Information superhighways

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This paper explains what information superhighways are and describes recent policy developments in the UK, Europe and the United States.

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CONTENTS

I. Summary

The phrase "information superhighway" was first coined by Vice President Al Gore to describe the telecommunications networks of the future. Different people use the term in different ways, but it in general it refers to networks capable of two-way delivery of pictures, text, and video. The number of possible applications is endless, and many have yet to be thought of, but they include:

- entertainment services - television, films and interactive video games
- video phones - from home use to international business video-conferencing
- teleworking - working from home using video phones and remote computers
- distance learning - an open university over the superhighway

Many of these applications will require high capacity telecommunications links and cannot be provided over traditional telephone lines. Instead either optical fibre or coaxial cable, as used by the cable television companies to connect individual homes, will be required. There is considerable debate about the advantages and disadvantages of these different technologies and their use by telephone and cable television companies. These issues are explained in Section II of this paper.

Discussion of information superhighways often encompasses the Internet. This is a global network of around 45,000 different computer networks but it cannot strictly be described as a superhighway because some important applications such as video-conferencing or movies are not readily available. The most important uses of the Internet are for exchanging electronic messages (e-mail) and taking part in electronic discussion groups on an incredible range of subjects. The Internet is discussed in Section II.C.

Much of the impetus for the development of superhighways has come from the United States under the leadership of President Bill Clinton. His Administration published a white paper on the National Information Infrastructure (NII) in September 1993, and is encouraging the development of infrastructure by the private sector. Some Government funding is available for "pump-priming" public sector applications. In Europe, the Bangemann report on the information society has provided a similar focus to the NII. This report was commissioned to build on the ideas contained in the Delors white paper on Growth, Competitiveness and Employment. The European Commission is currently working on an Action Plan to put the various ideas into practice. International developments are dealt with in Section III.

In the UK, the debate on superhighways has focused on the development of optical fibre networks and the relative roles of the telephone and cable television industries. This has been prompted to a large extent by the recent Trade and Industry Committee inquiry into the subject. More recently, the Government has published a command paper on the development

of superhighways which emphasises the role of the private sector in developing a suitable infrastructure. The paper also discussed the current telecommunications regulatory framework in the context of the Trade and Industry Committee report, concluding that no changes are required to existing Government policy. All these issues are discussed in Section IV.

This paper concludes with a brief look at the future in Section V.

II. Introduction

A. What is the information superhighway?

The term "information superhighway" is used to describe advanced telecommunication networks used for the transmission of interactive computerised services as part of the "multimedia revolution". Such services would include those devoted to entertainment (eg. television, videos, computer games), education (eg. distance learning and collaborative university research), business (eg. information interchange, video conferencing, teleworking), medicine (eg. remote consultations) and many others. The term was originally used in the context of plans by the US Administration to develop a "National Information Infrastructure", but is now often being used to describe any developments in pursuit of providing large scale, high capacity telecommunications networks.

There has been much press comment on these issues in recent months and considerable confusion whether such developments as multimedia, home shopping, video on demand and the "Internet" constitute an "information superhighway". Exciting as they are, it generally accepted that these developments have not delivered a true superhighway. Definitions do differ but, in general, it is accepted that true superhighways must be capable of carrying "two-way broadband" traffic. The term "broadband" refers to a high capacity, or large bandwidth, data channel capable of carrying significantly more information than a "narrowband" telephone line. The House of Commons Trade and Industry avoided the term "superhighway" in their recent report on *Optical Fibre Networks*, but instead referred to "broadband networks" [1]:

> "6. There is no precise definition of broadband networks, but their key features, which we use as a definition in this report, are the ability to carry enormous quantities of information at high speed, the capacity for two-way (interactive) communication, and the ability to deliver any media, including video, text, audio and images. It is these features which make possible a very large range of new services. Narrowband networks, by contrast, can carry only two-way telephone conversations and relatively small amounts of data."

Following the introduction of digital compression techniques for transmitting greater amounts of information over a standard telephone line the distinction between broadband and narrowband networks is no longer as clear as it used to be. For instance British Telecom is currently conducting trials of a video-on-demand service which involves sending video films into customers' homes over telephone lines [2]. That being said, the capacity offered by such a service is still limited to at most 3 video channels, whereas a broadband network could offer hundreds, if not thousands, of video channels.

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[1] Trade and Industry Committee *Optical Fibre Networks* 19 July 1994 HC 285-I 1993/94
[2] Further details can be found in Library Research Paper 94/68 *Video on demand* 9 May 1994

B. The infrastructure and different technologies

In considering the development of superhighways it is important to understand the different technologies and infrastructure which can be used to send information from one place to another.

1. Information

Any information can be stored or transmitted in either **analogue** or **digital** form. For instance, music can be stored in analogue form on a cassette tape or in digital form on a compact disc. Analogue information is stored as a continuously varying electrical signal, whereas digital information is stored in **bits**. A bit is a binary digit, either a "0" or a "1". Analogue signals can be converted into digital information using an electronic device called an analogue-to-digital converter. However, a huge number of bits might be needed to represent an analogue signal, and so **digital compression** is often used to reduce the number of bits to a more manageable level. For instance, television is broadcast in analogue form, but when converted into digital form, a single second's worth occupies 200 million bits (usually written as 200 Mbit). With digital compression the number of bits can be reduced to 6 million bits if a broadcast-quality picture is required, or only 2 million bits if a video-quality picture is sufficient. This number of bits is required every second, so a telecommunications network capable of carrying broadcast-quality pictures must have a minimum capacity of 6 million bits per second, which is usually written as 6 Mbit/s.

The advantage of digital information over analogue information is that it can be transferred from one telecommunications network to another without any loss or degradation and that the information itself can easily be processed/manipulated using computers. Increasingly more and more information is being stored in digital form. As mentioned above, the compact disc is now widely used for storing music, and digital television is beginning to be developed.

2. Copper cables and optical fibres

There are three main types of telecommunications cable which can be used for transmitting information: copper telephone wires; copper coaxial cable; and optical fibres. The type of cable used is important as different cables can carry different amounts of information. Much of the recent debate on the development of superhighways in the UK has focused on whether optical fibres going right into the home (fibre-to-the-home, FTTH) are required or whether other methods, principally copper cables, can be used for the final "drop" of the superhighway into the home.

Copper telephone wires - these are used to connect domestic telephones to the local exchange or distribution point (and are sometime known as "twisted pairs"). They carry analogue signals such as those generated by a telephone, or those which have been created from a digital source (such as a computer) using a digital-to-analogue converter (such as a modem). The amount of information that can be carried on a copper cable (its capacity) is limited - it can only provide a "narrow band" connection. As mentioned above, recent technological advances have meant that it is possible to transmit a limited number of video-quality television channels on copper telephone wires over distances less than 5 km.

Copper coaxial cables - these are the type of cables which are used to connect a television to an aerial socket and are also used by cable television companies to take their services into the home. They carry analogue signals but have a much higher capacity than copper telephone wires and are capable of providing a "broadband connection". A coaxial cable can carry about 50 analogue television channels, but if the channels are digitally encoded and compressed hundreds of video quality channels can be carried. It would be possible for both analogue and digitally-sourced signals to be transmitted over the same cable. Currently, cable television operators only supply analogue television signals without the use of digital compression.

Optical fibres - as their name suggests these are thin fibres made from glass. They are used to carry digital signals and have a much higher capacity than copper cables. Both telecommunications and cable television networks use optical fibres to carry their network or "trunk" traffic. In all practical respects, given current applications for superhighways, the capacity offered by fibre is unlimited.

