

Video on demand

Research Paper 94/68

9 May 1994



British Telecommunications plc has recently announced that it has started technical trials of a "video on demand" service which would allow subscribers to select a video film from a menu displayed on their television and have it sent to their home over the telephone line.

This paper examines the technical developments which have allowed such a service to be considered, and discusses the telecommunications and broadcasting regulatory structure within which such a service would have to operate.

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I. Introduction

British Telecommunications plc (BT) has recently announced that it has started technical trials of a "video on demand" (VOD) service amongst 70 of its employees in Kesgrave, near Ipswich¹. This is due to be followed by consumer trials with 2,500 households in the autumn. The service will allow viewers to select a video they want to see from a menu displayed on their television and have it sent to them over their telephone line. They will still be able to receive or make telephone calls at the same time as watching the video.

The introduction of a VOD service would be highly significant in several ways. As a result of Government policy, BT is currently barred from supplying "entertainment services" until 1998 at the earliest. If introduced nationally, such a service would seem to circumvent this ban and allow BT to compete with the cable TV companies just as they are expanding their television networks and beginning to offer telephone services as well (see section III).

The service is also significant in that it opens the way for television pictures to be transmitted to the home without the expense of laying additional cabling, be it with optical fibres or coaxial cable. Until recently this was thought impossible, but new technologies such as digital compression and ADSL (asymmetric digital subscriber line) transmission techniques would seem to allow video quality pictures to be sent to domestic homes over existing copper telephone wires.

The possibility of sending large quantities of information into people's homes has long been the goal of those wishing to exploit the digital revolution taking place in the music, television, telecommunications and computer industries. Many companies are seeking to break down the barriers between these sectors and to provide a seamless web of "multimedia" and "interactive television" services. The services which could be offered over a high capacity two-way "information superhighway" into the home have been long anticipated. For instance, the following comments concerning Japan's plans to develop an Integrated Network System were made in 1986²:

"Once this network is in place in most of the country, communications will become radically cheaper... and a large range of new services (many of them two-way, or interactive) will become available and affordable. In this way, the videophone will at last become a commercial reality; shopping-from-home and banking-from-home (tele-shopping and tele-banking), based on expanded use of television 'terminals', will become commonplace; working-at-home, using personal, intelligent work stations (i.e. computers with data, graphics and text-

¹ "BT to trial Interactive services to the home" *BT News Release NR9414* 3 March 1994

"BT looks abroad for video trials" *Financial Times* 4 March 1994 p.8

"BT technology set to rival cable TV" *The Independent* 4 March 1994 p.1

² Mackintosh I, *Sunrise Europe: The Dynamics of Information Technology* 1986 p.57

processing capabilities) will begin to become significant enough to presage a reduction in business travel (by road, rail and air); and the local fibre-optic cables, still with multiple megahertz of spare capacity, will probably also deliver a full range of entertainment services, including public-service television, pay TV to cater for a wide variety of entertainment, sporting and educational needs, and high-fidelity audio programmes."

Although it is clear that such multimedia services could be made available over a fibre optic network in the UK, not all these services would be available with the ADSL technology being developed by BT. The capacity of this VOD service is strictly limited. However, a range of services could still be offered, particularly if they were not required simultaneously, and did not require a substantial amount of two-way traffic. BT has already stated that potential applications, apart from videos, include home shopping, educational and training material, electronic publishing, information services and video games. Even a basic VOD service would enable BT to enter the "entertainment market", acting as a useful stop-gap until the installation of optical fibre links become economically feasible at some point in the future (see Section V).

Even if the trials are successful from a technical point of view, there are doubts surrounding the costs of the new technology. As a result, BT will also be investigating the use of fibre optic links in the trial as an alternative to copper. The ADSL equipment used in the trial is being supplied by Northern Telecom, Alcatel Network Systems is supplying much of the fibre technology, nCube and Oracle will provide the hardware and software for supplying the videos from the telephone exchange, and Apple Computers will supply the "set top boxes" required in people's homes. Further details of the technology are explored in Section II of this Paper.

The position from a regulatory point of view is also uncertain. As mentioned above, under Government policy, BT is barred from carrying "entertainment services" over its network to people's homes until 1998 at the earliest. The ban on the conveyance of such services is implemented by a clause in BT's telecommunications licence and further restrictions are imposed by the need to obtain a licence under the *Broadcasting Act 1990*. From a legal point of view, although it is clear that the ban in BT's licence prevents it from carrying broadcast television over its networks into people's homes, the situation regarding VOD services is not clear cut.

The telecommunications regulatory authorities, OfTel and the DTI, believe that BT's licence would permit it to provide a VOD service. Similarly, the broadcasting regulatory authority, the ITC, believes that VOD services would not require a cable TV licence (a "local delivery service" licence) and it has in fact already awarded BT a "licensable programme service" licence for VOD. However, the ITC has stated that there is some uncertainty over the legal position regarding which type of broadcasting licence is required and "the issue is one which could be resolved definitively only by the courts". Further details on these issues can be found in Sections III and IV.

II. Technology of video on demand

Until recently, it was not thought that the information content of a television programme could be squeezed into the limited capacity of a copper telephone cable to provide a VOD service of acceptable quality. This was because the **bandwidth** required to broadcast a television signal across the airwaves is 2,000 times greater than that required to send a speech signal over a copper telephone wire. VOD services have only become possible by decreasing the amount of information contained in a television signal using **digital compression** techniques and by increasing the amount of information that can be carried over a copper telephone wire using **ADSL** techniques (see p.5).

A. Bandwidth of telecommunication systems

The bandwidth of a telecommunications system is simply a measure of the amount of information it can carry: its capacity. All telecommunications signals are transmitted at a particular frequency. For instance, *Radio 4* is broadcast across the UK on a longwave frequency of 198 kHz. A **hertz** (1 Hz) is just one oscillation or one cycle in a (radio) wave every second. So the radio wave used to broadcast *Radio 4* oscillates 198,000 times a second. In fact it is slightly misleading to say that a radio wave has a particular frequency. To be able to carry any information, a wave must actually contain all frequencies within a certain band - the **bandwidth**³. The greater the frequency spread or bandwidth is, the greater the information which can be carried. The quoted frequency is simply the frequency at the centre of this band. For example, the bandwidth required to transmit a telephone call is about 4,000 Hz (4 kHz) whereas the bandwidth of a broadcast TV signal is 8,000,000 Hz (8 MHz).

The use of different frequencies for broadcasting over the airwaves is strictly controlled, and the bandwidth available for a particular purpose is limited. Generally, the applications which need large bandwidths are broadcast at high frequencies. For instance, FM radio stations are broadcast in the Very High Frequency (VHF) band at frequencies of 88-108 MHz, whereas television channels, which require larger bandwidths, are broadcast in the Ultra High Frequency (UHF) band at frequencies of 470-854 MHz in the UK. However, because of interference problems, not all this bandwidth can be used to broadcast television programmes in any given area.

