Report for the Minister of Health, England and Wales

Digital Interactive TV (DITS) in the UK

The development of new 'interactive' technology systems for the mass market is creating the possibility of expanding the use of the domestic television set as an sophisticated information and communication tool. It is widely considered that many people will have access to interactive television systems, instead of or complementing computer based Internet access. New technology enables the television medium and the 'interactive medium' to be linked in innovative ways. How can these systems be exploited in the provision and support of public services? This document provides some background on the technology, the industry, and the market. It suggests that any services that are developed should integrated with existing Internet and non-electronic systems. Many people will have access to several systems and except a common style and interface. For those who do want to use interactive services, they offer the chance to access localised, and personalised services that can improve quality of service, convenience, access to information and efficiency for the organisation. There are considerable benefits for many groups, including elderly and disabled, and those currently wary of the Internet. It warns that access to the technology is not to be correlated with its use: many people will not use the services despite having the facilities available at home. The technology and the services are still very much in their infancy: there will be a great deal of innovation in the next 5-10 years, which will require constant investment to maintain and develop services.

1 Digital Television

Digital television is a completely new system of broadcasting. It brings the power of computer technology to the television set, and increases the number of channels of TV that can be broadcast on the same bandwidth . Digital television broadcasting equipment has been installed on most terrestrial broadcasting stations, on some cable networks, and most new satellites for television are digital. The technology gives the broadcasters much more control over the broadcast, enabling pay per view, pay per channel, and interactive services. The users of digital television benefit from more channels, on-screen menus and listings, advanced text information facilities and interactive services.

The set-top-box (STB) or integrated digital TV set (idTV) for receiving digital television is a computer, but with limited configuration. As the cost of components is reduced, suppliers are building in more and more facilities, including as home-network connections, software and phone connections for interactive services and recording devices. Digital television has the limitation that it is a broadcast medium, not an 'on-demand' medium, expect in specialised cases now being trialled[1]. However the development of digital video recorders is about to change this.

[1] Video on demand technology and services are being trialled by Kingston Telecom in Hull, with Video Networks. Video Networks and other companies expect to be able to use the new BT and NTL broadband Internet technology to deliver television on demand.

As many new set-top boxes are such sophisticated computers, they are also being developed to run interactive services separately from television broadcasts. In particular this includes having a direct Internet connection that enables Internet sites to be used on the television screen.

a Four types of interactive television system

There are essentially four types of interactive television system:

1. *Enhanced television* – an extension of current teletext services, where broadcast data can be accessed in on the television screen in the form of text and graphics to provide information, games, etc. The data is normally downloaded via the broadcast path, but can come, though another path, e.g. a telephone line. A further extension of the system enables data applications to be linked directly to television programmes, for interactive adverts, games etc. Where the data is broadcast, there is usually a carousel arrangement as for teletext. A limited set of data is broadcast in a loop alongside the TV pictures, in the same channel (the vertical blanking interval, VBI) or on a dedicated channel. The more channel space allocated to the interactive services, the faster they are accessible, or the more applications can be offered. A considerable amount of user 'interaction' can be introduced into enhanced TV applications . This technology is the basis of most information-based interactive television today. Confusingly 'Enhanced television' is also used to describe the 'enhancement' of television programmes using any sort of interactive technology – such as having multiple camera angles broadcast on different channels, or facilities for viewers to play along with game shows.

2. *Interactive television* adds a return link or 'back-channel' from the television to the service provider. This is usually used in conjunction with enhanced television services to provide on-line shopping, banking transactions, bookings, voting, games, etc. It is also used to provider users with e-mail facilities. With terrestrial and satellite broadcasts the 'back channel' currently has to be through a dedicated telephone line, although the technology for a return path via the satellite or terrestrial aerial is being developed. Currently these systems use a modem to dial the broadcaster directly, but future more open systems could use an Internet connection. Cable TV can provide this link integrated into the cable service. This type of interactive facility service is available on all current digital TV services in the UK. While every digital TV receiver will be able to show information services, only those who pay for the use of a set top with a modem from a commercial service provider will have access to interactive services with transactions. The service provider controls use of the return channel through a system known as 'Access Control' which users and other broadcasters pay to use.
3. *Internet access* on the television is the third main form of interactive television, that has grown up outside the existing television development process, but has had a profound effect on the development of interactive television. Currently it can be provided through a separate dedicated STB or built into a television. The specifications for interactive television standards are starting to include provision for Internet access, and it is up to the suppliers of set top boxes to decide whether it is worth integrating into their product. Some companies provide this in the UK.