The Trade and Industry Committee report contained the following summary of the digital capacities of the different types of cables [3]:

Type of cable	Over 1km: Mbit/s	Over 3km: Mbit/s	Over 10km: Mbit/s
Twisted pair (copper)	6	2	0.5
Cable TV coaxial	1000	150	25
Optical fibre	>10,000	>10,000	>10,000

[3] Table 2, p.10

Further information on capacities of different transmission media and the techniques of digital compression can be found in Library Research Paper 94/68 on *Video on demand* and Research Paper 94/83 on *Digital and High Definition Television*.

The figures quoted in the above table represent the maximum capacity of a given type of cable. In practice lower transmission speeds are often used. For instance, computer modems which send information over the telephone network usually operate at 10-15 kbit/s (thousands of bits per second).

From the point of view of creating a two-way broadband information superhighway it can be seen that only two types of cables are capable of carrying the required amount of data: copper coaxial cable and optical fibre. In terms of establishing such an infrastructure in the UK, there are two different groups of players: the national and local telephone companies and the cable television companies.

3. Telephone companies

Currently, telecommunications companies are normally only connecting large business customers[4] directly with optical fibre. Smaller customers are connected with "twisted-pair" copper wires. The reason for this is simply one of economics, an optical fibre connection is more expensive than a single copper connection, but a single optical fibre can carry hundreds of phone calls. Consequently, there comes a break-even point at which it becomes cheaper to put in fibre then to put in copper.

A report commissioned by the DTI on the international competitiveness of UK telecommunications, published in February 1994, commented on the feasibility of taking optical fibre connections directly into the home and into small businesses [5]:

> "The choice of the technology to be used in the access network for residential and small business users depends heavily on its cost. This part of the network represents a major part of the capital investment of a TO [telephone operator], and generates a relatively low level of traffic, and therefore revenue, per line. To meet their business objectives operators need a low cost, low maintenance network with a long working life. If the choice of access network permits the provision of any additional services that can increase the revenue stream, then the investment case for that technology can be improved.

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[4] With at least 4 or 5 telephone lines

[5] R Harrison, PA Consulting Group *Study of the International Competitiveness of the UK Telecommunications Infrastructure* DTI 1994 p. 40

> "Considerable research has gone into establishing the point at which fibre becomes more attractive than copper. At present the consensus amongst all operators covered by the study is that the cost of the terminal electronics makes fibre to the home (FTTH) uneconomic for both telephony and cable TV applications, whether supplied separately or in combination. The magnitude of the cost differential varies according to the assumptions made, and whether the fibre is being considered for new or replacement installations, but on current costs it ranges between 3:1 to 18:1. FTTH is expected to become economic for new installations after 1995-97, and for replacement of existing copper early in the next century. However, deployment of fibre to the kerb (FTTK), to multi-occupancy buildings (FTTB), or to businesses (offices) with several lines (FTTO) can usually be justified at today's costs for new installations. Most operators argue that the ability to carry both telephony and cable TV makes it easier to justify investment in fibre owing to the increased revenues returned by the investment, but in contrast PTT Telecom [Netherlands] has published a chart showing an earlier cost cross-over point for telephony alone than for telephony and cable TV. This view is based on the high additional costs of the terminal equipment required to handle cable TV."

As far as business premises are concerned, the study found that:

> "In the UK, BT and Mercury make extensive use of fibre for direct connection to business premises. BT has installed fibre to 8,000 business premises...BT is now planning to deploy fibre rings on a large scale with the intention of connecting 95% of all business users to fibre rings within 5 years."

4. Cable television companies

As far as the distribution of television services is concerned, cable companies are connecting all homes with coaxial copper cable rather than optical fibre. However, optical fibres are used extensively higher up the transmission chain. Programme material is carried from the cable companies to local "distribution nodes" on optical fibres, and from this node is relayed out to homes on coaxial cable, in analogue format. The number of homes served from a single distribution node varies from company to company, but figures range from 2,400 to 8,000 homes.

The majority of cable companies also supply telephone services in addition to television. These services are not piped into the home on the same cable as television but instead a traditional copper twisted pair wire is used. As with television, telephone services are carried on optical fibre higher up the transmission chain, and then relayed out on copper from a distribution node. However, fibre for telephone services is taken closer to the home than that

for television, and a telephone distribution node might serve between 400 and 600 homes. These telephone services have proved popular with cable TV customers and as of October 1994 there were 570,000 cable-telephony lines in the UK (515,000 were residential lines and 56,000 were business lines)[6]. Cable companies will take optical fibre directly into business premises, in the same way as telephone companies do, if the number of telephone lines required makes it economic.

Currently, cable companies do not envisage a need for replacing coaxial cables with optical fibre. Although television services are currently relayed in analogue format setting a limit of about 50 on the number of channels, the use of digital technology might allow the transmission of 500 channels. Such digital technology would require new equipment at the cable company's "headend" and new "set-top" boxes to convert the digital signals into analogue ones (as required by televisions). However, the digital information could still be relayed over the existing coaxial cables. Nynex, the largest cable television operator in Britain, commented on this issue in its evidence to the Trade and Industry Committee[7]:

> "...Current technology prevents fibre from economically being deployed closer to the home. However, the main point is that coaxial cable has sufficient bandwidth to provide the services that customers require both today and in the future. The structure of the duct network that cable companies are constructing will enable the future replacement of coaxial cable by fibre as the development of technology over the next few years improves the economics..."

There is some debate about the cost of this upgrading. The Trade and Industry Committee commented[8]:

> "BT argued that the cost of replacement technology would be "significant", but according to the CTA [Cable Television Association], 70% of the current cable investment is in civil engineering or construction of the network, so the cost of increasing bandwidth would be relatively low."

One important aspect that needs to be considered in the context of the cable companies' contribution to the development of the information superhighway is the degree of "switchability" in their networks. Currently, their television services are not "switched". This means that since it is not possible for a particular programme to be sent to just one home, every home receives the same television signals[9]. Obviously, a true superhighway would have

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[6] "Cable takes £200 million telephony revenue a year" *New Media Markets* 3 November 1994 pp 7-10

[7] Minutes of Evidence 23 March 1994 HC 285-ii 1993/94, Para. 3.2, p.54

[8] Paragraph 62, p.28

[9] The cable company can still control which programmes are watchable through the use of set-top boxes and encryption

to be capable of sending a single programme to a single customer. Cable companies argue that this is not a problem as switched services are available over their telephone infrastructures and their television infrastuctures could easily be upgraded (particularly through the use of new technologies such as ATM[10]).

This issue of switching was addressed by Peter Walker, OFTEL's Technical Director in evidence to the Trade and Industry Committee[11]:

> "I would say that the sort of fibre networks that the cable companies are rolling out have a very great potential for being upgraded to the switched or interactive form of broadband we talk about. Clearly with the infrastructure they are putting down one can run various services over the fibre so there is an element of future-proofing of that. And one can easily add more fibres to their system and indeed upgrade their present TV and local switching fabric to include broadband switching which would be needed for that longer-term vision..."

5. Interactivity

If a true superhighway is to offer broadband *two-way* communication then certain communications technologies are not be feasible. For instance, television satellites can provide broadband delivery of programmes, but there is no scope for providing a return path for communications via the satellite. However, it might be possible to provide a limited form of interactivity through the use of intelligent "set-top" boxes and telephone lines. Similarly, cable television systems currently only provide one-way broadband information, although some do allow for interactivity via a narrowband return path. The difference between satellite and cable though, is that cable can be upgraded to offer a broadband return path whereas satellite cannot.

In both cases, the important question is whether a broadband return path is actually required. At the moment there would appear to be few applications for the domestic market which could make use of a broadband return path. Since the superhighway is described as a two-way, broadband communications channel, the lack of applications throws some doubt about the need for superhighways, as currently defined, connecting every home. This issue is examined further in Section V.

