HOW WORKS
WIRELESS TECHNOLOGY
WHAT’S INSIDE

Inside your wireless phone, there is a compact speaker, a microphone, a keyboard, a display screen, and a powerful circuit board with microprocessors that make each phone a miniature computer. When connected to a wireless network, this bundle of technologies allows you to make phone calls or exchange data with other phones and computers around the world. The components operate so efficiently that a lightweight battery can power your phone for days.

Today, wireless phones fit in the palm of your hand, weigh only a few ounces, and offer features such as color graphics, musical ring tones and voice-activated dialing. Only a few years ago, the electronics in this sleek device would have filled a large briefcase.

With wireless data services, you can receive faxes, browse the Internet, send and receive email or play video games—all on your wireless phone. Some even include built-in digital cameras, spreadsheet software, GPS location services and music features.

A wireless phone is really a radio—a very sophisticated and versatile radio. Much like a walkie-talkie, a wireless phone receives and sends radio signals. Because these radios connect into a network, wireless phones offer much more—the ability to call any telephone anywhere in the world, Internet access and data services.
Wireless networks operate on a grid that divides cities or regions into smaller **cells**. One cell might cover a few city blocks or up to 250 square miles. Every cell uses a set of radio frequencies or **channels** to provide service in its specific area. The power of these radios is controlled in order to limit the signal’s geographic range. Because of this, the same frequencies can be re-used in nearby cells. So, many people can hold conversations simultaneously in different cells throughout the city or region, even though they are on the same channel.

In each cell, there is a **base station** consisting of a **wireless antenna** and other radio equipment. The wireless antenna in each cell links callers into the local telephone network, the Internet or another wireless network.

No longer just big radio towers, wireless antennas can be mounted in church steeples, on trees and flagpoles, and on top of tall buildings. Many are no larger than stereo speakers. In rural areas, taller antennas send signals further distances to better serve users who are more spread out.

Wireless antennas transmit signals just like your local radio station. And just like your car radio, these radio signals can be obstructed by trees, tall buildings and even weather.
Connecting to the Wireless Network

When you turn on your wireless phone, it searches for a signal to confirm that service is available. Then the phone transmits certain identification numbers, so the network can verify your customer information—such as your wireless provider and phone number.

If you are calling from a wireless phone to a wired phone, your call travels through a nearby wireless antenna and is switched by your wireless carrier to the traditional landline phone system. The call then becomes like any other phone call and is directed over the traditional phone network, and to the person you are calling.

If you are calling another wireless phone, your call may go through the landline network to the recipient’s wireless carrier, or it might be routed within the wireless network to the cell site nearest the person you called.

If you’re calling someone further away, your call will be routed to a long distance switching center, which relays the call across the country or around the world through fiber-optic cables.

All of this takes place in a few seconds—before you say “hello.”
HOW YOUR VOICE MOVES WIRELESSLY

Most wireless phones use digital technology, which converts your voice into the binary digits 0 and 1—much like a music CD. These small packets of data are relayed through wireless networks to the receiving phone. On the other end, the conversion process is reversed and the person you are calling hears your voice.

But what makes your phone mobile? Say you’re talking on your wireless phone while walking down the street. The wireless network senses when your signal is getting weaker and hands off your call to an antenna with a stronger signal. Using smaller cells enables your phone to use less power and keep a clear signal as you move. Even when you’re not talking, your wireless phone communicates with the wireless antenna nearest to you. So, it’s ready to connect your call at any time.

If you travel outside your home area and make a call, another wireless carrier may provide service for your wireless phone. That provider sends a signal back to your home network, so you can send and receive calls as you travel. This is called roaming. Roaming is key to mobile communications, as wireless providers cooperate to provide callers service wherever they go.

Because the shape and size of cells vary, there may also be empty spaces between the coverage areas of two or more cells. These gaps or dead spots can also be caused by trees, tall buildings or other obstructions that block your wireless signal from reaching a nearby antenna. If a local government or landowner won’t allow placement of a wireless antenna, that too creates a dead spot.
A wireless phone is actually a computer connected to a radio. Thus, it works much like your personal computer does to send and receive information. Digital technology is used to convert data, such as short messages, e-mail or digital pictures, into small packets of 0’s and 1’s. These packets are also transmitted securely over wireless systems.

As the wireless industry converts to packet-based networks, utilizing the same technology as the Internet, wireless data services continue to expand. Today wireless networks operate at data speeds five to ten times greater than dial-up telephone or earlier wireless networks. New networks will offer even greater speeds, equivalent to DSL and beyond.

These faster networks mean that Internet services formerly available only on desktop PCs are becoming available anywhere, in the palm of your hand, as a result of digital wireless technology.
Remember, wireless phones are complex radios. Your wireless call travels over airwaves to another phone, just like music travels over airwaves into your radio receiver. Just like radios, wireless calls can be obstructed by tall buildings, hills, bad weather or the concrete and steel of underground garages. If you’re moving through rural or mountainous regions, or unpopulated areas, you might enter a dead spot where there is no wireless antenna close enough to connect your call or to hand off your call to another antenna. In densely populated areas, you may approach a wireless antenna that is already operating at full capacity. Unfortunately, many local authorities are not allowing wireless antennas to be built in their areas, so coverage and capacity cannot improve until they grant wireless companies permission.