The biggest impact in this area is likely to come from the next generation of video games machines which offer internt access and other network features. Benefits and limitations of this are covered in a later section.

4. *Video on demand* is the least developed application, but the focus of a great deal of investment. It is the 'holy grail' of interactive television, but requires a dedicated channel for each household, and very expensive technology in the neighbourhood exchange. Viewers can watch any programme whenever they like, and enhanced and interactive applications can use video as well as still pictures, text and graphics. For example, a viewer looking for information or advice could not only be offered text, but also a video explaining the information. Currently the Internet to a PC is the only technology that comes close to being widely available. Cable TV and specially converted phone lines are the current technologies to provide this on TV, and there are a few companies in the UK pioneering the services: BT, Kingston, Video Networks and BSkyB, and are certain to launch these services within the next 2 years.

Another technology recently developed is inclusion of a computer hard disk in the STB in a product called a Personal Video Recorder (PVR). This will enable the device to record broadcasts, so that live programmes they can be paused and rewound while the broadcast in progress, and for video and interactive application to be downloaded and stored in the user's set to use later. This offers the possibility of limited video on demand based the STB rather than in the service provider's premises. BSkyB plans to sell this equipment in the UK in 2001, and it is causing considerable controversy in the television industry.

b Standards for interactive digital television

Interactive services are developed to run on particular hardware and software used by broadcasters and in the user's receiving equipment. However the services, technology and industry are still in a formative stage, and broadcasters have chosen different technologies and standards. At one key level of the receiver the 'middleware'[2] or the API (Application Programming Interface) where the interactive applications run, there are commercial battles between the supporters of MediaHighWay+ (developed and used by Canal+, based on MPEG-5), MHEG-5, a European standard used for digital terrestrial in the UK[3], EuroMHEG an extension of this, Liberate, PowerTV, two US proprietary systems, HTML, the Web page format code, JavaTV developed by Sun, and OpenTV (a system used by BSkyB and many other broadcasters) and a few other systems[4]. Microsoft promotes set top boxes running Windows CE and WebTV software, although, like other products, they can be adapted to comply with standards such as MHEG-5. A receiver can run several APIs for different types of application, but most currently only run one. Subscribers who have a receivers from one provider are unable to use software and content produced for other systems, and are unlikely to be able to upgrade the same box to future common standards.

[2] In the computer industry this is called the operating system, such as Windows, Unix, or MacOS.
[3] (Multimedia & Hypermedia Expert Group) (ISO/IEC 13522)
[4] In the US there is a separate standards making process and body. There are also several companies (WebTV, Wink, Worldgate) producing enhanced television products based on the Vertical Blanking Internal (VBI) on both analogue and digital TV, the system used to broadcast teletext in Europe, but never before exploited in the US.

DVB (Digital Video Broadcasting Project[5]) and ATSC, the European and US broadcast standards development bodies respectively, have both chosen Sun's Java programming language as the standard for interactive service. One thing is clear, the success of the Internet has made Internet standards and technologies very powerful, so that HTML, Java and other common formats will certainly be part of future standards.

DVB project in particular has recently developed a set of open standards and architectures called the 'Multimedia home platform' standard (DVB-MHP), based on MHEG-5 and Java which is hoped will finally resolve issues. In Europe most broadcasters and manufacturers are adopting the standards developed by DVB and are expected to adopt the MHP as it becomes a European standard in 2001[6]. If would seem that those with proprietary systems, such as OpenTV will certainly have to develop their product to comply with this standard. The most important reason is to allow the same content to run on any system, a secondary reason is to facilitate conditional access and access control[7] to scrambled and pay TV broadcasts and interactive services from any consumer equipment.

There is considerable pressure from government, from consumer electronics manufacturers and from the developers of content to have common standards for the preparation, broadcast and reception of material for interactive systems[8]. Publishers want to produce one set of material on standard tools, and know that everyone will be able to use it. In order to keep costs down, many would like to be able to use the same content that is produced for the Internet and for mobile phones. Manufacturers want to produce standardised digital television products for international markets. Governments want to make sure that there is an open market, and consumers do not get locked into one interactive service supplier.

Unfortunately the issues of common standards are still not finally resolved, partly because of the very different way digital broadcasting is developing in Europe and the USA. Broadcasters have invested in existing technologies that are now in millions of homes, and upgrading will not be cheap. However, solutions are in sight.