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[10] ATM - Asynchronous Transfer Mode - is a technology which allows voice, video and data communications to be carried efficiently on the same digital network. For further information see:
"ATM knits voice, data on any net" *IEEE Spectrum* February 1994 pp 42-45

[11] Minutes of Evidence 4 May 1994 HC 285-iv 1993/94 Q.347, p.123

C. The Internet

In recent months there has been much media comment about the Internet and how it relates to the information superhighway. The following section explains what the Internet is and what it is used for.

1. What is the Internet?

The Internet is most accurately described as a global network of around 45,000 different computer networks. It cannot really be described as an information superhighway because individuals using the Internet do not have access to the broadband communication channels which a true superhighway would require. For instance, video-conferencing or movies are not available in real-time over the Internet.

There are many different uses of Internet, but the main ones are:

- sending/receiving electronic mail
- accessing "newsgroups" - discussion forums on hundreds of different topics
- obtaining free information and software (via FTP, see below)
- using on-line databases (via Telnet, see below)

Electronic mail allows any two people connected to the Internet to exchange messages electronically. All computers connected to the Internet have a unique IP (Internet Protocol) address number. In theory you can send someone electronic mail if you know this number, but for the sake of convenience a name is given to each number, under the Internet Domain Name System (DNS). This is a hierarchical system, with names being tied to the type of user. For instance, HM Treasury has recently set up a service on the Internet and has the following e-mail address: info@hm-treasury.gov.uk. The name can be dissected into two parts: a user name (info) and a domain name (hm-treasury.gov.uk). The domain name is composed of various sub-domains usually including the name of the organisation the user is based at, the type of organisation, and the country the organisation is in:

user name	at	name of organisation	type of organisation	national code
info	**@**	**hm-treasury.**	**gov.**	**uk**

In the UK the main "domain codes" for organisations are:

.ac	educational establishment	eg. leawf@vaxa.strath.ac.uk [12]
.co	commercial organisation	eg. cixadmin@cix.compulink.co.uk
.gov	governmental organisation	eg. info@mail.ccta.gov.uk
.org	other type of organisation	eg. info@bbcnc.org.uk
.net	network providers	eg. pipex@pipex.net

E-mail addresses in the US do not have a .US country code, and have slightly different codes for the different types of organisations (eg. .edu instead of .ac and .com instead of .co).

Newsgroups are essentially electronic notice boards on which anyone can post an electronic message. There are hundreds of different newsgroups and include such diverse subjects as coin collecting, gambling, the American drink "Kool-Aid", and film reviews. Some of the more useful newsgroups are on computer related subjects, for instance on particular software products. If you have a problem with a piece of software you can then put a "plea for help" on the relevant newsgroup which should hopefully quickly be answered by an expert out on the Internet.

FTP (File Transfer Protocol) allows Internet users to download files from other computers connected to the Internet. Such files might be text documents or they could be free software. Files on particular subjects on the Internet can be located with a software tool called "Archie". There are various other tools you can use to locate information on the Internet which are known as "gophers" and "Veronica".

Telnet allows users to connect to a computer somewhere else on the Internet and use it just as if they were sitting directly in front of it. This is particularly useful for accessing on-line computer databases or other computer accounts. For instance, Government press releases are available on Data-Star Dialog (Europe) or Mead/Lexis/Nexis databases which have "gateways" onto the Internet[13]. The disadvantage, however, is that in many cases you have to have an account set up on the computer database with a password before you can gain access to it and then pay for the information you retrieve.

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[12] Unfortunately this e-mail address of the author is no longer valid
[13] HC Deb 10 May 1994 c.113W

2. A brief history of the Internet

The Internet started in 1969 as a research project by the US Defense Department's Advanced Research Projects Agency to allow its researchers to share computer resources[14]. The network was then known as the ARPANET and was first demonstrated to the public at the first International Conference on Computer Communications in 1972, by which point 37 computers were connected. ARPANET continued to grow and in 1983 the military part of the network was separated off to create MILNET. The resulting system of networks became collectively known as the Internet. In 1986 the US National Science Federation (NSF) launched a plan to create a network linking its researchers to its supercomputer centres. The scope of NSFNET was widened to include the whole education community in 1987, and went on-line in 1988. NSFNET has continued to grow and has since been connected to networks introduced by NASA (NSINET) and the US Department of Energy (ESNET). The NSFNET still only carries academic and research related traffic. Commercial organisations connected to the Internet use networks supplied by private Internet service providers. Recently, the number of private commercial (.com) users has surpassed the number of public sector users.

In the UK, the academic and research community have their own computer network, JANET - the Joint Academic NETwork, which is connected to the Internet (see p. 24 below). Currently, commercial concerns are not allowed to use JANET, although this is under review, and so they make use of an increasing number of commercial Internet Service providers. In September 1994 a number of these providers, together with JANET, announced the establishment of a common interconnection point between their individual networks. This means that each service provider does not have to have a whole network of links to every other provider, but can have a single high capacity line going into the central hub known as LINX - the London Internet Neutral Exchange.

In recent years the growth of the Internet has been extraordinary, but there are no precise figures for the number of people connected. Estimates can vary from 16.5 million to 30 million even from the same source[15]. The usual way of calculating the number of users is by multiplying an agreed count of host machines on the Internet by a constant usually given as 7.5[16]. Obviously this is somewhat arbitrary as there are no accurate figures on the ratio of users to hosts. However, as a guide, this standard measure would give 29 million users connected to the 3.9 million host machines currently connected (as of 1 October 1994 [17]).

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[14] "The Rocky Road to a Data Highway" *Science* 21 May 1993 pp 1064-5
[15] *.net - the internet magazine* December 1994 p.19, p.38
[16] "Accessing the Internet" *Guideline for IT Management: Number 197* November/December 1997
[17] "Internet survey reaches 3.8 million Internet host level..." *Internet Society Press Release* 4 November 1994

Whatever the precise number of users, there is no doubt that the growth of the Internet has been spectacular. Currently, the number of host machines connected to the Internet is roughly doubling every year, and currently stands at around 4 million. Figures showing the year-by-year growth are shown in Table 1 below.

Table 1: Growth of the Internet

Date		Hosts
August	1981	213
May	1982	235
August	1983	562
October	1984	1,024
October	1985	1,961
November	1986	5,089
December	1987	28,174
October	1988	56,000
October	1989	159,000
October	1990	313,000
October	1991	617,000
October	1992	1,136,000
October	1993	2,056,000
October	1994	3,864,000

Source: Internet Society

III. International developments

A. The United States

1. National Information Infrastructure

The term "information superhighway" was first coined by Vice-President Al Gore, many years ago when he was a member of Congress urging government support for high speed data networks to link researchers at universities and government laboratories throughout the country[18]. Following his election, President Bill Clinton set up an Information Infrastructure Task Force, chaired by the commerce secretary Ron Brown, to examine ways of creating an information superhighway. The task force's report *The National Information Infrastructure: Agenda for Action* was published in September 1993. This did not commit the Administration to investing large sums of money in a superhighway, but stated that "carefully crafted government action will complement and enhance the efforts of the private sector and assure the growth of an information infrastructure available to all Americans at reasonable cost". Such action on the National Information Infrastructure (NII) included:

- promotion of private sector investment through appropriate tax and regulatory policies
- maintaining a "universal service" obligation for information services
- funding of research programs to help private sector to develop necessary technologies
- ensuring government regulations and policies do not inhibit development of NII

