
Lesson 3: Voice over IP Applications

At a Glance



Most organizations operate two separate networks to handle their data transmissions and their voice communications. This model requires separate infrastructures and support personnel, which results in higher operating costs for the organization. This model is expected to become obsolete in the future, as the unifying of voice and data networks over IP packet-switched networks becomes a reality.

With the implementation of unified networks, organizations and individuals will reap the benefits, such as lower telephone costs, increased e-commerce with a personal touch, and extended support for the mobile user from around the world.

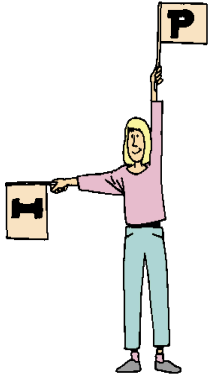
What You Will Learn

After completing this lesson, you will be able to do the following:

- Identify VoIP solutions for individuals and businesses
- Describe why the Internet Protocol offers the best advantages for unifying data and voice networks
- Identify the benefits of VoIP
- Describe three VoIP business applications

Student Notes:

Tech Talk



- **E-Commerce**—Electronic Commerce is a new and rapidly growing form of business using the Internet for the exchange of transactions, such as the sale of books and stocks.
- **Internet Call Waiting**—A service provided by ISPs equipped with an ICW server. The service permits end users who share their telephone line with their Internet connection to identify callers, accept a call using either their telephone or SoftPhone, forward a call to another phone number or voice mail, or play a greeting to the caller.
- **IP PBX**—A private branch exchange that is IP enabled, so that it can connect directly with an IP network to transport voice communications.
- **Policies**—In the field of networking, policies are the configuration parameters or rules that network components use to make intelligent decisions to manage network traffic.
- **SoftPhone**—A VoIP software application that allows PCs to send and receive voice calls over the Internet.
- **Subscriber**—A person paying for a service, e.g., a telephone subscriber or an Internet subscriber.
- **Toll By-Pass**—Applications that convert real-time voice to IP packets and route the packets over the Internet instead of the public switched telephone network, thereby avoiding the toll charges of the PSTN.

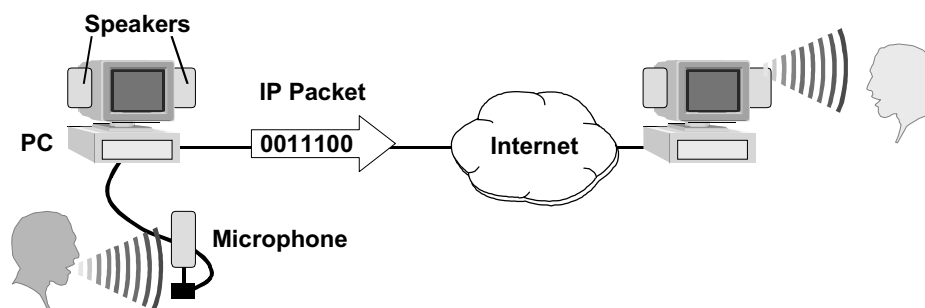
Making a VoIP Connection

There are many ways voice transmissions can be transported via an IP network. Some methods are as simple as installing a VoIP software application, often referred to as a SoftPhone, onto a PC equipped with a microphone, minimum 16 megabytes of RAM, a sound card, speakers, a modem, and a dial-up Internet connection. This is the most common scenario for home users due to its simplicity. A person talks into the microphone. The microphone is connected to the PC's sound card, which converts the analog signal into a digital signal (usually 64 Kbps PCM or 32 Kbps ADPCM). The software compresses the digital signal and packages the data into IP packets. Although the sender and receiver may not have to have the same operating system, they generally must have the same VoIP software installed on their PCs.

At this point, the process becomes slightly more complex. Before establishing a call, some software products require the user to access the software vendor's directory of registered users and select the destination of the call. Only registered users of the same software, who are online (connected to their ISP) at the time of the call, may receive phone calls over the Internet. Some software allows the user to enter the IP address of the recipient to establish a call and may offer voice mail services or text translation into an email message when the receiver is not available to take a call.

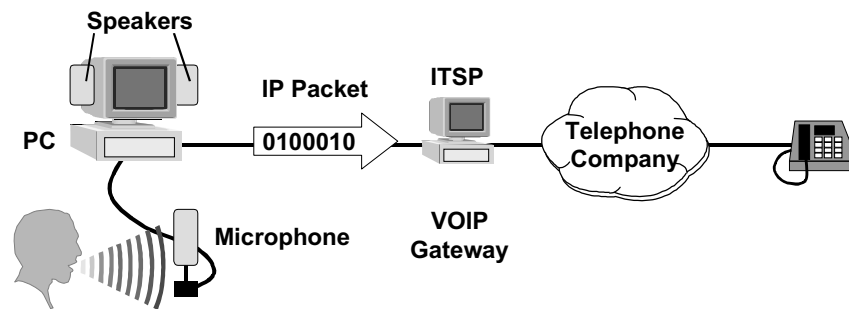
In each case, IP addresses are used in place of the telephone numbers of the users.