The Multimedia Home Platform will be a specification followed by most manufacturers that will enable people to buy digital television sets and receive a range of interactive material, including that broadcast free to air. Many broadcasters are insisting on an eventual migration to this standard, and the ITC (UK regulator) is considering making future MHP support a requirement for licensees. Newer set-top boxes will be able to be updated automatically with software to comply with the new

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[5] "The Digital Video Broadcasting Project (DVB) is an industry-led consortium of over 290 broadcasters, manufacturers, network operators, software developers, regulatory bodies and others in over 35 countries committed to designing global standards for the delivery of digital television and data services." The DVB website www.dvb.org.

[6] The standard has also been formally adopted by ETSI (the European Telecommunications Standards Institute).

[7] OFTEL, the regulator, defines conditional access as the services the operators require to control the supply of television services (e.g. Pay TV), and Access control, the controls over the supply of other digital services. Regulations are intended to prevent the abuse of market dominance with these systems, but always for reasonable recovery of costs associated with subsidy of consumer equipment, marketing etc. "Digital television and interactive services Ensuring access on fair, reasonable and non-discriminatory terms A statement issued by the Director General of Telecommunications"5/99http://www.oftel.gov.uk/broadcast/dtv0599.htm.

[8] These include UK Competition Law, and a specific EC directive: Advanced Television Services Directive (Directive 95/47/EC)

standards, but despite efforts at ensuring some backward compatability, some people will miss out.

There is also considerable development of third party software that will automatically convert material between standards – it is in the interest of content development companies to be able to offer this service to clients, but it requires the cooperation of broadcasters in allowing third party development. The development of XML[9] as a standard way of coding information including interactive applications (which has been adopted by the Government as the standard for all documents) means that material can be automatically repackaged for different platforms. However even when compatibility of technical standards is arrived at, the design and layout of services can still be dictated by each provider of packaged interactive services.

Future new standards will also enable more advanced types of interactive video and Internet applications to be integrated into the set top or television.

With confidence we can say that clear common standards have been developed and will become commonplace over the next 5 years. More powerful computing power in receivers may allow multi-standard operation, and automatic conversion of content, but regulators will have to put pressure on broadcasters to make the equipment that they supply conform to open standards. The actual layout and design of the interactive services is another matter, and providers of unified interactive services, such as Open, have the right to lay down firm guidelines on the style and presentation of material to fit in with the entire package of services they supply to the end user.

c The Delivery System

The system used to deliver digital television, cable TV, telephone (ADSL[10]), satellite, fixed wireless or terrestrial makes a difference to the type of service that can be offered. Terrestrial television (DTT) is limited by the bandwidth made available by the government for broadcasting. This bandwidth has been divided into 6 'multiplexes' run by the BBC, ITV, Channel 4 and Teletext, Channel 5 and SC4, and OnDigital, owned by Granada and Carlton . In both public and commercial systems there is competition for channel space, for both television and interactive services. Broadcasters will have to weigh up the costs and benefits of broadcasting public service interactive content. The limited channel space on DTT is always going to limit the speed and range of interactive services, and will have to be supplemented by using a telephone line.

The satellite broadcaster has many more channels (now reaching 500 in the UK) and is continually adding new satellites. This should enable it to carry many more, and faster interactive services. However interactive services have to generate income to justify taking channel space. Since satellite is a legally enforced open platform, anyone can buy channel space broadcast their interactive services, and pay to use the access control system owned by the company that subsidises the set top boxes.

Cable television also offers up to 500 channels, but these are targeted to individual neighbourhoods. Cable television also has the benefit of providing a direct cable

[9] XML – eXtensible Markup language

[10] ADSL – Asymmetrical Digital Subscriber Line. A technology that increases the bandwidth, or capacity of the telephone line going from the exchange to the subscriber's premises (the 'local loop'). It enables television to send over the line, or high speed Internet access. It is still in its early days. There are other sorts of similar technologies, referred to as DSL or xDSL

connection back to the network, something satellite and terrestrial suppliers have to use a phone line for. Cable television thus offers the possibility, if not yet the reality of two way video link ups[11] and video on demand. However currently the interactive services on cable television are very slow, making use rather unpleasant. Cable is currently a closed system, only accepting channels and services they approve.

Finally ADSL systems on telephone lines will offer similar benefits, but the technology is still rather unreliable. Fixed Wireless systems to provide television been developed, but have not been implemented in the UK.

While information and basic transaction services can run well on all systems, more complex applications, or those demanding more channel space may only be viable on cable services.