1. Broadcasting television over the airwaves

The total bandwidth available for television broadcasting in the UK is 384 MHz, allowing 48

³ Brown R, *Telecommunications: The Booming Technology* 1969 p.93

channels each of 8 MHz. These channels are numbered consecutively, starting at 21 going up to 68. Currently, channels 35-38 are not used, although they may be made available for a commercial Channel 5 station, leaving 44 channels for broadcasting. Even though there are 44 channels available, there are only 4 national television services. The reason for this apparent disparity is that if the same television station were broadcast at the same frequency from two adjacent transmitters then virtually the entire area between the two transmitters would suffer from interference⁴. Consequently, adjacent transmitters broadcasting the same television station must operate on different channels. With about 1,000 transmission sites in the UK, each broadcasting 4 programmes, each of the 44 available channels is used at roughly 100 transmitters across the country. In practice, because of interference with other telecommunication services, some channels are used more frequently than others.

2. Broadcasting television over cable

The solution to the problems with interference between different transmitters and the upper limit on the number of available channels is not to broadcast programmes over the airwaves but to transmit them over cable instead. The total available bandwidth of cable systems can be used for transmitting television programmes as interference problems do not arise in the same way. The capacity of a cable system varies according to the type of cable used to take the television pictures into the home. Currently, cable TV systems in the UK use **coaxial cable** for such connections and this has a maximum bandwidth of approximately 1,000 MHz. In practice, not all this bandwidth is used, and currently cable TV systems generally provide about 50 programmes over a frequency range of 50-550 MHz using traditional **analogue** transmission techniques. Technically, it would be possible to make use of the spare bandwidth above 550 MHz for other television or video services, but this would require different electronics for transmitting the necessary signals, and different "set-top" boxes for decoding them.

Fibre optic cables are an alternative to coaxial cable for providing a cable TV service. Fibres are made of glass with lasers being used to transmit information along them, and they are widely used by the cable TV companies and telephone companies for carrying information across their networks. The capacity of a fibre optic cable is measured in **bits per second** (bits/s) rather than as a frequency bandwidth measured in hertz (Hz) because optic fibres carry **digital** information rather than analogue signals. The term *bit* is shorthand for a binary digit, which can either be a 0 or a 1. Bits are the units used in all digital applications and computing. For instance, the information stored in a computer chip or recorded on a musical compact disc is represented in bits. In the past it has been possible to equate a capacity of 1 bit/s with a bandwidth of 1 Hz, but recent encoding techniques have allowed more than 1 bit to be carried in 1 Hz of bandwidth. As far as television pictures are concerned, a capacity of 5 Mbit/s (5 million bits per second) is required to transmit a single channel of

⁴ Report of the Committee on Financing the BBC Cmnd 9824 July 1986 Appendix F p.173

roughly equivalent quality to that of one broadcast over the airwaves if digital compression techniques are used⁵. The maximum information-carrying capacity of a single fibre optic cable is vast. Currently available commercial systems have capacities of 2,500 Mbit/s, but it has been estimated that the maximum theoretical capacity of a fibre is 10,000 times higher than this⁶.

Copper wires are used to connect most homes to the telephone network and have much lower capacities than either coaxial or fibre optic. In the past they have not had to carry large quantities of information, as the bandwidth required to carry a human voice is only about 4 kHz. If attempts are made to transmit signals at higher frequencies, problems arise through attenuation of signal strength. Attenuation increases with increasing frequency. Computer data can be transmitted over telephone networks using a device called a **modem** and, in practice, the highest data rate normally used is 9.6 Kbit/s (V.32 standard). Obviously, this rate is much lower than the 5 Mbit/s required to transmit a digitally-compressed broadcast quality picture. However, the 9.6 Kbit/s rate applies to two-way traffic (duplex), but a VOD service is very much a one-way service, with virtually all the information travelling out from the telephone exchange to the home. It is this factor which ADSL technology takes advantage of enabling much higher data rates to be used, which are suitable for the transmission of video services.

B. ADSL technology

1. Basic principles

ADSL - Asymmetric Digital Subscriber Line - technology allows compressed video pictures and telephone calls to be sent over copper telephone cables at the same time by transmitting the information at different frequencies. Telephone calls are carried at low frequencies as normal, whilst the video data is transmitted at higher frequencies up to about 1 MHz. In addition to video data being sent to the home, provision is made for a return signal from the home allowing the video to be controlled by the viewer (eg. freeze frame, fast forwarding). This allocation of signals to different frequencies is known as **frequency division multiplex** (FDM) and is shown in the figure overleaf.

All video data is transmitted in one direction (to the home) and as there is no corresponding data transmission in the other direction at the same frequencies there are fewer problems with

⁵ ITC *ITC Discussion Document on Digital Television* June 1993 Technical Annex p.1

⁶ PA Consulting Group/DTI *Study of the International Competitiveness of the UK Telecommunications Infrastructure* February 1994 p.34

interference or cross-talk on the line. These low levels of interference allow signals to be transmitted over a much greater distance before they become too weak to be picked up. The other problems of signal distortion and attenuation at high frequencies which arise from the use of copper cables can be reduced through the use of digital adaptive equalisers.

The actual distance over which signals can be transmitted depends on the rate at which data needs to be sent. At a rate of 2 Mb/s, signals should be capable of being transmitted over about 3 miles, reaching about 90% of BT's customers, but this reduces to between one and two miles when data is sent at 6 Mb/s^{7,8}. The data rate is important as it determines the quality and number of video programmes which can be sent. The issue of picture quality is addressed in more detail below, but essentially at 2 Mb/s a single video-quality programme could be sent whereas at 6 Mb/s, three video-quality or one broadcast-quality programme could be sent. For VOD services alone, picture quality is probably more important as it is unlikely that many homes would want to receive more than one video at the same time.

2. Transmission techniques and international standards

There are various different transmission methods or modulation techniques which can be used to actually transmit the video information over the copper telephone wires. Most people will be familiar with the existence of modulation schemes through the fact that radio programmes broadcast on medium wave are amplitude modulated (AM) and VHF radio programmes are

⁷ N Cole, Asymmetric digital subscriber line technology - a basic overview *BT Technology Journal* Vol.12(1) January 1994

⁸ "Bell Atlantic rides ADSL into video future" *Telephony* 1 November 1993 pp 60-62

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frequency modulated (FM). In conventional broadcasting, modulation is simply the process by which a carrier wave used for transmitting a signal, such as pictures or sound, is modified so that it can carry that signal.

Various different modulation schemes have been proposed for use with ADSL: carrierless amplitude/phase modulation (CAP); quadrature amplitude modulation (QAM); and discrete multi-tone modulation (DMT). Each of these modulation schemes work on different principles and so perform differently in terms of their ability to withstand interference problems and the distance over which signals can be accurately transmitted.

The issue of which modulation scheme should be used with ADSL has been considered by the Alliance for Telecommunications Industry Solutions in the United States in trying to produce a suitable national standard for the American National Standards Institute (ANSI). The issue has been considered by a subworking group of the Alliance (T1E1.4) and in March 1993, following laboratory tests organised by Bellcore, the telephone company representatives in the group voted unanimously in favour of DMT. In these tests DMT was found to be capable of operating at almost 7 Mbit/s⁸. A working draft standard has been drawn up by the group and the details are expected to be finalised at a meeting in June 1994. Although the standard will be an American one, work has been conducted on an annex to the standard dealing with European ADSL. The details of this annex are being agreed with ETSI, the European Technical Standards Institute, and there are no plans for an independent European standard at present⁷.

