

# The Internet and Its Uses

## Objectives

After completing this chapter, you should be able to answer the following questions:

- How is the Internet evolving?
- How do businesses and individuals use the Internet?
- What is the importance of standards in the continuing growth of the Internet?
- What is the role of an Internet service provider (ISP)?
- How does the hierarchical structure of the Internet allow the efficient movement of information?
- What are a point of presence (POP) and an Internet Exchange Point (IXP)?
- What types of devices do ISPs use to provide services?
- What is scalability, and why is it important in the ISP network?
- What support teams work at an ISP, and what is their purpose?

## Key Terms

This chapter uses the following key terms. You can find the definitions in the glossary.

*Internet* page 2

*electronic commerce (e-commerce)* page 2

*Request for Comments (RFC)* page 3

*Internet service provider (ISP)* page 4

*bandwidth* page 4

*digital subscriber line (DSL)* page 5

*Metro Ethernet* page 7

*point of presence (POP)* page 7

*Internet Exchange Point (IXP)* page 7

*Network Access Point (NAP)* page 7

*Tier 1 ISP* page 9

*Tier 2 ISP* page 9

*Tier 3 ISP* page 9

*Internet Control Message Protocol (ICMP)* page 9

*transport network* page 12

*DSL access multiplexer (DSLAM)* page 13

*cable modem termination system (CMTS)* page 13

*scalable network* page 14

The globalization of the Internet has occurred faster than anyone could have imagined. The manner in which social, commercial, political, and personal interactions occur is rapidly changing to keep pace with the evolution of the Internet. This expansion has created a wider audience and a larger consumer base for whatever message, product, or service can be delivered. Today millions of individuals are connected to this global network, and the number is growing. This chapter discusses the importance of standards in maintaining this rapid growth and provides an overview of the hierarchical structure of the Internet and the role of the ISP.

Part II of this book includes the corresponding labs for this chapter.

## What Is the Internet?

The *Internet* is a worldwide, publicly accessible network of networks. Through interconnected computer networks, the Internet enables individuals and businesses to share information, resources, and services. Because no single individual or group of individuals controls the Internet, it is imperative that certain rules and guidelines are adhered to so that it can function efficiently.

## The Internet and Standards

In the beginning, the Internet was used strictly for scientific, educational, and military research. In 1991, regulations changed to allow businesses and consumers to connect as well. Since that time, the Internet has grown rapidly and now covers the globe. New technologies are continuously being developed that make the Internet easier and more attractive to use. Online applications are available to the Internet user, including e-mail, web browsing, streaming music and video, online gaming, and instant messaging.

The way people interact, share information, and even do business is changing to keep up with the continuous evolution of this global network. The Internet is creating a wider audience and consumer base for whatever message, product, or service can be delivered. For many businesses, having Internet access has become critical, not only for communication, but also for day-to-day operation. This includes e-commerce, communications, and collaboration and training, as shown in Figure 1-1 and described in the next sections.

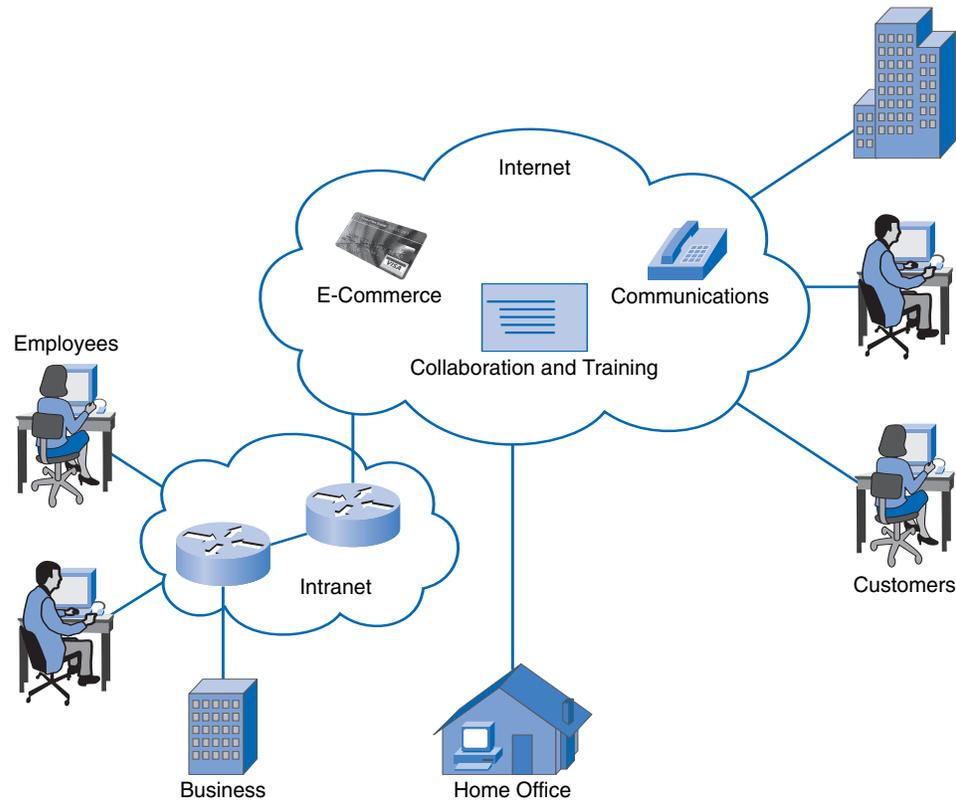
### E-Commerce

*Electronic commerce (e-commerce)* is any business activity that can be conducted over the web. This includes using web space for advertisements, brochures, and catalogs, as well as ordering and distribution services. Companies can sell products and services over the Internet from their own websites, through auction sites, or through affiliated websites.