Services developed should be scaleable, and able to be implemented at different levels across television, Internet and mobile platforms, for example, video options being offered on cable services. Interactive services using the back channel will only work for users who subscribe to a commercial service that gives them the necessary hardware, or buys an expensive set top box themselves.

d The Internet and the television

While there are efforts to integrate interactive services with digital television, there are also products that use the television screen as a screen to connect directly to the Internet, bypassing the broadcasters. Products such as Microsoft's WebTV (1 million customers in the US) allow web pages to be seen on a TV screen. These initially offered only a selection of web pages specially modified for TV (the walled garden approach)[12]. The aim of this product was to make the Internet available at a low price to people who did not have or could not afford a computer. Many other similar products have failed to live up to expectations, but most of the industry is sure there is a market in some form.

The latest in a long line of products is a TV with built-in Internet technology which went on sale in the UK at the beginning of March 2000 (marketed under the brand Bush). OnDigital, the terrestrial digital television provider has also launched an Internet access (OnNet) product that is rented to the television subscriber alongside the television services. These products allow users to send and receive e-mails and see web pages. NTL are currently offering walled garden Internet access though their TV set top, and this will be expanded to full access in 2001.

The imminent arrival of the next generation of video games machines with network connections, from Sony, Sega, Nintendo and also Microsoft, is likely to have a much bigger impact than Internet-only products. This development should be watched carefully.

These systems work though software that changes the web pages to make them more readable on TV, but in general they require a high quality, large TV set. These products show the incompatibility between the TV and the computer screen, which is a much higher resolution and works in a different way. Web pages designed for a

[11] Trials in the UK have been run on one system that link a sales person by video to a user's home when they connect to an e-commerce site.

[12] The WebTV system is also integrated into US digital satellite broadcast products and PVR products to provide enhanced programming. It is based on the Internet html standard – yet another alternative technology. In the USA WebTV is used with analogue television and data is broadcast in the VBI.

computer screen are virtually unreadable on the TV. Pages of text and graphics have to be carefully designed to be usable on TV. New developments in Web standards and the impetus for making simpler, clearer pages for mobile web phones may make this much less of a problem in the future. One benefit for all users, especially those with difficulty understanding web pages, is that the lower resolution TV set forces designers to make better and simpler interfaces than those designed for the PC screen which can be too fussy and complicated.

Technical systems and standards for Internet on television, whether it be though the digital TV box or on a separate system are another dimension of complexity, with competing products from Sun, Microsoft, AOL, 3Com as well as the games companies and others who are linking this product to mobile phone Internet connections.

Critics of the Internet on television argue that the format is not suitable for the television, and many users will be confused, and at risk from the huge variety of content and services available. Dedicated interactive television systems with a limited number of well known branded services may be much more acceptable to consumers. Proponents claim that it offers everyone the choice and freedom of the Internet, and does not oblige service providers to conform to the requirements and standards of particular broadcasters.

Internet site and digital TV interactive pages will exist side by side on many systems, so they should have a similar interface and content, making use of the strengths of each medium. Eventually these may be integrated. Service providers can already use the same 'backend' e-commerce systems for conducting transactions on ther Internet or digital TV based service.

2 Types of interactive and enhanced services and content

The basic interactive service is information that can be access though on screen menus, and buttons on the key pad. Digital Text services are an up to data version of old teletext services, with menus and graphics instead of text and selection by entering page numbers. The BBC, ITV, Channel 4, the pay TV companies and Teletext are all providing or launching this service. This service needs software (the API) that formats and displays the information, and provides for linking between pages, like a web browser. This could be used for providing an information system for NHSDirect.

Basic interactive applications are similar, but they require the receiver to run a computer program. All the services have simple video games that can be played from the remote control. This technology can also be used to provide multiple choice questionnaires, such as those used in NHSDirect to provide basic health diagnosis and advice. This service requires the API interface that will run the program.

Transaction applications, such as shopping, voting and home banking require a return link to the service provider, so that bank details can be accessed, orders placed, appointments made etc. The system has to link the information pages to a secure encryption system for sending user's commands and often credit card details over a phone line, that may include the Internet. This could be used for requesting for information to be sent by post, booking appointments, sending information etc.

The return path can be used for other applications. These include e-mail, on-line games, where players compete for prizes against other subscribers.

Enhanced television applications links the interactive content directly to television programmes being broadcast simultaneously. This can use all of the previous types of content. There are many potential uses. Adverts that can be 'clicked on', calling up additional information, or sending a request for information. Viewers can vote or play in TV games shows (such as 'Big Brother'). This type of application often involves shrinking the television picture, and providing information or transaction services on other parts of the screen. This could be used in a variety of ways, linking documentary or drama programmes to information services on related topics. However many argue that the enhancement has to add to the value of the programme, not distract from it – most people will not want to turn to interactive services in the middle of enjoying a TV show.