DMT was originally developed by researchers at Stanford University in California who formed a company, Amati, to develop the technique. The technology has been licensed to major companies such as Northern Telecom and Motorola, and it is Northern Telecom which is supplying ADSL equipment to BT for its VOD trials using microchips produced by Motorola⁹. DMT works by splitting the video data into smaller pieces, allocating them a small bandwidth, and transmitting them at different frequencies. In other words, the information is transmitted in a number of sub-channels each of which operates at a different frequency. The advantage in doing this is that if interference occurs at a particular frequency, such as radio interference at 198 kHz, then the sub-channel at this frequency can be avoided. At the beginning of any transmission, the DMT system tests the quality of the telephone line with a training sequence of pulses and then allocates information to those sub-channels with the least interference problems. The system can gradually adapt to any new interference problems as they arise during transmission by re-allocating sub-channels.

Other sporadic interference problems are managed through the use of error-correcting codes.

⁹ "BT trips over ADSL cost" *Electronics Weekly* 9 March 1994 p.13

These codes are sent on different sub-channels than the information to which they relate, so that even if the original information is not received correctly, the error correction codes should be¹⁰. If the interference problems are fairly minor then the error codes should be able to be used to reconstruct any lost data, or at least be used to signify that a transmission problem has occurred.

C. Digital compression

Video pictures must be digitally compressed before they can be sent over the telephone lines, as a studio-quality television picture when initially digitised takes up around 200 Mbit/s compared with the 2 Mbit/s which is available for transmission using ADSL.

1. Basic principles

Television pictures broadcast in the UK are made up of 625 horizontal lines with alternate lines being broadcast every 1/50th of a second. This means that altogether 25 frames are broadcast every second. Digital compression techniques take advantage of the fact that in any given frame there are usually areas of the picture which are very similar, and that usually there are only small differences in consecutive frames. So instead of every frame being sent in its entirety, it is possible to send one frame to start off with followed by only the differences between frames thereafter. The fact that not every frame, nor every single picture element (pixel) in every frame, needs to be transmitted to reconstruct a television image implies that there is a degree of **redundancy** in the original television data. Digital compression techniques work by trying to reduce this redundancy to a minimum.

There are two types of redundancy associated with television pictures¹¹:

Statistical redundancy - picture sample-values are not independent, but are correlated with their neighbours in the same line, the previous line and the previous frame [as described above]. This means that the level of the signal any time is to some extent predictable from its past.

Psychovisual redundancy - picture sample-values do not always have to be reproduced at the receiver with the same fidelity with which they were represented at the encoder if the signal is destined for the human observer (and not for further studio processing for example). This is because the human visual system exhibits some tolerance to distortion where the level of tolerance is dependent upon the nature of the image in the locality."

¹⁰ "Can telephone kill the video shop?" *New Scientist* 27 November 1993 pp 22-24

¹¹ NK Lodge, "Low Bit-Rate Video Compression Techniques" *Image Technology* December 1992 pp219-223

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In many situations where digital compression is used it is important for the uncompressed data to be identical to the original, however with television pictures this is not the case. This is clear from the fact that although video-recorded pictures are not as high quality as the original broadcast images, such pictures are perfectly acceptable to viewers at home. In other words there is some psychovisual redundancy in broadcast-quality pictures which compression techniques can take advantage of. Obviously, it would be possible for pictures to be compressed so far that the reconstituted programmes would not be acceptable to viewers.

2. MPEG compression

The industry-standard methods for digital compression are based on two standards introduced by the Motion Picture Experts Group (MPEG) of the International Standards Organisation (ISO); MPEG1 and MPEG2. Both these standards use the widely established method of **motion-compensated hybrid discrete cosine transform coding**, known as motion-compensated DCT. The mathematics of this coding method are complex, but the general principles are easier to understand:

Digitisation - first the individual frames of a given video sequence are digitised. This is done by breaking down the individual lines making up the frame into a number of pixels. Each pixel has an individual luminance (brightness) level, and every 4 pixels have two chrominance (colour) values associated with them. Luminance and chrominance values are arranged into separate blocks of 8 x 8, and macroblocks representing 64 x 64 pixels are then composed from 4 luminance blocks and two chrominance blocks. The video frame is broken up into adjacent macroblocks going from left to right, from top to bottom.

DCT coding - blocks of 8 x 8 are encoded by calculating their DCT transform, producing 64 DCT coefficients for each block. The transform essentially represents the picture block in terms of one average value and 63 difference-values. Because of the way the transform works, for a given block it normally turns out that many of the coefficients are small or zero.

Compression - the data contained in the coefficients can be simplified through the techniques of thresholding and quantisation. This results in the DCT coefficients being rounded up or down so that they can only hold certain values. The information can then be compressed by coding the individual coefficients. This coding process is similar to that used in Morse code where very common coefficients (letters) are given short codes. For instance in Morse code, the letter 'e' is represented by a single short dot (.) whereas the letter 'z' is represented by two dashes and two dots (--.). The amount of data that is needed to convey the DCT coefficients can be reduced further through the use of an end of block (EOB) symbol. Most of the information content of a block is contained in the first few coefficients with the later coefficients being zero. If, for instance, the last 20 coefficients were zero, instead of the codes for 20 zeros being transmitted, the EOB symbol could be transmitted instead, signifying that any remaining coefficients were zero. These techniques and others allow substantial compression rates to be achieved.

The above description of the compression process applies to the transmission of a single frame, but further compression can be achieved for the second frame by the use of **motion-compensation**. In a normal video sequence there is not much change from one frame to the next, so instead of the whole second frame being transmitted it is much easier just to send details of any changes. One way of doing this is by assuming that the macroblock for one frame is identical to the same macroblock in the previous frame, and then just transmitting any actual differences between the two. Although this might be satisfactory on static scenes, in moving scenes macroblocks are likely to change significantly from one frame to the next. In this situation, a better prediction for the macroblock can be obtained by taking into account any motion which has occurred since the last frame and using the nearest equivalent macroblock from the previous frame as the prediction. Information on the macroblock is then transmitted in the form of a displacement vector describing the difference between its location and the location of the equivalent macroblock in the previous frame together with a prediction error which describes any differences between the equivalent and the actual macroblock. The prediction errors are DCT coded as described above.

As can be seen from the above there are different ways individual frames can be encoded depending on whether motion compensation is used. The MPEG standards for video compression allow 3 different types of coding¹²: intra, predicted and bi-directional. These vary in the amount of prediction which is used and hence achieve differing degrees of compression.

Intra frames are coded purely from the information contained in that frame without reference to any other frames. Consequently, these frames are the least compressed (of the three different types of frames). Intra frames have to be used at the start of any video sequence and form the basis of predictions for other frames.

Predicted frames are coded on the basis of forward predictions made from the nearest, previous intra or predicted frame. In other words, predicted frames can be used to help code subsequent predicted frames. Predicted frames achieve a higher degree of compression than intra frames.

Bi-directional frames are coded using forward and back predictions made from previous and subsequent frames. Only intra and predicted frames are used as the basis for predictions for bi-directional frames. In other words, these type of frames are never used to code any others. Because of their greater use of prediction, bi-directional frames achieve the highest degree of compression.

The fact that bi-directional pictures are partly based on subsequent pictures leads to the

¹² "Clear highway for digital television" *Electronics World + Wireless World* November 1993 pp 892-897

strange requirement that frames need to be transmitted in a different sequence than they are actually viewed in. Any intra or predicted picture needed for a back prediction will have to be transmitted before the bi-directional picture which actually uses it as a reference.