### Communications

Communications refers to any electronic method of communication, such as the use of e-mail, instant messaging, and online chat. In addition, many businesses use internal phone systems that operate over the Internet using IP phones and voice over IP (VoIP) technology to reduce phone costs.

Figure 1-1 Common Uses for the Internet



## Collaboration and Training

The Internet enables the sharing of documents, presentations, and spreadsheets among users around the world. It allows teams of people to work together virtually from remote locations for business and training purposes. Examples include videoconferencing, virtual meeting places, virtual classrooms, online learning, online bulletin boards, FTP sites, and password-protected databases and applications.

With the increasing number of new devices and technologies coming online, it is important that all users and technologies adhere to a set of rules or guidelines. This allows services such as e-mail to be reliably delivered to all users. These rules and guidelines are known as *Internet standards*.

A standard is a set of rules for how something must be done. Networking and Internet standards ensure that all devices connecting to the network use the same set of rules. By having standards, different types of devices can send information to each other over the Internet. For example, an e-mail message is formatted, forwarded, and received by all devices in a standardized manner. If someone sends an e-mail via a PC, someone else can use a mobile phone to receive and read the e-mail as long as the mobile phone uses the same standards.

An Internet standard is the end result of a comprehensive cycle of discussion, problem solving, and testing. When a new standard is proposed, each stage of the development and approval process is recorded in a numbered *Request for Comments (RFC)* document so that the evolution of the standard is tracked.

Thousands of Internet standards help define the rules for how devices communicate on networks. These different standards are developed, published, and maintained by a variety of organizations. These include the International Organization for Standardization (ISO), Institute of Electrical and Electronics Engineers (IEEE), Internet Corporation for Assigned Names and Numbers (ICANN), Internet Assigned Numbers Authority (IANA), and Internet Engineering Task Force (IETF). Because these organizations create and maintain standards, millions of individuals can connect to the Internet using a variety of devices, including PCs, cellular phones, handheld personal digital assistants (PDA), MP3 players, and even televisions.

## ISPs and ISP Services

Regardless of the type of device an individual or business uses to connect to the Internet, the device must connect through an *Internet service provider (ISP)*. An ISP is a company or organization through which a subscriber obtains Internet access. A subscriber can be a business, a private consumer, a government body, or even another ISP.

Users connect to the ISP through a Point of Presence (POP) using a variety of access technologies. In addition to offering connection to the Internet, an ISP can offer a variety of other services:

- **FTP hosting:** The ISP provides the server and application software for a business FTP site.
- **Applications and media hosting:** The ISP provides the server and software to allow a business to provide streaming media such as music, video, or applications such as online databases.
- **Technical support:** Many businesses do not have the in-house technical expertise to manage large internal networks. Some ISPs provide technical support and consulting services for an additional fee.
- **Voice over IP:** A business can save on long-distance telephone charges, especially for internal calls between geographically distant offices, by using VoIP.
- **Equipment co-location:** A business may opt to have some or all internal network equipment physically located on the ISP premises.
- **Web hosting:** The ISP provides the server and application software for storing web pages and web content for the business website.



### Interactive Activity 1-1: Which ISP Is Best? (1.1.2)

In this activity, you determine the best ISP for a given scenario. Use file d2ia-112 on the CD-ROM that accompanies this book to perform this interactive activity.

---

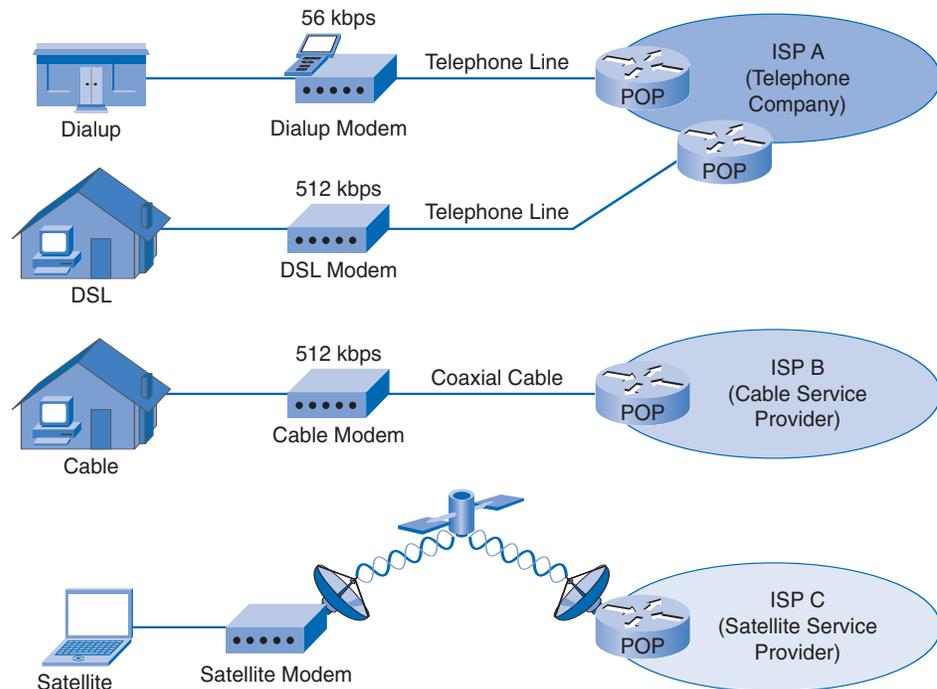
## Internet Service Providers

Although ISPs offer their clients many different services, their main role is to provide a connection to the Internet. The actual type of connection varies according to the region. Not all connection types are available in all areas. Some connection options provide continuous connection, and others provide connection only when required. *Bandwidth*, both upstream and downstream, varies between the different options and must match the requirements of the individual or business. Bandwidth is measured in bits per second (bps), kilobits per second (kbps), megabits per second (Mbps), or gigabits per second (Gbps).