3 Interactive Television in the UK

Currently all the main broadcasters and programme makers in the UK offer enhanced and interactive television services. These include on-screen TV guides (EPG[13]), information services, games, home shopping and banking applications, e-mail, enhanced adverts and TV programmes, interactive text and graphics etc.. Broadcast services use the carousel system, some of the cable services use an Internet standard based system. The terrestrial and satellite broadcasters provide STBs connected to a phone line to act as the back-channel, and to provide access to additional information. Cable systems have a cable return path, and use Internet technology to provide interactive services. All the providers offer Internet e-mail though the television, connecting via the phone line. NTL and OnDigital are also offering Internet access though their television systems. Indeed their interactive services are largely based on 're-purposing' Internet pages for the television screen.

There are currently two ways of accessing interactive services. First, by buying an integrated receiver set (idTV), or STB, which can receive free channels, currently those broadcast by the BBC, ITV and Channel 4 and 5. These broadcasters also transmit limited interactive and information services. Second, by obtaining a STB or an add-on to a idTV from a subscription TV company, which gives access to more advanced interactive products available on their channels.

Most of the users of interactive television have access though subscription TV providers NTL, TeleWest, BSkyB (Sky Digital), and OnDigital. On subscription to the service, or sometimes on the payment of a installation fee without subscription, a user gets a STB that receives digital channels, runs interactive services and connects to the interactive service provider. Currently a separate STB is needed for each broadcaster's services, as they use different standards. Integrated digital TV sets (idTV) have shown poor sales, as the STBs are now given away free of charge. Most people are interested in digital television because of specific extra subscription channels such as sport, films and children's entertainment, despite free-to-air broadcasts being available from the BBC and ITV. idTV sets are available from nine manufactures, and will receive the free terrestrial services and. An add-on will allow owners of some of these sets to subscribe to OnDigital services.

[13] Electronic Programme Guide

All interactive services on terrestrial Digital (DTT) broadcasts are based on MHEG-5. Sky Digital interactive services are based on OpenTV, and the cable providers use other systems. Organisations wishing to offer interactive services must either negotiate to be part of the interactive services package of the broadcaster, or alternatively, in the case of cable and satellite, negotiate to occupy an entire channel. Programme makers and advertisers can also offer enhanced and interactive applications to be broadcast simultaneously with their programmes. The interactive material has to be prepared to the technical and production standards of the broadcast system provider.

Those who own the system (e.g. Sky, OnDigital etc) generally charge third party broadcasters (such as the BBC) and service providers to use the Access Control system for interactive services, a fee to join the service, a charge per use of the modem, and use of the authentication service, and a percentage of transactions[14].

a The free set top box effect

The uptake of digital television in the UK is based on people buying digital televisions or renting set top boxes. The government projected an almost complete uptake of digital TV by 2010, when the analogue transmitters can be closed down and alternative use found for the spectrum. This would require 95% of the population to have a digital receiver. Licence fee payers will then receive existing and new free to air channels. Providers of Pay TV services were expected to provide add on equipment for integrated digital TV sets to descramble their signals. However since BSkyB and OnDigital decided to give away the set top boxes, the market for digital television sets (idTV) has evaporated and so has the impetus to produce the add-on's (only OnDigital do this). This currently means that almost all those with digital television have it through a subscription to pay TV services, and have it because they wanted those services. Very few have opted to buy the set top boxes or digital televisions. However this will certainly change, as there are currently nine manufacturers producing idTVs, with 24 models available . These sets can only run interactive services produced in the MHEG-5 format. This creates a fundamental problem for the universal uptake of digital television. Even if everyone subscribes to multichannel TV or buys one idTV, most households now have two or three sets that will all need upgrading.

b Providers in the UK

The main digital television providers in the UK are BSkyB/Open, the BBC, Teletext, ITV and Channel 4, and OnDigital, Telewest/Microsoft, and NTL. Of these, BSkyB and to a lesser extent OnDigital supply and control the vast majority of digital receivers. The other channels provide free to air services on terrestrial television, and have negotiated to broadcast on cable and satellite too.

BSkyB, the satellite broadcaster offers an interactive television service as part of its Sky Digital pay TV product. This consists of enhanced television programmes linked to some of the channels, particularly football matches and adverts, a home shopping interactive service, run by QVC, and an interactive information and transaction service, called *Open*. Satellite offers national coverage, but currently the number of

[14] E.g. Sky charge £100 000 sign up fee, 5% of transaction and £0.04 per

interactive services on Open are limited by the bandwidth allocated, although this is changing as new satellites are launched, and the market and supply of interactive services develops. Open is a joint venture between BSkyB and BT[15] Those dealing with Open say they have a demanding and limiting process for creating interactive content, with Open having to create the applications themselves for the OpenTV system. Open claim that this enables them to control the quality of content to be used on a TV screen, to make it easier to use and to maintain consistency across services. Some of there service are already developed in XML, but they have no secure plans to move to the MHP.

