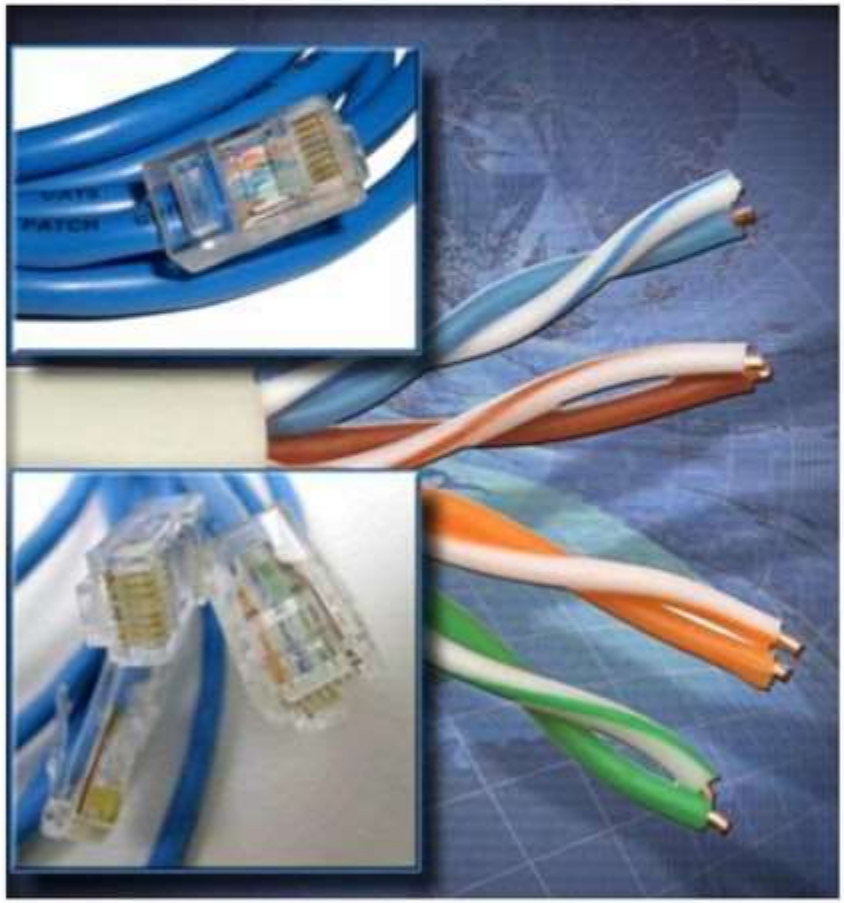
- Fiber optics are useful for communications, but they have certain hazards:
  - Dangerous chemicals
  - Light that you cannot see that can burn your eyes
  - Tools with sharp edges that produce glass splinters

- Specific types of tools and chemicals are used when working with fiber-optic cable and must be handled safely.
  - Solvents and glues
  - Tools
  - Harmful light
  - Glass shards

CAUTION: Obtain proper training before you attempt to cut, strip, or splice fiber-optic cable.

Cable Safety

- Know the hazards before working with network cable and equipment.



- **WARNING:** When handling cable, always wear eye protection. Never touch the ends of any type of cable with bare skin.
- Copper cables can be dangerous to handle
  - Sharp ends
  - Cutting and crimping tools
  - Electricity

Network Design

A network will work best if it is designed to meet the needs of your customer.