## Delivering Internet Services to End Users

ISPs offer various connection options for home and business users. The main connection methods used by home and small business users include dialup, DSL, cable, and satellite connections. These are shown in Figure 1-2.

**Figure 1-2 Internet Connection Technology for Home and Small Business**



This section describes these connection methods as well as dedicated bandwidth options and the role of a point of presence (POP).

### Dialup Access

Dialup access is an inexpensive option that uses a phone line and a modem. To connect to the ISP, a user calls the ISP access phone number. With connection speeds of about 56 kbps, dialup is the slowest connection option. At this speed it would take approximately 12 minutes to download a 5-MB file. Dialup is typically used by mobile workers and in areas where higher-speed connection options are not available.

### DSL

**Digital subscriber line (DSL)** is more expensive than dialup but provides a faster connection. DSL also uses telephone lines, but unlike dialup access, DSL provides a continuous connection to the Internet. This connection option uses a special high-speed modem that separates the DSL signal from the telephone signal and provides an Ethernet connection to a host computer or local-area network (LAN).

Speeds of 512 kbps and higher are common with DSL services. At this speed, a 5-MB file would take approximately one minute to download. Upload and download speeds vary based on geography, distance from the ISP, and the type of service offered by the ISP.

DSL comes in several flavors. Typically, a home user uses an asymmetric digital subscriber line (ADSL), in which the download speed is faster than the upload speed. Because most home users download significantly more than they upload, this type of connection is sufficient. In a business environment, the amount of data uploaded may be equal to or even greater than the amount of data downloaded. For these users, an ADSL line is insufficient; a symmetric digital subscriber line (SDSL) service is more appropriate. SDSL offers the same upload and download speeds.

## Cable Modem

A cable modem is a connection option offered by cable television service providers. It offers faster connection speeds than that generally provided by DSL. Cable Internet connections offer speeds of 5 Mbps to 10 Mbps. At these speeds a 5-MB file would take only seconds to download. The Internet signal is carried on the same coaxial cable that delivers cable television to homes and businesses. A special cable modem separates the Internet signal from the other signals carried on the cable and provides an Ethernet connection to a host computer or LAN. Unlike DSL, the distance from the ISP does not affect the performance of the cable connection. Cable is a shared-bandwidth service, so as more customers in an area connect and use the Internet, the speed is negatively affected.

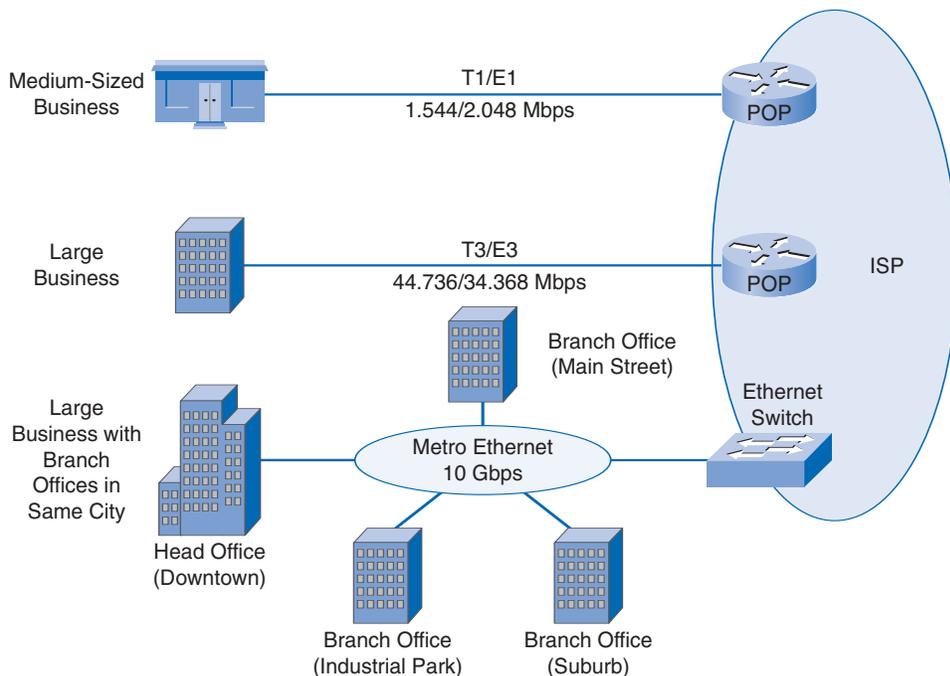
## Satellite

Satellite connection is an option offered by satellite service providers. The user's computer connects through Ethernet to a satellite modem that transmits radio signals to the nearest POP within the satellite network. Satellite Internet access speeds range from 128 Kbps to 512 Kbps, depending on the subscriber plan. Satellite connection may be the only available technology in many regions of the world.

## Dedicated Bandwidth Options

Business customers often require dedicated, high-bandwidth connections to the Internet. Figure 1-3 shows the three main types of dedicated, high-bandwidth connection options that are used by businesses: T1/E1, T3/E3, and Metro Ethernet.

**Figure 1-3 High-Speed, Dedicated-Bandwidth Internet Connections**



### T1/E1 Connections

T1 connections transmit data at rates of up to 1.544 Mbps. They are symmetrical, meaning that the upload bandwidth is the same as the download bandwidth. A medium-sized business may need only one T1 connection for all its connectivity requirements. T1 connections are common in North America and some other parts of the world. E1 is a European standard that transmits data at 2.048 Mbps.

