

MODEMS

M. Lutfar Rahman

Transfer of small amount of data between two computers can be done by a physical storage device such as a magnetic disk or a magnetic tape. But faster transfer of a large amount of data requires wiring the computers together to enable direct exchange of information. Vast amount of data are now carried by telephone lines and applications of electronic data communications are expanding in our country. Electronic data communications are going to change the way the business operates and the way we work. As more and more people get access to computers there will be greater reliance on the use of telephone lines for data transfer for electronic mail, facsimile, file transfer etc. Computer based systems also can save time and travel costs through the use of data communication through telephone lines. Modems are required to set up a communication link between two distant computers through the telephone line (Fig. 1).

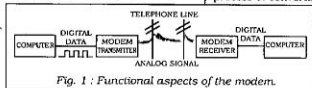


Fig. 1 : Functional aspects of the modem.

Communication Modes

The commonly employed communication modes in a modem are : simplex, half-duplex and full-duplex. The simplex mode provides one-way communication between two points involving a transmitter at one point and a receiver on the other. The half-duplex provides two-way communication between two points but only one-way at a time. The arrangements use a receiver and a transmitter at each end. The full-duplex operation provides a two-way communication with both points able to transfer data simultaneously. This mode requires a four-wire telephone line unless when split-frequency band modem is employed. For split-frequency band the bandwidth is split into two separate bands one for transmission and the other for reception.

Data transmission rate

Data transmission speed, utilizing conventional telephone lines, is an important parameter for a modem and depending on this speed modems can be categorized as : low speed (0 to 600 bps), medium speed (600 to 4800

bps) and high speed (4800 to 9600 bps) modems.

Data transmission rates are specified as bit rate or baud rate. The bit rate is the actual rate of transfer of data, whereas baud is the unit of signaling. For higher data transmission rate special modulation techniques are used which enable the transmission of multiple number of bits per baud. High speed modes require two, three or four bits per baud to implement bit rates of 2400, 4800 or 9600 bps.

Modulation techniques

Telephone signals are analog in nature, that is these signals rise and fall continuously. Computer data are digital (0, 1) in nature and transmission of data from one computer to another over telephone lines creates special problems. Thus it is necessary to convert a digital signal to analog form in order for a computer to send information over telephone lines. The process of converting a digital signal to its analog form is called modulation. At the receiving end the analog signal is converted back to its digital form and the process of this conversion is known as demodulation.

The major forms of modulation (Fig. 2) used in modems are : amplitude-shift keying (ASK), frequency-shift keying (FSK) and phase-shift keying (PSK). In ASK a single frequency is turned on to represent "1" and it is turned off to represent "0". ASK is used for very low speed transmission because of its poor noise rejection characteristics. The FSK uses one frequency to represent a "0" and another frequency to represent a "1". In the simplest form of PSK, the phase of a sine wave carrier is shifted by 180 degrees to represent a change in the data from a 1 to 0 or from a 0 to a 1.

A special device called modem is used at the transmitting end to convert digital signal to its analog form for transmission over telephone lines and another modem at the receiving end converts the analog signal back to the digital form. Thus modems must be present at the transmitting and receiving ends of a communication link. The term modem is formed by combining the terms modulation and de-

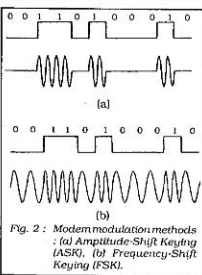


Fig. 2 : Modem modulation methods : (a) Amplitude Shift Keying (ASK), (b) Frequency Shift Keying (FSK).

modulation. Modems operating on telephone lines are called voice grade or voice band modems.

For error free data transmission, modems employ sophisticated modulation techniques. The FSK technique is normally used in low speed modems. The receiver and transmitter sections of the modems respond to two different frequencies one for representing 0's and the other for 1's. In PSK data are transmitted as a phase change information. The data are encoded by phase information of the carrier signal (1700 Hz in some modems), that is phase changes define the data. Transmitting multiple phase changes enable higher data encoding.

