How A Modem Works Essay, Research Paper

Abstract

This paper has explained in some detail what a modem is and how a modem works. The evolution of a modem, transfer of speeds through various sized modems, and how data transferred has also been discussed.

The word modem is an acronym for Modulator Demodulator. Modems accept digital data supplied by the personal computer, and convert it to a modulated analog waveform that can be transmitted over an analog telephone line. Modems also work in reverse. They take a modulated analog wave from the phone line, then convert it to a digital form, then pass it onto the personal computer (PC). Modems, at connection, send tones to each other to negotiate the fastest mutually supported modulation method that will work over whatever quality of line has been established for that call. There are two main differences in the types of modems for the PC, internal and external.

Modem data transfer rates have gone from 300bps to 1,200bps to 9,600bps to 14.4kbps to 28.8kbps and to 33.6kbps. Now new modem standards are emerging, reaching speeds of 56kbps. Viewing graphics or downloading sound files improves dramatically with 56kbps. The experts say that the next major improvement will have to come from the telephone companies, with the fiber optic cables so we can have an integrated services digital network (ISDN). Digital connections are more efficient because of the frequent disconnects and modem freezing of the analog modem. These errors can be caused by line noise, which can come from many sources such as lightning storms, sunspots, and other electromagnetic phenomena. Modems will automatically reduce their speed to avoid introducing data errors.

The transmission of speed sometimes causes confusion. The root of this problem seems to stem from the term’s baud and bits are used interchangeably. A baud is a change in a signal from positive to negative or vice-versa that is used as a measure of transmission speed and bits per second is a measure of the number of data bits (digital 0’s and 1’s) transmitted each second in a communications channel.

Synchronous and Asynchronous data transfer are two methods of sending data over the telephone line. In synchronous data transmission, data is sent via a bit stream, which sends a group characters in a single stream. In order to do this, modems gather groups of characters into a buffer, where they are prepared to be sent as such a stream. In order for the stream to be sent, synchronous modems must be in perfect synchronization with each other. When the clocks of each modem are in synchronization, the data stream is sent. In asynchronous transmission, data is coded into a series of pulses, including a start bit and a stop bit. A start bit is sent by the sending modem to inform the receiving modem that a character is to be sent. The character is then sent, followed by a stop bit designating that the transfer of a bit is complete.

There are about 16,000 bits in a full page of English text. In order to view a full motion full screen video it would require approximately 10,000,000 bits per second, depending on the data compression.

In some cases, the PC equipped with a 28.8kbps modem would be faster than a 33.6kbps or even a 56k modem, especially with sites that do not have a great deal of graphics. There are several factors in determining the time it takes to connect and display a Web site. These include the speed of your computer, your connection to your Internet service provider (ISP), your ISP’s connection to the Internet itself, traffic on the Internet and the speed and current traffic conditions of the site your visiting.

U.S. Robotics, Cardinal, Rockwell, and other manufacturers have developed modems capable of 56k speeds over standard telephone lines. U.S. Robotics line of modems called X2 uses an “asymmetric” scheme. This lets you download at speeds up to 56kbps from any on-line service or ISP using matching U.S. Robotics modems. One catch with the data you upload to the provider is still limited to 33.6kbps or 28.8kbps.

There are no set standards for the 56kbps modems as of yet, not all vendors support the same specifications. This means that the Rockwell based modem will not work with the U.S. Robotics modems.

ISDN (Integrated Services Digital Network) is a way to move more data over existing telephone lines. ISDN cards are like modems, but are approximately 5 times faster then regular 28.8 modems. It can provide speeds of up to 128,000 bits per second. ISDN has a couple of advantages. It can use the same existing phone line, so the telephone company may not have to install new line. A physical ISDN line provides two 64kbps phone lines called channels that can be used for voice and data. The cost on ISDN is substantial, installation, setup fees and the cost of a special digital adapter. An ISDN line goes through a converter powered by AC current and if the power fails, so does the telephone line.

Cable modems offer a very fast connection and are capable of uploading and downloading approximately 10 to 27 megabits per second. A 500k file that would take 1.5 minutes download over ISDN would take about one second using cable. Cable modems use the same coaxial cable that connects televisions.

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