3. Picture quality

In some situations where the image is particularly complex, or where there are sudden appearances (such as a train coming out of a tunnel), there might be more information in the frame than can be easily compressed to fit in the limited capacity of the ADSL transmission equipment. Since it is an absolute requirement that available capacity cannot be exceeded, data has to be compressed more than is ideal, leading to the appearance of strange artifacts.

Other television transmission techniques do not generally suffer from distortion which is dependent on the actual material being transmitted, and because of this it is difficult to make simple comparisons between the quality of ADSL-quality pictures and video-quality pictures¹¹. However, some indication can be given of the general quality of the picture from the data rate that is used for transmission. The following definitions are taken from an ITC discussion document on digital television¹³:

(i)	Studio high definition (HDTV) quality (1,250 lines) with no perceptible degradations	40 Mbit/s
(ii)	HDTV quality with some distortion on critical scenes	20 Mbit/s
(iii)	625 line studio-quality with no perceptible degradation	10 Mbit/s
(iv)	625 line studio-quality with some distortion on critical scenes	5 Mbit/s
(v)	Reduced quality (312 line) with no perceptible degradations	2.5 Mbit/s
(vi)	Reduced quality (312 line) with some distortion on critical scenes	1.2 Mbit/s

"As a guide for comparison, the fourth example here (5 Mbit/s) is often considered as roughly equivalent to PAL and the sixth (1.2 Mbit/s) as roughly equivalent to home video (VHS) quality (although the nature of the distortions which occur in the digital and analogue systems is very different in both cases)..."

¹³ ITC *ITC Discussion Document on Digital Television* June 1993 Technical Annex p.1

Consequently, it could be expected that a VOD service operating at 2 Mbit/s might provide slightly better quality than VHS and a service at 6 Mbit/s could provide as good a quality as broadcast television (PAL).

Some research has been done on which types of programme are likely to contain scenes which might suffer from distortion but much of this work is still at an early stage. In order to investigate these issues further, an EC research programme has been established on Methods for Optimisation and Subjective Assessment in Image Communications (MOSAIC). The programme will focus on two fundamental questions¹⁴:

- (a) for a particular system delivering general entertainment television, how often will distorted scenes appear?
- (b) what will be the reaction of viewers to the resulting quality variation while they are watching their favourite programmes?

The programme will also examine the effects of interference during transmission, but it may well be that such interference will be greater for digital broadcast television rather than for videos sent over telephone cables using ADSL. It is expected that BT will examine these issues in its VOD trial.

E. Costs

Although it would appear that VOD services are technically feasible, doubts have been expressed as to whether such services will be economically feasible using currently available technology¹⁵. A recent article in *Electronics Weekly* quoted Motorola's strategic planning manager for communications products as saying that the electronics necessary for ADSL would have to be manufactured on a single chip for the technology to be cost effective and that the cost of the chip would have to be less than \$100¹⁶. The article suggests that doubts over the commercial feasibility of the technology forced BT to incorporate tests of optical fibre technology in its VOD trial as an alternative to ADSL. Commenting on the future costs involved, the article went on to state that:

"Equipment costs should fall as manufacturing volumes rise. The problem is that no other operator in Europe and only Bell Atlantic in the US, is fully convinced about the feasibility of ADSL. Everyone prefers to wait and see how BT's trial goes.

¹⁴ ITC Engineering, *MOSAIC: Methods for Optimisation and Subjective Assessment in Image Communications* [information note]

¹⁵ "Viability of ADSL technology in doubt" *Electronics Weekly* 2 March 1994 p.3

¹⁶ "BT snag as ADSL proves expensive" *Electronics Weekly* 9 March 1994 p.1

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This is making many component and systems suppliers reluctant to enter the ADSL market very early. The prospect is that hardware costs will not fall very quickly. Which is the reason that some engineers within BT are less enthusiastic about ADSL than they were six months ago."

The costs and availability of ADSL technology also depend on the type of modulation scheme adopted. As described above, BT have decided on the more sophisticated DMT technology, whereas Bell Atlantic in the US will be using a CAP modulation scheme in a VOD service to be established in Washington¹⁷. Several electronics companies have been planning ADSL products, but it is not clear whether they will be based on DMT or CAP. For instance, an article in *Electronics Weekly* reported that one such company, Advanced Micro Devices (AMD), has not decided whether to adopt DMT or CAP, but the DMT design is 12 to 18 months behind its CAP counterpart, and as such it is still too expensive for the price sensitive set-top box receiver market [ibid]. A spokesman from the company is quoted as saying that "the main problem with ADSL is that it is still an expensive technology".

Estimates for the cost of set-top boxes used to receive and decode the ADSL signals have varied. Some commentators have suggested that, once available, their price will be up to £600 compared with about £150 for a cable television set-top box¹⁸. However, a recent article in the *Sunday Times* suggested that the cost of a set-top made by Apple would be as low as £250¹⁹.

Apart from the ADSL technology needed for transmitting video pictures over the telephone lines, BT will also need to have the technology for storing the films in digital form and then playing them out on-demand (video-servers). It would seem that the films themselves will be stored on optical discs (large-scale versions of compact discs), but if more than one viewer wishes to watch the same film at the same time then a simple real-time playback process cannot be used. One possible solution is for video information to be read off the disc at high speed in ten minute pieces at a time, say, and stored in computer memory which has been assigned to the viewer. The information could then be played out from this memory and transmitted to the viewer at the appropriate rate. Alternatively, the whole video could be stored in computer memory. However, each video would require a large amount of memory, about 1.5 gigabytes²⁰, which could prove very expensive if a large number of videos had to be stored in this way. Although the required technology is rapidly being developed, it would

¹⁷ "All systems go?" *Electronics Weekly* 2 March 1994 p.14

¹⁸ "BT hits back: Video on demand will start, will work and will make money" *New Media Markets* 7 October 1993 p.1

¹⁹ "Oracle leads race on digital superhighway" *The Sunday Times* 24 April 1994 p.13

²⁰ 1.5 gigabytes = 1.5 billion bytes = 12 billion bits. For comparison purposes, a typical personal computer would have a memory of 1-8 million bytes (megabytes/Mb)

appear that video servers are not yet in commercial production²¹.

British Telecom have insisted that there are no problems with the video server technology. A recent article in *Broadcast* reported the views of a senior BT executive who said that there would be no problems in scaling up the capacity of its existing prototype server being used in its trials to allow simultaneous access by a large number of consumers²². The server being used by BT in its trials has been developed with Oracle which is also supplying server technology to Bell Atlantic for its service in Washington. According to a recent article in the *Sunday Times* the video server technology is based on a supercomputer using massively parallel processing techniques with films being stored on "discs" and each viewer having a "video pump" allocated to them¹⁹.

Even if the costs of the technology can be contained, there is still the question of whether there will be sufficient demand for service and whether it will prove cost effective. The article in *Broadcast* gave details of a report by SG Warburg which predicted that BT's initial trials would cost around £65-75 million. This is based on the expectation that the trials will be extended to 25,000 homes by spring 1995, and works at an equivalent cost per home of around £2,500. The article reports that BT is hoping that with volume demand, the eventual cost per home will be £400. It has been reported that Northern Telecom, the company supplying BT with ADSL technology, has estimated that within two years, the per-customer cost of providing a VOD service over BT's telephone network would be £1000²³. This estimate is based on equipment being produced for between 50,000 and 100,000 subscribers.