The simple PSK has no real advantage over FSK. By using additional phase angles besides 180 degrees, two or three bits can be sent in one baud. Two bits sent in a single baud are called dibits and three bits sent in a single baud are called tritbits. Each pair of bits in the data stream is treated together for dibit encoding, and the value of the two bits determines the amount that the phase of the carrier will be shifted. Common set of phase-shifts used to represent the four possible dibit combinations are :

| Dibit values | phase-shift (degrees) |
|--------------|-----------------------|
| 00 | 0 |
| 01 | 90 |
| 11 | 180 |
| 10 | 270 |

The value of the carrier, here, only

has to change for each two transmitted bits. For example, if the value of two bits taken together is 00, the phase of the carrier will be shifted by 90 degrees to represent that dibit. Baud rate is the rate at which the carrier changes. In this case it is not the same as the number of bits transmitted per second. Here 1200 bits are transmitted in one second at a rate of 600 baud. This scheme is employed in Bell 212A type modems. For full-duplex mode using PSK scheme two different carrier frequencies (1200 Hz and 2400 Hz in some cases) are normally used.

The data stream is divided into groups of three bits for tritbit encoding. The following table shows one common set of phase-shifts used to represent the eight possible tritbit combination :

| tritbit values | Phase-shift (degrees) |
|----------------|-----------------------|
| 001 | 22.5 |
| 000 | 67.5 |
| 010 | 112.5 |
| 011 | 157.5 |
| 111 | 202.5 |
| 110 | 247.5 |
| 100 | 292.5 |
| 010 | 337.5 |

The Bell 208 modems use this tritbit scheme to transmit data at 4800 bps.

High speed modems employ a combination of amplitude modulation and

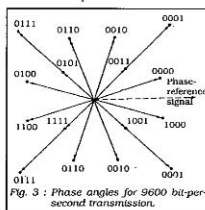


Fig. 3 : Phase angles for 9600 bit-per-second transmission.

phase modulation called by the name quadrature amplitude modulation. For example, a standard 9600 bps modem uses twelve phase angles four of which has four amplitude values (Fig. 3)

Acoustic modems

Two different types of modems are : acoustic modems and direct-connect modems. An acoustic modem consists of a small box with two doughnut-shaped speaker cups made of spongy material. It is also known as acoustic coupler. The acoustic cou-

pler is connected to the computer and a telephone hand-set is placed on top of two speaker cups. An acoustic coupler is used for applications which require special communication needs. A standard telephone hand-set can also be placed on (top of the coupler. For using an acoustic modem, the telephone number of the remote computer is first dialed and the telephone hand-set is placed on the coupler when the answering tone is heard.

Direct-connect modems

These modems can be connected directly to the telephone lines. Most of the direct-connect modems can be used for voice as well as computer communications. Two types of direct-connect modems are : external modems and internal modems.

An external modem is completely a self-contained unit and is plugged into a serial port the back of a computer. An external modem, a small box in appearance, also requires external electrical power supply. An external modem, attached to a computer by a cable, is connected to the telephone line. A number of status lights of the modems indicated the activities to the modem. Such activities include: test mode, auto answer, carrier detect, send data, receive data, ring indication etc.

Interfacing

Most of the personal computers have a built-in communication adapter. This adapter is called an RS-232C connector or serial port. The RS-232C (also known as EIA-232D) refers to the type of cable that is used to connect the serial port and a modem. If the computer do not have a built-in communication adapter, a board should be added to the computer for connecting a modem.

An internal modem is an expansion card that can be purchased and installed in the expansion slot on the mother board of the computer. Internal modem boards contain the electronic circuits for the communication adapter. Some personal computers are supplied with internal modem built into them. The cost of an internal modem is less than that for an external one.

Some modems are smart or intelligent in the sense that they do more than translate information. Such a modem can test itself, connect directly to telephone line, dial the phone number of another computer, answer a telephone call, adjust to the rate of data transmission. A normal telephone line is good enough for data transmission at low speeds. However, most business organizations transmit data

at very high speeds and require special noise free dedicated or leased telephone lines.