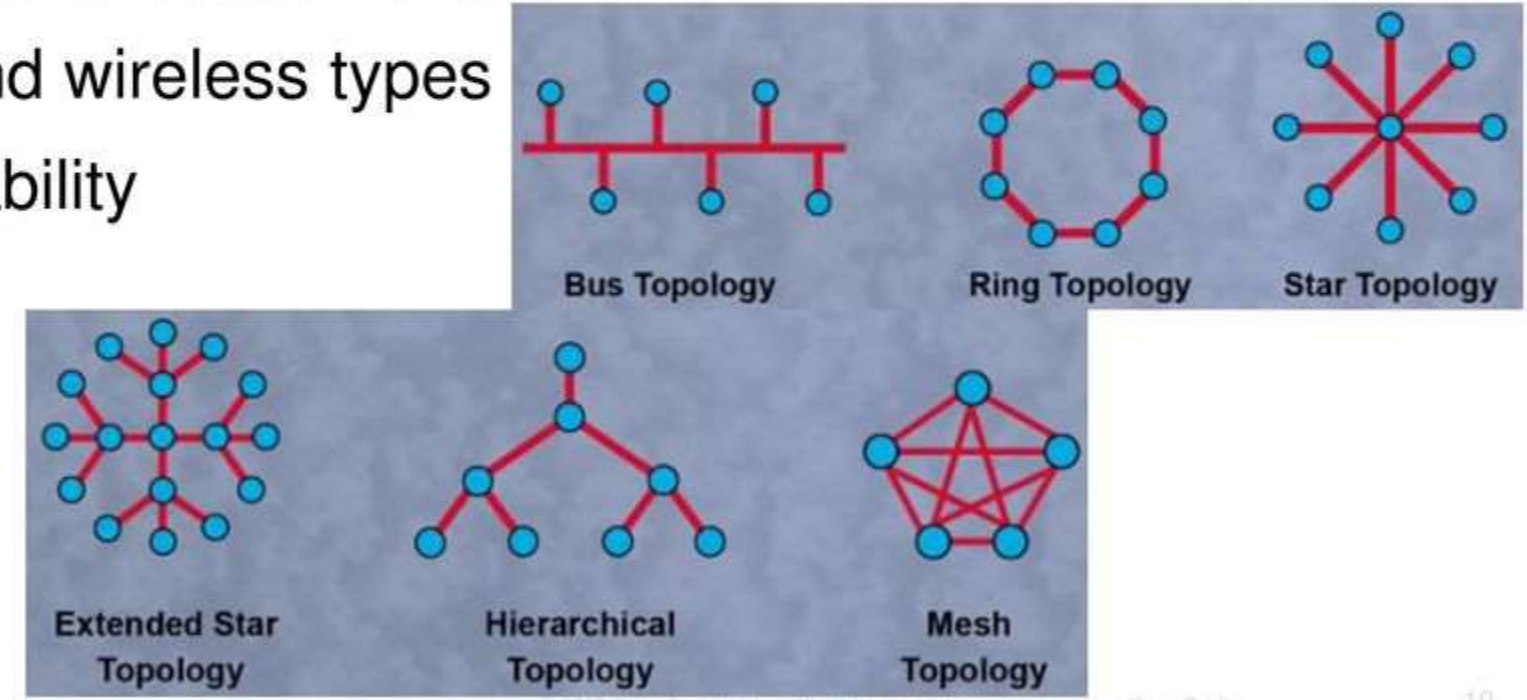
- Analyze the environment
- Understand network options
- Interview the customer and other people involved
- List hardware and software to be used
- Consider future growth of the company and the network

Determine a Network Topology

A **site survey** is a physical inspection of the building that will help determine a basic logical topology, which is the flow of data and protocols.

Considerations for topology choice:

- Number and location of users
- Cable and wireless types
- Expandability



Protocol Ports

When the TCP/IP protocol stack is enabled, other protocols become available on specific ports:

Protocols	Port	Purpose
HTTP	Port 80	Transports web pages over a TCP/IP network
HTTPS	Port 443	Securely transports web pages over a TCP/IP network
SMTP	Port 25	Sends email over a TCP/IP network
TELNET/SSH	Ports 23/22	Provides connections to computers over a TCP/IP network
FTP/TFTP	Ports 20 or 21/69	Transports files over a TCP/IP network
DNS	Port 53	Translates URLs to IP address
DHCP	Port 67	Automates assignment of IP address on a network

Components of a Network

- The network topology chosen determines the type of devices, cables, and network interface that will be required to construct the network.
- A connection to an Internet service provider (ISP) must be established.

Cable Types

Which cable type is most beneficial and cost effective for the customer?

- Types of twisted-pair copper cable: Cat5, Cat5e, Cat6, and Cat6A
- Cat5e is the most common type of cable used in a network
- Cat6A is the most recent type and it carries signals at a rate of 10 Gbps

Considerations for Cable Choice

- Installing cables is expensive, but after a one-time **expense**, a wired network is normally inexpensive to maintain.
- To make a wireless network as **secure** as wired network requires the use of encryption.
- Install the highest-grade cable available to ensure the network will handle **future network speeds**.
- A **wireless** solution may be possible in places where cables cannot be installed.

ISP Connection Types

Considerations when selecting an ISP connection type: speed, reliability, availability, and cost.