Predictions on the income that might be generated by a VOD service vary widely according to the source. Some initial estimates put the revenue as high as £2 billion a year, but more recently figures of around £600 million or less have been quoted²⁴. Details of the predictions made by SG Warburg were published in the *Broadcast* article:

"Warburg also predicts that given 1.13 million VOD subscribers by 2000/2001, each viewing 3.5 films per month at £2.50 a throw, BT will have total revenues of £268 million (BT predicts a £500 million per annum market by the same stage). It will not enjoy positive net cash flow until 2003, by which time accumulated losses will be £476 million."

At the end of the day, BT's revenue will depend on consumer demand for VOD, which in turn will depend not only on the costs and the types of films which can be provided, but also on

²¹ "Only Nynex in a hurry to launch video on demand" *New Media Markets* 24 March 1994 p.10

²² "A question of supply and demand" *Broadcast* 8 April 1994 p.18

²³ "BT hits back: Video on demand will start, will work and will make money" *New Media Markets* 7 Oct 1993 p.10

²⁴ "BT video service is part of new-technology dilemma" *New Media Markets* 16 December 1993 pp 10-11

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the availability and costs of alternatives such as satellite and cable television.

III. Telecommunications regulation

Currently, British Telecommunication's licence prevents it from conveying broadcast television programmes over its network for delivery to people's homes. This ban on "entertainment services" was introduced to allow "effective competition" to develop, in particular to give new cable companies a chance to establish themselves.

A. Duopoly review

In November 1990, the Government announced its intention to review its duopoly policy under which only British Telecom and Mercury had been permitted to provide fixed link telephone services in the UK for a period of seven years from 1983. Its proposals were published in a consultative document which sought comments on future policy of licensing new telephone operators and other issues such as provision of entertainment services²⁵. In March 1991, following a period of consultation, the Government published its white paper on *Competition and Choice: Telecommunications Policy for the 1990s* (Cm 1461).

As far as entertainment services were concerned the Government came to separate, but similar, conclusions regarding the *conveyance* and *provision* of such services:

"5.7 The Government does not intend to remove the present restriction on BT, other national PTOs [public telephone operators] and Kingston Communications [which provides telephone services in Kingston upon Hull] from conveying entertainment services in their own right until ten years after the publication of this White paper. The Government would be prepared to reconsider the position after seven years if the Director General [of OFTEL] advised that removing the restriction would be likely to promote more effective competition in telecommunications...

5.19 The Government intends...not to allow the national PTOs to provide entertainment services nationally in their own right. This policy will not be reviewed for at least the next ten years. Thereafter the Government would expect only to review it if the Director General advised that a change of policy would be likely to lead to more effective competition in telecommunications."

In looking at entertainment services, the White Paper did not discuss the issue of video on demand. And until British Telecom started to develop its plans for such services, it was thought by many that the company was barred from supplying any type of entertainment services over its network. Although the situation is complicated, it would appear that under

²⁵ DTI *Competition and Choice: Telecommunications Policy for the 1990s A Consultative Document* November 1990 Cm 1303

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its current telecommunications licence, British Telecom is not barred from supplying video on demand services.

B. BT's licence

Paragraph 1(b)(i) of Schedule 3 of British Telecommunications Licence states:

"1 Nothing in this Licence removes any need to obtain any other licence that may be required under any other enactment but, subject to that limitation, this Licence authorises: ...

(b) the provision by means of the Applicable Systems of telecommunication services consisting in:

- (i) the conveyance (not including switching) of Messages (**not including cable programme services sent under a licence granted under section 58 of the Act**) [bold added] and switching incidental to such conveyance; ..."

C. *Telecommunications Act 1984*

Section 58 of the *Telecommunications Act 1984* permitted the granting of a licence for the provision of "cable programme services" where such services were defined as:

56.-(1) In this Part "cable programme service" means a service consisting in the sending by any person, by means of a telecommunication system..., of sounds or visual images or both either-

- (a) for reception, otherwise than by wireless telegraphy, simultaneously in two or more dwelling houses in the United Kingdom; or ...

Using this definition, it would appear that a video on demand service would not be classed as a "cable programme service" because the visual images of the service are not simultaneously broadcast to two or more dwelling houses (intentionally). However, the meaning of the term "cable programme service" was extended and a new concept of a "licensable service" was introduced by the *Cable and Broadcasting Act 1984* (the Cable Act) which repealed the above sections of the *Telecommunications Act 1984*.

D. Cable and Broadcasting Act 1984

Section 2 of the Cable Act defined the meaning of a "cable programme service" and a "licensable service" as:

2.- (1) In this Act "cable programme service" means a service which consists wholly or mainly in the sending by any person, by means of a telecommunication system..., of sounds or visual images or both either-

(a) for reception, otherwise than by wireless telegraphy, at two or more places in the United Kingdom, whether they are sent for simultaneous reception or at different times in response to requests made by different users of the service; or...

(2) In this Part "licensable service" means a cable programme service which consists wholly or mainly in the sending by any person, by means of a telecommunication system..., of sounds or visual images or both either-

(a) for simultaneous reception, otherwise than by wireless telegraphy, in two or more dwelling houses in the United Kingdom; or ...

Under this Act it would appear that a VOD service would have been a "cable programme service" but not a "licensable service". Section 58 of the Act stated that:

"...a licence granted or having effect as if granted, by the Secretary of State under Section 58 of the 1984 Act²⁶ shall have effect as if granted by the Cable Authority under section 4 of this Act; and the provisions of this Act and the enactments amended by this Act shall have effect accordingly".

It would therefore appear that the reference in British Telecom's licence to "cable programme services sent under a licence granted under section 58 of the [Telecommunications] Act" would be equivalent to cable services sent under a licence granted under Section 4 of the Cable Act. In other words the restriction in BT's licence would seem to apply to the "licensable services" in the Cable Act rather than to the "cable programme services" (such as video on demand).

²⁶ *Telecommunications Act 1984*

E. Broadcasting Act 1990

The interpretation of the exclusion contained in British Telecom's licence would seem to have been clarified by the *Broadcasting Act 1990* which repealed the Cable Act. Section 190 of the new Act states:

190.-(1) This section applies to licences which have been granted under section 7 of the Telecommunications Act 1984 (licensing of telecommunication systems) before the transfer date and continue in force on or after that date.

(2) In any licence to which this section applies, any reference (however expressed) to a cable programme service sent under a licence granted under section 4 of the Cable Act shall be construed, as from the transfer date, as a reference to a licensable service within the meaning of Part I of that Act (other than an exempt service), whether sent-

(a) under a diffusion licence, which is continued in force by, or granted under, Part II of Schedule 12 to this Act, or

(b) under a local delivery service granted under this Act,

or otherwise...

(5) In this section...any reference to licence granted under section 4 of the Cable Act includes, in relation to a licence to which this section applies ("the relevant licence"), a reference to a licence granted under section 58 of the Telecommunications Act 1984 (whether described in the relevant licence in those terms or in any other way).

