

## **New ways to communicate: services provided by British Telecom**

*Malcolm Jones*

*British Telecom Research Laboratories, Ipswich, UK*

### **INTRODUCTION**

Since 16 November 1984 British Telecom has been a private company with some two million shareholders who hold 50.2 per cent of the shares, with the UK government retaining the remaining 49.8 per cent. British Telecom now operates under a licence from the Department of Trade and Industry (DTI) which is administered by a special unit of the DTI called Oftel whose main task in life is to reprimand BT when they breach the terms of their licence.

British Telecom is one of the largest companies in the United Kingdom with an annual turnover of some £10 billion in 1987 and it reflects this magnitude of trading in its capital investment programme which has been running at £2,000 million per annum since privatisation. A very large part of this expenditure, approximately 90 per cent, is with UK companies.

### **NETWORKS**

The British Telecom telephone network is similar in size to that of France and the Federal Republic of Germany at about twenty-two million lines with only the United States and Japan having significantly larger networks. The international connectivity provided by British Telecom is one of the best anywhere, with over 90 per cent of the world's telephones (550 million) being available by direct dialling from practically any telephone in the country. To support this international traffic there are approximately 28,000 international telephone channels connecting the United Kingdom with the rest of the world and all these channels carry some 500,000 calls per day.

**The Public Switched Telephone Network**

Since privatisation the Public Switched Telephone Network (PSTN) has been the subject of a massive modernisation programme with the installation of System X type electronic exchanges at a rate of almost one per day. The mainline trunk network with its high capacity inter-city transmission systems and heavy-duty switches is now completely digital with a consequent improvement in speech quality on the longer connections.

The new electronic exchanges can provide many new facilities as well as better telephony, for example, itemised billing and supplementary services like call diversion where incoming calls can be diverted to another telephone for a short period by the customer.

A particularly interesting facility for translators and interpreters will be the three party conversation service. This will enable a translator or interpreter to be called into the connection when required by just dialling their telephone. Then, all three people will be able to converse as they do now on the current, operator-controlled conference bridges.

**Mobile**

With the invention of the cellular radio concept for the reuse of radio frequencies it became possible to provide a mobile telephony service with a large number of channels in small geographical areas such as cities. This was the key technology which enabled the introduction of a mobile telephony service for large numbers of customers in 1985. Such has been the interest in this service that it has been rapidly expanded to provide access to over 90 per cent of customers by the end of 1987 and already there are over 200,000 subscribers using the service. The initial analogue system is not standardised throughout Europe and there are some seven different systems within the continent. However, a new fully digital system which is standardised across Europe will be introduced in 1991.

**Telex**

As well as the telephone network which carries not only telephony traffic but also facsimile and voice band data calls there is the automatic telex network. The UK telex network is in the process of being modernised, with most of the country outside London now operating on the latest technology in the form of fully electronic stored program controlled (SPC) digital exchanges. There are over 70,000 telex lines connected to these new SPC exchanges already, with the remainder of the 110,000 lines in the United Kingdom being due for changeover in the next two years.

The UK telex network has connections to every country in the world and offers direct dialling to over 200 of them. It may be of interest to note that almost half of the 233 million calls made in 1985/6 were to or from a destination outside the United Kingdom.

### **Data networks**

In addition to these more familiar networks there is another switched network specially for data traffic. This is called the Public Data Network (PDN) and it offers a secure and economical way of interconnecting computer systems of various sizes by operating in a fully digital manner and using a packet switching principle, as defined in the CCITT Recommendation X25.

Data transmission speeds up to 48,000 bits per second are available inland and access may be either by direct 'dataline' connection or via a Packet Assembler and Disassembler (PAD) gateway from the telephone network.

International interconnection is already available to the major industrial countries, sixty-two currently, but more are joining as their own packet networks are installed.

### **Integrated digital access**

The latest innovation in networks is the Integrated Services Digital Network (ISDN). This is a development made possible by the rapid changeover of both telephone transmission and switching technology from analogue to digital which thus allows 64,000 bits per second (bps) channels to be provided between ordinary telephony customers at reasonable costs. With such a high speed digital connection being available to support telephony there is no need to separate data and speech calls onto separate networks, hence the integration of services onto one network, the ISDN. At the time of writing the initial version of the ISDN, called integrated digital access (IDA) has been made available in the major centres of the United Kingdom by British Telecom.