What is the industry doing to improve wireless services?

The wireless industry is the most competitive part of the telecommunications market. Wireless companies work hard and invest heavily to serve their customers. Almost 20% of the average wireless phone bill is reinvested in expanding and improving wireless networks. Unfortunately, state and federal governments are imposing requirements more appropriate to a monopoly service, which transfer investment dollars away from expanding coverage and services, and into paying for regulatory decrees.
**What is the wireless industry doing to improve coverage?**

Wireless carriers add more than 50 new antennas every day and have invested over $80 billion in the last five years to improve coverage, to add capacity and to better serve you. They monitor their networks, adding capacity and "filling holes" where it is needed most. However, wireless carriers often struggle to get permission from zoning authorities, which is required before a new antenna can be placed. Federal, local and state authorities often resist adding wireless antennas—even though they can be camouflaged on trees, flagpoles and even church steeples. Even more resources would be invested in improving coverage if millions of dollars were not tied up in fulfilling new government rules and regulations that do not address consumers’ number one priority—increased quality and coverage.

**Why are there so many taxes and fees on my wireless phone bill?**

Government-added taxes and surcharges reach as high as 20% of your total monthly bill. Telecom taxes have risen by more than 60% since 1986. Only alcohol and tobacco are taxed more. Every phone bill includes a 3% Federal Excise Tax. This “luxury tax” was first levied in 1898 to fund the Spanish American War. Today, the tax remains, even though the Spanish American War is, literally, history. Wireless bills also include fees for the federal Universal Service Fund to help provide telecommunications services to rural areas and poor Americans, as well as Internet access to schools and libraries. Most users also pay a 9-1-1 surcharge, which is intended to pay for upgrades to 9-1-1 call centers. Unfortunately, many states have raided these 9-1-1 funds to pay for other items in their state budgets.
When will the wireless industry provide location information for wireless 9-1-1 calls?

When a wireless call is made to 9-1-1, the signal also includes information regarding the caller’s general location. Unfortunately, many 9-1-1 call centers and the local phone companies that relay location data have not upgraded their computer equipment, so they can’t transport or process the location information. Wireless carriers continue to invest millions of dollars in upgrading equipment so that a wireless caller’s location can be pinpointed. This continual improvement in the accuracy of the location information, however, will be unusable until local 9-1-1 operators and local phone companies cooperate to ensure that access and equipment are available to process the location information.

Can my wireless phone be cloned or my calls intercepted?

Almost every wireless phone sold today uses digital technology, meaning it transmits information over the airwaves as a series of 0’s and 1’s. It is extremely difficult to clone such phones or intercept such calls. Wireless phones also have many built-in security features, such as automatic phone authentication and electronic serial numbers. All these features make your digital wireless phone and your digital wireless calls very secure.
I’ve read that some wireless networks are not secure, does that include my cell phone?

Your wireless phone uses sophisticated authentication and encryption technologies to secure your calls. Some other technologies—also called ‘wireless’—have a lesser degree of security. These technologies, such as Wi-Fi, 802.11 and Wireless LAN, have recently made headlines as having a lesser level of security than your wireless phone. Through a combination of constant monitoring of wireless networks for intrusion or fraud, and unique electronic serial numbers on each phone, your wireless phone has a high level of security.

Why do I have to sign a service contract with my wireless company?

Most consumer packages contain incentives, such as free or discounted equipment, free minutes or other promotions. In return, wireless companies ask for a contract commitment, which specifies that beneficiaries of the special deal will do business with the company on specific terms for a certain period of time. Most wireless companies also offer a trial period, which allows you to try out the service for between 14 and 30 days, and terminate the contract within that period without penalty.
Will wireless carriers continue to provide analog service?

Wireless carriers are phasing out analog services over the next few years, for both capacity and security reasons. Analog uses scarce spectrum—or airwaves—very inefficiently, meaning that fewer calls and fewer callers can get through. To support the growing number of wireless users, as well as government users and others who share limited airwaves, we all must use spectrum as efficiently as possible. More efficient technologies also mean lower costs for your wireless services, and more advanced features like text messaging, Internet access, music and graphics. Already, 85% of Americans use digital services, which are more secure, and innovation is moving so quickly that more consumers are ‘going digital’ every day.

What can I do with a used cell phone?

Put your used wireless phone to good use! Since 1999, the Wireless Foundation has worked with various charities to collect and recycle used phones. More than 1.5 million wireless phones have been collected to support charitable organizations, such as domestic violence shelters, scholarship funds and numerous other causes. The Foundation has also helped more than 300 charities begin their own collection programs nationwide. Several wireless carriers and retailers have programs that allow you to drop old phones at stores around the country to benefit specific charities. Go to www.donateaphone.com for more information.
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