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Business Strategy and Regulation of Multi-media in the UK*

By Martin Cave and Mark Shurmer**

Summary

The paper examines the commercial prospects for alternative delivery platforms for multi-media services in the United Kingdom, and proposes an approach towards regulation of the sector. Multi-media services involve four stages of production: content creation, service provision, network delivery and the installation of appropriate customer premises equipment. In connection with network delivery, the paper argues that a variety of techniques exist, some wire-based, some wireless, each with its own costs and capabilities. In particular, it is suggested that the development of ADSL (Asymmetric Digital Subscriber Line) and of digital television provides opportunities for a much wider range of entertainment services, incorporating a limited degree of interactivity. These cheaper alternatives create doubts about the viability of broadband delivery systems in the medium term. In connection with regulation of the sector, current UK arrangements divide responsibility between broadcasting and telecommunications regulators. The paper argues that a better distinction should be made between economic regulation of the sector as a whole, and content regulation. Given the technological and market uncertainties, regulation should not favour any particular technology but should draw its inspiration from standard competition policy, focussing primarily upon the regulation of bottlenecks, most likely to occur in network delivery or in the conditional access system.

This paper is devoted to an analysis of developments in the provision and regulation of multi-media services in the United Kingdom by broadcasting and telecommunications firms. Such services are literally defined as involving two or more media taken from, for example, speech or music (i.e. audio), text, graphics, and video (moving pictures). More generally, the term is used to mean the expanding range of information-rich services provided by the convergence of telecommunications and broadcasting.

Rather than address all the issues raised by the development of multi-media, in this paper we focus upon a sub-set, namely, the development of broadband services for the mass market, especially video services, using wireless or wire-based networks. This emphasis derives from the fact that the relatively liberalised environment of broadcasting and telecommunications regulation in the United Kingdom is already generating competition among firms offering a multiplicity of one-way and interactive video services and the means for their delivery. As a consequence of these developments, multi-media issues in the UK are focussed upon regulation of operators employing a variety of alternative delivery platforms and involved to varying degrees in horizontal and vertical integration. This is creating increasing problems for the regulatory system, which is uncomfortably

split between a communications regulator (OFTEL) and a variety of broadcasting regulators.

The provision of multi-media services involves a variety of stages: content creation, service provision, delivery networks and customer premises equipment, including key areas such as set-top converters and conditional access systems. For reasons given below, our focus will be upon the last three, rather than upon content creation.

The plan of the paper is as follows. Section 1 summarises the current framework of broadcasting and telecommunication regulation in the United Kingdom. Section 2 focusses upon delivery systems, first wire-based ones, including a discussion of the delivery of video both by cable operators and, using ADSL, by telecommunications operators, and then on developments in satellite and terrestrial broadcasting, notably the prospects for digital

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television. Section 3 considers how the resulting regulatory problems should be addressed, and Section 4 contains conclusions.

1. The existing framework of regulation

It is important to distinguish policy making at the macro level for the communications sector from regulation. The former involves setting the broad framework of policy towards the sector, including issues of ownership (public versus private), structural policy (free versus restricted entry), socio-political objectives (the extent of universal service obligations and the role of public service broadcasting) and the broad framework of (positive and negative) content regulation. Regulation then involves the detailed interpretation and implementation of policy.

In the United Kingdom, the Telecommunications Act 1984 imposes the task of devising the overall framework of telecommunications policy upon the Secretary of State, while the Secretary of State and Director-General of Telecommunications (head of OFTEL) share certain generally specified duties such as protecting consumers, developing competition and ensuring the supply of telecommunications services — and by implication the continued availability of capital investment to the sector. The Director-General then has special responsibilities relating to the implementation of changes in licences and other matters. In broadcasting, Parliamentary Acts and Royal Charters lay down general obligations. The detailed interpretation is the responsibility of regulatory bodies such as the Independent Television Commission (ITC). In addition, a variety of other bodies have specific responsibility for particular aspects of the content of broadcasts.

As far as the regulation of multi-media is concerned, the key regulatory policies currently in place are as follows. Competition in the provision of telecommunications infrastructure and services in the United Kingdom is now liberalised, and the Government has issued 150 or so licences to telecommunications operators (including cable operators) in addition to those held privately by BT and Mercury. Several such licences permit the construction of national networks, both wire-based and wireless. Cable companies are also entitled to offer telephone service and increasingly do so (see Table 1). However, BT and Mercury may neither convey nor provide broadcast (i.e. point to multi-point) entertainment services under their main licences. This line of business exclusion has provoked strong objections from BT, but the present Government is committed to it until a review in 1998 at the earliest, although the Labour Party is likely shortly to express support for a more limited policy of restriction.

Cable television is regulated primarily under the 1990 Broadcasting Act, which established a cable division within the ITC. Under the legislation, a local delivery licence is awarded through a competitive bidding process, and confers exclusive rights to provide multi-channel television

Table 1

The Growth of Cable

	Homes Passed	Homes Connected	Pene- tration %	Total Telephone Exchange Lines
January 1986	66 238	7 523	11.4	—
January 1987	143 066	19 758	13.8	—
January 1988	276 671	40 609	14.7	—
January 1989	426 056	62 728	14.7	—
January 1990	557 193	87 062	15.6	—
January 1991	828 227	148 948	18.0	2 224
January 1992	1 322 478	267 430	20.1	21 225
January 1993	1 937 501	434 458	22.4	109 133
January 1994	2 778 067	610 256	22.0	312 222
January 1995	4 116 212	915 592	22.2	741 146

Source: Cable Communications Association.

over a specified service area for a period of 23 years. The licence is technologically neutral, as it does not specify the means of distribution. Licences have now been issued passing 65 per cent of households. Table 1 shows the numbers of homes actually passed and homes connected.