### **Terminals and services**

Traditionally British Telecom has provided a complete communications service to the customer so that there is only one point of contact for all communications needs from a basic telephone to a satellite broadcast data facility. This is still the situation after privatisation but now customers also have the freedom to buy their terminal equipment from a different supplier and their private branch exchange from yet a third supplier. To meet this competitive situation British Telecom has had to introduce a new and wider range of terminal equipment. The range is now so wide that it is not possible to provide a comprehensive survey in a short paper but a few relevant product descriptions will be included to give a flavour of the breadth of the product line now available. Additional details of these and many other British Telecom services can be found in *Products and Services*, issued by British Telecom.

#### *Bureaufax*

Bureaufax is a fax service run by BTI Bureau Services for customers who wish to send documents or messages abroad or in the United Kingdom. Bureaufax is

ideal where the sender or recipient or both do not have fax equipment. It is particularly useful for journalists or businessmen on the move.

The main Bureaufax centre is at Electra House, Victoria Embankment, London WC2R 3HL, with more than twenty-five regional offices around the country. More than 100 countries can be contacted by Bureaufax and there are bureau-to-bureau arrangements with more than 70 countries.

### *Datacomms*

The current British Telecom range of datacommunications equipment offers the most comprehensive choice that has ever been made available from a single UK supplier.

At the heart of the range is the Fourth Generation 'X' range of datel modems. Transmission speeds from 300 to 19200 bps are all supported by the range and together with the unique modular concept offers a simple and business efficient upgrade path. Every major international standard is supported, indeed British Telecom is one of the major contributors to such standards. Whether the application is a low speed, part-time, dial-up link to access a national viewdata service such as Prestel, or a dedicated high speed private circuit, linking corporate databases, the Fourth Generation Range can provide the answer.

A full and integrated range of Multiplexing equipment both Statistical and Time Division fully complements the modem range. The 4000, 5000, 6000 and 7000 ranges are all able to supply a unique user solution to any customer with the requirement for more than a single link.

### *Facsimile*

Facsimile, or fax, allows the transmission of and receipt of text, documents, diagrams and even handwriting, nationally and internationally.

The introduction of the 'group 3' standard has meant that fax machines from different manufacturers are now compatible. This has helped fuel the enormous growth in the number of businesses using fax to speed information around the world for the price of a telephone call. Fax works by scanning a document, encoding the data, and transmitting it over the telephone network. An image of the document is then reproduced on the distant machine.

To take advantage of the speed and flexibility of fax, BT has introduced the MerlinFax range of high quality facsimile terminals.

### *MerlinFax HS20*

The MerlinFax HS20 is a personal facsimile machine with many advanced features, including twenty one touch dial keys, fifty abbreviated dial keys and a journal print. The HS20 has its own integral handset.

*MerlinFax Basic*

MerlinFax Basic is for general office use. Features include a thirty page automatic document feed and a transmission verification stamp to indicate that a document has been sent.

*MerlinFax AD100*

MerlinFax AD100 is based on the basic, but includes comprehensive autodialling, re-try and timed transmission facilities. The addition of a sixteen step grey scale allows the AD100 to scan detailed documents, even photographs, accurately.

*MerlinFax SF100*

MerlinFax SF100 is a fully featured machine offering all of the facilities of the AD100, but with the addition of a memory capable of holding up to sixty pages of information and a group broadcasting facility to allow a document to be transmitted from memory to up to 200 destinations.

*PC100*

The PC100 brings together a British Telecom M5000 series computer, an AD100 and a software package (developed by British Telecom) to produce a highly sophisticated fax terminal. The PC100 offers a very large (20 Mb) memory, and computer-controlled address lists for the widespread distribution of documents.

*Fax Book*

The Fax Book is British Telecom's directory of UK facsimile numbers. The 1987 edition contains approximately 40,000 numbers. As in the telephone directories, customers are listed alphabetically along with their address and facsimile number.

A copy of the Fax Book is obtained automatically on requesting a free entry in the Book. Further copies are available, for a small charge, from the Directory Supply Department of your local District Manager's Office (the operator will connect you free of charge).

*GOLD 400*

GOLD 400 is a new public message handling service from British Telecom which allows all electronic messaging systems, regardless of make or type, to communicate with each other. Freely structured text messages and documents can be passed between incompatible private electronic mail systems, different public electronic mail bureaux and all telex and (delivery only) fax terminals. GOLD 400 is a store and forward service offering customers comprehensive

business benefits and an electronic directory with real-time access for confirming addressing details. With a national service in the United Kingdom and international connections to the fast growing network of X400-based public services around the world, it provides the opportunity to integrate communications both within and between organisations, to maximise the return on office automation investment and to capitalise on the implementation of permanent and universal messaging standards.