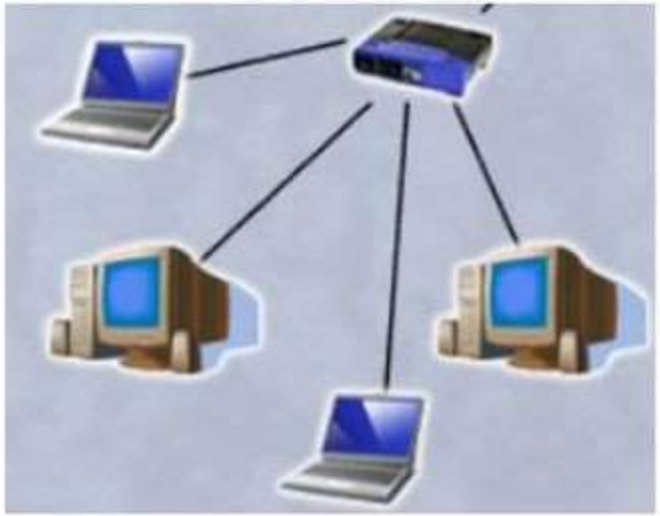
	Advantages	Disadvantages	Speed
POTS	Very common	Very slow speeds Cannot receive phone calls while connected	Max 56kbps
ISDN	Higher speeds than POTS	Still much slower than other broadband technologies	BRI – up to 128kbps PRI – up to 2.048Mbps
DSL	Low cost	Must be close to carrier	256kbps – 24Mbps
Cable	Very high speed	Slow upload speeds	384kbps – 27Mbps
Satellite	Available when DSL and cable are not	Significant lag, more expensive than other broadband technologies	9kbps – 24Mbps
Wireless	Scalable to customer needs	Very expensive Limited market availability	Up to 45Mbps

Select Network Interface Cards (NICs)

Considerations include speed, form factor, and capabilities of NIC and of hub or switch.

- Most NICs for desktops are either integrated into the motherboard or are an expansion card that fits into an expansion slot.
- Most NICs for laptops are either integrated into the motherboard or fit into a PC Card or ExpressBus expansion slot.
- USB network adapters plug into any available USB port and can be used with both desktops and laptops.

Select Network Device



- Hub
  - Sends all traffic received out all ports
  - Regenerates traffic that passes through it
- Switch
  - Filter and segment network traffic by sending only to the destination device
  - Higher dedicated bandwidth provided to each network device
- Router
  - Connects networks together (example: connects a home network to the Internet)
  - Wireless routers also act as a firewall
- ISP equipment
  - A cable or DSL modem

Installation Checklist

Careful planning will help ensure an easier and faster network installation.

- ☑ All parts are in
- ☑ Installation scheduled
- ☑ Backups are available
- ☑ Access to needed passwords
- ☑ Extra supplies handy
- ☑ Install components
- ☑ Test components

Network Installation

1. To install cable in ceilings and behind walls, perform a **cable pull**. Terminate each end of every cable. Label the ends of every cable.
2. Test the cables for shorts or interference.
3. Install NICs in network devices. Configure client software and IP address information on all devices.
4. Install switches and routers in a secured, central location.
5. Install patch cables from wall connections to devices. Check NICs for link lights on all devices.
6. Test the network for connectivity. Configure and test network applications.

Configure a Web Browser

- Configure settings and perform maintenance tasks

  Microsoft Internet Explorer (IE) > Tools menu > Internet Options…

- Occasionally delete the **Temporary Internet files**

- Confirm which web browser is the default browser

  Select **Start > Run**, enter a website address and click **OK**

Share Network Resources

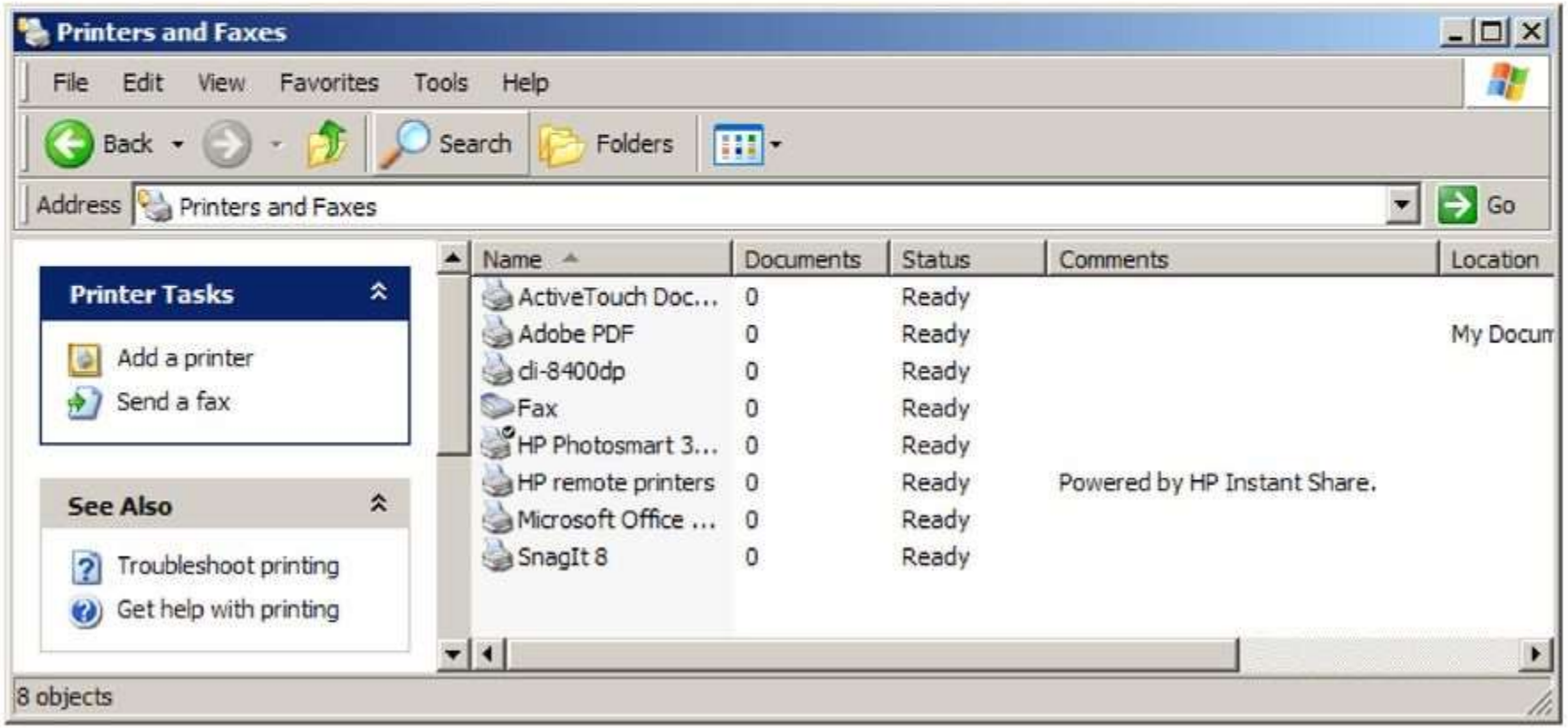
To share a single file, multiple folders filled with files and folders, or an entire drive:

1. Copy the item to share to a folder
2. Right-click the folder and select **Sharing and Security**
3. Select **Share this folder**
4. Identify who can access the folder and which permissions they have

Share Network Resources

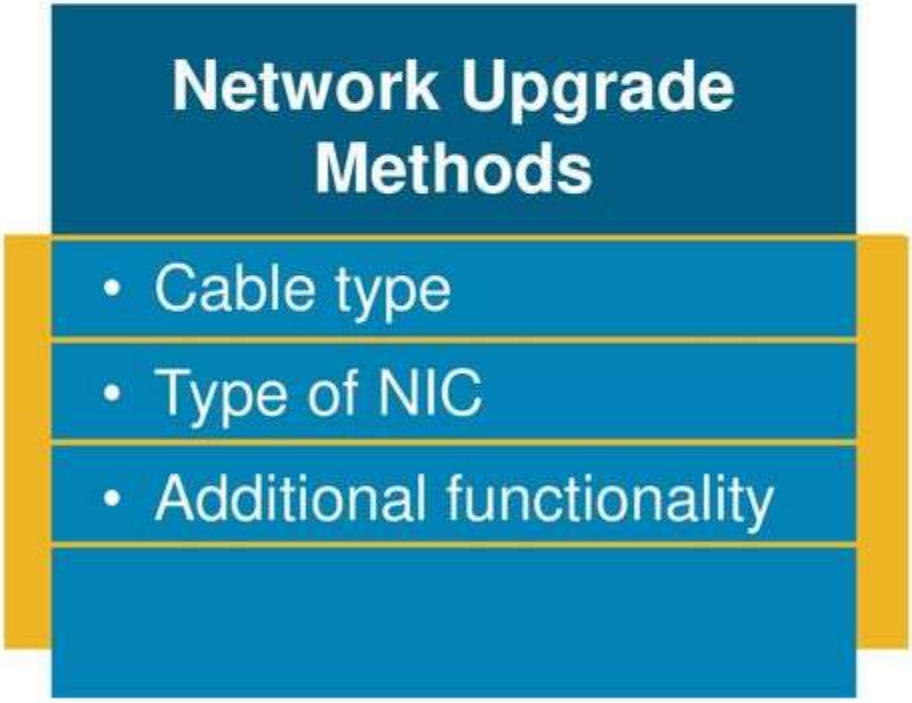
To share a printer:

1. Select **Start > Control Panel > Printers and Faxes**



Network Upgrades

- You must be able to upgrade, install, and configure components when a customer asks for increased speed or new functionality to be added to a network.



Install and Configure Wireless Adapter

- Before purchasing a wireless adapter, make sure it is compatible with other wireless equipment that is already installed on the network.
- To install a PCI wireless adapter:
  - The adapter must be the correct form factor to fit the computer
  - Remove the case cover
  - Install the NIC into an open PCI slot or PCI express slot
  - Configure device drivers
  - Enter network address information

Install and Configure Wireless Router

1. Position wireless router for maximum coverage.
2. Connect the wireless router to the existing network. Connect a DSL or cable modem to the wireless router. Connect one computer to any of the remaining ports to access the configuration web pages.
3. Turn on the broadband modem and plug in the power cord to the router. When the modem finishes establishing connection to the ISP, the router automatically communicates with the modem to receive network information from the ISP: IP address, subnet mask, and DNS server addresses.