Vice-President Al Gore outlined the Administration's proposals further in a speech he gave to the University of California in January 1994[19]. He said that the Administration would shortly be introducing a legislative package "that aggressively confronts the most pressing telecommunications issues" based on five principles to:

- Encourage Private Investment
- Provide and Protect Competition
- Provide Open Access to the Network
- Take Action To Avoid Creating a Society of Information "Haves" and "Have Nots"
- Encourage Flexible and Responsive Governmental Action

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[18] "Uncle Sam's super-highway" *Financial Times* 13 January 1993 p.23
[19] *Remarks by Vice President Al Gore* UCLA, Los Angeles 11 January 1994

2. Legislative reform

In pursuit of these objectives, the Administration supported the *Brooks-Dingell Bill* (H.R. 3626) in the US Congress which aimed to remove regulatory restrictions in telecommunications provision. It would have allowed, over time, the seven local "Baby Bell" telephone companies to offer long distance telephone services in competition to AT&T, allowed them to design and manufacture telecommunications equipment in the US, and, for four years, only allow the Bells to participate in electronic publishing through separate affiliates or joint ventures. The bill was accompanied by the *Markey-Fields Bill* (H.R. 3636) which sought to open up competition for local telephone services, retaining universal service provisions, and removing some, but by no means all, of the restrictions governing telephone companies involvement in cable TV services[20].

Both Bills were passed virtually unopposed by the House of Representatives in June 1994[21]. The Senate version of these bills was introduced by Senators Hollings, Inouye and Danforth. It passed through the Senate's Commerce Committee with a vote 18-2 in favour but was withdrawn from the floor of the Senate by Senator Hollings following opposition from the Senate Minority Leader Robert Dole[22].

The *Washington Post* reported [ibid]:

> "Hollings said his efforts to pass the Bill ended due to disagreements over amendments that Senate Minority Leader Bob Dole (R-Kan.) proposed Thursday. Dole's changes included letting telephone and cable companies enter each other's markets at the same time. Hollings wants the Bell companies' entry into new markets to proceed more slowly. Hollings accused Bell companies Bell South Corp., Ameritech Corp. and US West Inc. of being the force behind Dole's amendments. Their industry association denied the charges."

Although the legislation has been dropped for this year, press reports indicate that telecommunications reform will be a top priority for both the Republicans and Democrats next year[23].

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[20] "Spirit of Cooperation Breaks Media Industry Gridlock" *Congressional Quarterly* 15 January 1994 pp 64-69
[21] "House Passes Bills on Phone, Cable Industries" *Dow Jones* 29 June 1994
[22] "Telecommunications Reform Effort Halts" *Washington Post* 24 September 1994
[23] *Dow Jones* "Hollings, Telecomm Bill" 23 September 1994

3. Funding issues

In March 1994, the US Commerce Department announced that $26 million of federal matching grants would be available for telecommunications technologies for schools, hospitals and libraries[24]. The funds would be directed at those who needed help, to avoid the creation of pockets of "information haves and have nots" with the Department providing up to 50 per cent of the cost of demonstration projects. Grants amounting to $24.4 million were awarded in October 1994 for 92 projects in 45 different states with matching funding from private and other public sources bringing the total funds available to $67.6 million[25]. Only one in ten of applicants for funding were successful. The Administration has announced that $64 million will available for similar projects next year. In addition to this programme, the National Institute of Standards runs a larger grant programme to help industries research and develop new technology for the NII.

Recently, Vice-President Al Gore set out his views on the development of a Global Information Infrastructure (GII) to complement the NII[26]. He said that such a development would "bring economic progress, strong democracies, better environmental management, improved healthcare and a greater sense of shared stewardship of our small planet". He believed that much of the GII could be built by the private sector, although only if there was sensible regulation ensuring open and non-discriminatory access to networks.

B. Europe

1. Delors white paper

In December 1993, Jacques Delors presented the Commission's white paper on *Growth Competitiveness, Employment: The Challenges and Ways Forward into the 21st Century*[27]. This devoted a large section to the development of a Community-wide "common information area", namely:

- the information itself, converted and collated in electronic, i.e. digital form (databases, document bases, image bases, CDI etc.)

- the hardware, components and software available to the user to process this information

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[24] "US grants will aid 'telecoms highway'" *Financial Times* 8 March 1994 p.6
[25] "US pays to make superhighway fair" *Financial Times* 13 October 1994 p.8
[26] "Plugged into the world's knowledge" *Financial Times* 19 September 1994 p.22
[27] COM(93) 700 final 5 December 1993 see Chapter 5.A. The Information Society pp 105-114

- the physical infrastructure (terrestrial cable infrastructure, radio communications networks and satellites);

- the basic telecommunications services, particularly electronic mail, file transfer, interactive access to databases and interactive digital image transmission

In pursuing its strategy for developing an "information society" the white paper stated that Europe should aim at achieving three objectives:

- from the outset, placing its approach in a world perspective, and therefore encouraging the international alliance strategies of its companies and operators; promoting where possible the development of open systems and international standards; working resolutely towards the opening up of third country markets, in order to seek genuine reciprocity, and opposing any from of discrimination.

- ensuring, at the same time, that the systems developed take due account of European characteristics: multilingualism, cultural diversity, economic divergence, and more generally the preservation of its social model.

- creating the conditions whereby, in an open and competitive international system, Europe still has an adequate take-up of basic technologies and an efficient and competitive industry.

Five policy priorities were highlighted:

- diffusion of best practice and development of European ICT [information and communications technologies] applications

- creation of an appropriate regulatory and political environment

- providing the Community with basic trans-European telecommunications services

- providing the right training

- harnessing technologies and improving the performance of Europe's ICT industry

The Commission concluded by calling for a Task Force on European Information Infrastructures to be set up to establish priorities, decide on procedures and to set schedules.

The Action Plan contained at the beginning of the white paper estimated that the funding needed over the next ten years in these areas would be ECU 150 billion and that[28,29]:

> "Some ECU 67 billion will be needed between 1994 and 1999 for the priority projects selected. They will be covered mainly by private investors. Financial support from the national and Community authorities will play a marginal role to provide an incentive, as with other [Trans European] networks."

2. Bangemann report

The white paper was considered at the Brussels European Council meeting in December 1993. As a result of discussions, the Council requested that a report be prepared for the Corfu summit in June 1994 by a "group of prominent persons on the specific measures to be taken into consideration by the Community and the Member States for the infrastructures in the sphere of information". To write this report, the Commission established the High Level Group on the Information Society, under the chairmanship of the industry commissioner Martin Bangemann. The Group was composed of 19 industrialists from Europe's biggest electronics and media firms, but not from the public telephone companies (PTTs). The head of telecommunications research at the Commission, Roland Hüber, was quoted as saying that Europe's problem was not one of too little research, as "everything in the US programme today has been done in Europe" but that currently, no-one was coordinating development across Europe[30]:

> "'We can't compete with the huge corporate linkups between US media and telecoms companies,' says Hüber. The European PTTs are not allowed to buy each other so there is no structure in Europe that can attract sufficient private investment for a trans-European Network."

The Group's report, known as the Bangemann report, was published in May 1994[31]. The foreword to the report stated:

> "This report urges the European Union to put its faith in market mechanisms

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[28] p.25
[29] "Ministers consider Delors' £100bn hi-tech proposals" *The Independent* 14 December 1993 p.10
[30] "Europe plans its information autobahn..." *New Scientist* 26 February 1994 p.4
[31] High Level Group on the Information Society *Europe and the global information society: Recommendations to the European Council* 26 May 1994

as the motive power to carry us into the Information Age.