VoIP Software Solution for PC-to-PC Calls



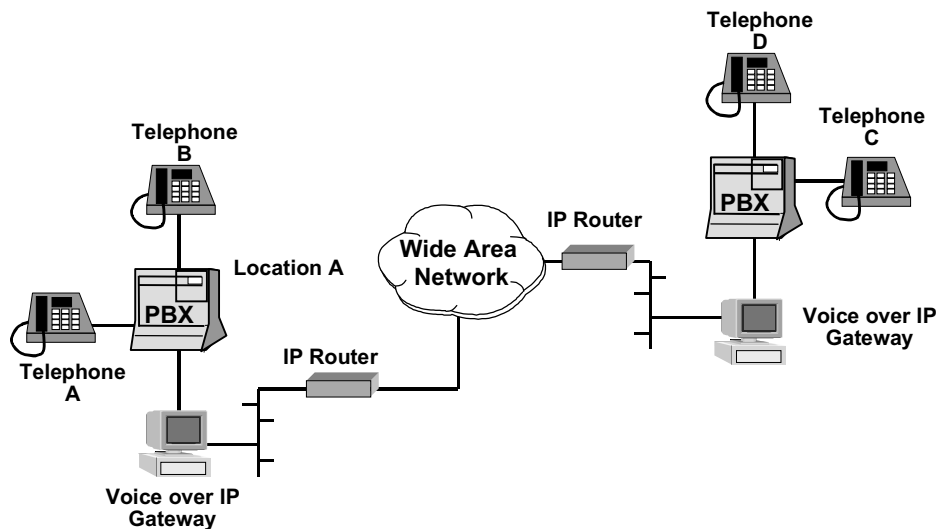
Yet another approach is the use of Internet Telephony Service Providers (ITSP) to transmit a PC generated call to a standard telephone. Using a VoIP SoftPhone, an Internet call is sent to the ITSP via a VoIP gateway managed by the ITSP. The ITSP then routes the call to one of its VoIP gateways in the destination city, where the call is converted and sent to the local PSTN for delivery to the destination telephone. No long distance charges occur since the only PSTN connection made is a local call. The ITSP provides this service for a fee.

VoIP ITSP Solution for PC-to-Telephone Calls



The most common approach for business is the connection of the PBX to a VoIP gateway. The VoIP gateway digitizes, compresses, and packetizes the analog calls and then addresses the calls for delivery to their destinations. At the destination gateways, the voice packets are converted back into their analog waveform and routed through the PBX to the called parties.

VoIP Solutions Using the PBX and VoIP Gateways



An alternative to the PBX and a separate gateway is the IP PBX. With an IP PBX, the VoIP gateway is integrated into the PBX, allowing the PBX to connect directly to an IP network.

There are two other VoIP devices that either an individual or a business may use as the IP telephony interface: IP-enabled telephones and universal serial bus (USB) telephones. An IP-enabled telephone converts the analog signal into a digital signal and packetizes the signal for transport over the IP network to which it is directly connected. The USB telephone connects to the USB port of the computer, which is connected to the IP network. Although development is still in its infancy, the USB telephones interact with speech recognition and call management software on the PC. The user speaks the name of the person they are calling and the PC will match the name to the destination telephone number and complete the call.

Check Your Understanding

- ◆ What problems are associated with using SoftPhones that may interfere with the popularity of these software programs?

Internet Call Waiting

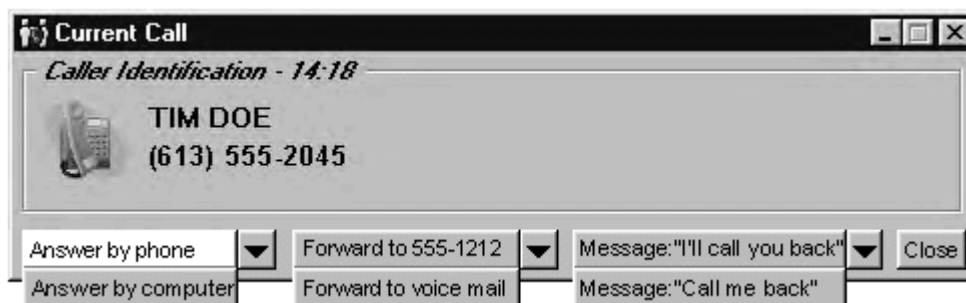
Market research indicates that over 50 percent of home Internet users log on at least once a day, and the average duration of each Internet session is 65 minutes. For those individuals that use a single line to support their telephone and Internet connection, that leaves them unreachable for at least one hour per day. There are two obvious solutions to this problem.