In other words, under its licence BT is barred from sending "sounds or visual images or both" for "simultaneous reception...in two or more dwelling houses in the United Kingdom"²⁷ but it would not seem to be barred from sending "sounds or visual images or both" for "reception...at two or more places in the United Kingdom" if they are sent "at different times in response to requests made by different users of the service"²⁸.

Consequently, using the above definitions, it would seem that under the terms of its licence BT is free to offer a video on demand service. However, using different arguments, not based on Section 190 of the *Broadcasting Act 1990*, two commentators have suggested that "the scope of the exclusion from the BT Licence" remains "uncertain"²⁹.

²⁷ A "licensable service" under s.2(2)(a) of the Cable Act

²⁸ A "cable programme service" under s.2(1)(a) of the Cable Act

²⁹ "Video On Demand" *TRR Special Issue* Number 7.06 28 February 1994 pp 1-6

F. ITC's position

The Independent Television Commission (ITC) published a statement giving its views on the licensing of a video on demand service in September 1993. This statement is discussed more fully in Section III of this paper, but as far as BT's telecommunications licence is concerned, the ITC stated³⁰:

"There has been public discussion over recent weeks, in the press and elsewhere, about the licensing position of video on demand, particularly if it became possible for such a service to be provided by means of BT's main network. No detailed application or proposition has been received by the ITC, and the nature and circumstances of any proposed service would need to be examined before a final view on the licensing position was taken. However, the ITC has discussed the matter with the telecommunications regulatory authorities (DTI and OFTEL) whose view is that the licences held by BT, other national fixed-link PTOs and Kingston Communications under the Telecommunications Act 1984 would not prohibit the conveyance of a video on demand service which did not require to be licensed under Part II of the 1990 Act". [details of such licences are described in Section IV.B below]

G. DTI's position

The Government's view on whether BT is permitted to provide a video on demand service was given in response to a parliamentary question from Lord Morris in October 1993³¹:

Lord Morris asked Her Majesty's Government:

Whether they intend licensing British Telecommunications plc to convey or retail video entertainment services to the public.

The Parliamentary Under-Secretary of State, Department of Trade and Industry (Lord Strathclyde): My Lords, British Telecommunications plc is already licensed to provide a wide range of telecommunications services to the public. There has been speculation recently about whether such services could include what has become known as "video on demand". Her Majesty's Government's view is that BT's licence could permit certain types of video on demand.

³⁰ "ITC statement on licensing of video on demand" *ITC News Release 40/93* 29 September 1993

³¹ HL Deb 21 October 1993 cc 634-636

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Lord Strathclyde made further comments on the issue in response to a follow-up question from Lord Peston:

...We believe that British Telecom should be allowed to develop a new service, which is why I said in my original Answer that its licence currently allows it to do so.

H. OFTEL's position

OFTEL's view on the issue became clear in a speech that Don Cruickshank, the Director-General, gave at the Financial Times Conference on "World Telecommunications" on 7 December 1993³²:

"Nothing in the recent statement from the Independent Television Commission should call into question my commitment to the policies set out in the 1991 White Paper and our continuing support for the Cable PTOs. The Minister, Mr McLoughlin, has twice confirmed that the Government remains fully committed to these policies and there will be no stepping back from them and that speculation on this point is entirely misplaced. I endorse that position.

Oftel has been encouraged by the progress of the cable TV sector particularly in telephony. The Cable PTOs are beginning to deliver choice to customers and I intend to continue developing a regulatory environment which encourages effective competition in telecommunications within the framework of the White Paper policies. I will be looking closely at any video on demand service offered by BT, or others, to make sure that the terms on which it is made available are fully consistent with the UK policy on the competitive provision of telecommunications. I will also want to ensure that the principles of 'fair trading' in licences held by BT and others apply equally to any new services they might carry in the future."

I. Summary

Although BT may be free to provide a VOD service under the terms of its telecommunications licence, it still needs a licence under the *Broadcasting Act 1990* for such a service. The Act extended the scope of services which required a licence, introducing two new types of licence, a "licensable programme service" licence defined in Part I of the Act (s.46) and a "local delivery service" licence defined in Part II of the Act (s.72). The issue of which type of licence is required for a video on demand service is discussed in the following section.

³² "Don Cruickshank spells out policy for video on demand" *OFTEL Press Release 34/93* 7 December 1993

IV. Broadcasting regulation

There is no doubt that under the *Broadcasting Act 1990* British Telecom requires a licence to provide a video on demand service. However, there is considerable debate about which type of licence it requires: a "licensable programme service" (LPS) licence or a "local delivery service" (LDS) licence. The significance of this is that BT already has a LPS licence³³, but under current ITC policy it would not be able to obtain a LDS licence, essentially a cable television licence, for a national VOD service (see below).

A. Licensable programme service licences

LPS licences are defined under section 46 of the Act:

46.-(1) In this Part "licensable programme service" means...a service consisting in the provision by any person of relevant programmes with a view to their being conveyed by means of a telecommunication system-

- (a) for reception in two or more dwelling-houses in the United Kingdom otherwise than for the purpose of being received there by persons who have a business interest in receiving them, or
- (b) for reception at any place, or for simultaneous reception at two or more places, in the United Kingdom for the purpose of being presented there either to members of the public or to a group or groups of persons some or all of whom do not have a business interest in receiving them,

whether the telecommunications system is run by the person so providing the programmes or by some other person, and whether the programmes are to be so conveyed as mentioned in paragraph (a) for simultaneous reception or for reception at different times in response to requests made by different users of the service.

A VOD service would therefore require a LPS licence, particularly because of the stipulation that a licence is required if programmes are conveyed "for reception at different times in response to requests made by different users of the service".

³³ Oral communications, ITC and BT

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As mentioned above BT has already obtained a LPS licence from the ITC. The Commission has a very open policy towards the granting of these licences³⁴:

"Unlike that for terrestrial television, the licensing approach for cable and satellite programme services is based on the premise that, in practical terms, there is no finite number of outlets for such services and there is accordingly no reason why the number of licences granted should be limited.

Against this background, the ITC continued the process of granting licences virtually on demand. Save in the cases where an applicant is prohibited by law from holding a licence or the ITC considers that the applicant is not a fit and proper person to do so, an application may only be turned down on the grounds that the proposed service would appear to contravene the provisions of Section 6 of the Act, the 'consumer protection' requirements. In the circumstances, the licensing process is a simple and speedy one.

Subject to the above, it is not for the ITC to specify the nature of the service or any elements of its content. Licence applicants are, therefore, free to decide for themselves how general or how specialised a programme service they wish to provide, the hours each week or day it will be available and how it is to be financed..."

One consequence of the fact that the service is licensable under the *Broadcasting Act 1990* is that any programmes transmitted must conform to the requirements of sections 6 and 7 of the Act regarding good taste, indecency and the showing of violence:

6.-(1) The Commission [ITC] shall do all that they can to secure that every licensed service complies with the following requirements, namely-

(a) that nothing is included in its programmes which offends against good taste or decency or is likely to encourage or incite to crime or to lead to disorder or to be offensive to public feeling...

7.-(1) The Commission shall draw up, and from time to time review, a code giving guidance-

(a) as to the rules to be observed with respect to the showing of violence, or the inclusion of sounds suggestive of violence, in programmes included in licensed services, particularly when large numbers of children and young persons may be expected to be watching the programmes...