"This means that actions must be taken at the European level and by Member States to strike down entrenched positions which put Europe at a competitive disadvantage:

- it means fostering an entrepreneurial mentality to enable the emergence of new dynamic sectors of the economy
- it means developing a common regulatory approach to bring forth a competitive Europe-wide market for information services
- it does NOT mean more public money, financial assistance, subsidies, *dirigisme* [state intervention], or protectionism.

"In addition to its specific recommendations, the Group proposes an Action Plan of concrete initiatives based on a partnership between the private and public sectors to carry Europe forward into the information society."

The report discussed the regulatory framework required to establish the information society and examined the issues of intellectual property rights, privacy, security and media ownership. It highlighted ten applications for launching the information society:

Teleworking - More jobs, new jobs, for a mobile society
Distance learning - Life long learning for a changing society
A network for universities and research centres - Networking Europe's brain power
Telematic services for SMEs - Relauching a main engine for growth and employment in Europe
Road traffic management - Electronic roads for better quality of life
Air traffic control - An electronic airway for Europe
Healthcare networks - Less costly and more effective healthcare systems for Europe's citizens
Electronic tendering - More effective administration at lower cost
Trans-European public administration network - Better government, cheaper government
City information highways - Bringing the information society into the home

The report was discussed at the Corfu Summit in June 1994 and the Council welcomed the opportunities presented by the information society and commented[32]:

"...It is primarily up to the private sector to respond to this challenge, by evaluating what is at stake and taking the necessary initiatives, notably in the matter of financing. The European Council, like the Commission, considers that the Community and its Member States do, however, have an important

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[32] *Presidency Conclusions* European Council at Corfu 24-25 June 1994 (SN150/94)

> role to play in backing up this development by giving political impetus, creating a clear and stable regulatory framework (notably as regards access to markets, compatibility between networks, intellectual property rights, data protection and copyright) and by setting an example in areas which come under their aegis."

3. Action plan on the information society

To develop the ideas contained in the Bangemann report the Commission published *Europe's way to the information society: an action plan* in August 1994[33]. The proposed plan covered four areas:

- The regulatory and legal framework
- Networks, basic services, applications, and content
- Social, societal and cultural aspects
- Promotion of the information society

Actions to be taken in various areas are summarised in three annexes: pending measures; new measures under consideration; and possible partnerships. The Department of Trade and Industry have issued an Explanatory Memorandum (EM) which broadly welcomes the Commission's paper but expresses reservations about some of the measures under consideration[34].

The plan was discussed at a special joint telecommunications and industry council on 28 September 1994[35]. The Council welcomed the Commission's rapid submission of the Action plan. It emphasised that the "rapid development of efficient information infrastructures (including networks, services and applications) is indispensable to Europe" and stressed the importance of establishing a clear legal and regulatory framework. The Council highlighted the following areas as particularly urgent:

- rapid liberalisation of the voice telephony market in Europe
- acceleration of the technical standardisation process
- protection of intellectual property rights
- the security of information systems
- maintenance of an international approach
- improvement of the audiovisual and information industries competitiveness
- issues concerning privacy of the individual

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[33] EC Cons Doc 8791/94, COM(94) 347
[34] DTI *Explanatory Memorandum on Draft instrument 8791/94* 29 September 1994
[35] Council Press Release 9561/94 (Presse 197) Industry/Telecommunications Council 28 September 1994

- early adoption of a suitable action plan

The Council welcomed the forthcoming G7 Ministerial Conference on the Information Society due to be held in Brussels on 25-26 February 1995 and invited the Commission to submit a progress report in time for the next European Council meeting in Essen.

The issue of liberalisation of the European telecommunications market was considered further at a Telecommunications Council meeting on 17 November 1994. The Council reached general agreement that there should be a free market in the provision of telecommunications infrastructure from 1998[36]. As with the earlier agreement on liberalisation of the voice telephony market, the Council accepted that some member states would be allowed a five year transitional period before full liberalisation took place.

The "Information Society" was discussed at the Essen meeting on 9-10 December 1994, and the Council confirmed that the Commission's Action Plan and decisions made at the Industry and Telecommunications Councils had set the agenda for further development[37]. It stressed the role of the private sector in "building up and financing information infrastructures" and called for Member States to establish a suitable environment for such initiatives. The Council called for the rapid creation of the necessary legal framework to deal with such issues as market access, data protection and the protection of intellectual property.

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[36] Council Press Release 10633/94 (Presse 233) Telecommunications Council 17 November 1994
[37] *Presidency Conclusions* European Council meeting on 9 and 10 December 1994 in Essen (SN300/94)

IV. UK developments

A. Existing infrastructure

1. Telecommunications infrastructure

The UK telecommunications market is one of the most liberalised in the world, with competition existing or at least rapidly developing in all sectors of the market. The Government is relying on this competitive market to produce the infrastructure required for the information superhighway. In March 1994 the DTI was asked what steps it was taking to promote information superhighways in the UK[38]:

> "A recent study, commissioned by this Department, concluded that the United Kingdom is one of the most advanced countries worldwide on a range of key telecommunications infrastructure indicators, including use of optical fibre at trunk and local level, digitalisation of exchanges and availability of advanced services such as ISDN. This position has been achieved through our policies of privatisation, liberalisation and competition. A large number of companies are now competing to provide high-capacity telecommunication services, including BT, Mercury, Energis, COLT, MFS and the cable TV operators. I hope to license more shortly.

However, an article in the *New Scientist* suggested that the study[39]:

> "..indirectly criticises the British Government for its failure to follow the Clinton administration in championing the coming telecommunications revolution. The quality and variety of services in Britain will be competitive with those of other countries in the medium term, it says. But in the longer term 'there is a view held in industry that a clearer vision of the future shared with government would help'."

The DTI's views on telecommunications infrastructures were most recently set out by Ian Taylor, the Trade and Technology Minister, in response to a parliamentary question from Anne Campbell MP asking when the UK would have a national fibre optic network in place[40]:

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[38] HC Deb 3 March 1994 c.802W, PQ from Gordon Prentice MP
[39] "...as Britain moves into the fast lane" *New Scientist* 26 February 1994 p.4
[40] HC Deb 12 December 1994 c.512W

> "The Government's policy of telecommunications liberalisation has encouraged substantial investment in modern telecommunications networks. The promotion of competition between interconnected networks is essential if the full benefits of liberalisation are to be realised for consumers. The main fixed link telecommunications operators already have wholly fibre optic trunk networks, and provide fibre optic links to business customers. Cable TV operators are providing fibre closer to the home.
>
> "Optical fibre is one of a number of technologies which can be used to provide residential customers with access to communications networks - including optical fibre, coaxial copper cable, copper wire, radio or satellite. For many residential consumers the superhighway applications now being developed are likely to be delivered through using advanced compression technologies over copper networks rather than through wholly fibre optic networks. This process is already underway."

2. SuperJANET

It has been argued that the UK already has a superhighway in the form of SuperJANET. SuperJANET is a development of JANET, the Joint Academic NETwork, which has linked 200 higher education establishments since 1983, allowing academics around the country to communicate by computer[41]. SuperJANET is being developed over the next four years at a cost of £20 million and two different services are currently being offered[42]:

SMDS (Switched Multi-megabit Data Service) - 55 sites are connected to this service which is suitable mainly for text, data and images, but video and voice can be carried to a limited extent. The service operates at a maximum rate of 34 Mbit/s which compares to a maximum of 2 Mbit/s over the existing JANET network.