- The user can add a second telephone line into their home that can serve as a dedicated line for their Internet connection, thus freeing the other line for telephone calls. This option adds at least another \$20 to the user's monthly expenses.
- The user can use a SoftPhone solution to receive calls over the Internet. However, as previously stated, SoftPhones are not a universal solution. Usually both the caller and the receiver must have the same software. Those making a call to the end user are probably not using a SoftPhone or an Internet phone. Instead the caller is typically using a standard telephone and a PSTN line, which can not directly interface with the SoftPhone on the end user's PC.

Internet Call Waiting (ICW) solves the problem of missing telephone calls while the end user is connected to the Internet. ICW takes advantage of both PSTN and VoIP connections. It allows Internet users to be notified of incoming calls while they are connected to the Internet. It also gives users control over the handling of their calls. When the end user receives a call a message pops up in the user's web browser. There are several actions the end user can take at that point.

1. **Answer the call**—The user can choose to answer the call using either a PSTN or a VoIP connection. If the user chooses to take the call via a PSTN connection, the caller is told to hold while ICW connects the call. ICW disconnects the user's Internet session and rings the user's telephone. If the user has Microsoft NetMeeting installed, the user can choose to answer the call on the computer using VoIP and continue to be connected to the Internet.
2. **Forward the call**—The user can choose to forward the call to either a voice mail system or to another telephone number, such as a cellular telephone or a second telephone line.
3. **Play a message**—The user can choose to play a pre-defined message that asks the caller to call back later or informs the caller that their call will be returned later.
4. **Ignore the call**—The user can simply do nothing. After 20 seconds pass without a response, the call is automatically sent to the end user's voice mail. If the end user does not have voice mail, the caller will hear the following message: "We're sorry, the person you are calling cannot take your call at this time."

ICW Options

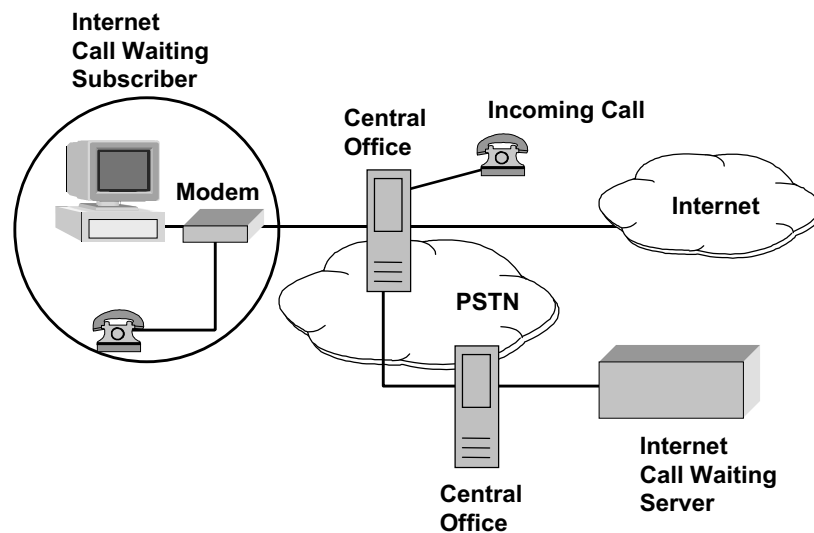


How Does ICW Work?

Internet Call Waiting is a service provided by Internet Service Providers (ISP) and telephone companies. The Telephone Company or ISP must install an ICW server and ICW application software. When the user is connected to the Internet, their incoming voice calls are redirected to the ICW server. The server extracts the caller and subscriber (the user connected to the Internet) information and generates a pop-up window via the Internet to the subscriber's PC.

The end user (or subscriber) requires only an Internet dial-up (PSTN) connection and a PC with Windows 95,95, or NT installed. If the end user wishes to receive calls using VoIP, the user is required to use Microsoft NetMeeting.

Internet Call Waiting



The Benefits of VoIP

Using IP packet-switched networks for unifying both data and voice applications offers many advantages.

- The growth of the Internet has made IP the world's most popular network protocol suite. Most PC operating systems include IP. This has led to the development of many new and exciting computer applications that run over IP.
- IP is the best open standard in the market. IP-based products can be purchased from any vendor and still interoperate. Internet standards are developed and maintained via a large, worldwide organization called the Internet Engineering Task Force (IETF), which has representation from the majority of networking vendors. This collaborative group ensures interoperation between vendor products.
- IP is a network layer protocol that can be delivered on any type of transport media, i.e., Ethernet, ATM, Frame Relay, ISDN, cellular or wireless, and dial-up modems with POTS. This offers a major benefit to mobile users and telecommuters who rely on the Internet for connections to their corporate network.

Benefits to the Individual

When researching the benefits of VoIP, the majority of resources speak to the benefits to the corporation. However, there are benefits to the individual. Perhaps these benefits are less dynamic; however, they are not any less intriguing.

Although standards are still under development and interoperability remains an issue, the individual can already take advantage of SoftPhone solutions, i.e., Microsoft NetMeeting, DigiPhone Deluxe, and NetSpeak's WebPhone.

