Data communications over the telecommunications network

An important complement to local data communications is external communications. This is for example the possibility of connecting up to external databases in order to search for information on markets, to find out stock-exchange rates or to access public registers etc.

The number of databases which can be accessed has increased enormously and these databases are linked through global networks. For example, you might connect up to a national database and end up in an international financial database in New York.

External data communications can be justified for many reasons. For example, the telecommunications network is one way of gaining access to your office and your computer when you are engaged in field work.

Dial-up connections

Telephone modem

External communication via the telecommunications network means that you call the receiver's modem which answers. Both modems then set up a carrier over the PSTN line. The carrier is a signal which the modems listen for. When the two modems connect, it means that they can hear each other's carriers and lock into or "synchronise" on the signals.

Transmission speeds over the telecommunications network have increased, and nowadays, 2 400–56 000 bit/s are common. It is not only the modem itself which determines the speed, but also the PSTN line. The quality of the line is largely affected by the distance, the number of stations and relays. Most high-speed modems can automatically reduce their speed in order to maintain a high transmission quality.

Within telephone communications, it is very important to comply with the accepted standards, since the transmitter and receiver have no way of knowing what devices are being used on either side. The transmission speeds which are used in certain standards are shown in the table on the left.

Standards and speeds

V.21	*300 bit/s*
V.22	*1 200 bit/s*
V.22 bis	*2 400 bit/s*
V.32	*9 600 bit/s*
V.32 bis	*14 400 bit/s*
V.34	*28 800 bit/s*
V.34 bis	*33 600 bit/s*
V.90	*56 000 bit/s*

The language of the telephone modem

In order to communicate via the telecommunications network, in addition to a standardized modem, you need a terminal or a computer with communications software installed which uses the serial port of the computer.

Instructions are required to control the telephone modem. Hayes Micro-computer Products has developed such a language of instruction which has become the standard and which is known as the Hayes® commands. These are a set of instructions to the PSTN modem which can either be manually sent from the computer, via the keyboard, or which are automatically sent from the communications program when different tasks are carried out.

Error correction and data compression

Most telephone modems transmit data synchronously between the modems, even if the communication between the computer and the serial port is asynchronous. In order to monitor the transmission, the data can be divided into blocks and each block can be assigned a check sum. If there is interference, the check sum will be incorrect and the receiver will request re-transmission, also known as an ARQ (Automatic Repeat reQuest). The most common method of error correction using the ARQ approach is in accordance with the ITU-T V.42 error correction standard which is supported by both MNP (Microcom Networking Protocol) and LAPM (Link Access Procedure for Modems).

On-line services

The telephone modem can be used to connect to other computers, directly or indirectly via a network. The internet has rapidly expanded into the largest world-wide network with millions of users. The TCP/IP protocol used on the Internet allows electronic mail, discussion groups, world wide web (databases, information and marketing), file transmission and retrieval, telephony, video conferences, chat etc. However, there are also other networks and services available via a modem such as MEMO, Lotus Notes, CompuServe, etc. The PSTN modem can be used for distance working by connection to a company's computer.

Superhighways

Intensive work is being conducted on creating international standards and on constructing "Superhighways" for data communications. Fast digital high-speed networks, such as broadband ISDN, can rapidly convey large quantities of information containing data, sound and graphics, across the continents. The huge capacity of the cable TV networks can also offer a new resource for faster data traffic.

However, it is important to remember that the foundations of such efficient highways must first be laid locally, through efficient local data communications. With such a vital infrastructure in place, it will then be possible to open up and access national and global networks.

ARQ and MNP

MNP Level 1:
asynchronous protocol, half duplex

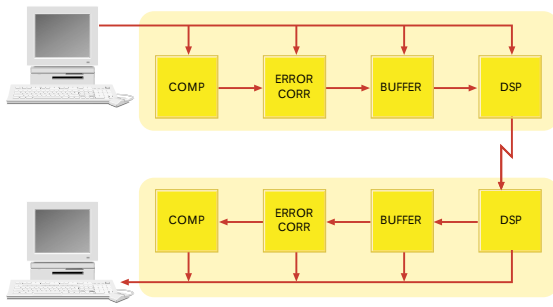
MNP Level 2:
asynchronous protocol, full duplex. Data divided into blocks. Actual data transmission speed somewhat lower than normal.

MNP Level 3:
synchronous protocol, full duplex. Data in blocks. 10% higher speed with error-free transmissions.

MNP Level 4:
data in blocks, block size according to line quality. Smaller blocks than Level 3 which results in a 20% faster transmission rate, when free from interference.

MNP Level 5:
as in Level 4, but with data compression which results in up to double the speed.

MNP Level 10:
a further development of MNP 5 which monitors the line dynamically and guarantees error-free transmission.



The fastest communications route is always in what is known as direct mode. Every stage of compression, error correction and buffering causes a time delay.