Uses

A modem can be used for sending and receiving electronic mail, accessing electronic bulletin board, utilizing public data networks (yet to be installed in Bangladesh) and many other applications. Modems are necessary to connect two computers at a distance. If two computers are closed together and both have serial ports then a modem is not required to transfer data or exchange messages between them. The connection between two computers without modem is called a null-modem connection or direct connection.

Selection of Modems

Modems are manufactured following CCITT standards. The standards relating to modems start with the letter V. Examples are : V.26 which is a 2400 bps modem, V.27 which is a 4800 bps modem, V.32 which is upto 9600 bps modem etc. In the USA most of the modems follow Bell Telephone standards. Examples of these standards are type 103, 202, 208, 212 A modems.

The basic qualities of a modem are: registration with FCC (in USA), industry standard (such as 1200 bps, 2400 bps), compatibility with the computer etc. The manual of the computer should be consulted before purchasing a modem. An internal modem draws power from the computer and if the power supply of the computer is enough (150 watts or more) then an internal modem may be installed. However, external modems are plugged into external power source and thus draw no power from the computer.

Cost of modems varies considerably depending upon the transmission speed (1200 bps, 2400 bps, 9600 bps etc.) and other features. Most no-line services and bulletin boards do not ordinarily require speeds greater than 2400 bps. For sending and receiving vast quantities of data through on-line services expensive high speed modems can be justified. However higher speed modems are susceptible to electrical noise and interference. While purchasing a modem a balance between cost and features are generally taken into account. Such features, among other, include : automatic fallback that is automatic adjustment to transmission rate to match the remote system, auto dial, automatic hang-up on carrier loss for incoming calls etc. *

Protection and Networking in dBASE III+

Kazi Sayeda Momtaz (Sharmin)

The encryption process in particular useful if one wishes to market programs developed in the dBASE programming language and in the case it helps reduce the possibility of unauthorized use. Encrypting command files is also useful in a LAN environment as the Source Code Program, therefore, the actual program listing is not accessible to the users. Moreover, encryption reduces the size of programs by removing the comment lines and indentation and thus results in faster program execution. This process writes the command files in different way and this is why these files cannot be read directly by dBASE III+ or any other DOS program or a standard word processor. However, the encrypted programs still run on dBASE III+.

Another feature of encrypted files is that they can be linked together to generate a single linked file and this helps reduce the number of files present on the disk.

Two separate programs come with dBASE III+ package for encrypting and linking program files viz. dBCODE and dBLINKER and the package is called RunTime+.

dBCODE is used to encrypt the program files. It removes the comment lines and extra blank spaces from the command file and rewrites the files in such a fashion that can be understood and run by dBASE III+ or dBRUN but not by any other standard word processor. Command files may be encrypted one file at a time or all command files at a time through a response file.

Now if we want to encrypt our file then we must use encrypt program DBC.COM and we can get this type of file in the "Sample programs and Utilities" diskette in dBASEIII+ package.

dBCODE requires that the file which is to be encrypted should have the file extension name ".src". So we have to copy the program file to some other file name with file extension ".src" with the help of DOS copy command. Lastly, for encrypting the file, we have to type

```
c:\dBASE>DBC J
```

then the monitor displays a message and asking for a source filename and also prompting that the filename should have ".src" as the file extension name. Now if we want to encrypt Test.src file then we have to type

```
C:\dBASE>Test J
```

After locating the source file dBCODE encrypts the Test.src file and displays the following message:

```
Creating C:\Test.prg .....  
Completed.
```

Enter a source filename (.src) or press enter to end:

Thus, it has encrypted the Test.src file and generated a new file Test.prg which is the encrypted file. We have to remember that if we want to encrypt a file we have to copy the above-mentioned file to the ".src" extension name before encryption.

When encryption is over, removing the ".src" files from the disk we have to preserve them in a safe place. The encrypted files will run like a normal program, but will not be able to view them. If any modification is required, we can use the ".src" files and then we can encrypt them again.