As previously indicated, most SoftPhone products allow a user to place a call over the Internet using only their ISP connection and the standard Point-to-Point Protocol (PPP). Since these products allow the user to bypass the PSTN and its associated tolls, they are referred to as Toll Bypass solutions.

The main advantage of a software solution lies in saving long distance charges. Using the Internet instead of the PSTN, the user avoids the high cost of a long distance connection. There are no fees, other than the fees associated with the standard ISP (Internet Service Provider) connection, associated with calls placed over the Internet. The savings are even greater for those individuals with friends and family living overseas.

However, these savings do not come without problems. VoIP software solutions are based on "best effort" quality of service. Since placing a call is dependent on the availability of the Internet, the caller must accept that not all calls will be successful or have the same quality as the telephone service provided by the PSTN. When the Internet traffic becomes high, the voice transmission may break up, resulting in hearing only parts of a sentence. Most software programs will compensate for congestion and drop packets, which will distort the sound quality. However, during off-peak hours, the sound quality is often as good as a cellular phone, which is generally acceptable to most users.

As a potential customer, individuals will also reap benefits from the implementation of VoIP within the business setting.

Check Your Understanding

- ◆ Speculate why VoIP saves more money over the costs of using the PSTN when placing calls to overseas locations than when placing calls locally or even within the United States.

Benefits to Organizations

Comparing the number of simultaneous voice calls over a full T1 circuit demonstrates how the use of IP packet switching increases the efficiency of an organization's voice network. The maximum number of simultaneous voice calls over a circuit switched T1 line is only 24. Using digital compression rates of 20 Kbps and IP packet switching, that number increases to 77 calls, and still leaves 1.064 Mbps free for data applications. Using Conjugate-Structure Algebraic Code Excited Linear Prediction (CS-ACELP) to compress the voice signals to 8 Kbps allows up to 193 simultaneous calls, with 1.352 Mbps free for other applications. (Gareiss, 1998). The ability to utilize the full bandwidth of a connection to support both data and voice transmissions is only one benefit to a large organization. There are several benefits to unifying data and voice networks.

- **Telephone Costs**—There are several ways to reduce costs using unified networks. One of the more obvious is bypassing the toll charges of the PSTN by using VoIP to transmit telephone calls over the Internet. Although this is not a major saving for local or even long distance charges within the United States, organizations that conduct business overseas will realize significant savings.
- **Single Management Platform**—In a unified network, there is only one infrastructure that supports all applications, data, voice, video, and fax. Costs to an organization are reduced since sharing of equipment between voice and data networks reduces the amount of equipment purchases and maintenance.
- **Support Staff**—Support staff need only be trained on one network infrastructure, rather than two, saving valuable time and money in training of staff. Often, organizations must have two sets of support staff, one set for the data network and one set for the voice network. With everything transported over the data network, organizations can reduce the number of support staff.
- **Network Management**—With only one network, a manager can easily set policies that control which applications receive higher levels of quality of service, higher priority status, and allocation of bandwidth. Managers can enable gateways to route voice calls over alternate routes (such as the PSTN) to avoid congested networks.
- **Productivity**—With the consolidation of applications over one network, the day-to-day operations become more efficient. Providing voice, data, video, and fax at the desktop means employees can quickly access any application. A single in-box for e-mail, voicemail, and fax unifies messaging applications.

- **Mobility**—Providing virtual desktop voice and data capabilities for telecommuters and mobile users greatly increases their accessibility wherever they happen to be working. Remote users can participate in meetings and discussions as easily as employees located at the headquarters and the long distance charges are eliminated.

Check Your Understanding

- ◆ Why would productivity be increased with the consolidation of voice and data over the same network?

VoIP Business Applications

With the advent of the Internet, businesses responded to the increasing demands of their customers for convenient, fast, and easy means of "shopping." Through the development of e-commerce, customers shop over the Internet, making secure transactions, such as purchasing books, without leaving the comfort of their homes. Although convenient, these transactions lack the human quality consumers have grown to expect when making their purchases. Through computer and telephony integration, a personal touch can be added to e-commerce transactions.

- **E-Commerce Purchasing**—The process of trade over the Internet is fast becoming reliable and streamlined. It is easy to view a catalog of goods, such as books and music CDs, on the web. Making a selection is not as easy. Perhaps the customer is thinking of purchasing a blouse or a pair of pants and is not sure if their selection runs larger or smaller than usual. Most web sites provide an e-mail option where the customer may send a written request for clarification. However, this takes time. With VoIP, a voice icon replaces the email icon. When the voice icon is clicked, the customer is connected directly to a service representative who can answer questions immediately and process the order.
- **Call Back**—Perhaps the customer does not have VoIP capabilities. In such a case, the client can click on a "call back" button on the web page that will prompt the customer to fill in information such as his/her name and telephone number and specifics about the product that interests the customer. With an integrated call management system, the information from the customer is passed to the appropriate customer service representative. The representative places a call, via a VoIP gateway to a PSTN connection, to the customer and relays the information needed by the customer to make a decision.