### T3/E3 Connections

T3 connections allow data to be transmitted at rates of up to 45 Mbps. Although T3 is considerably more expensive than a T1 connection, a larger business may need a T3 connection to accommodate all its employees or business volume. Large businesses with multiple locations might use a combination of T1 and T3 lines. Quite often the main office or data center has a T3 line, and each branch office has a T1 connection. E3 is a European standard that transmits data at 34.368 Mbps.

### Metro Ethernet

*Metro Ethernet* offers a wide range of high-bandwidth options, including Gbps links. Large companies with many branches in the same city, such as banks, often use Metro Ethernet. Metro Ethernet connects the main office location and all the branches using switched technology. It allows the transfer of large amounts of data faster and less expensively than other high-bandwidth connection options.

### Point of Presence

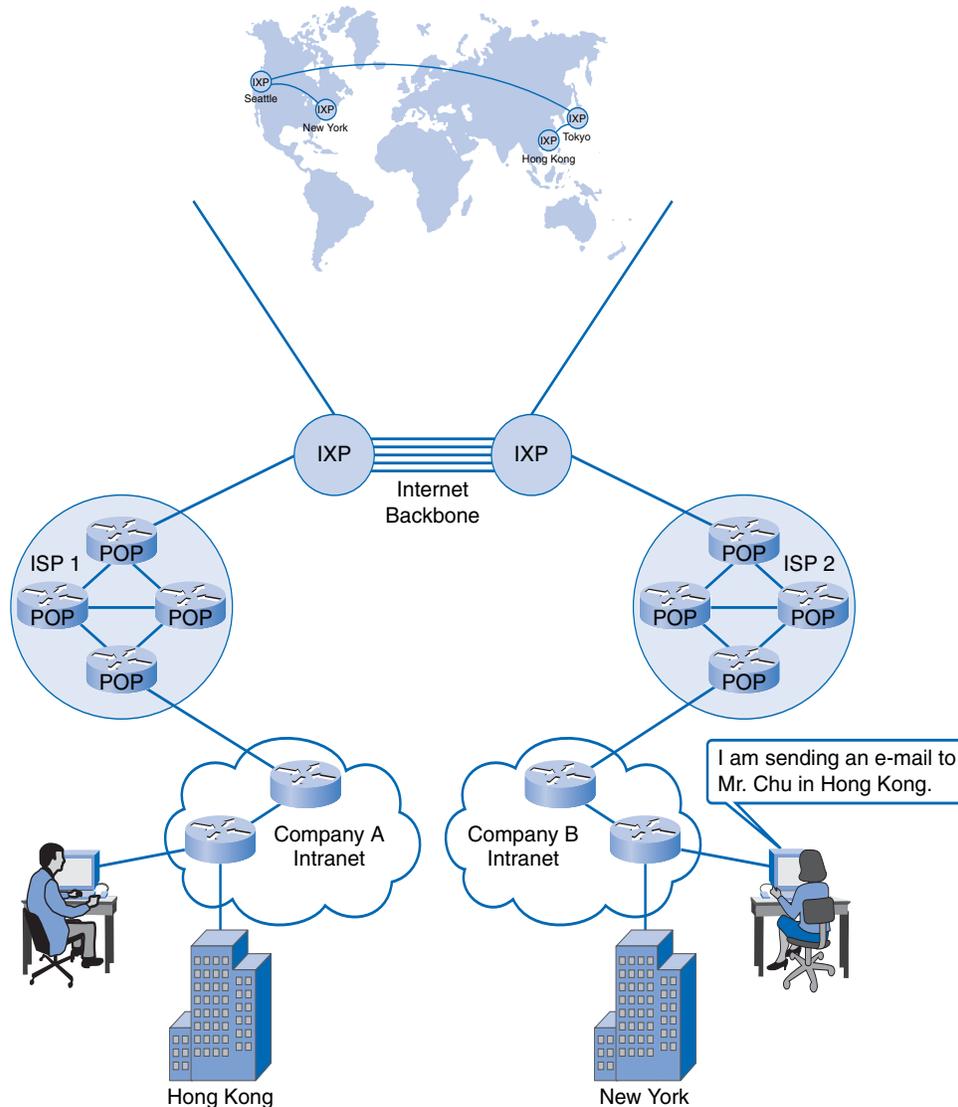
After the type of connection is established, it is necessary to connect to the ISP to get access to the Internet. Individual computers and business networks connect to the ISP at a *point of presence (POP)*. POPs are located at the edge of the ISP's network and serve a particular geographic region. They provide a local point of connection and authentication (password control) for multiple end users. An ISP may have many POPs, depending on the size of the area it services.

Within the ISP network, high-speed routers and switches move data between the various POPs. Multiple links interconnect the POPs to provide alternative routes in case one of the links becomes overloaded with traffic or fails.

## Internet Hierarchy

The Internet has a hierarchical structure. At the top of this hierarchy are the ISP organizations. The ISP POPs connect to an *Internet Exchange Point (IXP)*. In some countries, this is called a *Network Access Point (NAP)*. An IXP or NAP is where multiple ISPs are joined to gain access to each others' networks and exchange information, as shown in Figure 1-4. Currently more than 100 major exchange points exist worldwide.

Figure 1-4 Internet Hierarchy



The Internet backbone consists of this group of networks owned by various organizations and interconnected through IXPs and private peering connections. The Internet backbone is like an information superhighway that provides high-speed data links to interconnect the POPs and IXPs in major metropolitan areas around the world. The primary medium that connects the Internet backbone is fiber-optic cable. This cable typically is installed underground to connect cities within continents. Fiber-optic cables also run under the sea to connect cities between continents.