#### *International facsimile*

UK fax users can contact over two and a half million fax machines in more than 100 countries using BTI's telephone network. Documents can be sent around the world at less than one minute per page for the same price as an ordinary telephone call.

International facsimile is a cost-effective alternative to postal and courier services for sending all types of business documents. It is particularly suitable for sending documents containing diagrams, tabulations, handwriting, signatures and company logos. Most fax machines are set to receive calls even when the office is closed and can be programmed to send documents automatically, taking advantage of off-peak telephone charges.

#### *International Telex*

Telex is the world's largest public message service giving access to almost two million lines in more than 200 countries, 194 of which can be dialled direct. The benefits of Telex include: an efficient and economical means of written communication; automatic confirmation of messages which are in effect legally binding; a reliable, worldwide 24-hour service that overcomes time and language problems; autocal for unattended operation; proven delivery by the exchange of answerbacks.

Its business applications include: confirmation of orders; booking hotel accommodation; issuing invoices and chasing payments and deliveries. It can also be used to telex mailshots, particularly when coupled with Telex Plus.

The Telex network offers satellite and radio links with ships at sea, and can also be accessed through other services including Radiopaging, Telemessage, IPSS, Telecom Gold, Prestel, and Teletext

#### *MerlinWord 5000*

MerlinWord 5000 is a professional word-processing system which is available to run on standard personal computers including British Telecom's M5000 series. It is also suitable for use with the T-Net 1000 local area systems for networked operation.

The system operates on the principle that everything displayed on the screen is produced on the printed page. Thus underlining, boldening, super- and

subscripts and foreign characters are shown clearly to the user when preparing text. MerlinWord 5000 has been developed from the proven MerlinWord 4000 and M3300 systems and offers complete two-way exchange of documents with those systems, in addition to its ability to accept documents from a range of other text handling systems.

#### *Telecom Gold*

British Telecom's public electronic mail service with more than 76,000 mailboxes providing 24-hour electronic messaging throughout the UK and internationally. Using the standard telephone network, Telecom Gold enables a wide range of terminals (including personal computers, word processors and viewdata sets) to send messages to each other in seconds. Telecom Gold also allows users access to Telex, Radiopaging and information services. The service is inexpensive; the distance user can connect at a fraction of the long distance or international phone rate by using Packet SwitchStream or International PSS.

Telecom Gold is based on the internationally accepted Dialcom system and provides integrated communications with the Dialcom community in 18 countries.

The continuing expansion of Telecom Gold is just a part of the total growth of office automation which has resulted in a variety of messaging products and services. British Telecom's electronic messaging arm is being further expanded with the introduction of Gold 400 (formerly MHS – Message Handling Service). This facility will enable all electronic messaging systems complying with international X400 standard to interconnect. The first customers joined the system on 1 July 1987 after successful completion of trials with 12 independent office automation equipment suppliers.

#### *Teletex*

Teletex is a high quality, high speed text communication service directly between otherwise incompatible terminals, such as electronic typewriters, word processors and suitably equipped personal computers. The benefits of Teletex are accuracy, security, efficiency, flexibility and convenience.

Documents are accurately transmitted and received and formats are faithfully reproduced. Facilities include a 309-character repertoire and letter quality text. Teletex offers a 24-hour service with unattended receipt of messages. Teletex also offers access to and from the Telex network. International Teletex service has been opened with France and there are plans to extend the service to other countries.

International Telex services are also available from Teletex terminals.

#### *Telex*

Telex is the world's largest and fastest growing public messaging network, with

than 111,000 BT Telex connections having direct and automatic access to two million lines in over 200 countries.

Features include: confirmation of message receipt, universal availability, automatic answering and 24-hour operation.

Many new Telex terminals enable a Telex line to be extended (via a PBX or LAN) and be used by other text producing workstations within the office environment. Telex can easily be used to generate Telemessages (to non-telex users) and messages to some radiopagers.

Prestel and most electronic mail services, e.g. Telecom Gold, offer their customers a two-way Telex service.

Additional chargeable facilities available to Telex subscribers for casual use include:

- Access to the UK Public Data Network for information retrieval or messaging.
- Exchanging messages with Teletex terminals.
- Storage of messages for onward transmission to single or multiple addresses (see Telex Plus).

#### *Telex Bureau*

A Telex service run by BTI Bureau Services for customers who wish to send telexes but do not possess their own machine. Messages can be dictated over the phone, sent in by post, fax or by hand to Electra House, Victoria Embankment, London WC2R 3HL. There are facilities for multi-address telex messages, for distribution lists and for mailshots by telex for those companies who do not wish to occupy their own telex machines with such functions.