PDH/SDH (Plesiochronous Digital Hierarchy/Synchronous Digital Hierarchy) - PDH is an interim technology until SDH becomes available and both systems make use of ATM technology (see p. 9 above). There are 14 sites connected and the service offers a total capacity of 140 Mbit/s currently made up of four 34 Mbit/s channels. It can carry real time interactive video and voice traffic in addition to text, data and images. The ATM technology is still under development, and a production service is unlikely to be available to universities before mid-1996. There is scope for upgrading the service: the implementation of SDH should allow 155Mbit/s to be carried and eventually rates as high as 2,480 Mbit/s should be possible.

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[41] "Knowledge sans frontières" *New Scientist* 6 November 1993 pp 24-27

[42] Joint Information Systems Committee *SuperJANET Crib Sheet* November 1994

Currently, JANET and SuperJANET are only available to organisations in the research and academic communities or to outside bodies, including commercial companies, which are collaborating with such organisations. However, the body which runs the networks, the Joint Information Systems Committee (JISC) of the Higher Education Funding Councils, has already decided to encourage greater commercial use of its networks. It is currently reformulating its policy on "acceptable usage" and introducing charging policies to allow such use from April 1995. JISC will not be offering a subsidised service to companies but will set it charges at such a level to recoup its full costs. It sees commercial interest for access primarily coming from companies or organisations that work closely with the academic and research community or wishing to develop new computing/networking technologies over SuperJANET. For instance, it will not be seeking to compete with the private sector in providing a commercial Internet service. There is already a link between JANET and the commercial Internet service providers (see p. 13 above), and so commercial Internet users can already communicate with users on JANET.

B. Public sector superhighway applications

The Office of Public Service and Science has been one of the main Government departments taking an interest in the public sector applications of the superhighway. In March 1994, the then Minister for Science, William Waldegrave, commented on his department's role in this area[43]:

> "Information super highways are an emerging technology on which much interest has focused recently, particularly on the possible access to services for the citizen that such technology could offer. There are to date only a few pilots in operation globally, most notably in the United States.
>
> "Clearly, these developments are being watched with interest. The Government are also working closely with other members of the European Union in considering the requirements for such networks within Europe. The CCTA - Government centre for information systems -has already begun work on a study to look in detail at the possible development of information superhighways within the United Kingdom. It will be working closely with the Department of Trade and Industry in considering this issue.
>
> "It is important that the roles of the private and public sector are taken into account. Full and thorough analysis of the global pilot projects will be needed to evaluate their benefits to the citizen and to the public and private sectors both within the United Kingdom and across Europe as a whole."

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[43] HC Deb 14 March 1994 cc 486-487W, PQ from Gordon Prentice MP

As a consequence of its study, the CCTA published a consultative report, *Information Superhighways: Opportunities for public sector applications in the UK*, in June 1994. The report briefly examined how superhighways would work in practice, and looked at possible public sector applications. It concluded by saying that the "Government will coordinate a review of the opportunities available to the relevant departments, involving key private sector interests in this work".

A public consultative meeting on information superhighways was held on 21 November 1994 to build on the ideas put forward in the CCTA report[44]. This followed on from the launch of the "Government Information Service" on the Internet on 10 November 1994[45]. At the meeting the Minister for Public Service and Science, Robert Hughes, stressed the importance of public and private sector co-operation in developing applications of the superhighway. He described the Government's role in the process as threefold [44]:

1. providing funding for research and development in projects such as SuperJANET

2. ensuring through regulation that competition offers benefits for business and individual citizens alike;

3. setting an example through innovative and effective use of the information superhighway.

The CCTA is leading the Government's development of public sector applications and at the meeting it proposed the establishment of several "collaborative open groups" or COGs to examine particular issues. So far, COGs established include:

- Opengov COG - mainly focused on the Government Information Service
- Policy COG - policy issues relating to the use of Internet for information sharing
- Legal COG - including copyright, data protection and privacy
- Secure COG - security issues of connection to the Internet including encryption
- Local COG - local authority applications
- Euro COG - European projects
- Electronic commerce COG

So far only a limited amount of information is being provided on the Government Information Service, but it is expected that this will increase as Government departments decide how (or in some cases whether) to make use of the service. Currently, there is information from the Citizen's Charter Unit, HMSO, the Machinery of Government Division of OPSS, and more recently from the DTI. The information on the Internet is being provided through a "world

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[44] "Planning the future on the information superhighway" *OPSS News Release 234/94* 21 November 1994
[45] "UK Government joins the internet" *OPSS News Release 225/94* 10 November 1994

wide web" server[46]. The world wide web (WWW) is a relatively new development on the Internet which allows information to be accessed in a much more user friendly manner using a computer "mouse" rather than having to type commands on a keyboard. Related documents can be linked together with "hypertext links" making information easier to find.

The Treasury has also established its own Internet WWW server[47,48]. A variety of information is available including Ministers' speeches, Minutes of the Chancellor's Monthly Monetary Meetings with the Governor of the Bank of England and Reports of the Panel of Independent Forecasters. In addition the Chancellor's budget speech was made available immediately after its presentation. Unlike the other Government Departments, the Treasury is also putting all of its press releases on the server. Other Department's press releases are currently only available over the Internet at a charge from commercial databases[49].

C. Trade and Industry Committee report on Optical Fibre Networks

Reference has already been made in this paper to the Trade and Industry Committee report on *Optical Fibre Networks* which was published in July 1994[50]. This made various recommendations about regulation of the UK telecommunications market and the development of broadband networks. A selective summary of the main recommendations is shown in Box 1.

Many of the Committee's recommendations related to the current regulatory regime on the supply of broadcast television over telephone networks. This is a complex area of UK telecommunications regulatory policy, but in short the debate focuses on whether British Telecom should be allowed to deliver cable television over its network to the home. Currently, BT (and Mercury) is barred from conveying broadcast television ("entertainment services") over its national network to people's homes until 1998 at the earliest. This ban is set out in BT's telecommunications licence and stems from the Government's telecommunications policy set out in its white paper of March 1991[51]. It was introduced to allow "effective competition" to develop, in particular to give new cable companies a chance to establish themselves.

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[46] The Internet WWW address is http://www.open.gov.uk
[47] "Treasury joins the information superhighway" *HM Treasury News Release 124/94* 15 November 1994
[48] The Internet WWW address is http://www.hm-treasury.gov.uk
[49] HC Deb 18 May 1994 c.477W, PQ from David Shaw MP
[50] Trade and Industry Committee *Optical Fibre Networks* 19 July 1994 HC 285-I 1993/94
[51] *Competition and Choice: Telecommunications Policy for the 1990s* Cm 1461 March 1991

Box 1: Selective summary of Trade and Industry Committee recommendations

As regards areas of the UK not yet franchised [for cable television]:

- all such areas should be divided into franchises and offered for franchising to any operator, including PTOs [Public Telephone Operators], by the end of 1995;
- areas where a franchise has not been awarded by the end of 1995 should be opened to any operator, including PTOs, to provide any service after that date;
- for new franchises awarded before the end of 1995, the normal period of exclusivity, subject to the ITC's [Independent Television Commission's] discretion, should be seven years, or five years where adjacent to an existing franchise and awarded to the same franchisee; and such franchises should be opened up to competition thereafter (possibly through over-franchising).

The Government should reduce the uncertainty concerning the restrictions on PTOs by directing OFTEL and the ITC to review the licences for current franchise areas, taking account of the build obligations contained in the licences, with a view to allowing competition into franchise areas by providing for the lifting of the restrictions on PTOs on a franchise by franchise basis at specified future dates, subject to the principle that all cable franchises should be exclusive for seven years from the granting of the original licences; and the Government should make clear that all restrictions on PTOs conveying or providing entertainment will be lifted by the end of 2002, provided that the PTOs permit fair and open access to their networks.

The Government should make clear that the Director General's views on the continuation or otherwise of the restrictions on PTOs will be treated as advisory only.