ISPs are classified into different tiers according to how they access the Internet backbone. Three tiers of ISPs are identified.

## Tier 1 ISPs

*Tier 1 ISPs* are at the top of the hierarchy. Tier 1 ISPs are huge organizations that connect directly with each other through private peering, physically joining their individual network backbones to create the global Internet backbone. Within their own networks, the Tier 1 ISPs own the routers, high-speed data links, and other pieces of equipment that join them to other Tier 1 ISP networks. This includes the undersea cables that connect the continents.

## Tier 2 ISPs

*Tier 2 ISPs* are the next tier in terms of backbone access. Tier 2 ISPs can also be very large, even extending across several countries, but very few have networks that span entire continents or between continents. To provide their customers with global Internet access, some Tier 2 ISPs pay Tier 1 ISPs to carry their traffic to other parts of the world. Some Tier 2 ISPs exchange global traffic with other ISPs less expensively through public peering at IXPs. A large IXP may bring together hundreds of ISPs in a central physical location for access to multiple networks over a shared connection.

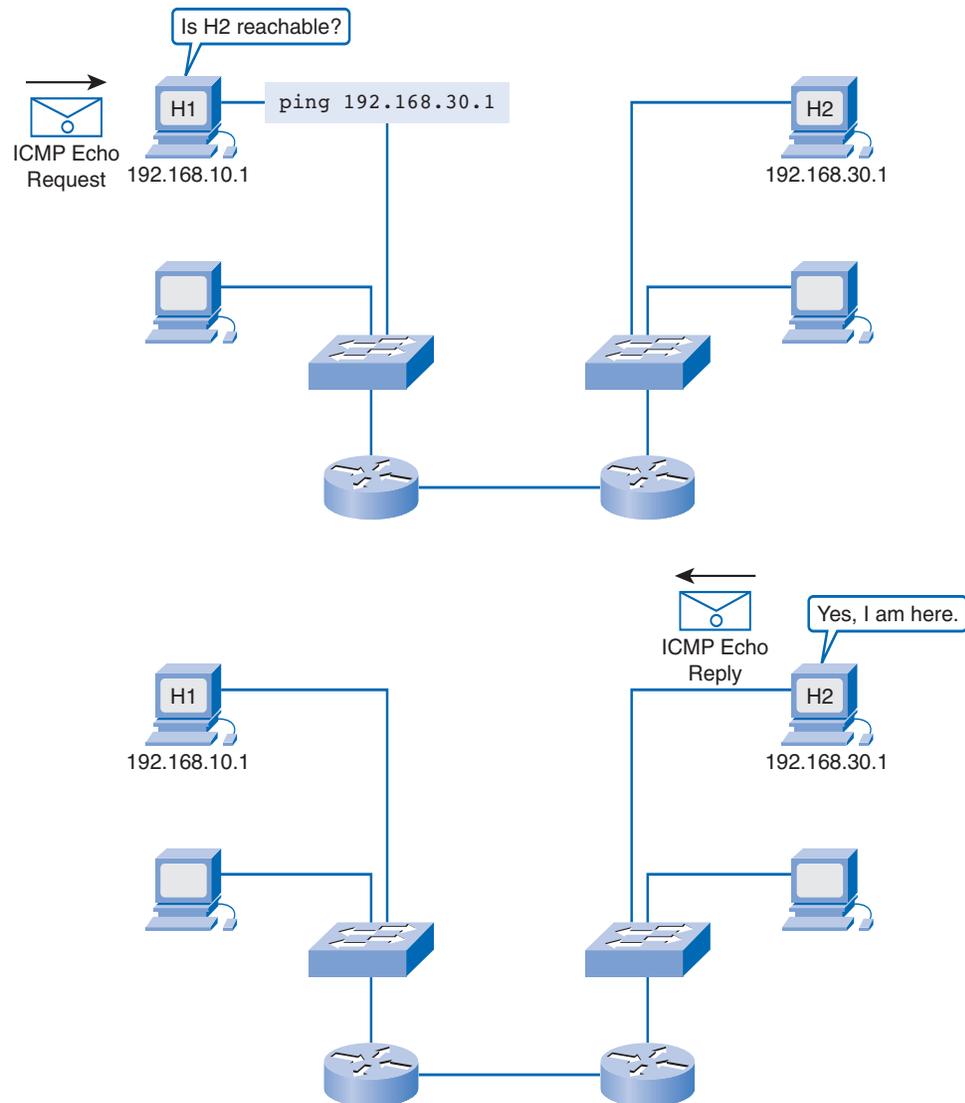
## Tier 3 ISPs

*Tier 3 ISPs* are the farthest from the backbone. Tier 3 ISPs generally are found in major cities and give customers local access to the Internet. Tier 3 ISPs pay Tier 1 and 2 ISPs for access to the global Internet and Internet services.

## Identifying the Structure of the Internet

Network utilities can be used to create a map of the Internet to visualize how ISP networks interconnect. These utilities also illustrate the speed at which each connecting point can be reached.

The **ping** command tests the accessibility of a specific IP address. This command sends an *Internet Control Message Protocol (ICMP)* echo request packet to the destination address and then waits for an echo reply packet to return from that host, as shown in Figure 1-5. It measures the time that elapses between when the request packet is sent and the response packet is received.

**Figure 1-5 ping Utility**

The **ping** command output indicates whether the reply was received successfully and displays the round-trip time for the transmissions. Example 1-1 shows the syntax and result of a successful **ping** command from a Windows-based host. Note that either the IP address or the domain name may be used. If the Domain Name System (DNS) is not functioning properly, the IP address should be used.