Terrestrial broadcasting rights are issued to the BBC under its Charter and to other operators by the ITC, under the terms of an Act of Parliament. There are currently two advertiser-supported channels. A third licence (Channel 5) has recently been allocated. Proposals to introduce further digital terrestrial channels are discussed below. Analogue satellite broadcasts are delivered to the United Kingdom by a variety of service providers under licence from the regulatory authority in the country of origin. Of these the dominant player is BSkyB, which provides services to over three million households.

It is not necessary to elaborate at length on the mismatch between current technologies, regulatory objectives and the current system of regulation. Specific problems with the current framework include:

Duplication: Several firms are subject to multiple and overlapping regulation, not apparently guided by a clear and explicit organising principle (an example is the regulation of cable companies by the ITC and OFTEL).

Uncertainty About Regulators' Powers: In some cases, for example video on demand delivered by ADSL (see below), the regulatory framework has not been explicit.

Uncertainty Arising From Regulatory Discretion: Regulatory agencies can decide how much or how little to disclose about their long-term intentions; interactive effects make this process especially damaging for multiply-regulated firms.

Regulatory Capture: Regulators are tempted to vie for power in the political market place by favouring their own regulatees (such criticisms have particularly been directed against broadcast regulators).

Lack of Accountability: Although regulators have a Parliamentary mandate, arrangements for feedback to democratic institutions are weak.

Non-Equivalence of Rules/Tilted Playing Fields: Demonstrated by confused rules on cross-media ownership, arguments about line of business restrictions, etc.

Against this critical background, attempts are now being made to regulate the development of multi-media. We first review such developments, and then propose a framework for regulating them.

2. Technologies for the delivery of multi-media

2.1 Wire-based technologies

Wire-based technologies are now capable of supplying interactive video on demand (VoD) services of better quality than that provided by the VCR. Video becomes interactive when viewers can transmit data to an external source in response to programmes. This facility in turn enables a range of interactive multi-media services (IMS) such as the purchase of goods and services, allowing financial transactions, the playing of video games, answer questions on educational programmes, participating in quiz shows and sport events, etc.

Currently, there are three types of wire-based networks which will allow an interactive process, the telephone twisted pair access network, the hybrid fibre/coaxial access network and the fibre access system. In addition, viewers may instruct a wireless distribution network via a wire-based return path (see below).

The telephone twisted pair access network enables interaction to take place on the existing, copper base, telephone network through advancements in digital coding. ADSL coding will support the transport of high bit rate (1.5 — 6 Mbps) information. ADSL allows the reuse of the existing copper wire network. However a splitter and top box are required at the consumer end, and an interface is needed in the local exchange. The video signals are generated by a server which may (if required) be located independently of the exchange. Use of VoD via ADSL does not affect the network's ability to carry voice services.

A hybrid fibre/coaxial access network, which is routinely used by the cable companies to distribute analogue TV, needs structural modification to allow interaction. Firstly, the distribution network has to be segmented into smaller user groups to provide each subscriber with an individual VoD channel. Secondly, a return channel has to be provided to transport controlled information from user to the network. The modification will involve replacing parts of the

coaxial tree and branch network by a star fibre network carrying VoD information into the subscriber's home where it is decoded by a set top unit. The system enables both analogue TV and digital interactive TV to be delivered.

A fibre access network is the ultimate broadband system. It is based on the provision of fibre up to the subscriber's premises. It offers full fibre connectivity to a range of two-way high bandwidth services. The subscriber will again require a set top unit. The set top unit, which is an integral part of the access system, is a major part of consumer premises equipment which is required for all three types of networks. The equipment performs three main functions. It provides access network termination; it decodes encoded video programmes and it interprets user interface messages.

Cable operators' strategies

The large investment outlay of cable operators on their network has been predominantly geared to supply one-way television. Upgrading their current network to provide interactivity would involve an investment outlay estimated at about £1.4bn. This gives announcements made by cable operators a cautious tone, with VoD being described as anything from 'little more than a dazzling gadget' to 'what the consumer really wants'.

NVoD involves distributing the same content over several channels with staggered start times of between 10-30 minute intervals. This approach is obviously less expensive than full VoD, and costs can be controlled by altering the time lag. There are disadvantages in implementing NVoD. The most obvious disadvantage is the limited service since the system does not allow full interaction. This might diminish the value of first mover advantages.

Telephone companies' strategies

The telecommunication companies, which already have networks and customers in place are in a very good position to exploit the VoD market. The interest in the market is highlighted by BT's trials described below.

The reasons for such a move are two-fold. First, the potential of the VoD market is a powerful pull factor. Second, BT is seeing a reduction in revenues from its core activities. Competitors have made an inroad into BT's market by supplying innovative pricing packages which combine traditional telephone services and cable TV. The shift of customers threatens BT with relegation to a commodity bit-carrier. This increases the company's keenness to leverage revenue per subscriber as well as play a bigger role in the value added chain.

Two technical conundrums currently face BT. Firstly, with its present copper network, the company has to decide whether to use ADSL for transmission. ADSL has a limited bandwidth, offering 2Mb (in recent trials); they could have implications for the quality of the picture as well as the level

of interactivity. However, ADSL could act as a platform for a fibre/coax network, which is more efficient at high penetration rates. On one hand, BT does not really want to get involved with an 'interim technology'; while on the other, investing in a fibre or hybrid network while the VoD market is underdeveloped, would incur vast risks.

The second technical conundrum is whether to have the server network centralized or decentralized. The key aspect to this problem is costs. The whole issue comes down to the cost of distribution through the network relative to the cost of data storage. The situation is further complicated by the expected falls in the cost of both services, not necessarily at the same rate.