Conditions should be imposed in return for any lifting of restrictions on PTOs, relating to:

- fair and open access to their networks;
- the extent and timing of the development of broadband infrastructure;
- the linking to the network of public facilities such as schools and hospitals.

The Government should adopt a more active and co-ordinated approach to the development of broadband applications for the public sector.

The Government should examine how it could ensure that all public institutions such as hospitals and schools are connected to broadband networks as soon as possible, and should consider targets in this respect for the network operators.

The Government and OFTEL should keep under review the adequacy of the telecommunications facilities available to less densely-populated areas and the potential ways of ensuring that these areas are not disadvantaged.

The Government should make the promotion of broadband services central to its policies on broadband developments.

The Government should review the structure of telecommunications and broadcasting regulation in order to ensure consistent principles and clear responsibilities in all matters relevant to broadband regulation and development.

The main provisions of the white paper concerning entertainment services are set out below. Further details on this policy and telecommunications regulation controls can be found in Library Research Paper 94/68 on *Video on demand*.

> "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 [until 2001]. The Government would be prepared to reconsider the position after seven years [1998] 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 [until 2001]. 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."

British Telecom have argued strongly that there is asymmetry in regulatory policy in that cable TV companies can offer telephone services whereas it may not supply television services. In evidence to the Committee, BT's Chairman, Sir Iain Vallance stated[52]:

> "...To bring multi-media services within the reach of everyone - the ordinary customer, small and large business - would cost £15 billion or more. An investment of that sort would give the UK the leading broadband infrastructure in the world and, of course, it would put BT ahead of other national telecommunications operators such as AT&T and France Telecom, in this respect. We have the technological capability to do it and the financial strength but...
>
> "...we would be replacing much of our existing narrowband network with a new and not wholly developed broadband technology from which new sources of revenue are largely speculative. We have an idea, of course, of the sectors which might benefit from broadband capability but we do not and cannot know the full extent of the services that will be provided or what people will be willing to pay for them. These commercial risks for the company are, in this instance, compounded by a regulatory framework which is designed specifically to inhibit BT's investment in broadband infrastructure and services. I refer in part to the restrictions on our conveyance of broadcast television services across our network which effectively excludes us from the baseload revenues required to make any broadband network financially viable...

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[52] Minutes of Evidence 9 March 1994 HC 285-i 1993/94 Q.2, p.16

> "The objective of these licence asymmetries, as we call them, may have been laudable enough to encourage the establishment of competition to BT on preferential terms but what does this mean for BT?...
>
> "Either we assume the restrictions are here to stay, in which case our competitors will establish effective broadband and narrowband regional monopolies over time...
>
> "Alternatively, do we assume that, in spite of the Government's current stance, the restrictions will be removed in the future? Do we press ahead with an already risky investment programme in the hope that commonsense will prevail?"

However, the cable companies, OFTEL and the Government all argue that there is no asymmetry. For example, the Director General of OFTEL gave his views on the issue in December 1993, before the Committee started its inquiry[53]:

> "First asymmetry. There is one myth which I am anxious to dispose of today so that future debate can move forward on a sensible footing. The myth propagated in various quarters that there is some 'asymmetry' in the regulatory framework in that particularly BT, but also Mercury, Kingston and some others, are restricted from conveying broadcast entertainment services in a way others are not.
>
> "Now, anyone can apply for a telecommunications licence. Equally, anyone, including BT, Mercury etc, could have bid for cable franchises and can bid for local delivery licences. That strikes me as symmetry.
>
> "It is true that BT and the others would have to hold these franchises in a separate subsidiary until being able to operate LDO services in their own right, from April 1994. But this can hardly be said to be a major issue for the business. The fact is that BT has had the chance to control a significant number of cable franchises. The current regulatory framework does not force BT or the others to build an entirely separate, and costly, network from scratch. BT could, and this is very, very important to realise, could have integrated its cable franchises with its local network to deliver broadband services and telephony. It could, and those of you knowledgeable about the costings of networks will recognise the significance of this, have used its existing ducts. It would also have been allowed with Oftel's agreement to transfer its universal service obligation under its telecoms licence to its cable subsidiary. This was made clear in Oftel's 1988 Annual Report. I defend the present carefully framed regulatory structure and would like to hope we can move the debate away from the myth and onto the real issues."

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[53] In a speech at the Financial Times Conference on 'World Telecommunications' 7 December 1993

In their evidence to the Committee, the cable company Nynex pointed out that[54]:

> "2.6 BT's current low level of participation in the cable market is a direct result of its own decision to exit from the market. In the 1980s BT was one of the major owners of cable television franchises, and even today BT owns one of the most desirable franchises in the UK: Westminster Cable in the heart of London. If it so wished, BT could today own and run other combined telephone and television broadband networks delivering integrated services to consumers."

D. Government Command paper on superhighways

On 22 November 1994 the Government published a command paper on *Creating the Superhighways of the Future*[55]. This contained the formal response to the Trade and Industry Committee report with specific comments on the report being made in Annex A to the paper and in a separate Oftel response[56]. The paper examined applications for emerging "communications networks", the role of the regulatory framework and the role of Government in the development of superhighways and reached four main conclusions:

(a) that the existing regulatory framework, based on the 1991 Telecommunications White Paper, continues to provide the best framework for developing internationally competitive communications in the UK. It does so by providing a stable effective and evolutionary environment within which the necessary investment in new competitive networks, and in new services, can take place. The main task ahead is to build on the UK's current strength in telecommunications, especially in the new era of broadband communications;

(b) that new local delivery franchises for broadcasting services should continue to be awarded on an exclusive basis, subject to the wider policy framework already in place. However, given the Government's keenness that all broadband operators should have opportunities to develop the full range of new interactive services, it hopes that national PTOs such as BT and Mercury will bid for new local delivery franchises to gain such expertise in innovative new technologies. The Government would seek to license any such franchises in a way which allowed PTO franchisees to test new technologies alongside their existing services, using the same infrastructure where possible;

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[54] Minutes of Evidence 23 March 1994 HC 285-ii 1993/94 Memorandum p.54

[55] *Creating the Superhighways of the Future: Developing Broadband Communications in the UK* Cm 2734 November 1994

[56] Oftel *Response to the Trade and Industry Committee Report on Optical Fibre Networks* November 1994

(c) that the Government will place more emphasis on coordinating and encouraging its own use and promotion of communications applications, building on existing work underway throughout the public sector; and

(d) that in order to focus the DTI's interests in multimedia services, Ian Taylor (Parliamentary Under Secretary of State for Trade and Technology) will have a new co-ordinating role, drawing on advice from a group of senior industrialists.

In an interesting development the paper was the first command paper to be made available over the Internet on the Government Information Service[57]. More recently, the Minister responsible for superhighways, Ian Taylor MP, has announced that he now has an e-mail address and is the first Minister to be on the Internet[58,59].