#### Example 1-1 Sample Output from the ping Command

```
C:\> ping cisco.netacad.net

Pinging cisco.netacad.net [128.107.229.50] with 32 bytes of data:

Reply from 128.107.229.50: bytes=32 time=560ms TTL=115
Reply from 128.107.229.50: bytes=32 time=636ms TTL=115
Reply from 128.107.229.50: bytes=32 time=460ms TTL=115
Reply from 128.107.229.50: bytes=32 time=645ms TTL=115

Ping statistics for 128.107.229.50:
```

```

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 460ms, Maximum = 645ms, Average = 575ms

C:\> ping 128.107.229.50

Pinging 128.107.229.50 with 32 bytes of data:

Reply from 128.107.229.50: bytes=32 time=118ms TTL=115
Reply from 128.107.229.50: bytes=32 time=376ms TTL=115
Reply from 128.107.229.50: bytes=32 time=577ms TTL=115
Reply from 128.107.229.50: bytes=32 time=120ms TTL=115

Ping statistics for 128.107.229.50:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 118ms, Maximum = 577ms, Average = 297ms

```

If a packet does not reach the destination, or if delays are encountered along the way, you can use the `tracert` utility to display information about where the packet encountered problems. The `tracert` utility displays the path that a packet takes from the source to the destination host. Each router that the packet passes through is called a hop. The `tracert` utility displays each hop along the way. It also calculates the time between when the packet is sent and when a reply is received from the router at each hop.

If a problem occurs, use the output of the `tracert` command to help determine where a packet was lost or delayed. The output shows the various ISPs that the packet must pass through during its journey from source to destination. The Windows `tracert` utility works the same way. Also, a number of visual `tracert` programs provide a graphical display of the route a packet takes. Example 1-2 shows an example of `tracert` command output.

### Example 1-2 Sample Output from the `tracert` Command

```

C:\> tracert cisco.netacad.net

Tracing route to cisco.netacad.net [128.107.229.50]
over a maximum of 30 hops:

  0  0 ms  0 ms  0 ms  192.168.1.1
  1  1 ms  <1 ms  <1 ms  192.168.1.1
  2  8 ms  8 ms  12 ms  bas1-toronto46_lo0_SYMP.net.bell.ca [64.230.197.216]
  3  7 ms  7 ms  7 ms  dis7-toronto01_Vlan147.net.bell.ca [64.230.202.105]
  4  6 ms  7 ms  6 ms  core1-toronto01_GE3-1-2.net.bell.ca [64.230.161.69]
  5  7 ms  7 ms  7 ms  core3-toronto12_POS13-1.net.bell.ca [64.230.242.157]
  6  16 ms  17 ms  17 ms  core1-chicago23_pos13-0-0.net.bell.ca [64.230.147.18]
  7  17 ms  17 ms  17 ms  bx2-chicagodt_so-2-0-0-0.net.bell.ca [64.230.203.146]
  8  18 ms  17 ms  17 ms  ex2-p6-1.eqchil.sbcglobal.net [151.164.250.241]
  9  68 ms  68 ms  68 ms  ded4-g8-3-0.sntc01.pbi.net [151.164.41.165]
 10  69 ms  68 ms  68 ms  Cisco-Systems-1152786.cust-rtr.pacbell.net [64.161.0.62]
 11  68 ms  68 ms  68 ms  sjc5-dmzbb-gw1.cisco.com [128.107.224.105]
 12  68 ms  68 ms  68 ms  sjc12-dmzdc-gw1-gig1-1.cisco.com [128.107.224.14]
 13  70 ms  69 ms  70 ms  cna-prod-nv.cisco.com [128.107.229.50]

```

```

C:\> tracert 128.107.229.50

Tracing route to cna-prod-nv.cisco.com [128.107.229.50]
over a maximum of 30 hops:

  0  <1 ms  <1 ms  <1 ms  192.168.1.1
  1  9 ms    8 ms    7 ms   bas1-toronto46_lo0_SYMP.net.bell.ca [64.230.197.216]
  2  7 ms    7 ms    7 ms   dis7-toronto01_Vlan147.net.bell.ca [64.230.202.105]
  3  7 ms    6 ms    6 ms   core1-toronto01_GE3-1-2.net.bell.ca [64.230.161.69]
  4  7 ms    7 ms    7 ms   core3-toronto12_POS13-1.net.bell.ca [64.230.242.157]
  5  17 ms   17 ms   17 ms   core1-chicago23_pos13-0-0.net.bell.ca [64.230.147.18]
  6  18 ms   17 ms   17 ms   bx2-chicagodt_so-2-0-0-0.net.bell.ca [64.230.203.146]
  7  20 ms   17 ms   26 ms   ex2-p6-1.eqchil.sbcglobal.net [151.164.250.241]
  8  68 ms   68 ms   68 ms   ded4-g8-3-0.sntc01.pbi.net [151.164.41.165]
  9  68 ms   67 ms   68 ms   Cisco-Systems-1152786.cust-rtr.pacbell.net [64.161.0.62]
 10  68 ms   68 ms   68 ms   sjc5-dmzbb-gw1.cisco.com [128.107.224.105]
 11  67 ms   68 ms   68 ms   sjc12-dmzdc-gw1-gig1-1.cisco.com [128.107.224.14]
 12  69 ms   69 ms   70 ms   cna-prod-nv.cisco.com [128.107.229.50]

Trace complete.

```



### Lab 1-1: Mapping ISP Connectivity Using traceroute (1.2.3)

In this lab, you use the **traceroute** utility to check ISP connectivity through the Internet. Refer to the lab in Part II of this book. You may perform this lab now or wait until the end of the chapter.