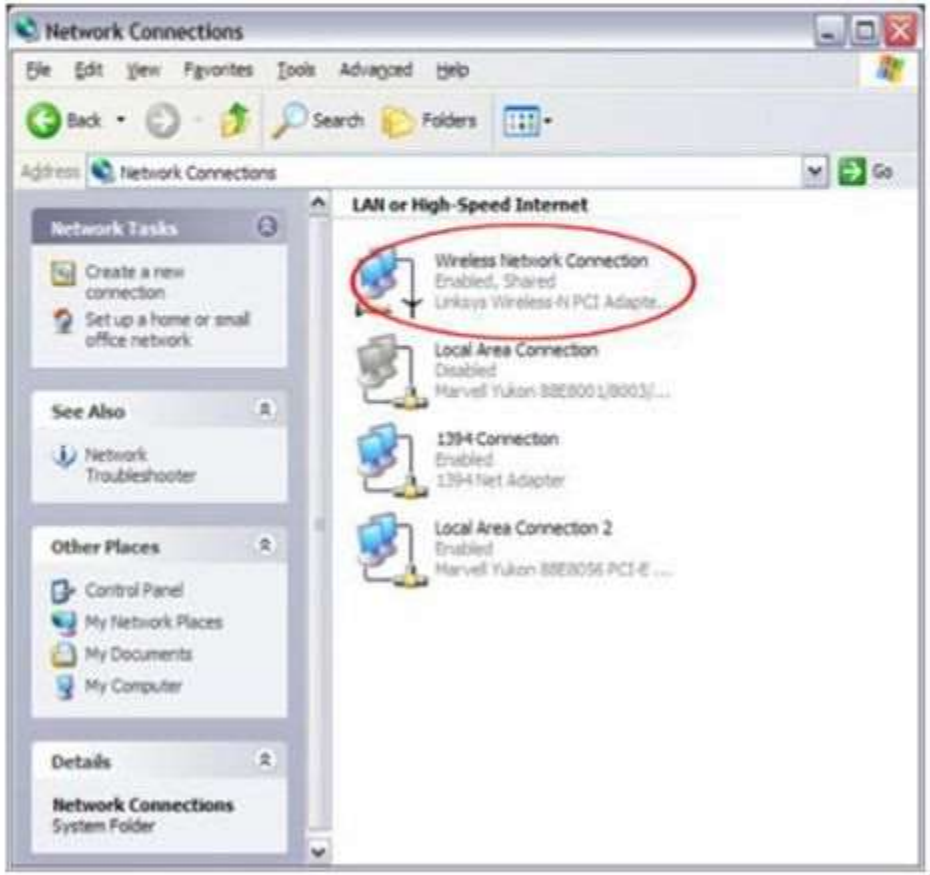
Install and Configure Wireless Router

The following steps are specific to the Linksys WRT300N router:

4. Turn on the computer that is connected to the router and open a web browser. In the Address field, enter **192.168.1.1** to go to the default address for router configuration and management.
5. A security window opens prompting you for authentication to access the router configuration screens. The user name field should be left empty. Enter **admin** as the default password.
6. Click **Save Settings** at the bottom of each screen after making any changes.

Test Network Connection

- Open a web browser and see if the Internet is available.



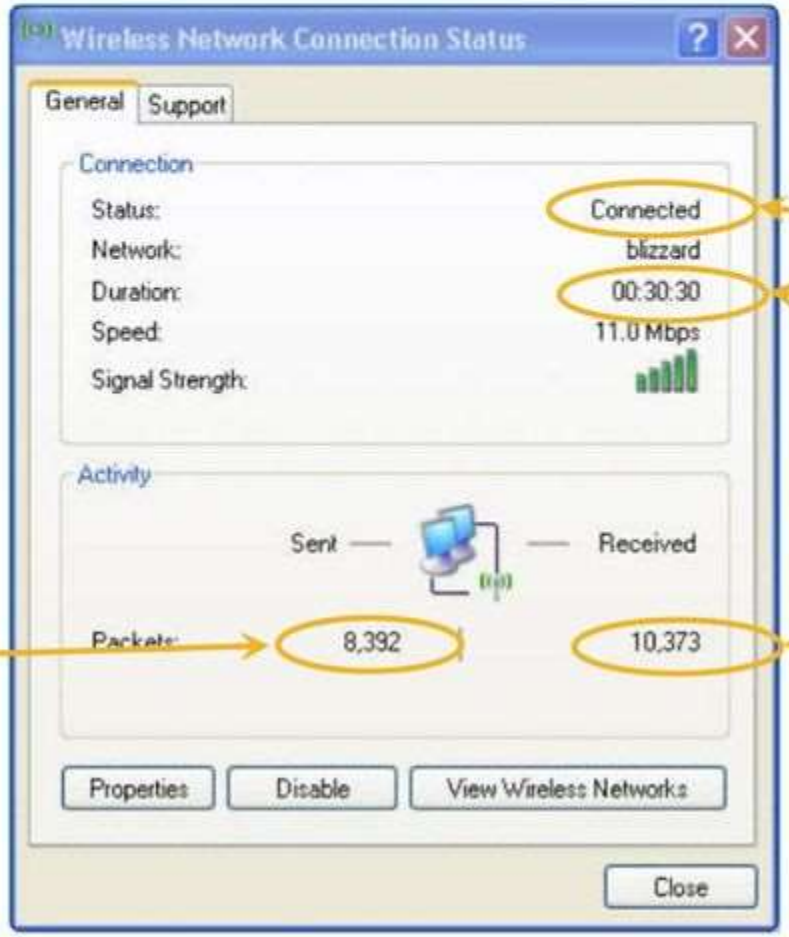
- To troubleshoot a wireless connection, you can use the Windows GUI or CLI.