For encrypting a few files there is a advantage in dBASE III+. Let us assume that we have more than five files and if we want to encrypt them at a time then we can encrypt them in one stroke though a response file. The response file is standard ASCII text file which can be created by MODIFY COMMAND or any text editor. This response file contains only the names of the command files to be encrypted. Each line of this type of file contains one file name and file name followed by J. As for example, to create a response file Test.rsp and to include STUDENT, MARKS, EXAM, SUBJECT, REPORT files in it we have to use the following commands:

```
Modi Comm Test.rsp J
```

```
STUDENT J
```

```
MARKS J
```

```
EXAM J
```

```
SUBJECT J
```

```
REPORT J
```

and lastly by pressing ^W we can save it.

Through the response file if we want to encrypt above-mentioned files then we need to create a directory which is called the source directory and we must copy the above-mentioned files with the file extension name ".src". After creating source directory we have to create another directory and which is called destination directory which will receive the encrypted files. If we want to know more about dBCODE we must type C:\dBASE>DBC J and then we will get more information about dBCODE. The screen displays all the available options with dBCODE. However, only

the required options should be entered. These options may be entered in any sequence and a dash (-) precedes the options letter and different options should be separated by at least a space e.g.,

```
C:\dBASE>DBC-Test.rsp-s /  
Source-/0/Output/J
```

where rTest.rsp is the response file, Source is the source directory and output is the destination directory.

The dBCODE reads all the files to be encrypted from the source directory and writes them in the output directory after encryption.

dBLINKER is used to link all the encrypted files together to generate one consolidated application program. dBLINKER reduces the number of program files on the disk and speeds up the execution of a program. Now if we want to link encrypted files then we have to use DBL.COM file which is available in the "Sample Programs and Utilities" disk.

Like dBCODE, dBLINKER too can be used to link files in the interactive mode or through the response file. To use the interactive mode, we have to use DOS prompt and then we have to type C:\dBASE>DBL J and then monitor displays a message and asks a file name to store the final file. After this, it prompts to enter the source file names. After typing the encrypted files one by one dBLINKER generates a final linked-up output file.

For using dBLINKER to link several files in one stroke like dBCODE we can use a response file.

After all files have been correctly linked up, the final file can be run on dBASE III+ or dBRUN. To run the final linked-up file through dBRUN we may use

```
C:\dBASE>dBRUN Final J
```

where Final is the final linked-up file. Without dBRUN package we can use the final linked-up file through dBASE dot prompt e.g.,

```
.Do Final J
```

dBASE can be used in the Local Area Network (LAN) environment through the dBASE Administrator. The Microcomputers communicate with each other through cables. The purpose of connecting computers in a LAN environment is resource sharing. dBASE III+ (version 1.1) is supported on three LANs viz.

- (1) IBM PC Network
- (2) Novell Network
- (3) 3Com 3 + Network.

(Contd. on page 35)

EDUTAINMENT AND BANGLADESH

Azam Mahmood

Children point out dull learning session as their main excuse for staying away from school. Some experts say that children cannot cope with the teaching methods used in most school now a days.

Therefore, teachers should modify their teaching techniques to make learning more interesting rather than downloading the children with formulas and theoretical concepts.

Children are easily attracted to visual information. They learn things, concepts and ideas faster from images and graphics. There goes a saying - a picture is worth a thousand words.

Today the word edutainment is a popular buzzword. Edutainment means software that integrates education and entertainment elements, with each element playing a significant role. For parents who own PCs, can install games or edutainment applications to give extra lessons to their children.

Basically, edutainment products can be categorised as such: drill-and-practice products, multimedia reference materials, simulation programs, compact disk-read only memory (CD-ROM) story books, preschool products and creativity tools.

Most of the early edutainment applications were drill-and-practice products. Typically these applications require users to solve a set of equations or answers to a series of questions. The closest example is the *Mental Math* application from WordPerfect's Main Street collection.

Multimedia reference materials make use of the CD-ROM capabilities to store large amount of data and placid graphics as alternative to the typical paper-based encyclopaedias. Microsoft's *Encarta* is one of the attractive CD-ROM encyclopaedias that combines graphics, sounds and motion. With a CD-ROM encyclopaedia, text, pictures as well as sound and motion pictures can be incorporated.

In edutainment products, simulation is now the most exciting feature. The objective of an edutainment simulation is to help users understand the simulated system or event.