### Interpreting ping and traceroute Output (1.2.3)

In this activity, you interpret successful and unsuccessful **ping** and **traceroute** command output. Use file d2-123.pka on the CD-ROM that accompanies this book to perform this activity using Packet Tracer.

## ISP Connectivity

ISPs must be able to provide clients with a reliable connection to the Internet. To accomplish this, they require a variety of equipment and controlled power and environmental conditions. In addition, the ISP must be able to provision and install new services for customers as well as support existing services.

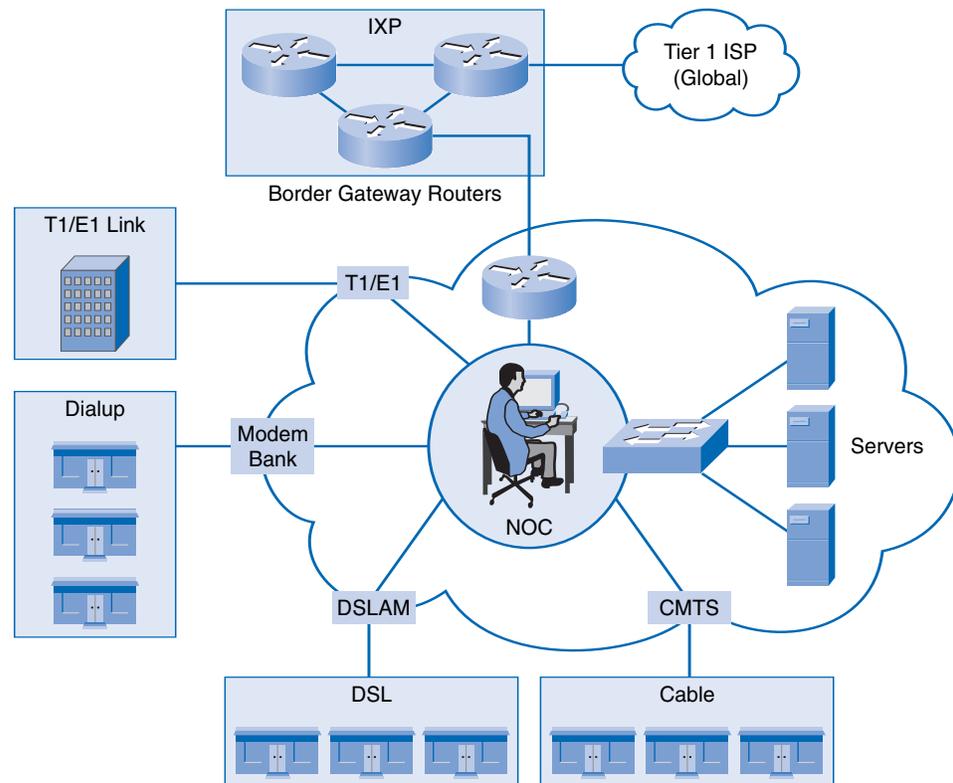
## ISP Requirements

An ISP requires a variety of devices to accept input from end users and provide services. To participate in a *transport network*, the ISP must be able to connect to other ISPs. An ISP must also be able to handle large volumes of traffic.

Some of the devices required to provide services are shown in Figure 1-6:

- Access devices that enable end users to connect to the ISP, such as a *DSL access multiplexer (DSLAM)* for DSL connections, a *cable modem termination system (CMTS)* for cable connections, modems for dialup connections, or wireless bridging equipment for wireless access
- Border gateway routers to enable the ISP to connect and transfer data to other ISPs, IXPs, or large business enterprise customers
- Servers for such applications as e-mail, network address assignment, web space, FTP hosting, and multimedia hosting

**Figure 1-6** ISP Connection Devices



In addition, the ISPs must be able to provide uninterrupted power to the devices and also remove the large amount of heat generated by the equipment. To accomplish this, ISPs also require the following:

- Power conditioning equipment with substantial battery backup to maintain continuity if the main power grid fails
- High-capacity air conditioning units to maintain controlled temperatures

Like other businesses, ISPs want to expand so that they can increase their income. The ability to expand their business depends on gaining new subscribers and selling more services. However, as the number of subscribers grows, the traffic on the ISP's network also grows.

Eventually, the increased traffic may overload the network, causing router errors, lost packets, and excessive delays. In an overloaded network, subscribers can wait for minutes for a web page to load, or may even lose network connection. These customers may choose to switch to a competing ISP to get better performance. Loss of customers directly translates to loss of income for an ISP. For this reason, it is important that the ISP provide a reliable and scalable network.

Scalability is the ability to allow for future change and growth. A *scalable network* can expand quickly to support new users and applications without impacting the performance of the service being delivered to existing users. The most scalable devices are those that are modular and provide expansion slots for adding modules. Different modules can have different numbers of ports. In the case of a chassis router, some modules also offer different interface options, allowing for different connection options on the same chassis.

Packet Tracer  
Activity

### Identifying Equipment to Meet Customer Requirements (1.3.1)

In this activity you identify the appropriate equipment to meet the business needs of ISP customers. Use file d2-131.pka on the CD-ROM that accompanies this book to perform this activity using Packet Tracer.

---

## Roles and Responsibilities Within an ISP

ISP organizations consist of many teams and departments. These teams are responsible for ensuring that the network operates smoothly and that the services that the ISP offers are available on a reliable basis. Network support services are involved in all aspects of network management, including planning and provisioning new equipment and circuits, adding new subscribers, network repair and maintenance, and customer service for network connectivity issues. When a new business subscriber orders ISP services, the various network support service teams work together to ensure that the order is processed correctly and that the network is ready to deliver those services as quickly as possible.