  Select **Start > Control Panel > Network Connections**.

  Double-click on the wireless network connection to display the status.

Connection Status

The **Connection Status** screen displays the number of packets that have been sent and received.



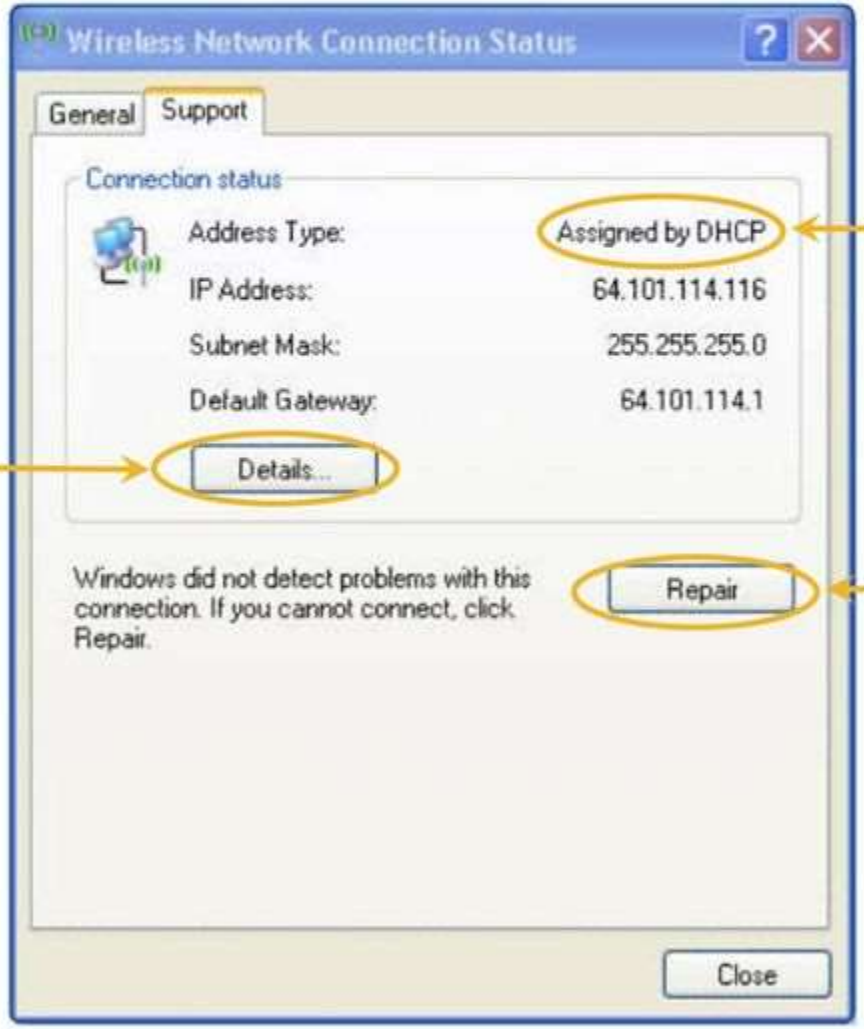
connection status

duration of connection

# of packets sent

# of packets received

Support Tab of Connection Status



Static or dynamic

View MAC address and other information

Reset the connection information and establish new

Ipconfig Commands

- Used to verify basic IP address information

ipconfig Commands	Purpose
ipconfig /all	Displays full configuration of all network adapters
ipconfig /release	Releases the IP address of a network adapter
ipconfig /renew	Renews the IP address of a network adapter
ipconfig /flushdns	Empties the cache that stores DNS information
ipconfig /registerdns	Refreshes DHCP leases and re-registers the adapter with DNS
ipconfig /displaydns	Shows DNS information in the cache

Ping Command

- To confirm that your adapter is working properly, ping your NIC.

