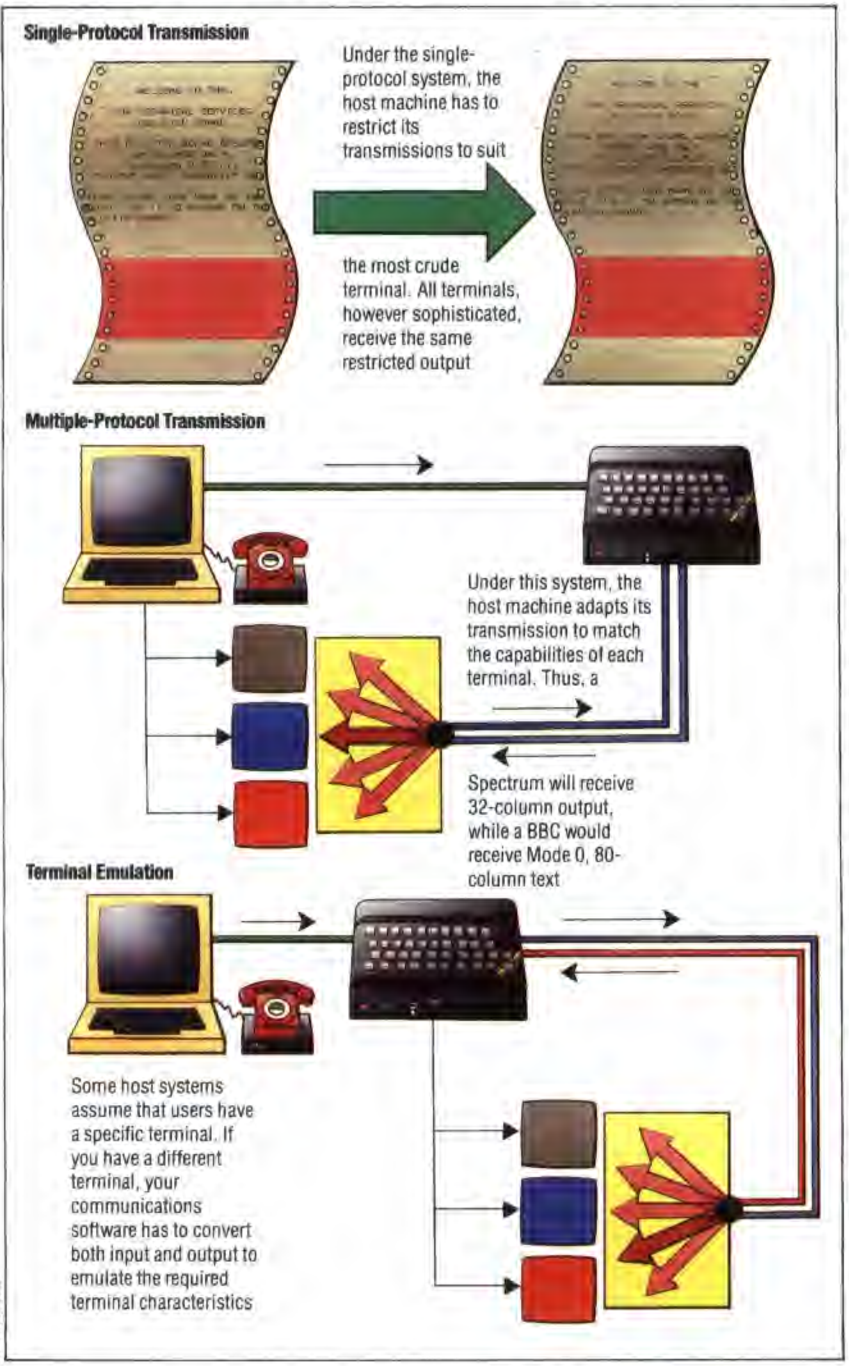
Observing Protocol
There are three main ways to approach communications protocols. The first is to assume the lowest common denominator (slow baud rate, narrow column-width, no colour or graphics, and so on). The second is for the host machine to modify its output to suit a variety of terminals (the technique used by most bulletin boards). The third is for the terminal to 'act like' a particular terminal — this is achieved through a software technique known as 'terminal emulation'

approach is more common, and is used by most bulletin boards. The third method is generally used by commercial and university systems, and relies on a software technique known as 'terminal emulation'.

As the name suggests, terminal emulation is simply a method of persuading a micro to act like a particular terminal. Very simply, terminal emulation software translates incoming terminal control characters (such as those used to clear the screen or position the cursor) into commands understood by the computer being used. Similarly, if the host expects a control character sequence from the terminal, the emulation software will supply it.

Almost all systems will understand a subset of ASCII control characters (for the full ASCII set see page 77). Some of the more useful characters are Control-S (ASCII 19, known as 'XOFF'), which temporarily halts data reception; Control-Q (ASCII 17, known as 'XON'), which restarts it; Control-J (ASCII 10, known as 'LF'), which forces a linefeed without a carriage return; and Control-G (ASCII 7, known as 'BEL'), which sounds the console bell. The last character can be useful if you need to attract the attention of the system operator at the receiving terminal.



Single-Protocol Transmission

Under the single-protocol system, the host machine has to restrict its transmissions to suit the most crude terminal. All terminals, however sophisticated, receive the same restricted output

Multiple-Protocol Transmission

Under this system, the host machine adapts its transmission to match the capabilities of each terminal. Thus, a Spectrum will receive 32-column output, while a BBC would receive Mode 0, 80-column text

Terminal Emulation

Some host systems assume that users have a specific terminal. If you have a different terminal, your communications software has to convert both input and output to emulate the required terminal characteristics

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THE XMODEM PROTOCOL

Having looked in detail at how ASCII data is transmitted, let's now consider how software is communicated. Transmitting software written in BASIC is straightforward. Most micros support some means of detokenising programs (that is, converting them from their compressed program format into ASCII form): on the BBC, we use *SPOOL; on the Commodore 64, we LIST to a disk or tape file; on the Tandy, the instruction CSAVE <filename>,A is used; and so on. The detokenised file is then transmitted and retokenised at the other end.

However, CP/M command (.COM) files cannot be turned into ASCII form, and any attempt to transmit one results in garbage. For this reason, a protocol known as 'XModem' was developed. XModem, which is a feature of some communications software, simply reads in a C/PM file from disk and transmits it in a standard binary format. The receiving terminal, of course, must also support XModem.

We'll be taking a detailed look at the uses of computer communications in a later article in this series. For now, let's take a brief overview of the range of activities a modem makes possible.

Electronic mail is the name given to systems where users can exchange private messages by transmitting them to a mainframe computer, where they are stored until the recipient logs on and retrieves them.

Most home micro users are interested in two particular applications. The first is to exchange software over the telephone. As we've already seen, transmitting BASIC programs is a simple matter, and is quicker, easier and cheaper than swapping cassettes by post. If you're having difficulty with a program you're writing, you can transmit a copy to friends and see if they can help. If they can, they can transmit a working version back to you!

The second hobbyist use is bulletin boards. These allow you to pass on information to other users, leave requests for technical help, swap jokes, download public domain software, play adventure games, and so on. Bulletin boards are run by enthusiasts, and there is normally no charge (although some boards may charge a once-only nominal fee — a pound or so — in order to cover running costs). We'll examine bulletin boards in detail in a later article. In the next instalment, however, we'll look at how to select modems and communications software.