Open offer targeted local information down to the post code area. This information is not broadcast, but requires the STB to make a phone call to download the data. Open are developing their content to target women, who continue to do most of the shopping in family households, Sky's main market. BSkyB are by far the dominant provider of digital television and interactive services in the UK. This makes it essential that any successful service should be available on their system, although not necessarily through Open. BSkyB are also the target of repeated regulatory interventions over their monopoly position which may change the situation.

Digital Terrestrial Television (DTT) can be received by anyone who buys a digital receiver (idTV). However most people receiving digital DTT broadcasts are subscribers to OnDigital, who give STBs as part of the subscription. DTT reaches most of the major urban and suburban areas, with different channels reaching between 70 and 90% of the population. However due to the limited bandwidth and current technology, interactive services are very slow, and are unlikely to become faster until more bandwidth is made available. The system cannot be used for those with communal aerials[16], nor those out of range of a digital transmitter. The BBC ITV, Teletext and Channel 4 provide free interactive services, but these are primarily teletext style services. OnDigital interactive services are available with subscription, and for those with an idTV using the MHEG-5 standard. OnDigital has enhanced programming such as that produced by Carlton Active, a dedicated interactive channel with information services, shopping and banking, e-mail etc, and for an additional subscription, full Internet access. So far there are less than one million DTT households, compared to over four million satellite households.

Telewest and NTL (which includes Cable and Wireless) are both cable companies that have large areas of urban and suburban housing supplied by cable in discrete licence areas across the country.

Telewest provides multi channel television, telephone and Internet services to more than 1.6 million UK households, and currently has 225,000 subscribers to its new Active Digital service, expect to grow to 500 000 by Q1 2001. Telewest claims to have the largest interactive retailing 'mall' with some 150 retailers. Content is re-purposed from Internet html pages for the Liberate platform. Microsoft has a 25% stake in Telewest and they will certainly migrate to Microsoft software, but configured to run open standard applications as well as those specifically catered for

[15] Currently owned BSkyB (80.1%) and BT (19.9%). It was originally hoped that other digital broadcasters would carry the Open service, but since Sky Digital is the only UK broadcaster using OpenTV software, it is not compatible with other systems.
[16] OnDigital is currently trying to upgrade communal systems to work with digital TV.

by Microsoft. Telewest also have an interactive content division, previously called Flextech interactive. They have entered into a partnership with US company Atomic Tangerine to set up a new company, SmashedAtom which will develop interactive applications for third parties, including government departments, that will run on all interactive platforms

NTL are the largest cable TV provider in the UK, having recently bought Cable and Wireless operations. They too have developed an package of interactive service based on the Liberate platform. NTL are also introducing full Internet connection via the TV as a complement to the 'walled garden' interactive channels. NTL have set up an interactive content fund to promote the development of original interactive services.

Provider	Subscribers to TV services	Installation Costs/ subscription	Use costs	Platform standard	Figures on interactive use
Free to air terrestrial digital	-	£300-700 for STB and £100-200 for satellite aerial installation if desired	free	MHEG-5	
BSkyB/ Open	3.8 household subscribers on last figures. Now likely to be 4.3 m	£100 installation, gives access to 'Open' and free-to air-channels free, or £40 +£7 month for basic subscription. The set must be connected to a phone line, otherwise it costs around £500	Local call charges for transactions and e-mail	Open TV platform – service created on dedicated authoring system	1.6 million households/week
On Digital	900 000 subscribers.	Either £99 for STB access to OnDigital interactive for one year or £6.99 a month	Local call charges for transactions and e-mail	MHEG-5	No interactive figures
On Digital Internet 'On Net'		Internet additional £5 month (or prepay £159 including TV)	Local Call	HTML and other Internet standards	
NTL	500 000 digital subscribers	£10 month, interactive services £40 installation. Full Internet access due 2001		HTML on Liberate platform	
Telewest	1..6 million subscribers – 225 000 digital subscribers	£9/month inc. phone		HTML for the Liberate platform	225,000 can use it.