  Select **Start > Run > cmd**.

  At the command prompt, enter **ping localhost**.

- To confirm that your WAN connection is working properly, ping your default gateway.

  Find the address for the default gateway by using the ipconfig command.

- To test the Internet connection and DNS, ping a popular website.

- The response shows replies from the ping or that the request timed out because there is a problem.

Tracert Command

- Traces the route that packets take from your computer to a destination address.

  Select **Start > Run > cmd**.

  At the command prompt, enter **tracert**.

- The first listing in the window for the tracert result is your default gateway.
- Each listing after that is the router that packets are traveling through to reach the destination.
- Tracert will show you where packets are stopping, indicating where the problem is occurring.

Email Protocol Comparison

A technician should know the advantages and disadvantages of each email protocol.

Protocol	Advantages	Disadvantages	Port	Send Mail	Retrieve Mail
SMTP	Delivers email from one server to another Can send mail directly to the destination	Client upload only	25	Yes	No
POP	Simple Supports intermittent connections	Download only Cannot manage the mail on the server	110	No	Yes
IMAP	Simple More features than POP Stores mail on server Faster than POP Allows simultaneous access by multiple clients	Requires more disk space and CPU resources	143	No	Yes

Email Server Setup

- Active directory servers, global catalog servers, and domain name servers (DNS) servers must all be in place and functioning before Exchange can be installed and work properly.
- Test the environment before installing Exchange.
- Set up the services required and install Exchange on a dedicated set of servers away from the main network.
- Keep the installation of Exchange separated from your production network until you are sure that it is functioning properly.

Prepare for Email Installation

Be prepared with proper equipment and information:

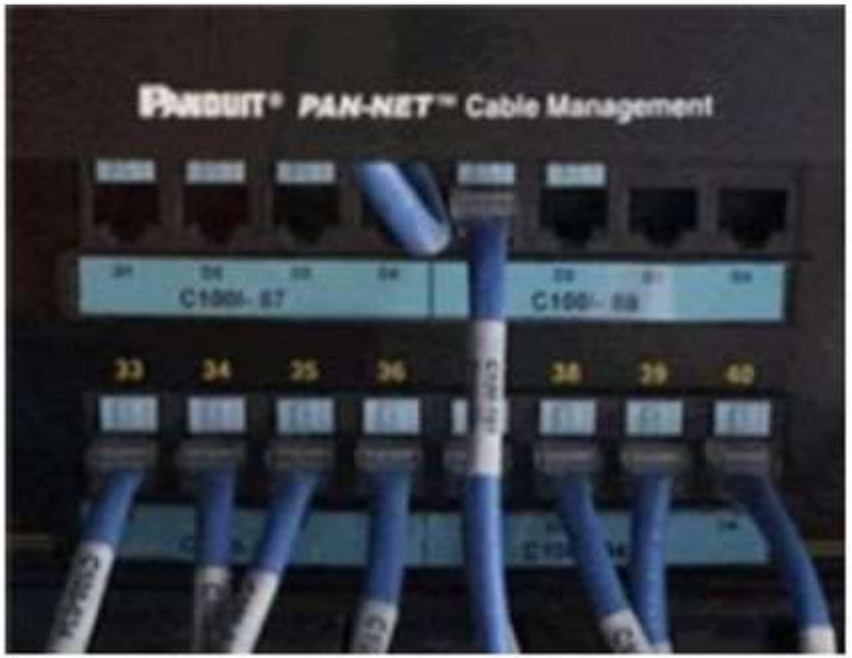
- DNS deployment
- Active Directory domain
- At least one Global Catalog
- Windows 2000 or higher native domain functionality
- Exchange server software
- Windows server support tools
- Schema master server
- High-speed Internet connection

Email Installation

- Add Internet Information Services (IIS) using the Add/Remove Windows Components wizard before initiating the installation of the Exchange server.
- Insert the Exchange installation CD and begin the New Exchange installation wizard.
- The wizard will verify that Exchange is ready to be installed.
- Once Exchange is installed, the Microsoft Management Console provides access to many settings. The Exchange System Manager is used to manage the options of the server.
- Use the Active Directory Users and Computer (ADUC) console to configure a user's mailbox.

Preventive Maintenance

- Check the condition of cables, network devices, servers, and computers to make sure that they are kept clean and are in good working order.
- Develop a plan to perform scheduled maintenance and cleaning at regular intervals.
- If you notice equipment is failing, damaged, or making unusual sounds, then inform the network administrator to prevent unnecessary network downtime.
- Educate network users by demonstrating to them how to properly connect, disconnect, and move cables.



