INTERNAL AND EXTERNAL MODEMS - DIFFERENCES

What it stands for

Modem is short for modulate, demodulate. It is a way to get a message from a PC across telephone lines to another PC. Your computer is digital and works with 0s and 1s, whereas the telephone is analog and works with waves. Thus you need to alter the form of the information in your computer generated message to enable it to be carried across the telephone lines.

How they work?

The PC is considered a digital device. Thus everything about your computer and what you do with it, breaks down to a series of 0's and 1's. This comes about through a series of electronic switches which turn off and on. When the switch is off a 0 is created, when the switch is on a 1 is created. Thus when you type in the number 9, the switches have been programmed to see this as 00001001.

To pass a message between PC's using a modem, it must go through the telephone system. The telephone lines use an analog signal. This signal resembles your voice which has many tones and frequencies, ups and downs to it. It carries your voice in waves.

The modem is the bridge between the digital of your computer and the analog signal of the telephone lines. When you send a message via a modem from your PC the process is this:

- The message in your PC is in digital form therefore your PC has converted your message to a whole bunch of 0's and 1's. This message is sent to the modem which converts your digital message into the analog required by the phone system by modulating the frequency of the electronic wave.

- This encoding process puts the transmission into a mode compatible with the media of the telephone system which uses copper wire, microwave, fibre optic and satellite. The code is then transferred across this media. On reaching the PC the message is sent to, the analog signals are demodulated back into digital code through another modem and the message is received.

Buying a Modem

When deciding on a modem to buy, select a model that matches your computer and level of expertise. Modems can be purchased in three different forms, external, internal and as a PCMCIA card - commonly referred to as PC Card (used with laptops).

External Modems

If your expertise is minimal, you should purchase an external modem as it's the simplest to install.

External modems usually come with a panel of lights which display information about the current sessions (see the section titled 'The lights on your modem' further on), these can aid you in working out what problems are and how to fix them.

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Many external modems also have a volume control which is great if you really don't want the whole household hearing you connection signals. The external modem can sit on top of your hard drive or on your desktop and is connected to your computer by a serial cable.

Internal Modem

Internal Modems tend to be cheaper since there is no case or power supply, no cables to knock loose or get in your way and you don't have to find somewhere to put it since it lives inside your computer.

Installing an internal modem involves locating an unused IRQ interrupt and COM serial port in your computer and then simply configure your internal modem to use it.
Once you've got to this stage, take the outer case off your computer and install the card in a free expansion slot.

Plug &Play

Plug and play is an essential part of PC modem installation. This is a Microsoft standard dictating that hardware devices must declare their presence to Windows 95/98 and tell the operating system how to install the specified hardware. This makes installing an internal or external modem far easier than it used to.

USB

USB stands for Universal Serial Bus. It is a technology that makes installing a modem much easier. Most new computers have USB ports, which allow devices like modems to be connected and automatically installed.

Modem Speeds

When you are using your modem to download something there will be two modems involved - yours and the modem at the site you are downloading from, the speed of the transfer is set to whoever has the slowest modem.

Not all sites use modems though, some have ISDN lines which work much faster (see the explanation on ISDN further on in this tutorial). V.90 technology is another method to speed up transfer rates, this also is explained in a different section within this tutorial.

Very often, you will see that the speed of the transfer is nowhere near the speed of your modem - even when you know the modem at the other end is of the same speed or even better than yours.

There are many explanations for this such as:

- Bad telephone lines - similar to when you are talking on the phone to someone and have to hang up and try again because the connection is so bad.
- Your phone jack may be faulty - try plugging your modem into a different jack if you can

Dropped connections can occur if your phone line decreases in quality during a call. To compensate modems tend to switch to slower and slower speeds to compensate for this. Under

extreme conditions your modem may disconnect. Internet congestion can also slow up the response time. Try dialling in outside peak hours.

Bandwidth is also a problem in many cases, again try dialling in outside peak hours.
If you know someone who lives nearby, see what their connection rate is, this will alert you to whether it's the phone lines or your telephone jack or the software you have installed to run the modem.

You can check out the speed of your modem by going to Leslie Long's Modem Speed Test Page. These tests measure how long it takes to load a test page from its server, and display it on your browser. This simple test should be a good indication of how fast or slow your data transfer rate over the Internet really is.

V.90

V.90 is a modem standard. It can be found on many 56K modems. This technology has altered the speed of data transfer. For the first time, a technology has arisen which assumes that one end of the modem session has a pure digital connection to the network and it takes advantage of that high speed digital connection.