³⁴ ITC *ITC Annual Report & Accounts 1992 May 1993* p.16

- (c) as to such other matters concerning standards and practice for such programmes as the Commission may consider suitable for inclusion in the code;

and the Commission shall do all that they can to secure the provisions of the code are observed in the provision of licensed services.

Such a code has been drawn up by the ITC and the effects of this on VOD services are explored in further detail below.

B. Local delivery service licences

These licences, introduced by the *Broadcasting Act 1990*, replace the licences which used to be awarded by the Cable Authority. A local delivery franchise differs in two main respects from a cable franchise. First, it is technologically neutral and a franchisee is not required to serve the area by broadband cable, but may use other transmission systems; leaving operators free to decide upon the best mix of technologies. The second major difference is in the way in which an LDS licence is granted. This, like the terrestrial Channel 3 licences is done by a process of competitive tendering.

LDS licences are defined under section 72 of the Act:

72.-(1) In this Part "local delivery service" means a service provided by any person which-

- (a) consists in the use of a telecommunication system (whether run by that or any other person) for the purpose of the delivery of one or more of the services specified in subsection (2) for simultaneous reception in two or more dwelling-houses in the United Kingdom; and

- (b) is of a class or description specified in an order made by the Secretary of State.

(2) The services referred to in subsection (1)(a) are-

- (a) any television broadcasting service...

- (b) any non-domestic satellite service...

- (c) any licensable programme service (within the meaning of that Part);

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The order specified in sub-section 1(b) above defines the class of services for which an LDS licence is required as "services provided in an area in which there are more than one thousand dwelling houses, subject to the exceptions set out in the Schedule to this Order"³⁵. None of the exceptions listed in the Schedule would appear to include a video on demand service. The effect of the order is to abolish the need for a Cable Authority or ITC licence in respect of any system covering 1000 homes or fewer.

The debate as to whether the above section includes a VOD service focuses on the interpretation of the definition "services...for simultaneous reception in two or more dwelling-houses". Or more specifically whether the reference to "services" means the VOD service itself or the actual video programmes requested. This is because it could be argued that a VOD service is available for simultaneous reception whereas the video programmes themselves are not received simultaneously. Two different homes could watch the same video but it is unlikely that they would be viewing them simultaneously; some time lag would be involved.

This issue is of great importance because it is ITC policy, continuing on from that of the Cable Authority, that only one broadband cable franchise is awarded in any given area so that the new franchise is protected from direct competition in the early stages³⁶. Consequently, it is unlikely that BT would be awarded a national LDS licence to provide a VOD service.

C. Cable Television Association's position

The Cable Television Association's position on the licensing requirements of a video on demand system was set out in August 1993³⁷:

"There has been in the past some speculation in the national and trade press that a Video On Demand service would fall outside both the Broadcast Act of 1990 and OFTEL's Duopoly Review policy. **This is not the case.**

A video on demand service would be comprised of a number of programmes that could be chosen by the customer from a menu at any time. The customer could decide what to watch and when to watch it. Video on Demand would for example provide a choice of 1000 films provide on a screen menu and once the customer had chosen the desired title it would be instantly transmitted to the television screen.

³⁵ *The Broadcasting (Local Delivery Services) Order 1990* SI 1990/2839 as amended by SI 1991/2188

³⁶ *COI Aspects of Britain: Broadcasting* p.45

³⁷ *CTA Cable Companion: A Current Guide to UK Cable* August 1993 p.5-7

The regulatory and legislative regime would demand that the service be licensed under Paragraph 46(1)(b) of the Broadcasting Act 1990 and would thus fall under a Local Delivery Service as defined in Paragraph 72(1). Simply defined a video on demand service consisting of a number of films or programmes would by definition be receivable simultaneously in two or more dwelling-houses in the UK. 72(1)(a). Therefore because the ITC have stated that they will not for the time being over-franchise BT would not be allowed to provide a video on demand service on their national network."

However, since these comments were made, ITC has published a statement on the issue, and it would seem that the CTA is not necessarily of the view that a VOD service would require a LDS licence.

D. ITC's position

The Independent Television Commission (ITC) published a statement giving its views on the licensing of a video on demand service in September 1993³⁸:

"The ITC is today making clear to all parties that it does not consider that a service which consists solely of video on demand, that is, where individual programmes are transmitted by means of a telecommunication system to only one household at a time in response to a particular request, needs to be licensed as a local delivery service under Part II of the Broadcasting Act 1990. (Such a service would, however, require a licensable programme service licence from the ITC...)..."

Detailed consideration of section 72 of the Broadcasting Act 1990, which lays down the circumstances in which a local delivery licence is needed, has not been able to remove all the uncertainties about the effect of the law in relation to programmes delivered for reception in only one dwelling house at a time. The issue is one which could be resolved definitively only by the courts.

There is no dispute that a video on demand service would not have been licensable by the Cable Authority under the Cable and Broadcasting Act 1984. The question has been whether the slightly different wording of the 1990 Act, which replaced the 1984 Act, changed the effect of the law. The ITC has concluded that it is unlikely that it did...

Enforcement of the 1990 Act against unlicensed services is...primarily in the hands of the Crown (for civil proceedings) and DPP (for criminal proceedings),

³⁸ "ITC statement on licensing of video on demand" *ITC News Release 40/93* 29 September 1993

rather than the ITC (although third parties may also bring criminal proceedings if they obtain the consent of the DPP). The ITC's view on whether video on demand is licensable under Part II of the Act does not, of course, prevent the Crown, the DPP or other third parties from bringing enforcement proceedings in the courts. Neither does it prejudice any ruling of the court. Those contemplating the provision of such services will therefore need to take their own legal advice on the possible application of Part II to video on demand services."

The reference in the statement to the different wording of the *Cable and Broadcasting Act 1984* is that in that Act the term "sounds or visual images or both" is used instead of the term "services" (see Section III.D above). In other words, under that Act, licences are only required for the services consisting of visual images for simultaneous reception in two or more dwelling houses. The ITC believes there is no doubt that this definition would not include a video on demand service and that the change in wording between the two Acts was not intended to result in a change of the law³⁹.

It has been reported that the ITC believe [ibid]:

"...that if it was intended that the [term] 'service' would refer to the video on demand service as a whole rather than the individual programmes, it would be unnecessary to include the words "for simultaneous reception" in Section 72(a), since, by definition the service would be available simultaneously continually. The inclusion of the words "for simultaneous reception" makes it clear that it is the individual programmes which are referred to..."

The same commentator who reported ITC's views above believes that ITC's view is "likely to be correct" and put forward another reason why this might be so:

"A further argument may be provided by a comparison of Sections 72 and 46 of the Broadcasting Act...Section 46 is clearly intended to cover video on demand and express wording was included to put this beyond doubt. The fact that these words were not included in Section 72 implies that video on demand was not intended to fall within its scope."

D. ITC Programme Code and family viewing policy

³⁹ "Video On Demand" *TRR Special Issue* Number 7.06 28 February 1994 p. 3

As discussed above, the ITC have published a *Programme Code*⁴⁰ which sets out guidelines on broadcasting policy which all holders of LPS and LDS licences must follow. Video on demand services are not exempt from these guidelines⁴¹. The particular part of the code that is of relevance in this context is that concerning scheduling and family viewing policy. This policy is summed up as: "material unsuitable for children must not be broadcast at times when the largest numbers of children are viewing". The policy assumes a progressive decline throughout the evening in the proportion of children present in the audience and is the basis for the existence of the "nine o'clock watershed".