Troubleshooting Process

Step 1 Gather data from the customer

Step 2 Verify the obvious issues

Step 3 Try quick solutions first

Step 4 Gather data from the computer

Step 5 Evaluate the problem and implement the solution

Step 6 Close with the customer

1. Gather Data from the Customer

- Customer information

  Company name, contact name, address, phone number

- Laptop information

  Manufacturer, model, OS, network environment, connection type

- Description of problem

  Open-ended questions

  Is there anything else you can tell me about the problem?

  Closed-ended questions

  Have you rebooted the equipment?

2. Verify the Obvious Issues

Examine the most obvious causes of a problem.

- What is your IP information?
- Are the settings on the network equipment correct?
- Is there activity on the wireless router?
- Is there activity on the modem?
- Is your wireless client configured correctly?
- Has your network connection been disabled?

3. Try Quick Solutions First

A quick solution can save time and money.

- Restart the equipment.
- Renew the IP address.
- Flush DNS.
- Roll back a driver.
- Return to previous saved restore point.

NOTE: Remember to document each solution you try, as well as every outcome. You should undo failed solutions before implementing additional solutions. Otherwise, problems may begin to compound each other.

4. Gather Data from the Computer

Ways to gather information about a network problem:

- **Device manager** - Make sure that the NIC is properly installed.
- **Event viewer** - Check for system and hardware errors.
- **ipconfig** - Check that the IP address is properly configured.
- **Ping the localhost** - Make sure that the NIC is working properly.
- **Ping the default gateway** - Make sure the computer can reach the default gateway.
- **Ping a popular website** - Make sure the computer can reach the Internet using DNS.
- **Verify wireless router configuration**
- **Verify email client configuration**

5. Evaluate Problem & Implement Solution

- Problem solving experience
- Other technicians
- Internet search
- News groups
- Manufacturer FAQs
- Computer manuals
- Device manuals
- Online forums
- Technical websites

6. Close with the Customer

- Discuss with customer the solution implemented.
- Have customer verify problem is solved.
- Provide all paperwork to customer.
- Document steps of solution in the work order and in the technician's journal.
- Document components used in repair.
- Document time spent to resolve the problem.

Common Problems and Solutions

Problem Symptom	Possible Solution
Users report that a network printer is increasingly unreliable. The network cable travels under a desk and has become frayed and pinched.	Replace and reroute the network printer cable.
The user's Connection Status screen shows less than a dozen packets sent and received, even though the computer has been on for hours.	The wireless connection has failed. Reset the wireless adapter card, click Repair to refresh the IP address, and check again.
A user is making many changes in the configuration of a WRT300N wireless router, but the changes do not seem to remain in effect.	The user must click Save Settings at the bottom of each screen after making any changes.
A user receives a warning message that hard drive space is low.	Locate the folder where web browser or temporary files are stored and verify the folder size is a problem. Use Disk Cleanup to delete the temp files, the browser clean up utility, or manually delete them.
A network has become slow as more users are added. All users connect to a 24-port hub.	Replace the hub with a switch.

Apply Troubleshooting Skills

- It is time to apply your listening and diagnostic skills.

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15.8.3 Remote Technician: Fix a Security Problem

Print and complete this lab.

In this lab, you will gather data from the customer, and then instruct the customer on how to fix a computer that does not connect to the wireless network. Document the customer's problem in the work order below.

Company Name: Smith Lumber Supply
Contact: James Smith
Company Address: 1234 S. Main Street
Company Phone: 801-555-1212

Work Order

Generating a New Ticket

Category Security | Closure Code Open | Status Urgent

Type _____ | Escalated Yes | Pending _____

Chapter 15 Summary

- Security threats can come from inside or outside of an organization.
- Viruses and worms are common threats that attack data.
- Develop and maintain a security plan to protect both data and physical equipment from loss.
- Keep operating systems and applications up to date and secure with patches and service packs.

Instructor Training Activities

Activities for Instructor Training

1. Take the Quiz provided in Chapter 15 course content.
2. Complete the 2 worksheets, activity and 7 labs included in Chapter 15. While you are completing these, make notes of potential issues and questions that students may have.

Instructor Training Discussion

- Share and discuss with the other instructors, your list of any potential student issues and questions regarding the worksheets, activity and labs.

Additional Resources

- Whatis?com: IT Encyclopedia and Learning Center http://whatis.com
- TechTarget: The Most Targeted IT Media http://techtarget.com
- ZDNet: Tech News, Blogs and White Papers for IT Professionals http://www.zdnet.com
- HowStuffWorks: It's Good to Know http://computer.howstuffworks.com
- CNET.com http://www.cnet.com
- PC World http://www.pcworld.com
- ComputerWorld http://www.computerworld.com
- WIRED NEWS http://www.wired.com
- eWEEK.com http://www.eweek.com

Q and A