What is fundamental to the success of any implementation of VoD is the content of services and the price. Currently interactive TV will allow the transmission of interactive sport, news, game shows, video games, home shopping and movies. Each item has its own demand function and optimal price. Identifying the correct package is crucial to VoD's success. The market for VoD is predominantly of below average age, with medium incomes and households with children. This will give indication of the correct package. Current pricing of any package is in two parts — a fixed subscriber fee giving access to limited service as well as a pay as you use charge for other services such as movies. The current technology gives offers a great deal of flexibility in pricing and packaging of the service. However, considerable resources will have to be deployed in identifying market needs. This could disadvantage the first mover since only one company needs to deploy the resources needed to identify the correct package.

UK trials

Both cable companies and BT are currently experimenting with trials of interactive video services.

BT

In Colchester and Ipswich, BT is undertaking a marketing trial involving 2,500 residents. Phase One involved 60 BT employees for technical trials and vindicated proponents of ADSL which performed well in the technical trial, with a wider range (about 6 km) than expected. Resistance to noise and installation wiring anomalies, cited by some experts as ADSL's weakness, were less of a problem than feared. Stanford University and its spin-off Amata developed the ADSL system currently under test at BT, which is now under commercialisation in conjunction with Northern Telecom and Motorola. Phase Two of the trial will see 80 per cent of the 2,500 customer connections engineered via ADSL and 20 per cent fibre. Alcatel supplies the broadband ATM switches as well as the fibre access network and the integration of ADSL equipment. Oracle provides the multimedia database and navigational software based on an nCube media server. Apple is supplying

the set-top boxes and Sequent the customer management system.

Services provided are:

Shopping on Demand — Participating merchants include package holiday specialist Thomas Cook and fashion and sporting goods Sears. A grocery service will also be offered.

Education on Demand — Eight schools are participating and will be able to access educational material free of charge.

Magazines on Demand — Among the electronic publications offered will be a TV programme guide and sports and lifestyle magazines.

Television and Movies on Demand — Television service is developed with the BBC. 600 hours of TV programming, 400 hours of movies and 200 hours of music are available.

Home Banking — National Westminster will provide information such as balances and statements as well as transfers between accounts.

Community Link — Local information and advice service based on local authorities, job centres, training and enterprise councils and police, social groups, clubs and societies.

BT has recently announced that movies will be charged in the trial at £1.50 — £4.00, with a monthly charge of £5. About 100 organisations will provide material (Financial Times, 23 June 1995, p 5).

Cable

Cambridge Cable plans ultimately to wire up 67,000 homes although the first phase involves only 200 homes and a school. Services include shopping from Tesco, banking from Natwest, TV programming from Anglia and news from ITN.

Videotron, which has over 100,000 cable subscribers in London, has launched an interactive comedy channel and a Reuters-like City service allowing private investors to download share prices into their computers. Videotron will soon offer an advertising-only interactive channel for property and cars and plans to give high-speed access to Internet in the second half of 1995.

Bell Cablemedia has announced the start of a home banking service for its cable subscribers in Peterborough. It begins with 100 customers in 1995. A full commercial service is expected for 1996.

NYNEX has launched Genesis 2000 to create interactive programmes in education, crime prevention, community information, health care and business development for future use by its cable subscribers.

Westminster Cable (owned by BT) is planning a video on demand trial beginning this autumn in Central London.

These trials should go some way to removing in particular the market uncertainties.

2.2 Wireless technologies

Advances in digital compression technologies also signal a revolution in wireless transmissions (satellite, terrestrial, microwave). The world's first digital satellite broadcast direct to the home took place in North America in 1994. Perhaps even more important is the impending revolution in terrestrial digital broadcasting, allowing more efficient use of a scarce resource — the UHF spectrum.

The move to digital wireless services requires digitization only at the transmission and reception ends. In contrast, wired solutions also require an upgrading along the transmission path (with the limited exception of ADSL). In many instances greater reuse can also be made of the existing infrastructure, for example, existing television aerials can be used to receive digital transmissions. Together these factors suggest that wireless technologies enjoy important cost advantages over wired services.

The main effects of digital on wireless services are (i) greater consumer choice (ii) a reduction in transmission costs and (iii) interactivity. The increased efficiency of digital transmissions enables many more programme services to be delivered per UHF channel or satellite transponder (with the consequent reduction in transmission costs per service). Alternatively, higher quality signals (widescreen or high definition TV) may be delivered, or capacity may be released for nonbroadcast purposes.

It is likely that much of this increased capacity will be used for a limited form of interactive television — subscription services, pay-per-view, NVoD. Service choices would be enabled by a combination of over-the-air addressability (which is easily facilitated by digital transmission) and smart-card implementations. Further levels of interactivity can be achieved through the use of a return path using the telephone network via a modem. This limited return path capability need not be a disadvantage over wired networks since most interactive applications are highly asymmetric in terms of their information requirements.

Digital satellite services

It seems likely that commercial digital television services in Europe will appear first in the direct-to-home (DTH) market. Two major European satellite operators, SES and Eutelsat, have announced plans to make capacity available for digital services in 1996. As noted above, this would follow the pattern in the USA, where DirecTV launched its digital service in 1994.

The analogue DTH delivery market in Europe is largely dominated by the Luxembourg company SES which operates the Astra Satellite system. There are an estimated 20m Astra DTH units installed across Europe. Other

Table 2

Typical Channel Capacity Per Transponder

Quality Equivalent	Bit Rate	Capacity
VHS (video recorder)	2 Mbits	12-16 channels
PAL/MAC	6 Mbits	5- 6 channels
EDTV	9 Mbits	3- 4 channels
<i>Source: Adapted from Crossley (1995).</i>		

operators such as Eutelsat are currently confined to cable head-end distribution and to "second rank" channels. The satellite operators lease transponders to various programme operators, the most significant of which in the UK is BSkyB largely owned by Rupert Murdoch's News International.

