A Technical Introduction to Choosing a Telephone Modem

UFIT

2046 NE Waldo Rd, Suite 2100
Gainesville Florida 32609-8942
(352) 392.2061
<editor@cns.ufl.edu>
Table of Contents

A Technical Introduction to Choosing a Telephone Modem .........................................3
Your Basic Modem Definition .....................................................................................3
A Technical Introduction to Choosing a Telephone Modem

This is part one of a series designed to help demystify modem designations. This installment covers modem terminology and speed protocols, including those supported by NERDC. To come: error correction (January) and data comprehension (February).


Your Basic Modem Definition

A modem (MOdulator/DEModulator) is a device that allows your computer to communicate via a telephone line. It converts digital signals sent by the computer into audible tones that are sent over a telephone line (modulating); and converts audible tones sent to it from the modem on the other end of the connection back into digital signals (demodulating). A modem can connect your computer to other computers so data can be shared between two machines, no matter how far away they may be physically.

Modem Speeds In Perspective

To put modem speeds into perspective, a transmission rate of 1200 bps translates roughly to 120 characters per second (cps), a rate of 2400 bps translates to roughly 240 cps, and so on. (This is because it typically requires 10 bits to transmit a single character or byte -- a stream of eight bits -- plus a start and stop bit.) If you are going to be running a simple text editor logged into a remote computer using a terminal emulation program, then 2400 bps might be an acceptable speed, but it would be very slow for transferring large files and would not be practical for surfing the World Wide Web. A transmission speed of 14400 or 28800 would be a much better choice for accessing services on the Internet.

NERDC customers often want to connect to NERDC services and the Internet from a microcomputer connected to a telephone line via a modem. At one time, choosing a modem was fairly straightforward, but as technology has advanced, modems have become more and more complicated. Worse, the terminology used to describe their features and capabilities is often bewildering.

To help you make better-informed purchases, this series explains the evolution and practical application of various modem communications protocols, such as the "V.34, V.42bis" standard supported by NERDC.

Further, we've provided a hypothetical modem advertisement (below) so you can compare advertised modem features with the explanations in this series. In this installment, Part 1, we principally cover modem speed, also known as "modulation." First, however, is a note about the scope of this article:

Modems for Standard Phone Lines Vs. "Other" Kinds of Modems There are many kinds of modems, not all of which may be appropriate for your computer. Several technologies exist to remotely access campus computers and the Internet. For example, "cellular modems" combine
modem and cellular telephone technology into one unit; "wireless modems" do not go through conventional telephone lines at all; and ISDN "modems" don't use modulation, but connect to a special high-speed digital telephone service. There is even a type of modem that works with cable television wiring. This article focuses just on modems that connect to standard telephone lines.

Protocols

Because of the wide variety of modems available, you can choose from a range of features and prices. But before you decide what kind of a modem to get, you should make sure that the modem you buy is compatible with the protocols supported by NERDC and any other service providers you intend to use. Communications protocols (or standards) fall into three broad categories -- modulation or speed, error correction, and data compression.

Some standards are international standards set by the International Telecommunication Union-Telecommunication Standardization Sector (ITU-TSS), formerly known as the International Telegraph and Telephone Consultative Committee (CCITT). ITU-TSS standards are normally designated by a capital letter "V" followed by a period (.) and a number. Some early standards in the United States are Bell System standards established by AT&T. Other standards are proprietary ones created by modem manufacturers; some proprietary standards have been adopted by other vendors and incorporated into international standards.

Speed or Modulation

The modulation protocol used by a modem determines how fast data, in the form of binary digits or bits, can be transferred over telephone lines. Speed is normally measured in terms of the number of bits per second (bps). (In the past, modem speed was often described in terms of baud, which refers to the number of signaling events that take place in one second. In some modulation schemes, more than one bit is transferred per signaling event. The term "baud" is often inaccurately used as a synonym for "bps.")

Generally, high-speed modems support lower-speed protocols as well. It is important to remember that modems on both ends of a connection must have at least one modulation protocol in common.

Following are the modulation standards most commonly used today. Protocols supported by NERDC (because they are incorporated into the V.34, V.42bis protocol) are prefaced by an asterisk (*):

* V.22bis is a worldwide standard that provides connections at up to 2400 bps. (The suffix bis is the Latin word for "twice," and it is used in standards to indicate a significant change or enhancement.)

* V.29 is a half-duplex standard normally used only by modems that have facsimile capability to send and receive faxes using the Group III fax standard. V.29 can operate at 4800, 7200, and 9600 bps. (Another standard for faxes is V.17, which can operate at up to 14400 bps. Fax machines that can operate at this speed are becoming more common.)

* V.32 provides connections at 4800 and 9600 bps.

* V.32bis is an extension to the V.32 standard that adds support for a maximum speed of 14400 bps and fallback speeds of 7200 and 12000 bps.
V.34, the preferred modulation protocol for connecting to NERDC dialup servers, supports modem connections at up to 28800 bps, with fallback speeds of 26400, 24000, 21600, 19200, 16800, and 14400 bps.

Other Standards

In addition, there are a number of proprietary and unofficial modulation standards for high-speed modems (9600 bps or faster) that you might come across. The best known of these are V.32terbo, which supports connections of up to 19200 bps; V.FC, a 28800 bps specification derived from an early draft of V.34; V.FAST, a preliminary implementation of V.34; Hayes Express 96, which was used on the earliest 9600 bps modems from Hayes Microcomputer Products, Inc.; HST (High Speed Technology) from U.S. Robotics, Inc.; and PEP (Packetized Ensemble Protocol) from Telebit, Inc., which was commonly used for UUCP (UNIX to UNIX copy) applications. These protocols generally are not compatible with each other or with the ITU-TSS standards, although modems that use these protocols now often support the international protocols as well.

'Supersets' of Speed Standards

Apart from the protocols discussed above, some modems support a "superset" of the ITU-TSS standards. For example, a few modem manufacturers are selling V.34 modems that can establish connections at speeds of up to 33600 bps; however, 33600 bps connections are not part of the current V.34 standard, so to take advantage of that speed you would need to connect to another modem with that same feature. An enhanced version of the V.34 standard supporting speeds of 31200 and 33600 bps was being finalized at the time this article was first written.

115,200 bps Data Transfer

Currently V.42 has become established as a protocol for error correction, and the related standard V.42bis (with MNP level 5) permits data transfers at speeds up to 115,200 bps by means of hardware compression of data. V.42bis is supported by NERDC.

Effective Speed

Note that speed in this discussion of modulation protocols does not refer to the effective data transfer rate. The effective speed of a modem can be diminished or augmented by factors such as error correction protocols, which can reduce the effective data transfer rate in certain circumstances, and data compression protocols, which can often increase it. When you are evaluating a modem, you need to know whether a "bps" figure refers to the modulation speed or the maximum effective data transfer speed. Error correction and data compression are addressed in the next installments of this article.

Your Comments are Welcome

We welcome your comments and suggestions on this and all UFIT documentation. Please send your comments to:

UF Information Technology
A Technical Introduction to Choosing a
Telephone Modem

UFIT
2046 NE Waldo Rd, Suite 2100
Gainesville Florida 32609-8942
(352) 392.2061
<editor@cns.ufl.edu>