The Code contains specific guidance about the times at which different types of films may be broadcast:

"...Where a British Board of Film Classification (BBFC) exists for the version of the film or programme proposed for transmission, it may be used as a guide to scheduling. It should be borne in mind that a stricter standard of acceptability is set by the BBFC for a video version than for the cinema version, since video classification includes the test of suitability for viewing in the home. A stricter standard again is applied to the version certificated for subscription TV. Not all films certificated for cinema or video release, however, will be suitable for the circumstances of television transmission, and scheduling decisions must continue to be made in light of the rules set out elsewhere in this code.

The following basic rules apply:

- (a) **No '12' rating should normally start before 8.00pm on any service**
- (b) **No '15' rating should normally start before 9.00pm (or 8.00pm on encrypted or 'additional' subscription channels [such as a VOD service], contents permitting).**
- (c) **No '18' rating should start before 10.00pm on any service.**
- (d) **No 'R18' rating should be transmitted at any time.**
- (e) **No version which has been refused BBFC certification should be transmitted at any time.**

These are, however, **minimum** requirements. In particular, many '15' rated films will not be suitable as early as 8.00pm even on a subscription channel if, for example, they contain scenes of drug taking or sexual intercourse or a greater than usual level of violence. Where no BBFC certification exists and the licensee relies only on this Code for guidance, special concern should be given to the interests of younger views. Nothing shown before 8.00pm by **any**

⁴⁰ ITC *The ITC Programme Code* January 1993 Section 1.5 Scheduling

⁴¹ Oral communication ITC, 5 May 1994

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licensee, whether on a subscription channel or otherwise, should be unsuitable for children."

These restrictions on the time at which videos can be transmitted would appear to be a real obstacle to the introduction of a "true" video on demand service. It could also have implications for the commercial viability of any VOD scheme. Figures provided by the British Video Association show that 42.2% of rented videos have a '15' rating and that 29.5% have an '18' rating⁴². It is open to question whether subscribers to a VOD service would be prepared to wait until 8pm to see a '15' video and until 10pm to see an '18' video if they could obtain the same film on cassette from their local video store at any time of the day.

Further enquiries on *Broadcasting regulation* should be referred to Jane Fiddick in the Home Affairs Section of the Library rather than to the author.

⁴² Letter from British Video Association 21 March 1994

V. The future

Much remains to be decided about the future for a video on demand service based on ADSL technology using copper telephone wires as the link into the home. BT will obviously only be able to make a decision about the introduction of national VOD service following evaluation of its trials. However, as described in Section II.E, there are doubts about the commercial feasibility of a full-scale VOD service. Some commentators have even suggested that BT's plans are largely a smokescreen, and that they are intended to raise doubts among potential cable investors about the financial stability and viability of the industry. An article in *New Media Markets* in October 1993 commented ⁴³:

"That view is supported by an analysts' paper from Kleinwort Benson Securities, which suggests that 'the major motivation for BT raising the profile of a possible video-on-demand service at the current time is to unsettle ... cable operators and particularly their backers.

'Any headlines which can raise the apparent risk of the cable industry will raise the effective cost of capital and so make life that little more difficult for BT's new competitors.'"

Other press reports have suggested that there has been argument within BT itself as to whether BT should adopt ADSL technology or go straight to optical fibre⁴⁴:

"Some executives had argued that BT should miss out the adsl step and head straight for fibre. They argued that an ADSL service would be an unnecessary expense because it would be overtaken by fibre. The argument was won by those who believed that BT would lose too much television market share if the company did not go ahead with ADSL."

This argument that ADSL would allow BT to enter the "television market" more quickly and to compete with the cable television operators is reflected in comments made by a senior BT executive in an article in *Broadcast* ⁴⁵:

"VOD can be rolled out extremely quickly, compared to cable,' he says. 'Our lines are already in place - 90 per cent of homes in the UK are within four miles of the local exchange, meaning they are passed to receive the service straight away.

⁴³ "BT hits back: Video on demand will start, will work and will make money" *New Media Markets* 7 Oct 1993 p.10

⁴⁴ "BT video service is part of new-technology dilemma" *New Media Markets* 16 December 1993 pp 10-11

⁴⁵ "A question of supply and demand" *Broadcast* 8 April 1994 p.18

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'Cable is 10 years old and has little over three million homes built passed. You have to dig up the road to lay cable, but with VOD all you'll need is a new connection box near the TV.'

More definitive information on BT's policy regarding ADSL has become available as a result of their evidence to the Trade and Industry Committee in connection with its current inquiry into Optical Fibre Networks. Sir Iain Vallance, BT's Chairman, appearing before the Committee on 9 March 1994, stated that the use of ADSL over copper telephone wires could only be seen as a stop-gap, until homes are directly connected by optical fibre at some point in the future⁴⁶:

"We are trialling both ADSL and fibre, and based on that and a market trial and what might happen with the regulations, we will decide which to invest in. If ADSL is okay, it will provide a gap-filler, even if the services are not as good as those which we could provide on broadband. ADSL would let us build up a demand for services which a broadband network could meet."

In their evidence, BT said that it would cost £15 billion to connect optical fibre to the home, and that the risks and costs involved could only be justified if it were allowed to supply broadcast and cable television services over such a network. Sir Iain said that if restrictions on BT conveying broadcast television services were lifted by 1997 then the company would still have a chance of competing with the cable television companies by installing fibre. However, as described in Section III.A above, it is Government policy that BT should not be allowed to "covey entertainment services" until 1998 at the very earliest and the telecommunications Minister, Patrick McLoughlin, has recently reaffirmed the Government position on this issue in a letter to the Cable Television Association⁴⁷.

Cable television operators have expressed doubts about both the commercial and technical feasibility of BT's VOD service and do not seem to have committed themselves to supplying an identical service⁴⁸. Instead cable TV companies have been examining ways of introducing near video on demand or "staggercast" where the same film is shown simultaneously on several channels but with different start times. With a sufficient number of channels available it would be possible for viewers not to have to wait more than, say, 15 minutes for the start of the film they wanted to watch. It has been suggested that cable TV companies are likely to take an evolutionary approach towards the development of new services [ibid]:

"Most cable operators are likely to develop through a logical progression of

⁴⁶ "BT calls for broadcast ban to be lifted by 1997" *New Media Markets* 10 March 1994 pp 6-8

⁴⁷ "Minister upholds ban on BT television" *Financial Times* 10 March 1994 p.1

⁴⁸ "Only Nynex in a hurry to launch video on demand" *New Media Markets* 24 March 1994 pp 10-11

three stages of on-demand programming, just "like a baby crawling, walking, then running," as one senior planning executive put it. The stages are (1) pay-per-view; (2) near-video on demand (an expanded ppv where each film is shown several times at short intervals); and (3) full video on demand (where viewers call up whatever they want from an electronic library of programmes).

Some operators could decide to stay with near-video-on-demand rather than go to the third stage. Most are likely to keep a pay-per-view service while at the same time introducing near or full video-on-demand. The latter would certainly show a large number of less up-to-date or big-events programming than a simple ppv service."

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