The market dominance of SES has resulted in the de facto standardization of consumer DTH equipment around the Astra IRD (integrated receiver/decoder) specification. Conditional access standards are determined by the programme operators and are divided largely into geographical regions Videocrypt (BSkyB, UK), Syster (Canal +, France), Eurocrypt (Scandinavia). The dominant transmission standard remains PAL, though again there are regional exceptions: MAC (mainly Scandinavia) and SECAM (France).

Transition to digital will greatly enhance the channel capacity per transponder. At present, each transponder provides one PAL/MAC programme service. In the digital environment, SES estimate that the same Astra Transponder could handle 5-6 6 Mbit services (each roughly equivalent in quality to PAL/MAC). By varying the bit-rate a mix of quality levels within each transponder is also possible, giving a capacity range of 3-16 programme services (see Table 2). With the lease of an Astra transponder estimated as costing £4-5m per annum, the move to digital clearly provides the scope for a considerable reduction in transmission costs per service.

The four current Astra satellites (1A-1D) offer analogue services via 64 transponders. SES plans three further launches over the period of late 1995-1997 (Astra 1E — 1G) providing a further 56 transponders. These new satellites will be assigned for digital, suggesting that by the end of 1997 Europe could have over 300 new DTH programme services. Eutelsat has also announced that its next satellite, Hot Bird 2, scheduled for launch in 1996 will also be available for digital services, extending capacity still further.

To receive these digital services consumers will be required to purchase new IRDs with decoders. Most set-top box manufacturers have built prototype digital IRDs for the European market, though in the absence of any service offerings none is yet in production. UK reception will typically require an 80cm dish size. New wideband LNBs

(low-noise block down-converters) are also required in order to receive the full range of Astra satellites (1A — 1G). These "universal" LNBs are starting to appear on the market at around twice the price of the older versions. For most consumers, therefore, the transition to digital will effectively require the purchase of a completely new satellite system (dish, LNB, IRD).

Some indication of likely market developments in Europe can be gained from experience in the US where digital DTH services have been available since mid-1994. DirecTV operates a high powered DBS service offering 150 digital programme services via 32 transponders. Two IRD specifications are available, the base level offering reception only retails at around \$600, while an advanced model offering dual service support, interactive services (via a modem) and NVOD capabilities retails at \$900. Early sales appear promising, with around 400,000 units sold in the first six months of operations.

It is important, however, to note the significant differences between market conditions in Europe and the USA. Unlike the USA, most European markets have a significant installed base of analogue satellite receivers. In the UK, for example, it is estimated that there are around 2.82 million DTH TV households representing about 12.5% of all households. The transition to digital will therefore require careful planning to ensure the migration of the existing analogue households. Much will also depend on the service offerings in Europe, and on the response of competing delivery systems (such as cable and terrestrial).

The transfrontier nature of satellite broadcasting has inevitably meant that most regulatory developments have taken place in the European arena rather than at national level. The EC's 1989 Television Without Frontiers Directive first established the principles governing cross-border broadcasting. National regulatory authorities retain some controls through media cross-ownership restrictions and through the setting of minimum standards of taste and decency. The UK's Department of National Heritage, for example, has issued proscription orders against a number of European pornography channels. When such an order is served, it becomes an offence to advertise or deal in subscriptions for the banned channel.

In the early 1990s the EC issued its so-called series of MAC Directives which attempted to impose MAC as the transmission standard for all satellite operators. The primary objective of this move was to set a uniform standard in order to promote a single market for broadcast services (European terrestrial transmission standards are fragmented into PAL and SECAM. Moreover, a number of national variants of PAL are used, each incompatible with the other.) It was also intended to use MAC as the platform from which to launch the European HDTV standard HD-MAC (for a review see Cave, Shurmer et al 1992). The Astra satellite systems, however, exploited a legal loophole in order to continue broadcasts in PAL. The result was a rapid growth in the installed base of PAL DTH units and this, com-

combined with continuing technical difficulties with MAC, effectively made the EC Directives unsustainable.

Since that time, the technological development of digital satellite within Europe has been largely market driven. Technical standards have been developed within the Digital Video Broadcasting Group (DVB) a cross-industry body comprising of over 100 broadcasters, production companies and consumer electronics manufacturers. Once finalised these standards will be passed to the European Telecommunications Standards Institute (ETSI) for approval, a process which most expect to be a mere rubber stamping exercise. The main area of contention within DVB, that of conditional access, is discussed below.

Terrestrial digital services

Terrestrial television is virtually universal in all European markets. In the UK, for example, the BBC and NTL transmitter networks extend coverage to 99.4% of the population. Currently four PAL services are broadcast, with bidding for a fifth national channel covering 70% of homes closing in May 1995. In the existing analogue environment one PAL service is broadcast in each 8 MHz channel. A move to digital would expand this capacity to around 4 PAL equivalent services. The ITC estimates that most regions in the UK could receive 8-12 new services. The real benefit of digital, however, comes after the closure of the existing analogue services, when around 350 services could be broadcast nationwide.

There has been little systematic quantitative analysis of the benefits of a move to digital terrestrial broadcasting. There seems, however, little doubt that the benefits could be substantial. For example, the recent White Paper on the Future of the BBC (Cm 2621) suggests that a figure of around £5bn per annum could be realised through the digitization of the broadcast spectrum.