Table 1

There are also significant developments in the provision of television by telephone. BT are currently installing the necessary ADSL equipment, which they will use themselves and rent to third parties. BT's intentions are not clear at the moment, pending major reorganisation and regulatory intervention. Kingston Telecommunications, based in Hull has major plans to provide digital television via BT lines, but is stumbling over raising necessary capital, and dealing with BT. Video

Networks has been working with Kingston to trial video on demand and expects to develop services nation wide . BSkyB are reported to be planning a similar service to complement their satellite operations, and there are currently rumours that BSkyB will buy Video Networks. Energis, another national telecoms network company also have plans to offer television services, as does a new firm called Thus.

c Content

There are a number of companies that are developing interactive television content and applications. The BBC and Teletext are the most well known. Other companies are proliferating as the demand for content increases, including content arms of existing programme makers such as Granada, Carlton, Anglia, BSkyB etc. These companies are catching up with independent companies who have pioneered interactive television for the last 10 years. Some of the best known include Victoria Real and Two Way TV who develop games, gambling, interactive adverts and other interactive products.

Digital television receivers can pick up free to air interactive or information services as well as those developed for the commercial broadcasters. However with so few people receiving free channels only, and with no common standards, these services are not yet making an impact. Teletext Ltd are developing a digital television version of their teletext services, that is now starting to be available on interactive services from the cable companies. However it is very slow. The BBC have also developed education services for interactive digital television.

As well as games and information, several of the broadcasters are developing digital television based education services for delivering the national curriculum. These are integrated into their Internet services, and also include some new technical innovations to allow automatic recording in schools.

4 Home Ownership and usage of digital television and the Internet.

a Why people choose Digital TV

The uptake of DTV is driven or influenced by several factors :

1. Replacement of television sets: when digital sets become available many people may opt for one instead of an analogue set. This uptake will follow normal replacement of television sets by households every 7-10 years.
2. Uptake of special interest television, especially sports, children's TV and movies, which have driven the success of SKY, OnDigital and cable TV.
3. Existing multichannel customers are being switched to digital services by their service providers
4. Bundling of digital TV services with broadband Internet connections. Just as cheap telephone connections have been key in the adoption of cable TV, broadband Internet connections will bring more people to digital television.
5. Competition from other consumer electronics products, especially the home PC with Internet access. Most people only have limited budgets, and in spending money on home media technology will have to make choices between digital

television, computers, Net enabled video games machines, DVD players, and many other products.

6. Interactive services. Depending on the attraction and success of interactive services for existing subscribers, these could bring people into adopting digital television.
7. The development of pre-pay services, currently by OnDigital, which allows digital television to be given as a gift, even to people who might not want it. This type of purchase system allows people to try out the services, without making a long term commitment.

b The users of interactive services on the television

According to the Joint ITC Oftel and OFT advice to Government on Digital Television

> "The familiarity of television and the capabilities of digital give this technology the potential to be a prime means for widespread domestic use of the Internet in addition to new and traditional programme services. This is reflected in the Prime Minister's goal of universal access to the Internet by 2005, with digital TV being an important way of ensuring this widened access. "

This is a widely held view across industry and the world. However one must not equate access to interactive services to the actual use of them. Introducing interactive services makes the television unfamiliar. While setting up the system may be straight forward, the use of interactive systems on the television and on the computer has similar drawbacks and advantages. Many people will struggle with this type of technology, and not use it though caution, lack of interest or ignorance. In the UK Teletext is widely available, but only 50% of the population use it (70% in Germany). Many people are not interested in information services, and those with literacy weaknesses find them difficult to use[17].

Others will find the services a great boon. The home PC is a notoriously unreliable and difficult product, that many people cannot afford and find difficult to use. Interactive television solves almost all those problems, although screen freezes etc still happen. Many elderly and disabled people will benefit considerably from accessing interactive services. It will also offer a terminal in the home that is perhaps more friendly to those who might be excluded from home PC.

c Uptake of Digital television

Most of the predictions for the uptake of digital television over the next 10 years suggest that 20-25% of households will have digital cable television (similar to current subscription levels to cable services, as most of the cable companies will switch their customers to digital), and another 30% at least will have digital satellite or terrestrial television. Currently the country is divided into those who are interested in multichannel TV and those who are not – and those who are not need will only be

[17] It is very important to design the services to be appropriate for the television screen and environment, rather than assuming that existing Web pages are suitable. In fact much can be learned from TV design to inform usability of Internet sites.

attracted by being given access free of charge[18]. More accurate estimates are impossible. Digital television is a political project as well as a commercial enterprise, and the decision whether and when to switch off the analogue transmitters will influence the uptake. It is unclear which sections of the population will be using digital television, and how much this will crossover with home PC and Internet use.