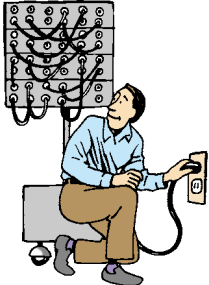
- **Electronic Help Desk**—Perhaps the customer is installing software and the installation is not going well. Software support is provided via email, but the client wants to install the software now, not tomorrow or the next day. The client may call the vendor, but the client often ends up listening to elevator music while on hold for 30 or more minutes. If the call is a toll charge, the client is likely to lose patience very quickly as his/her long distance charges continue to add up. Using the web, customers can click on a product web site and talk to live support agent at an IP-enabled call center and get help with the installation. This arrangement also saves the vendor money when the support service lines are dial-in 800 numbers. Since the call bypasses the toll charges of the PSTN, the vendor doesn't pay the tolls associated with the 800 number.

E-commerce is a competitive market that can bring major savings to businesses. Using the Internet as a marketing tool, a business can reach literally thousands of potential customers that otherwise would not be attainable. Implementing VoIP applications will only increase customer satisfaction and loyalty, resulting in higher profits for the business.

Check Your Understanding

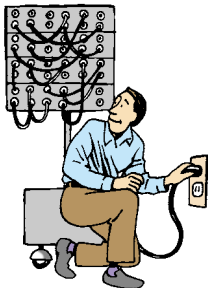
- ◆ The implementation of VoIP is not just about free telephone service. Explain why this statement is true.

Try It Out: SoftPhones



Materials Needed:

- Windows 95 PC
- Internet Connection
- Any VoIP Internet Phone Software that is free to download
- Any Spreadsheet (e.g., MS Excel)
- Pen/Pencil and Paper



1. Research the various SoftPhone products on the market today. Analyze the advantages and disadvantages of each product and create a spreadsheet that compares the products. Document your resources. From this research choose one program to fully evaluate.
2. Working with a partner, download a VoIP Internet phone software package. Configure the software on your PC and use it to conduct a voice conversation with your partner. Your goal is to become completely familiar with the product.
3. Create a role-play in which one of you is a SoftPhone salesperson and the other is a customer. The purpose of the role-play is to convey to the class the specifications of the software, its purpose and advantages for the client, and installation and performance problems. If possible, during the role-play conduct a live demonstration of this product in class.

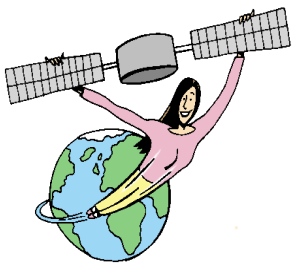
Rubric: Suggested evaluation criteria and weightings:

Criteria	%	Your Score
Complete spreadsheet with documented resources	25	
Quality and creativity of role play presentation	25	
The role play is highly informative	50	
TOTAL	100	

Stretch Yourself: Internet VoIP Protocol Laboratory

Materials Needed:

- Windows 95 PC with microphone and sound card
- Internet Connection
- PhoneFree Software, Manuals, and Documentation downloaded
- Basic Sniffer Software
- Any Word Processor (e.g., MS Word)
- Pen/Pencil and Paper



In this activity, you will download, install, and utilize the PhoneFree program and use it to contact one another across the classroom LAN. This free program transmits voice and video over IP connections. You will use the Basic Sniffer software to monitor traffic on the LAN and to identify the impact that Voice over IP traffic has on normal network operations, and the impact which normal network operations have on Voice traffic.

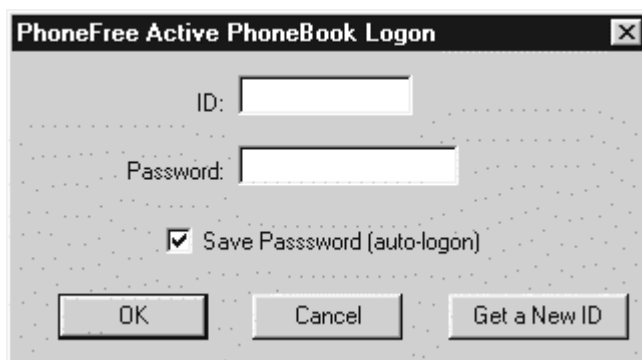
Materials:

- PhoneFree Software
- Basic Sniffer Software

Part 1: The Download and Setup

1. Visit the PhoneFree web site on the Internet to download the PhoneFree software to your PC. The URL is <http://www.phonefree.com/download/index.html> . The download is about 1.2 MB in size.
2. Click the DOWNLOAD button.
3. Click the "Run this program from its current location" option button.
4. After the download, click "Yes" to accept the VeriSign Certified Commercial Software Publishers certificate.
5. Click Setup. The PhoneFreeSM setup program runs automatically
6. If you are using Internet Explorer and chose "Open this file from its current location," the setup routine will begin executing as soon as the download is complete. If you chose to download the file to your computer prior to installing, then you'll need to find the "PhoneFreeSetup.exe" file that was downloaded to your computer and double click on it.