Digital terrestrial offers a number of important advantages over the other means of delivering digital television. UHF signals are particularly robust, and can penetrate deep into buildings. Reception is therefore possible on set-top aerials, an important consideration given the high penetration of multiple set households. It also enables the development of mobile broadcasting services, potentially an important new market segment. Finally, it maximises the reuse of infrastructure since reception is possible via existing aerials — only a digital decoder or an integrated digital receiver will need to be purchased at a cost of about £200 at high volume production. Full use can also be made of the existing transmitter sites — only new digital encoders are required.

There now seems little doubt that this technology works. Both the BBC and NTL (a private UK telecommunications and broadcasting transmission company) have recently given public demonstrations of it and are continuing with field trials. The DVB is currently finalising the details of the

technical specification. A move to commercial services, however, requires the development of a regulatory framework, and it is here that a degree of uncertainty remains.

The UK government has indicated general support for the introduction of digital terrestrial broadcasting in a number of policy documents. (This section draws on Foley and Shurmer (1995)). The ITC carried out a public consultation exercise on the introduction of digital services back in 1993. Since then, the Government has referred to their impending introduction in a number of policy documents, including the White Paper on the Future of the BBC, and the 1994 White Paper on Competitiveness (Cm 2563). Although it is clear that the UK government favours its launch, it remains far from clear as to how it wishes the transition to be implemented.

Among the key policy areas yet to be determined are the methods of allocating spectrum for the initial new services, support for a rapid transition to the all-digital environment, and closing down analogue transmissions. In each case, the government will face a difficult task trying to balance a number of competing objectives. A more rapid transition, for example, may only be achievable at the expense of an unfavourable impact upon the universal availability of terrestrial broadcasting. The need to incentivise the existing broadcasters may in the short-term limit the possibilities for allowing new entry into the broadcasting market.

Turning first to consider policies covering the initial introduction of digital terrestrial and the method of allocating spectrum for the new services. There are two main issues: whether the existing services should be simulcast on the digital frequencies; and whether additional channel capacity should be made available to incentivise existing broadcasters or to allow new market entry.

The main cost to simulcasting is that the capacity for new services introduction is reduced. However, previous experience suggests that the transition period will be smoother and more certain if consumers are able to receive their familiar set of services enhanced through improved picture and sound quality, better reception, electronic programme guides etc.

A single UHF channel corresponds to a capacity of around 20 Mbs, whereas only 5 Mbs are required for a PAL-equivalent quality service. Granting simulcast rights to existing broadcasters therefore leaves space within the previous analogue allocation for an additional three services. The question then arises of what to do with this extra capacity. The two extremes of the range of possibilities available are: to allocate each analogue incumbent a single UHF channel; or to award incumbents only a fixed 5 Mbit portion for the purposes of simulcasting, with the remainder being awarded by some allocation mechanism such as the highest-bid auction process.

The chosen policy needs to account for two competing objectives. First, it is important that the existing broad-

casters support the move to digital. The incumbents arguably enjoy advantages in terms of providing high quality programming, complementary scheduling and cross-promotion. Their support will be vital in the switch to an all-digital environment. At the same time, it is important that the opportunity that digital affords for new market entry is not lost. New and innovative approaches to broadcasting will be an important element of persuading viewers to switch to digital.

The government must also consider the extent to which it wishes to speed the transition process. Left to its own devices, it is likely that the transition to digital may take some considerable period of time, perhaps twenty years or more, and that a significant proportion of analogue households may persist. A variety of policy instruments are available to promote a more rapid transition, ranging from the early announcement of the closure date for analogue services (as has been adopted in Australia for mobile telephony and has been proposed by the FCC for the introduction of digital and HDTV), to more pro-active policies such as the establishment of a national conversion fund to subsidise the introduction of digital decoders.

Finally, the government will need to ensure the continued universality of terrestrial broadcasting, for any other policy would be politically unsustainable. In many respects this debate mirrors that surrounding the maintenance of the universal service obligation (USO) in telephony. USOs for television have not, however, been made explicit, though there seems little doubt that there is now a real public sense of right of access to free-to-air terrestrial television. Maintenance of USOs places important limitations on both the policies for transition, and for the method of closure of analogue transmissions.

The key point, however, is that digital television has the potential to change the number of broadcast services by an order of magnitude — to hundreds of satellite services and tens of terrestrial channels. It permits NVoD and, in combination with use of a telecommunications network on a return path, low levels of interacting for such services as pay-per-view, home shopping and video games. This raises the obvious question: if digital television can offer so much, what is the added value of the more expensive wire-based delivery system?

2.3 Alternative delivery platforms

The key difficulty for firms and regulators in taking decisions relating to multi-media is the absence to date of market information. Without knowing which services customers will seek to buy, it is as difficult for firms to appraise investments as it is for governments to adopt regulatory policies of one kind or another. Table 3 summarises our conclusions relating to the capabilities of alternative delivery systems, their existing availability and diffusion, and the incremental cost of their construction. The starting point in the calculation of the latter (which is

estimated in the form of broad categories rather than an annualised cost per household) is the assumption of ubiquitous networks for the delivery of analogue, terrestrial and satellite television and for basic telecommunication services.

As well as the technologies discussed above, Table 3 includes ISDN, which BT now makes available to all its UK customers, although at relatively high connection and rental charges. The Table omits switched wireless services, which are increasingly competing with wire-based telecommunications networks, but at present have no capacity for the delivery of video. It is, however, worth noting that a substantial research and development effort is being undertaken in the field of switched wireless broadband services which may, at some future date, add further to the options available.