1. Future infrastructure

The command paper examined the infrastructure which a superhighway would require and whether a single optical fibre network would be necessary:

> 11. Many of the more sophisticated (and technically demanding) applications, such as videoconferencing, require a full two-way broadband infrastructure, capable of being "switched" like conventional telephone cables. Other applications, such as delivery of multi-channel broadcast television, require only a broadband one-way unswitched infrastructure, or at most limited two-way communication with sufficient capacity provided by a normal telephone line for any necessary interactive responses. This points to the range of infrastructure development which is likely to be needed to provide the full range of communications most cost-effectively . Infrastructure should evolve, making full use of existing networks. A combination of fibre-optic trunk delivery and coaxial local delivery is likely to be adequate for most residential uses.
>
> 12. The Government considers efficient infrastructure is best developed by competing providers, rather than by promoting a single all purpose switched two-way infrastructure. The point is that competing infrastructures are more likely to evolve quickly, as a result of competitive pressures, without dispensing unnecessarily with existing investment and installed equipment. The resulting high capacity networks may - as in the case of UK cable companies initially offer little more than multichannel television. But the evidence is that they move quickly to experiment with new services, once their initial

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[57] At URL:http://www.open.gov.uk/dti/broadband.como.htm
[58] His e-mail address is taylor@mintech.demon.co.uk
[59] HC Deb 15 December 1994 cc 1249, during a debate on the *Internet* cc 1240-56

> investment is in place. Other telecommunications companies are equally innovative. A competitive environment tends to reduce the gap between the development and the deployment of new technologies, products and services, thereby rapidly increasing the products and services available to customers.
>
> 13. It is worth noting that there is a good deal of debate - and disagreement - as to how highly developed communications networks will need to be, and how fast new, interactive services will be taken up. A key advantage of competition in infrastructure and services is that market pressures promote faster innovation, investment and experimentation.

2. Regulatory policy

One of the key conclusions of the paper was that there should be no major change in the regulatory framework, particularly on the question of whether national telecommunications companies should be allowed to carry broadcast television. The Government views on this were set out in paragraphs 57-58:

> 57. The Government wants all broadband operators to be able to develop and to gain market experience with the full range of new interactive services. From April 1994, national PTOs (including BT and Mercury) have been able to apply in their own right for new LDO Franchises for local broadcasting services from the ITC. If these companies bid successfully for new LDO licences, the Government will also be prepared to issue these companies with Telecommunications Act licences which enable them to supply entertainment services within the franchise areas. It would seek to do this in a way which allowed them to test new technologies alongside their existing services, making use of the same infrastructure where possible. The intention is that national PTOs should be able to test and demonstrate new technologies without having to compete with themselves in the areas where they hold a new LDO franchise. This will provide them with an opportunity in the UK which should assist them in international markets. The Government recognises that such arrangements might limit competition. The Director General of Telecommunications is supportive of national PTOs taking such opportunities. He has, however, indicated that such a PTO may well be considered dominant for interconnection and related purposes, and would for example be subject to no undue discrimination provisions."
>
> 58. The Government remains of the view that the regulatory framework set out in the 1991 White Paper, which provides certainty for all participants in the markets with clear dates for reviews of the present regimes, is valid. It is therefore not appropriate to review this policy prematurely...
>
> 60. ...the Select Committee's proposals of a franchise by franchise relaxation of the 1991 White Paper commitments will not be pursued...

There would appear to be a slight change in policy in the above statement, or at least a development of existing policy, in that the command paper makes clear that national PTOs will be allowed to use the same infrastructure for cable television services as for telephone services (where possible) if they apply for new cable television licences (LDO - Local Delivery Operator - licences). From April 1994, national PTOs have been allowed to own cable TV franchises in their own right. However, prior to that franchises could only be owned by separate subsidiaries and had to be run on a separate infrastructure from the parent company's national telecommunications network.

British Telecom has given its views on this issue in a press release commenting on the command paper[60]:

> "We note with interest the new statement of policy announced by the Government in today's Command Paper concerning local delivery licences for national network operators in non-franchised areas and the use of their main networks. We shall be studying the implications of these statements very carefully.
>
> "That said, in our view the key issue is to ensure that all broadband customers have choice and this will only be achieved by competition nationwide. BT's and the other national network operators' ability to compete is still constrained.
>
> "We regret too that the government has given no certainty as to when the ban on BT and Mercury and other national operators providing broadcast entertainment services across their existing networks will be lifted.
>
> "Without certainty of what will be allowed and when, BT will be unable to invest to the extent that it would wish in the UK. The cable companies, too, will have to contend with uncertainty in their own investment programmes."

The Trade and Industry Committee report called for a review of the structure of telecommunications and broadcasting regulation in the context of developing broadband services. The Government's response to this was contained in the Annex to the command paper [Para 16, p.31]:

> "The Government is committed to a policy of regulatory stability combined with sensible regulatory evolution to provide the necessary environment to stimulate the continuing development of a competitive market and sustain a high level of investment in communications infrastructure and services. Any review of this regulatory system for telecommunications and broadcasting at this stage would create an unnecessary and unwelcome degree of uncertainty

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[60] "BT comments on DTI response to report on optical fibre networks" *BT News Release NR9481* 22 November 1994

> into a sector which is already called upon to make what the Committee notes is a great deal of high-risk investment. The Government is mindful that the growing convergence of telecommunications, broadcasting and information services may ultimately require a similar convergence in the regulatory structure. It would however be premature at present to promote change in the regulatory structures, in the absence of much more concrete information about how convergence will occur."

3. Funding of public sector applications

The Trade and Industry Committee also called on the Government to examine how it could ensure that all public institutions such as hospitals and schools are connected to broadband networks as soon as possible. The Government replied that this was ultimately a matter for the public institutions to judge for themselves [para 12, p.29]:

> "The Government welcomes the fact that a number of cable companies and other PTOs are already working closely with public institutions such as schools, universities and hospitals by providing a full range of communications services and sharing the benefits of their investment. There is already a good range of innovative educational literature available on the benefits and opportunities of broadband, and a number of operators are trialling extensive new services with hospitals, schools, universities, police and emergency services, local authorities and libraries. It is clearly to the operators' advantage to do all this, as it helps to create a more aware, informed and effective base of consumer demand. As explained above, the Government is increasing its effort in exploring and publicising the potential applications of broadband in the public sector. The joint Information Systems Committee of the Higher Education Funding Councils is also playing a leading role. But it is ultimately for budget holders in public bodies and institutions to judge whether the benefits of these services merit their participation, given the many competing priorities for effort and resources which these institutions face. It would not be appropriate for central Government to set targets in these areas, given that central Government has quite properly devolved decisions over spending and resource use to more local management. But the cost savings available on existing telephony services already mean that many public sector managers are well aware of the merits of alternative service provision. Wider consideration of how the greater use of broadband services can lead to improved delivery of public services and greater cost-effectiveness will be important in the future, and will be kept under review."

V. The future

It is difficult to predict the future development of information superhighways without knowing what the crucial or "killer" application(s) will be. Commenting on the development of UK infrastructure, Peter Walker, the Technical Director of Oftel has commented:

> "I think the deployment of these very expensive technologies will need to follow from customer and service demands. The future is not yet clear. One could not today determine precisely what fabric needed to be laid down in the next century until one really saw which services emerged and where there was real customer demand."

Similarly, Dr Roland Hüber from the European Commission, commented on the interplay between services and infrastructure in a recent speech to the Royal Television Society[61]:

> "It is important to notice that much happens between 1995 and 2000 in terms of the maturation between different kinds of applications. I consider the applications first because it is absolutely no good to have bandwidths and their terminals if you don't know what to do with them. The maturation of applications is the key for further progress, from research applications to public and environment uses. As we gradually find out how to do things demand gradually comes about. Now if you look at the same time frame in terms of service technologies, such things as file transfer, mobility and integration of services, you see also that a fair number of them are maturing in roughly the same time frame. So in other words, not only is the demand gradually articulating itself, but also the services which are required for it. A certain synchronisation is taking place which is not incidental.
>
> "In terms of network technologies we see a similar process. The digitalisation of the main network is progressing, ATM is coming in giving additional flexibility, optical fibre is penetrating the local loop... Across a whole range of technologies maturation is taking place in roughly the same period and it is the synergy of these which will be decisive for the information society."

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[61] "Superhighways or Superhype?" *Television* November/December 1994 pp 12-16

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