7. Once PhoneFreeSetup.exe has begun executing, the first window that appears allows you to continue with the setup, or cancel. Next, the setup routine will extract the PhoneFreeSM setup files and begin the setup process.
8. After the setup files have been extracted, you will be presented with the License Agreement; please read the agreement, then press the "Continue" button if you agree to the terms and conditions. Pressing the "Cancel Install" button will halt the setup process without installing PhoneFreeSM on your computer.
9. When prompted where to put the PhoneFree plugin, accept the default directory.
10. The setup will ask what browser you wish to use. Choose the browser you use for your Internet connection.
11. Next, the setup will ask you to choose your Internet connection method. Choose "Cable modem, LAN, or other permanent connection."
12. Finally, the setup program will ask you if you would like PhoneFree/Active PhoneBookSM to automatically launch when you start your machine. Click No.
13. Once the setup is complete, a PhoneFree icon will appear on your desktop. Double click the PhoneFree icon to launch the program.
14. The first time you run PhoneFree/Active PhoneBookSM you will be prompted to enter an ID and Password. Click the "Get a New ID" button to register PhoneFree/Active PhoneBookSM and receive your free ID and password.



15. After you have successfully logged on for the first time, PhoneFreeSM will ask you if you would like to add you friends from your local Windows Address Book and/or Netscape Address Book to your Active PhoneBookSM group. Click No. This will dismiss the window and you will not be asked again.

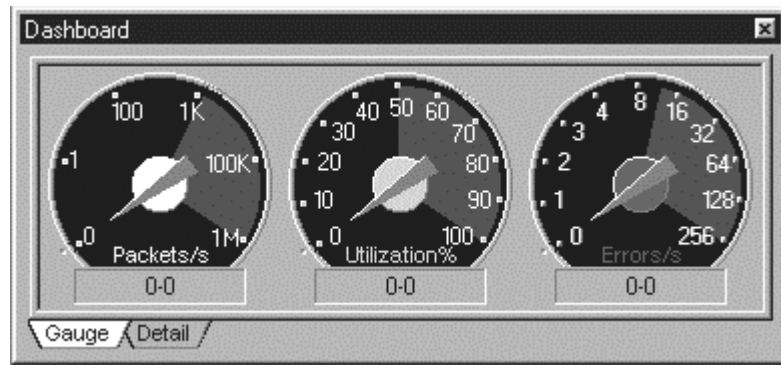
16. Once you have the software installed, you can make a PC-to-PC call by placing the IP address of the PC you wish to call in the dialing area of your phone.

Part 2: Using PhoneFree to place calls

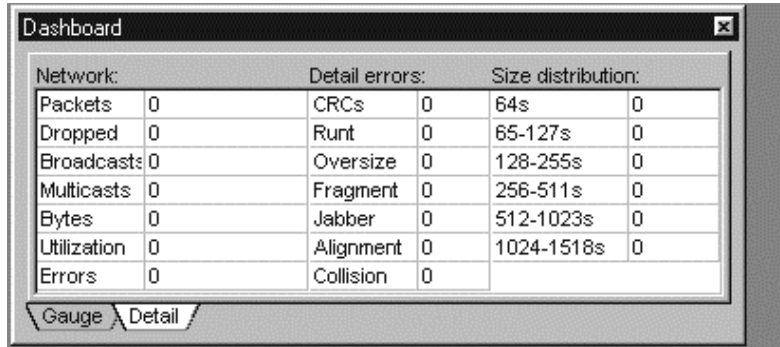
1. Make a connection to one of your peers across your classroom LAN.
2. Keep the conversation going.
3. Adjust microphone positions to get the best quality.
4. Keep a journal of connections made and the quality of those connections.

Part 3: Monitoring Voice over IP Traffic on your LAN

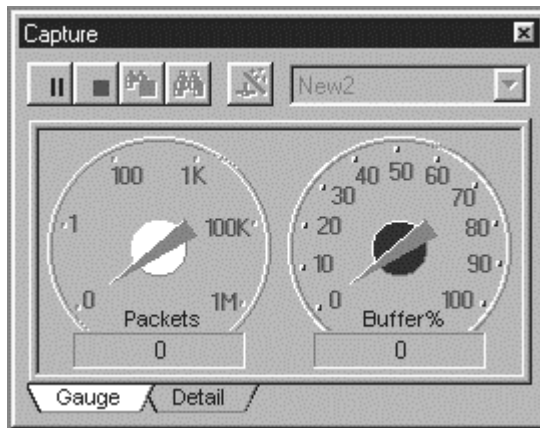
1. With several calls operating on your LAN, launch the Basic Sniffer software.
2. Find the Icon Bar in the Sniffer window.
3. Click the Dashboard icon.