Interpretation of Table 3 depends critically upon the interpreter's implicit or explicit evaluation of willingness to pay for the various additional services made available by the alternative technologies. At the least, however, we believe that it demonstrates that no firm conclusion can be formed about the inevitable dominance in the medium term of a particular delivery technology. In particular, full exploitation of the current copper network through ADSL and the new digital television services seem capable of providing entertainment material which is likely to yield the preponderance of revenue in the multi-media market. From this we con-

clude that the appropriate regulatory policy to take is one of technological neutrality. In the next Section we consider how this might be achieved.

3. Approaching the problems of regulation

The previous two sections have identified the significant developments occurring in the field of multi-media in the UK. The key developments are the growing availability of interactive switched multi-media services delivered by broad band cable and by copper pair, using the ADSL technology, and the dramatic growth in the availability of wireless delivery systems incorporating some degree of interactivity, as a result of digitisation of broadcasting services.

It is too early to anticipate what form these and other technological developments will take in the future, and what demand households and firms will exhibit for the services in question. Evidence to date suggests that households will show a predominant interest in video entertainment, principally in the form of additional movie and sports channels, and to a lesser degree in interactive services such as games and home shopping. The nature of business demand is at present more varied. As far as the technology of choice is concerned, in the longer term this is likely to be a fully interactive broadband service permitting full video exchange — at least for a substantial number of subscribers — based upon a wire-based or a wireless

Table 3

Alternative Delivery Platforms and their Capabilities

	Voice & Data Inter-activity	Point to Multi Point Services	NVoD	VoD	IMS	Limited Video	Full Video Exchange	Availability Exchange	Pene-tration	Incre-mental Cost*
Wirebased										
POTS	Limited	X	X	X	X	X	X	100	93	0
ISDN	/	X	X	X	Limited	/	X	100	1	L
ADSL	/	X	/	/	/	/	X	0	0	M
Fibre/coax	/	/	/	/	/	/	X	25	5	M
FTTH	/	/	/	/	/	/	/	0	0	H
Wireless										
<i>Terrestrial</i>										
Analogue	X	/	X	X	X	X	X	100	96	0
Digital	X	/	/	X	/**	X	X	0	0	M
<i>Satellite</i>										
Analogue	X	/	/	X	X	X	X	70	13	L/M
Digital	X	/	/	X	/**	/	/	0	0	M

* New investment per household (including CPE) required to implement service (L = £0 - £200; M = £200 - £1,500; H = £1,500+).
 — ** Requires access to telecommunications network for return path.

delivery platform. However, the cost estimates and diffusion data presented above suggest that it may take some time for such a delivery platform to be commercially viable, given the expanding availability of digital broadcast channels, which seem capable of meeting many customer demands. This implies that, in discussing regulation, the best approach to take is one which is both suitable for the control of more advanced networks, but also sufficiently general to deal with intermediate stages and the transition from one to the next. In this Section, we set out our conception of the regulatory principles and institutions capable of achieving these objectives.

In discussing appropriate regulatory principles, we will adopt the conventional starting point that a competitive market is most likely to satisfy household and firm demand. In an industry subject to such high technological and market uncertainties, the alternative of market management by the regulator or government seems remarkably unattractive.

On this premise, it is appropriate to begin the search for regulatory principles on the basis of standard competition analysis. We therefore make some observations on the manner in which this would apply to two key but related issues in the regulation of multi-media: access to essential facilities and vertical integration.

First, however, it is helpful to consider in general terms the potential for competition in each of the four sectors identified above. Content creation is characterised by critical dependence upon "talent" rather than upon substantial sunk or idiosyncratic investments. Creative capacity, of course, is not homogeneous but subject to both horizontal and vertical differentiation. Accordingly, one would expect to see substantial rents in the sector. However, the scope for monopolisation is relatively limited. One might, for example, witness attempts to corner the market in the television rights of sporting events of a particular kind, but the degree of substitution across such events is non trivial. For these reasons, the general case in favour of regulatory intervention in content is weak.

Equally, service provision *per se* is not an activity likely to be associated with substantial economies of scale. This would not preclude the possibility of anti-competitive conduct. As a recent example, the United Kingdom Office of Fair Trading is currently investigating the contractual relationship which exists between BSkyB and a number of cable companies (*Financial Times*, 20 June 1995, p 11). Essentially, the latter have entered into a contractual relationship with BSkyB which entitles them to distribute BSkyB programming to their audiences at a lower cost, in return for an undertaking not to supply rival materials. The effect of such an agreement is to make it harder for UK cable companies in combination to provide alternative programming, since the market to which such programmes would have access is substantially reduced. The OFT has given the satellite consortium and its partner cable operators a period to reconsider the restrictions, following

which a reference might be made under UK competition law to the Restrictive Practices Court. The point is not that service provision is not subject to anti-competitive conduct, but that the ordinary provisions of competition law should be capable of dealing with the associated problems.

The third sector identified above, delivery networks, represents an area of potentially serious competition problems. Equally, a company might seek to leverage market power in the delivery network back into the field of service provision. These points are considered below. Finally, many aspects of customer premises equipment are produced in competitive conditions, with no obvious need for specific regulation. However, one key issue of debate concerns the role of the conditional access system enabling service providers to generate revenue. It has been alleged that they represent a bottleneck which potentially confers a dominant position upon a service provider.

Essential facilities in multi-media

As a general rule, companies have a right to benefit from the exclusive use of assets. This applies both to vertically integrated companies and to vertically separated ones. However, it is well established under competition law and policy in a number of jurisdictions that this general principle may be over-ridden by considerations of protection of the public interest, in circumstances where a bottleneck or essential facility is considered to exist (Cave and Crowther, 1995).

The essential facilities doctrine (EFD) initially emerged in the United States immediately prior to the First World War in the well known case of "*United States v Terminal Railroads Association*". According to the doctrine, it may be unlawful under certain conditions for the owner of an asset to refuse to make it available to other companies which are in competition with it.