Each network support service team has its own roles and responsibilities:

- Customer service receives the order from the customer and ensures that the customer's specified requirements are accurately entered into the order-tracking database.
- Planning and provisioning determines whether the new customer has existing network hardware and circuits or whether new circuits need to be installed.
- The onsite installation team is advised of which circuits and equipment to use and then installs them at the customer site.
- The network operations center (NOC) monitors and tests the new connection and ensures that it is performing properly.
- The NOC notifies the help desk when the circuit is ready for operation. The help desk contacts the customer to guide the customer through the process of setting up passwords and other necessary account information.



### Interactive Activity 1-2: ISP Teams and Responsibilities (1.3.2)

In this activity, you determine which ISP team is responsible for a particular task. Use file d2ia-132 on the CD-ROM that accompanies this book to perform this interactive activity.

---

## Summary

Businesses continue to adapt to an evolving Internet. They use the Internet for such activities as e-commerce, communications, collaboration, and training. Many businesses rely on the Internet for their very existence.

Standards provide a mechanism to ensure that all devices that connect to the Internet, or that use the services offered on the Internet, follow the same set of rules. This allows different devices to communicate over the Internet.

Businesses connect to the Internet through the services of an ISP. ISPs not only provide connection services but also offer a range of support services:

- Equipment co-location
- Web hosting
- FTP hosting
- Application and media hosting
- VoIP
- Technical support

A number of connection options are available for home and business users. Home and small businesses typically connect using dialup, DSL, cable, or satellite technology. Larger businesses often require more bandwidth than home users and small businesses and therefore use connections such as T1/E1, T3/E3, and Metro Ethernet.

An ISP can be classified as Tier 1, Tier 2, or Tier 3, depending on how it accesses the Internet backbone. Tier 1 ISPs are at the top of the hierarchy and provide connectivity services to other ISPs. The Internet backbone is made up of a group of networks owned by various organizations and interconnected through Internet Exchange Points (IXP) and private peering connections.

To provide reliable services to its customers, an ISP requires a number of devices to accept input from end users and to provide the subscribed-to services. These devices include

- Access devices
- Border gateway routers
- Server
- Air conditioning units
- Power conditioning devices

The ISP's network must be reliable and scalable. A scalable network can quickly expand to support new users and services without impacting current performance. To be able to handle client requests for new services and to efficiently support existing services, ISPs are made up of many teams or departments, each with specific roles and responsibilities. ISP teams can include

- Customer service
- Network operations center
- Planning and provisioning
- Onsite installation
- Help desk

## Activities and Labs

This summary outlines the activities and labs you can perform to help reinforce important concepts described in this chapter. You can find the activity and Packet Tracer files on the CD-ROM accompanying this book. The complete hands-on labs appear in Part II.



### Interactive Activities on the CD:

Interactive Activity 1-1: Which ISP Is Best? (1.1.2)

Interactive Activity 1-2: ISP Teams and Responsibilities (1.3.2)

---



### Packet Tracer Activity on the CD:

Interpreting **ping** and **tracert** Output (1.2.3)

Identifying Equipment to Meet Customer Requirements (1.3.1)

---



### Hands-on Lab in Part II of this book:

Lab 1-1: Mapping ISP Connectivity Using **tracert** (1.2.3)

---

## Check Your Understanding

Complete the review questions to check your understanding of the topics and concepts in this chapter. Answers are listed in Appendix A, “Check Your Understanding and Challenge Questions Answer Key.”

1. For what purposes do businesses use the Internet? (Select all that apply.)
  - A. E-commerce
  - B. Communication
  - C. Collaboration
  - D. Training
2. Which of the following are services that an ISP might offer? (Select all that apply.)
  - A. Equipment co-location
  - B. Web hosting
  - C. FTP hosting
  - D. Application hosting
  - E. VoIP
  - F. Technical support

3. Which type of Internet connection might be the only choice for an individual in a remote community?
  - A. Dialup
  - B. DSL
  - C. Cable
  - D. T1/E1
  - E. Satellite
  
4. Which type of high-bandwidth connection is often used by organizations with multiple branches in a single city?
  - A. DSL
  - B. Cable
  - C. T1/E1
  - D. T3/E3
  - E. Metro Ethernet
  
5. Which tier of ISP normally has links between continents?
  - A. Tier 1
  - B. Tier 2
  - C. Tier 3
  
6. Where do multiple service providers join to gain access to each others' networks and exchange information?
  - A. DSL
  - B. ISP
  - C. IXP
  - D. IPX
  
7. Which ISP team is responsible for determining whether a customer has sufficient existing equipment or whether new equipment must be installed to support the new service?
  - A. Customer service
  - B. Planning and provisioning
  - C. Onsite installation
  - D. Network operations center
  - E. Help desk
  
8. Which ISP team is responsible for working with the customer to guide the customer through the final setup of a new service?
  - A. Customer service
  - B. Planning and provisioning
  - C. Onsite installation
  - D. Network operations center
  - E. Help desk

9. Which ISP team is responsible for testing a new service or circuit and ensuring that it is functioning properly?
  - A. Customer service
  - B. Planning and provisioning
  - C. Onsite installation
  - D. Network operations center
  - E. Help desk
10. Why might a medium-sized business decide to install a T1 connection in its offices rather than a cable Internet connection?
11. Why is it important that an ISP network be scalable?

## Challenge Questions and Activities

These questions require a deeper application of the concepts covered in this chapter. You can find the answers in Appendix A.

1. For what tasks do you use the Internet? What services do you use on a regular basis?
2. Outline the process that a typical ISP follows when a client calls and asks to have a new T1 connection installed in one of its branch offices.