#### *Telex Plus*

Telex Plus is an automatic exchange-based facility that is available to all telex users. There is nothing to buy, no subscription fee - you simply use Telex Plus as and when you need it from your existing telex terminal. It offers three main features:

- (1) Store and forward of messages. A simple input of your message to the Telex Plus computer ensures repeated delivery attempts, while leaving your telex terminal free to make and receive more urgent calls.
- (2) Multiple address messages. Users type in up to 100 addresses plus a single copy of the message. Telex Plus automatically transmits the message to each destination, making repeated attempts to deliver nationally and internationally. It also automatically confirms delivery.
- (3) Pre-recorded address list. The pre-recorded address list enables up to 100 telex numbers to be stored in the computer against a short code which identifies it. To telex each number on the list, a customer sends the confidential access code and the text and Telex Plus will do the rest.



*Telex stationery and consumables*

This department can supply a variety of consumables for use on equipment such as Puma, Cheetah and Whisper Telex. The consumables include:

- 1-4 ply paper with BT's 'Briterol' branding
- Whisper thermal paper
- ribbons
- tapes and other miscellaneous accessories

Future additions to the range will include floppy disks and ribbons for use with the Cheetah Plus.

*Telex terminals (teleprinters)*

British Telecom supplies a range of telex terminals which allow direct access to the international telex service. Telex is an established text messaging system which has its own special network quite separate from the ordinary telephone network. There are more than 100,000 telex lines in the United Kingdom (with more being added every day), and over two million worldwide.

British Telecom provides two new telex terminals which are designed to take full advantage of all that telex has to offer. The 'big cat' range, consisting of Cheetah Plus and the Leopard, have features such as automatic calling, re-try, foreground/background working, timed messages, short codes, etc. Both have powerful text preparation features which enable the user to prepare messages off-line before transmission.

The Leopard is a new telex terminal. Its special soft keys guide even the most inexperienced user through the process of preparing and sending messages. With the standard version a three-line liquid crystal display is used to show the prompts and text. The system is expandable by the addition of extra memory, a larger display, and a mailbox, which allows other devices to gain access to telex via the Leopard.

The Cheetah Plus is the successor to the Cheetah which is by far the most popular telex machine in the United Kingdom. It uses a full screen to display telex messages and a help menu. As well as battery packed random access memory the Cheetah Plus offers optional additional storage on flexible disk drives.

*TextDirect*

With TextDirect, you can send and receive telexes using a personal computer or word processor. No telex machine or telex line is required. Moreover, because the service is easy to use, no specialist training is needed. A telex can be sent to up to 100 addresses worldwide at a single input. Confirmation of delivery is provided free of charge and, as a TextDirect customer, you will be allocated your own unique telex number, so it is easy for correspondents to send telexes to you.

### *Tonto*

A personal information centre combining the functions of a sophisticated telephone and a business computer.

The basic machine incorporates, in a desktop unit, the microprocessor, keyboard, storage space and telephone. There is a choice of screens.

Tonto offers a featurephone with personal telephone directory and automatic answerphone, a messaging terminal, a computer terminal for access to other systems and a personal business computer. Optional extras include a business package of software printers, datacommunications adaptor, a tilt and swivel stand and a printer switch which allows two Tontos to use one printer.

### *Westminster Communications Centre*

Located at 1A Broadway, London, SW1, the Centre has been designed to meet the communications needs of local businessmen or visitors to London, whether there on business or pleasure.

Trained staff will send telex messages, fax documents, type letters and reports or send telegrams and Telemessages. Cellphones, radiopagers and Voicebank can be hired for periods as short as a day.

Payment can be made by cash, cheque or credit card. Account facilities are available to regular customers, enabling them to dictate telex messages, for example, over the telephone. Open seven days a week, 9 a.m. to 7 p.m. Contact: 01-222 4444

## **References**

For a more comprehensive guide the following publications are recommended.

1. *British Telecom Products and Services 1987*, Telecom 87 issue.
2. Simpson, Alan (Ed.), *Communications Users' Year Book* (1987). Manchester: NCC Publications, NCC Ltd.
3. Corby, Michael and Donohue, E.J., *Telecommunications User's Handbook: A Practical Guide to Business Communications* (1986-87). London: Telecommunications Press.
4. *Eurodata Foundation Year Book* (1987). London: Eurodata Foundation. There is a Voicebook and a Databook.