In the United States, the EFD has been deployed in a variety of cases, including *MCI Communications Corporation v AT&T* (1983). In this case, the trial court noted AT&T's substantial domination of the telecommunications industry and required the company to sell access to all long-distance carriers on equal terms. The case was appealed to the Supreme Court, whose judgement held that "such a refusal (to deal) may be unlawful because a monopolist's control of an essential facility (sometimes called a "bottleneck") can extend monopoly power from one market into another."

In the European Union, the European Court of Justice has decided a number of cases on access since the 1970's. More recently, the Commission has reached decisions in cases relating to infrastructure, notably in the transport industry. The current position of the Commission on essential facilities is best summarised in the standard work on European competition law written by three DGIV officials (Ritter et al, 1993). This states that a denial of access to an infrastructure will be contrary to Article 86:

- if the third party depends on the use of the infrastructure or facilities for supplying his customers and building his own infrastructure is not a realistic alternative;
- if the capacity of the infrastructure is adequate to carry the additional traffic having due regard to the operator's own requirements to provide supplies during periods of peak demand and its other long-term commitments;
- if the traffic for which a licence to use the infrastructure is sought satisfies the relevant technical standard and is in sufficient quantity to meet the operating requirements of the infrastructure;
- the request is reasonable — which requires a balancing of the interests of the operator, security of supply and the public interest in competition and free trade of goods and services within the Common Market.

It should be noted that to date, development of the essential facilities doctrine has not progressed to the extent of specifying the associated access pricing rule. A variety of possibilities exist, appropriate to particular sets of circumstances and regulatory objectives. We do not, however, discuss this issue further here.

In applying the EFD doctrine to network facilities for the delivery of multi-media services, the key issue concerns the degree of competition between networks. If there is essentially a monopoly wire-based broad band distribution network, then that network would probably satisfy the requirements of an essential facility. If, however, technology and market conditions developed in such a way that there was a variety of delivery platforms, the doctrine would cease to apply. However, there would still be the opportunity for potentially anti-competitive conduct in the form of collusive behaviour, etc.

The argument might be made that the requirement for access should be extended further to permit complete inter-connectivity, in the sense that a subscriber to any network should be required to have access to any service. This might be proposed by an analogy with the application of the "any to any" principle in voice telephony: any subscriber on any network has access to any other subscriber on any other network. However, this would go considerably beyond the implications of standard competition law, and we do not consider it further.

The second area noted above where a potential essential facility exists is in the conditional access system. A CAS is a mechanism for scrambling and decoding video and related services, designed to ensure that only those who have paid for access to the services receive them. In relation to competition policy, the key issue is whether a programme provider's control of the conditional access system is sufficient to exploit other programme providers.

The issue has surfaced particularly within the context of the digital broadcasting, where conditional access will play an increasingly important role. This importance was recognised early by the DVB project, which set up a sub-committee to deal specifically with issues pertaining to conditional access. After successfully specifying the uncontroversial common scrambling algorithm, the Condi-

tional Access Specialist Group set about developing specifications for the encryption process. The encryption process has become a highly contentious issue within the DVB, which polarized the membership between supporters of an open access system (Multicrypt) and of a proprietary system (Simulcrypt).

Supporters of the former argue vehemently that open access is the only way to prevent monopolisation of the conditional access market. The Multicrypt encryption system consists of a set top box with a common access port for a detachable conditional access module. The ability to switch modules could encourage active competition in this market, with broadcasters and consumers able to choose between a variety of conditional access packages, according to their individual requirements. Supporters of Multicrypt believe that competition is the best way of generating the innovation that is essential for the development of digital television.

Existing pay TV operators, such as France's Canal + and Britain's BSkyB, have proposed their own proprietary system, known as Simulcrypt. The Simulcrypt system consists of territorial divisions across Europe, within which there would be proprietary set top boxes and decoders. Simulcrypt would permit broadcasters to deliver programmes to a number of these geographical areas by merely signing up with the appropriate subscriber management service. The backers of the Simulcrypt process believe that their significant early investments in conditional access technology entitle them to some monopoly reward.

Proponents of Simulcrypt, in an attempt to allay fears of monopolistic abuse in the provision of conditional access services, proposed a code of conduct which sets out the principles under which the providers of subscriber management services permit programmers access to viewers administered by them. Much debate has centred on this code, with the contentious nature of the dispute meaning that the usual consensual approach to DVB specifications was never likely to succeed in generating specifications for a conditional access package. The steering board of the DVB pressed on with a simple majority vote as a means of settling the argument. The vote was decisive with eighty per cent of the vote in favour of accepting the code. The DVB had decided to approve both Multicrypt and Simulcrypt systems.

Supporters of the Multicrypt system, however, fearing the market power of the Simulcrypt group, believe that the refusal to mandate the open access port would result in market domination by Simulcrypt. The Multicrypt group did not give up the fight and lobbied Members of the European Parliament extensively. Despite the European Parliament's amendment to the Directive tabled by DGXIII, effectively proposing to mandate the open interface, the UK government's refusal to endorse it means that when the issue finally reaches the European Council of Ministers the outcome is certain. Multicrypt will probably not be mandated.

Although open access will not be mandated ex ante in the Directive referred to above, it will still remain an option for

operators to apply under Articles 85 and 86 for mandatory access, invoking the essential facilities doctrine. In the present state of knowledge, however, it is not possible to anticipate either how the market or the technology or associated costs will develop. Accordingly, we do not offer forecasts about how the competition policy approach will apply in this context.