In general the profile of users of digital television is adults with families in the age 25-45, and a reasonable disposable income, a similar profile to those who have home PC and Internet access. However within households not everyone uses the computer, and generally its use is limited to one or two people, so the TV offers others in the household an alternative interactive gateway. Computers at home are often dedicated to work, or to children.

Many people appear to be trying digital television, but then turning off, or moving to another supplier. This is called churn. OnDigital has 30% churn, NTL 1.9% churn per month. Many people are likely to try OnDigital and then move to Sky, given the much higher number of channels.

d Current figures on use

According to OFTEL, currently over 20% of households have digital television. Quoting from a recent report :

> Those that had used interactive services rated them as good for ease of use, range of services available, speed and security, while just over 40 per cent of non-users said they were likely to use the shopping services in the future.
>
> The survey also shows subscription to digital TV is greatest amongst the higher income groups (31 per cent), and is lowest amongst older consumers (10 per cent) and lower income groups (14 per cent).
>
> Despite 1 in 3 homes claiming to have Internet or email, and almost double this number claiming to have interactive services e.g. shopping and banking, fewer than 1 in 5 were making use of these facilities
>
> "Consumers' use of Digital TV Summary of Oftel Residential Survey" July 2000

Open are the only company giving details of the usage of their service. They suggest that Open: is : "Available to 3.8 million [now over 4m]". It is "visited by over 1.6 million homes on any given month and boasts more than one million email subscribers" "Over 1.1 million homes use Open at least once a week". They do not give figures for how people are using it.

e The problem of multiple television households

Televisions have become a common household item. In 1997 over 1/3 of the population have 3 TVs in the home, 2/3 at least two. Many families give televisions to children to have in their rooms. One problem with digital television is that it will almost certainly be installed on the main TV in the family space before the other TVs unless all new digital TVs are bought, or a household decides to pay for additional set top boxes. In considering whether people will have access to a interactive digital TV

[18] The cable companies do this by bundling telephone and television together for a low price. New idTV sets are the other route.

it is important to consider what goes on inside the home as well as basic figures on household connections.

5 Uptake of digital television and interactive services in other countries

Digital television services have been developed in most European countries and are underway in the United States. Many other countries are also beginning digital broadcasting. The UK is one of the most developed countries in terms of provision and use, particularly in terrestrial digital broadcasting. However France, Spain and the Netherlands have also very successful satellite and cable digital services.

However the use of interactive digital television for public services is almost unknown at present. Singapore appears to be the only country really committed to electronic service delivery including digital television. In this respect the plans of the UK government seem well advanced.

6 Conclusions

Interactive Digital television offers government and business a way to reach a large section of the population in their homes. Many businesses have now integrated digital interactive TV into their e-business strategy, as Andy King of Head of New Media Services Group, Computer Sciences Corporation[19] said in a recent report

> It's not an either/or approach to interactive television, because most companies are looking at their idTV initiative in conjunction with their Internet strategy. It's clear that those currently pursuing an integrated e-channel strategy are seeing an enormous opportunity for new sales growth and expansion.

At least 8-10 million households will have access to interactive digital television in the next 5 years. Despite differences in standards between providers, it will be an effective way to reach these households, as part of an integrated on-line strategy, and certainly worth working with each company to develop common guidelines for creating television friendly services

In the longer term, everyone will have digital access, but possibly without full interactive capabilities. Nonetheless, even basic broadcast information services on the new technology can offer similar functionality to today's web pages.

The Department will have to consider providing interactive services as part of the existing interactive packages of the broadcasters, such as Open, or setting up a more independent stand alone service to be broadcast on all platforms. This will probably make sense as part of integrated open government services that include television as well as interactive services

However the Department should not only focus on a stand alone service, but look at ways of integrating the service with other aspects of television – such as enhancements to programmes that deal with relevant issues. The technology gives a unique opportunity to bring public services into the home at moments where people are thinking about issues raised in dramas, the news and documentaries.

[19] A report by Computer Sciences Corporation 27.11.00

Health is also becoming an important field for commercial exploitation, so services should be linked to commercial health channels[20], and interactive services. Although more controversial, most interactive services depend on advertisements, and this is a factor that must be considered. Interactive services on digital TV will be part of a highly commercial media, where viewers are used to commercial messages, and will be using the services in an enviroment surrounded by adverts, whether or not they actually occur on the public health service.

The service will not reach everyone, but the idea behind open government is to provide people with the choice to access government services in the way they find most convenient. On-line technology reaches into people's homes in an important new way, and must be explored.

James Stewart
8 December 2000

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[20] The first health channel was launched in the US this year, and I understand that the Government has been in talks about funding a similar channel in the UK