V.90 can accelerate data downstream (data coming to you) to your computer at speeds of up to 56Kbps by digitally encoding the data instead of modulating it. It is unable to do the same Upstream (from your computer) so it sends this data as an analog transmission. This works well if you mainly download data to your computer from another site. But you need to make sure that your V.90 modem is connected to an ISP or company site which uses V.90 technology over their lines

The Lights on your Modem

Have a good look at your modem (if you have an external one). It has a line of lights with letters next to them. Ever wondered what they mean. Well here's the info:

- **MR** Modem Ready light which tells you that the modem is turned on and ready to go
- **HS** This is the High Speed light - if it's switched on it tells you that it's working at its top speed, this also tells you that the modem at the other end is either as fast as yours - or better
- **CD** Carrier detect light. This tells you that the modem has made a connection with another modem. This light goes out when either your modem or the remote modem breaks the communication
  OH Off hook light, it goes on when your modem is in control of the telephone line
- **SD** Send Data, it goes on when your sending your data
- **RD** Receive data, works in the opposite way as the SD light
- **TR** Terminal Ready, this light turns on when your modem has detected a DTR signal. It tells your modem that the communications program on your PC is up and running
- **AA** Auto Answer light, if switched on, it lets you know that any message sent to your computer will be answered
  PWR the Power on light

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What about ISDN lines

ISDN stands for integrated services digital network When you send a message through an ISDN line you aren't really using a modem at all because it works entirely with digital signals. Thus the analog of the telephone line is not used and the message isn't converted therefore no modem is required

Medium Difficulty

When you wish to send a message to another computer via a modem, your communications software must first send a signal to your serial point (also known as the RS232 interface which is named after the standard which defines which signal is carried on which wire). The signal is known as the DTR signal or Data Terminal Ready signal that tells your modem that the PC is on and ready to transmit.

The PC then detects a signal from the DSR, Data Set Ready pin, located on the serial port, which tells the PC that it is ready to receive instructions. The serial port plays an important part in this, it contains between nine and twenty five pins, all with specific tasks and definitions. Throughout this explanation different pins on the serial port are used to signal different definitions which will be explained as we go along.

The communications software then sends a command to the modem via the Transmit Data line on the serial port. This command orders the modem to open a connection with your phone line, then another command tells the modem to start up the tones and pulses necessary to dial the specific phone number.

The PC then receives an acknowledgment from the modem via the Receive Data line on the serial port. When the remote modem is contacted by your modem, and it is not currently busy it responds with a higher pitched tone, you can usually hear these if your modem comes with some form of speakers. This establishes communications.

The PC then receives a Carrier Detect signal vial the serial port again, which tells your communications software that a carrier signal is established. This is the steady tone you can hear via your modem, it is of a specific frequency which will soon be modulated to transmit data.
The two modems then need to work out how they will send the data, this is where the different speeds of the modem come into account. You may have a 56K modem, however if the modem at the other end is only a 28.8K modem, that is the speed at which the data will eventually be sent.

Other agreements the modems must work out is the number of bits which will make up the data packet what will signal the beginning and end of a packet, what sort of error checking they will use and whether they will work at half-duplex or full duplex . This process is known as hand shaking. If they do not agree the message will end up being completely mashed up or not sent at all.

½ **Duplex:** this is a two way transmission of data, but only one direction can transmit data at a time - similar to a walkie talkie.

Full duplex: this is a two way transmission of data, which allows data to be transmitted in both directions simultaneously.

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A message is not sent all at once, but in small packets of data. These packets range in size, and in addition to containing data from your message also contain a start bit and end bit to signal the start of a character and end of a character, an error checking bit (parity bit) and a bit to say where in the sequence of packets being sent, it comes - plus some data as well which is comprised of bits of your message.

The communications software then sends a signal to the modem via the serial port - on the pin which signals RTS or Request To Send, which as it suggests, is asking the modem if it can start sending the data.

If the modem is free it sends a signal to a pin on your serial port which signals CTS or Clear to send, the PC then sends the data on a specific line. If the data is sent to the modem, too fast, the modem stops the CTS signal that tells the PC to wait until further notice. The remote modem, hears the incoming data as a series of tones and pulses. It then demodulates these back into digital format and passes them onto its computer.

This incoming data comes in packets as mentioned earlier, and these packets are then put back into the correct order, checked for errors and opened. Once the message has been sent and received a command is sent to the modem to ensure the phone connection ceases. The modem drops the Carrier Detect signal, which tells your PC that the communications have stopped.

This information was taken from the NetGuide website at:

www.netguide.com.au/useful_stuff/tutorials