Vertical integration

The second generic issue in the regulation of multi-media from a competition policy standpoint concerns the appropriate response to vertical integration. The economic literature on this issue, summarised, for example, in Waterston 1991, is inconclusive. Some argue that there is no general advantage to a firm exercising dominance at one stage of a production process to extend its activities to another, on the ground that "a monopoly profit may only be made once". At the same time, there are a large number of models in which it can be shown that market power at one stage of a production process can be utilised to exercise leverage at another.

The EFD, described above, typically places particular obligations upon a vertically integrated bottleneck owner, particularly in respect of the exercise of non-discrimination: the owner must offer access to the essential facility to competitors on the same terms in respect of quality and price as it offers access to its affiliated organisations. Implementation of this condition may require dominant operators not only to avoid discrimination but also to separately account for network assets, as a mechanism for enforcing non-discrimination.

Some commentators have gone further and suggested that the principle should be adopted that a network owner would only be entitled to be vertically integrated into service provision if its network were open. Thus any closed network would have to be a freestanding business. However, this proposal goes beyond standard competition law and requires separate justification. In our view, no such justification is yet available.

Regulatory institutions

The emergence of multi-media has placed a major strain on regulatory institutions, as well as demanding new regulatory policies. As noted above, the current system of policy making and regulation divides the former between two Government departments (the Department of Trade and Industry and the Department of National Heritage) and the latter between a telecommunications regulator — OFTEL — and a variety of broadcasting regulators. While it is not too difficult to co-ordinate the policy making process, there is a strong case for adapting regulatory structures to conform more exactly to recent technological and market developments. For this reason, a review of regulatory arrangements is desirable, probably leading to the creation of a single economic regulator for the converging com-

munications sector supplemented by a content regulator to deal with issues of taste, etc (see Cave, 1995). The argument in favour of separate regulatory institutions is that the requirements placed upon each of them are substantially different. Economic regulation requires skillful technical and market analysis; content regulation requires a capacity to reflect popular taste. The distinction is not watertight, however, and certain issues such as universal service obligations involve cultural and social as well as economic considerations. Collaboration between the two bodies will thus be essential.

4. Conclusions

The conclusions to this paper can be quickly summarised.

- Existing regulatory structures in the United Kingdom, which divide responsibilities between a broadcasting and a telecommunications regulator, each sponsored by a separate government department, are inappropriate to the developing era of convergence and multi-media services.
- Multi-media services involve activity at at least four stages of production — content creation, service provision, network delivery and customer premises equipment.
- In connection with network delivery, there exists a variety of platforms offering combinations of services at different cost levels. These technologies, which are in a continuous state of rapid development, include both wire-based and wireless delivery systems. Crucial developments are the availability of ADSL, which permits delivery of VCR-quality pictures along an ordinary wire, and digital television, which will permit a rapid expansion in the number of broadcast services available, some combined with low level interactivity through a return path involving telecommunications networks.
- The multiplicity of delivery mechanisms and their rapid development make it impossible to "pick a winner". Accordingly, regulation should be at this stage technology-neutral.
- Standard competition law and policy provides an appropriate approach to the regulation of multi-media services. In particular, regulation should focus upon bottlenecks which are likely to take the form of monopoly delivery networks and dominant control of that part of the customer premises equipment which regulates conditional access to services. Vertical integration also creates potential regulatory problems, but of a kind often encountered in competition or anti-trust analysis.
- Finally, in order to implement a competition policy approach, there remains a need for an industry-specific regulator of the telecommunications sector. We propose a single "economic" regulator for the whole sector, supplemented by a "content" regulatory body concerned with matters of taste and decency.

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Zusammenfassung

Marktstrategien und Regulierung im Bereich von Multimedia-Diensten im Vereinigten Königreich

Der vorliegende Aufsatz untersucht die wirtschaftlichen Perspektiven alternativer Formen des Empfangs von Multimedia-Diensten für das Vereinigte Königreich und schlägt einen Regulierungsansatz für diesen Markt vor. Multimedia-Dienste lassen sich in vier Komponenten zerlegen: die Produktion von Informationsinhalten, die Ausführung der Dienstleistung, die Bereitstellung des Übertragungsnetzes und die Installation geeigneter Endgeräte beim Konsumenten. Für den Bereich der Übertragung werden verschiedene Techniken vorgestellt, von denen einige drahtgebunden, andere drahtlos sind. Sie unterscheiden sich jeweils in bezug auf Kosten und mögliches Leistungsspektrum. Dabei ist von besonderer Bedeutung, daß die Entwicklung von Asymmetric Digital Subscriber Line (ADSL) und digitalem Fernsehen Möglichkeiten schafft, ein deutlich größeres Spektrum an Unterhaltung und sogar einen gewissen Grad an Interaktivität anzubieten. Diese billigeren Alternativen lassen auf mittlere Sicht Zweifel an der Rentabilität von Breitbandübertragungssystemen aufkommen. Was die Regulierung des Marktes angeht, so teilen die geltenden Bestimmungen die Verantwortung zwischen Rundfunk- und Telekommunikationsregulierern auf. Im vorliegenden Aufsatz wird argumentiert, daß eine deutlichere Unterscheidung zwischen der Regulierung der ökonomischen Seite des Marktes und der Regulierung von Informationsinhalten getroffen werden sollte. Angesichts der Unsicherheiten bezüglich der technischen und der ökonomischen Entwicklung sollte die Regulierungsinstanz nicht eine bestimmte Technologie favorisieren, sondern von allgemeinen Überlegungen der Wettbewerbspolitik geleitet sein und sich auf die Regulierung von Versorgungsengpässen, die höchstwahrscheinlich im Netzbereich oder in bezug auf Abonnentenverwaltungs- und Entschlüsselungssysteme auftreten, konzentrieren.