A good simulation product lets users understand the situation and feel part of it. Users will easily get addicted to it. *SinCity 2000* is one good example of such simulation product.

CD-ROM storybooks use the combination of Multimedia PCs and CD-ROM storage. Most of CD-ROM storybooks use human narrator to tell the story with suitable sound effects. Also featured is pronunciation of certain words or phrases. Children can associate the words with the sounds.

Preschool products, also called toware are intended for children as young as two years old. With toware, children are treated to real interactivity,

lively colours, music and sound effect.

The latest entry in the category of creative tools is *PrintShop*. The title allows children to create their own cards or banner with variety of fonts and graphics.

These ever growing and diversified edutainment products, which are normally multimedia based, put additional demands on the PC. Before installing any edutainment application, users have to define their PC capabilities such as sight-and sound-enabled systems.

Although most PCs support VGA video cards which are sufficient for edutainment software today, they may not support future versions with sophisticated multimedia presentations. So it is recommended to use the SVGA cards as a long-term investment protection.

The size of video memory should also be considered. In addition to faster video processing, the cards also help determine the maximum resolution and number of colours it can display.

Usually one megabyte (MB) of video memory is enough to support up to 640 by 480 pixels of resolution or 16.8 million colours.

Again the use of either DOS or Windows based products can make a big difference in video performance. The use of graphics accelerator will speed up the video for Windows application but not DOS-based applications.

Another important element in edutainment software is the sound effects. In a basic PC configuration, the sound capability is very limited. In order to get a better quality sound, sound cards and speakers can be added. Before buying a sound card, make sure that it is compatible with most of the popular multimedia software and PCs.

CD-ROM has become an important device in today's edutainment software because of its huge storage capability. Most edutainment software incorporate excellent graphics and sound capabilities which require a big storage area.

A complete set of CD-ROM systems consists of a drive and the interface between the drive and PC such as SCSI interface and related software which links both items.

Speed is the most important criteria in choosing a CD-ROM drive. Drives with low-sustained transfer rate cannot supply information fast enough and the application compensates by skipping frames, when necessary. This results in jerky videos.

Let's now look at the user interface. Microsoft Windows is usually the preferred operating system as well as user interface for edutainment software today. It offers ease of use where users only have to click on icons rather than typing and memorizing commands as in DOS.

It is true that in a country like Bangladesh, with low level of income and savings rate, it takes parents a fortune to invest in hardware and edutainment software but then it's sound investment to give their children a good education to make a headstart.

Unlike most of the vibrant South East Asian countries, in Bangladesh, popular edutainment titles are not available. The home computing segment of Bangladesh though growing modestly, but still in the nascent stage. An upscale in home computing shall surely spur the edutainment software market in Bangladesh. And that days are not very far. ●

Protection and Networking

(Contd. from page 33)

In a LAN environment, a number of users can simultaneously access the same database file and try to modify the same record simultaneously. This may result in unpredictable data in records. To overcome this problem, the dBASE Administrator updates the records sequentially, thus maintaining the index files correctly. The dBASE Administrator locks the file/record before entering any data in it so that other users cannot access the file/record. Moreover, the database files may be encrypted through PROTECT.

PROTECT is a special facility available in dBASE Administrator. It is used for the security of database files. The PROTECT facility, though meant for the LAN environment, can also be used for a single user or for a single computer multi-user configuration. It includes three level of security.

LOG-IN Security: Unless the correct user Group Name, User Name and Password are entered, an access to dBASE III+ is impossible. File and Field Access Security: File and field access security is basically used for a LAN environment. Where different users are assigned different access levels for database files and their fields.

Data Encryption: Data encryption encrypts data i.e., dBASE Administrator rewrites the contents of a database file in such a fashion that they cannot be read. An encrypted file can be read only after decryption. dBASE Administrator automatically encrypts and decrypts the database files to which the user has legitimate access, as required, if accessed after successful log-in.

Using the protection facility we can market our program. So protection facility of dBASE III+ gives us great advantage.

Reference:
dBASE III Plus made simple with dBASE IV and FoxBASE+ By R.K. Taxali.