## **POSTSCRIPT**

As a postscript, the following press release gives a glimpse of the future:

August 5, 1987

### **TRANSLATING SPEECH BY COMPUTER**

People who cannot speak a word of each other's language will soon be able to talk

over the phone using a system developed by British Telecom.

The world's first instantaneous translation of speech by computer was unveiled publicly by British Telecom's Research Laboratories today (Wednesday August 5).

Simple sentences in English were translated into French and vice-versa.

The prototype equipment can translate English into German, Spanish, Swedish and Italian and the reverse capability is being developed.

This will then also make possible translation between any pair of these languages, such as French-German, Swedish-Italian.

Each speaker has a microphone linked to a Merlin 5200 personal microcomputer. These are connected by a telephone circuit capable of handling computer data.

The first participant speaks a sentence in English into his microphone, saying each word clearly and deliberately. The computer repeats the sentence in its own synthetic voice to check that it has understood correctly.

When this is confirmed – by saying the single word 'yes' – the originating computer sends the message to the distant computer which translates and speaks it in, say, French in its own synthetic voice.

When the French speaker replies, the process is repeated in the reverse direction.

The system is based on a set of more than 400 phrases in common business use stored in each computer's memory. Although this involves a vocabulary of more than 1,000 words, the computers are programmed to recognise only 100 key words. These are used to identify the appropriate phrases, reducing the word-recognition task required.

The system also recognises spoken proper names – such as John Smith, for example – and makes no attempt to translate them, eg rendering 'Mr White' into 'Monsieur Blanc'. Instead the names are repeated in the original speaker's voice in the translation.

The speech translation project is sponsored at the research laboratories by British Telecom International, which is now looking into the possibilities for carrying out a trial with another country.

The system will be demonstrated on the British Telecom Stand at the 'Telecom 87' international exhibition in Geneva in October.

#### *TECHNICAL NOTE*

Three technologies are required to produce a speech translation:

- speech recognition device to tell the computer what has been said.
- 'phrase book' prepared by expert linguists to provide an accurate translation.
- speech synthesiser to enunciate the translation.

British Telecom Research Laboratories have been working on automatic computer translation of text since 1984.

Studies have shown that speech recognition is especially prone to error, but that errors can be avoided if the domain of discourse is restricted. This enables the

number of distinct messages to be kept within the number that can conveniently be listed in a phrase book.

It has also been found that much of the information contained in a message resides in no more than a handful of key words which may be automatically selected for any given phrase book. This means that the speech recogniser may be instructed to recognise only a few truly key words, and in consequence is more likely to get those words right. Several key words would have to be incorrectly recognised before phrases become confused.

This provides the system with some immunity not only to recognition errors but also to the variability of the speaker's mode of expression.

A set of more than 400 business letter phrases in several languages, with total vocabularies of over 1000 words, has been analysed and key words extracted. All but four of these phrases in English contain at least three of the key words needed to distinguish one phrase from another.

This means that any one of the phrases can be identified reliably by recognising the appropriate combination of three or more key words. All 400 phrases can be covered by just 100 key words.

The booklet of phrases has been prepared by expert linguists and therefore the translation of any phrase can always be guaranteed to be accurate.

The British Telecom Research Laboratories' two-way speech translation system between English and French is based on these concepts.

It consists of two Merlin 5200 personal computers connected through an RS232 link and containing commercially available speech recognition and synthesis hardware. An English speaker pronounces a phrase into one Merlin machine which is then repeated back to the speaker by an English synthesiser for confirmation. Once this is done phrase codes are transmitted to the second Merlin computer which synthesises the French translation. A symmetric operation can then be carried out in the French-to-English direction.

Speaker-dependent isolated-word technology is at present used so that the input speech is far from fluent. The recogniser must be trained to the voice of each speaker if an acceptable performance is to be obtained.

Phrase parameters such as dates are processed by first identifying the basic phrase using key word recognition. The position of the date in the phrase can then usually be deduced, and a second recognition scan is carried out over a recording of the original utterance, but this time only recognising 'date' words. This manoeuvre increases the effective vocabulary of the recogniser without degrading performance.

Names are located in the same manner but no recognition is attempted and the actual speech is transmitted to the other computer. The spoken name is then embedded in the synthesised translation.

In the future speech recognition devices will become speaker-independent and handle continuous speech with larger vocabularies. Recognition of intonation, stress and prosody will reveal additional levels of meaning which are all used in day-to-day speech and may need to be translated. Synthesisers will produce more natural-sounding speech which can be matched to the voice of the original speaker.