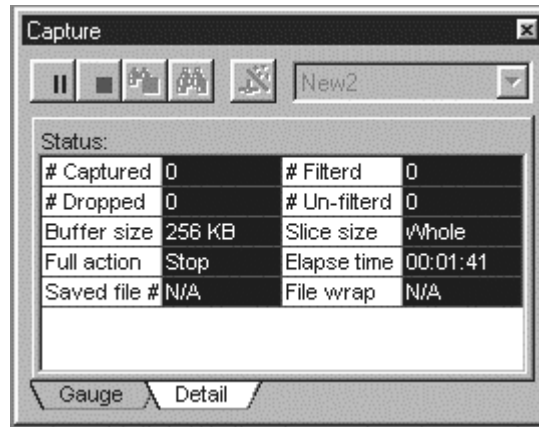
- Click Detail. You can see the numbers, which operate the three gauges and additional detail information. You will be particularly interested in looking at the size distribution of packets while you are making and audio call.



- Click the next Icon to view the Capture Tool. This tool can be started and stopped to capture traffic on your network for later analysis. It captures packets to a buffer and shows the packet count and how full the buffer is. You will use it to capture packets carrying digital voice data.



6. Click Detail. You can see the numbers, which operate the two capture gauges and additional detail information on the packets which have been captured and the buffer status.



7. While you are making an audio connection, click on the Capture Tool and it will begin capturing packets.
8. Click the Packet Distribution icon, to view the captured packets. You can look at the protocols graphically or in a listing.
9. View the connection diagram. Is it what you expected?
10. Click the Matrix icon to view the matrix connection. This will display a circle. On the diameter of the circle you will see the active IP addresses on your network. The traffic they are generating will be represented by the thickness of the lines between them. How do the IP addresses that have an open voice call appear?
11. Click the Packet generator icon. This tool lets you design and automatically generate traffic on your network.
12. Click the 0101 icon. This will display the Send New Packet Window. In this window we will design the traffic to be generated.
13. Click the Size button and enter 64 for the packet data size.
14. In the entry field labeled Delay, enter 10 milliseconds.
15. In the Send box, check the button labeled Continuously.

16. Click OK. You will notice the traffic displayed immediately on the Dashboard. There will be about 90 packets per second and the overall utilization will be 65 to 70%.
17. Click Stop on the Packet Generation control panel. You will notice that the Dashboard gauges drop back to 0.
18. Click Start on the Packet Generation control panel. You will notice the Dashboard gauges start up again.
19. Choose several combinations of larger packet sizes and greater delays to explore their impact on packets per second and utilization of the LAN.
20. You are now prepared to generate traffic loading on your classroom network while you make an audio call. Generate other lightly and heavily loaded traffic conditions while you conduct an audio call.
21. Write a lab report describing the various connections you made and the variations you attempted during this lab. Include in your report conclusions you drew about the operation of VoIP on LANs. Speculate what differences may exist using the phone over the Internet. What problems did you encounter during the lab? Speculate what caused the problems and what might be done to correct the problems. Would you recommend PhoneFree as an Internet SoftPhone to your friends? Why?
22. Include this lab report in your portfolio after you share it with your teacher.

Rubric: Suggested evaluation criteria and weightings:

Criteria	%	Your Score
Thorough record keeping in journal	25	
Cooperative teamwork	25	
Quality lab report with critical analysis of activity	50	
TOTAL	100	

Network Wizards: VoIP Product Brochure

Materials Needed:

- Windows 95 PC
- Internet Connection (optional)
- Any Word Processor (e.g., MS Word) or Any Desktop Publishing Tool (e.g., Pagemaker)
- Pen/Pencil and Paper
- Student Portfolio



There are many products on the market today and more under development that address VoIP solutions for the corporate environment. Some of the products introduced by Nortel Networks include:

- The Meridian product series, which includes PBXs and the Meridian 9617 USB Telephone with Personal Call Manager and Voice Dialer software.
- Symposium Multimedia Tool Kit offers application development tools for the creation of call centers.
- Passport VoIP gateways.
- Call Pilot that unifies the user's inbox for voice, fax, and email.

Although Nortel Networks is a leader in the IP telephony arena, they do have competitors. In this activity, your goal is to research the various products offered by not only Nortel Networks, but also at least three of their competitors. Once you have completed your research, create a brochure that outlines the various products, the options and services provided by each product, and if possible comparative prices.

You may wish to limit your research to one type of product, such as USB telephones or VoIP gateways. Your brochure should have a professional appearance worthy of review by a client. Using your word processor or another publishing program will help create an organized brochure that includes a graphic representation of each product.

Before you finalize your brochure, have three other students read and critique the brochure. Your reviewers are looking for grammar and spelling mistakes, poor or incomplete information, and overall quality of the layout and presentation.

Once reviewed by the students, correct any problems and print out the brochure. Give the brochure to your teacher for review. Incorporate any suggestions or corrections your teacher offers and print out the final brochure.

Finally, share the brochure with your contacts at your case study organization. Request comments, corrections or suggestions that they feel would improve the quality of the brochure. Their comments are very important, since they represent the target audience for your brochure. Be sure to incorporate any comments that will improve the quality of your brochure.

Once finalized completely, give the brochure to your teacher for grading.

Place your brochure in your portfolio. It will be an asset to you if you choose to work in the networking field in the future.

Rubric: Suggested evaluation criteria and weightings:

Criteria	%	Your Score
Thorough product research	30	
Grammar, spelling, organization, and information reviewed and corrected	20	
High quality brochure with complete product information and graphics	50	
TOTAL	100	

Summary

Voice Over IP Applications

In this lesson, you learned the following:

- VoIP solutions for individuals and businesses
- Why the Internet Protocol offers the best advantages for unifying data and voice networks
- The benefits of VoIP
- Three VoIP business applications

Review Questions

Voice Over IP Applications

Part A:

1. What is a SoftPhone?
 - a. A telephone that is connected to a computer via an USB port.
 - b. A telephone that is connected to the Internet via a PBX.
 - c. A VoIP software application installed on a PC that allows users to make calls over the Internet.
 - d. An IP-enabled telephone.
 - e. None of the above.
2. What does ITSP refer to?
 - a. Internet Transport Service Protocol
 - b. Internet Telephony Service Provider
 - c. Intermediate Telephone Service Provider
 - d. International Telephone Service Provider
 - e. None of the above.
3. What is an IP PBX?
 - a. A PBX with an integrated VoIP gateway.
 - b. A PBX that can connect directly to an IP network.
 - c. A VoIP solution for businesses and large organizations.
 - d. A and B only.
 - e. A, B, and C.

4. What is the minimal computer configuration to use a Softphone?
 - a. An Internet connection only.
 - b. A dial-up Internet connection, 16 MB of RAM, a sound card, speakers, microphone, and a modem.
 - c. A dial-up Internet connection, a PSTN telephone, a sound card, speakers, and a modem.
 - d. Either B or C
 - e. None of the above.
5. A VoIP gateway digitizes, compresses, and packetizes analog calls for delivery over the Internet.
 - a. True
 - b. False
6. What does ICW refer to?
 - a. International Calling Worldwide
 - b. Internet Call WAN
 - c. Internet Call Waiting
 - d. Information Carrier Workgroup
 - e. None of the above.
7. Using a SoftPhone to make a call over the Internet relies on best effort quality of service.
 - a. True
 - b. False

8. With ICW an Internet subscriber may
 - a. Accept a call using a regular telephone.
 - b. Accept a call over the Internet.
 - c. Forward a call to voice mail or another telephone number.
 - d. Play a pre-defined message to the caller.
 - e. All of the above.
9. It is possible to place a call from a PC to a telephone using a VoIP gateway provided by an ITSP.
 - a. True
 - b. False
10. Organizations and individuals can save a lot of money using VoIP to make all their calls, including local calls.
 - a. True
 - b. False

Part B:

Why does the Internet Protocol offer the best advantages for unifying data and voice networks?

Part C:

Identify each statement about the benefits of voice over IP and unified networks as either true or false.

1. The cost of telephone service is reduced when overseas calls are made using VoIP.

2. When unifying voice and data, an organization requires just one network infrastructure.

3. To maintain VoIP and a unified network, an organization must have two sets of support staff.

4. VoIP gateways can be configured to route voice calls over alternate routes to avoid congested networks.

5. Mobile users and telecommuters do not benefit from consolidating data and voice networks into one network.

6. SoftPhones save individuals money when making local calls.

- 7... Toll Bypass means that calls made using VoIP bypass the charges of the Telephone Company.

8. IP packet switch networks allows a greater number of simultaneous calls across a T1 line than circuit switched networks.

9. Using VoIP eliminates long distance charges for the remote user.

10. Providing voice, data, video and fax at the desktop increases the day-to-day operations of employees.

Part D:

Describe three business applications using VoIP.

Scoring

Criteria	%	Your Score
Part A: Identify VoIP solutions for individuals and businesses.	20	
Part B: Describe why the Internet Protocol offers the best advantages for unifying data and voice networks.	30	
Part C: Identify the benefits of VoIP.	20	
Part D: Describe three VoIP business applications.	30	
TOTAL	100	
Try It Out:	100	
Stretch Yourself:	100	
Network Wizards:	100	
FINAL TOTAL	400	

Resources:

Black, U. (2000). Voice Over IP. Upper Saddle River, New Jersey: Prentice Hall PTR.

Gareiss, R. (1998). Voice Over IP Services: The Sound Decision. Available Online: <http://www.data.com/roundups/decision.html>.

Goncalves, M. (1999). Voice Over IP Networks. New York: McGraw-Hill.

Held, G. (1998). Voice Over Data Networks. New York: McGraw-Hill.

Nortel Networks. (1999). Internet Call Waiting. Available Online: <http://www.nortelnetworks.com/products/01/icw/index.html>.

Nortel Networks. (1999). Voice Fundamentals. Santa Clara, California: Nortel Networks.

