Report on

Set Top Boxes

in the context of

The Digital Terrestrial Television Trial in Ireland.

Issued by Department of Communications, Marine and Natural Resources.

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1. Executive Summary

The Department of Communications, Marine and Natural Resources has been managing a trial of Digital Terrestrial Television (DTT) since 16th August 2006. This non-commercial trial is operating from two sites in Dublin and County Louth. It is intended to continue the trial until August 2008.

Digital Terrestrial Television provides for an upgrade of analogue terrestrial television which is currently used for the over the air transmission of RTE1, RTE2, TV3 and TG4. Digital technologies are more efficient than analogue technologies and can provide for higher quality pictures, more TV channels (currently between 16- 35) and additional services – such as radio stations, programme guide information and enhanced teletext services. High definition television (HDTV), data services and interactivity are also possible over DTT.

New legislation, enacted in April 2007, provides for the commercial rollout of DTT. Under this legislation, RTE is required to rollout national DTT services capable of providing RTE1, RTE2, TV3 and TG4. The Broadcasting Commission of Ireland has been tasked with providing opportunities for commercial operators to rollout additional DTT services. ComReg, the Comunications Regulator, is responsible for providing the DTT spectrum to RTE and the BCI.

Commercial rollout of DTT is expected to commence within the next 12 months and commercial DTT services are expected to be available by the time the DTT trial ends.

The size of any DTT market in Ireland is unknown. Ireland has about 1.5 million TV households. About 30% of TV households currently rely solely on terrestrial TV reception whilst about 90% of TV households have at least 1 TV which relies on terrestrial reception. Digital and analogue services are also provided by cable/MMDS and satellite systems, usually on a subscription basis.

The main aims of the trial are to introduce the concept of DTT to Ireland in advance of commercial rollout of DTT services and to identify potential issues which may affect a commercial and national rollout of DTT in Ireland. A successful DTT roll-out will pave the way for analogue switch-off, which will free up valuable spectrum. An early lesson learnt as a result of the DTT trial relates to the current availability of suitable set top boxes and receiver equipment in the market.

Key Discoveries with regard to set top boxes

In making a decision on suitable receiver equipment for the trial, DCMNR considered that it was important to locate:

- cheap, easy to use and readily available receiver equipment.
- equipment which caters for those with accessibility issues – e.g. provides for audio description and subtitling.
- equipment capable of indoor portable reception as well as rood-top aerial reception
- equipment capable of supporting encryption
- equipment possibly accessible from the UK electronics market
- equipment with good accessibility functionality
- In addition, DCMNR also sought more sophisticated equipment which could be used for testing advanced digital services such as interactive services and high definition TV (HDTV).

Cheap set top boxes were sourced in the UK but there were problems with most of these boxes. They have been manufactured specifically for the UK market so most of the boxes did not work or only partially worked in Ireland. In addition, for the boxes that were found to work, there is an issue with the numbering of channels in overspill areas (areas where the box is capable of picking up signals from the UK and from Ireland), such as close to the Northern Ireland border. A number of set top boxes were provided by the Irish divisions of major electronic goods suppliers and these were also found not to work. A number of specific issues were identified in relation to the UK's 'D-book' which complicate border area reception matters for a country bordering the UK – and which will complicate matters within Northern Ireland when Irish transmissions begin. Solutions may be found by manufacturers considering standards that are compatible with more than one market.

In relation to higher specification set top boxes which can operate on more efficient DTT networks – capable of providing HDTV and/or more TV channels– there are very few set top boxes currently on the market. However, there is growth in this market and it is likely that MPEG 4 compatible set top boxes will be the norm in the future.

To date, DCMNR have not found suitable set top boxes for testing interactive services. A licensing issue with the middleware product – MHP – has lead to some market uncertainty in this regard. If advanced interactive services are to be provided over DTT, the middleware problem will need to be resolved. It is possible that the trial will test interactive services over the next 12 months.

With regard to resolving the various set top box issues that have arisen, it is vital that Irish consumer electronic retailers, broadcasters, transmission companies and regulators work together to explore the various issues – technical and otherwise. Engagement with the various standard setting bodies, such as DVB and DTG (UK), is important in this regard.

2. Background

Ireland has broadcast television services from a terrestrial network on an analogue basis for over forty years. This has allowed for highly successful and popular free-to-air (FTA) services with near-universal coverage. The long-term viability of distinct Irish broadcast services, including nationally-made content, is an important cultural, political and social requirement. To maintain its viability, Irish broadcasting needs to keep pace with changes in technology. Terrestrial transmission possibilities have changed radically in recent years with the advent of Digital Terrestrial Television (DTT).

Similar to standard analogue television, DTT is transmitted on radio frequencies but DTT uses a process called "digital multiplexing" to allow reception of multiple channels on the space occupied by a single analogue channel. DTT also provides high picture and sound quality.

DTT is received through a set-top box, or integrated receiving device, that decodes the signal received by a standard aerial. DTT does not require a satellite dish or cable connection.

Possibilities for services using DTT go far beyond what is currently available through analogue transmission. They include:

- The availability of more channels (DTT is more efficient than analogue terrestrial TV so within the bandwidth occupied by 1 analogue TV channel, there is space for 4 to 6 digital TV channels);
- Improved quality of service to viewers (including wide-screen and high-definition TV). Unlike analogue television where the quality can vary, depending on the weather and on the distance from the broadcast transmitter, the quality of a digital signal is excellent wherever it is received;
- Increased viewer choice with regard to programmes, content and interactivity, including possibilities for data/broadband services.

Analogue terrestrial TV transmission services in Ireland currently consist of RTE1, RTE2, TG4 and TV3, along with associated teletext services. DTT can offer possibilities for a far greater range of services. A full DTT offering could typically provide between 16 to 35 television channels as well as a range of radio stations and enhanced teletext services. High definition television (HDTV), data services and interactivity is also possible over DTT. The scale of the development of DTT will obviously affect the range of services, but DTT is expected to provide, at minimum, additional channels and radio stations, enhanced information services, better reception and high-definition picture quality.

Ireland has already taken significant steps to allow for the development of DTT. The 2001 Broadcasting Act set out a specific regulatory framework for the roll-out of a commercial DTT network. The process that followed on from this legislation sought a

single commercial operator to provide digital content over a DTT network, based around a pay-TV platform. However, no commercial operator emerged from the process.

Revised legislation to develop DTT has recently been enacted. This legislation, the Broadcasting (Amendment) Act, 2007, provides a more flexible framework for a national roll-out of DTT. Under this legislation, RTE must develop a DTT service which is capable of providing RTE1, RTE2, TV3 and TG4, at minimum. The Broadcasting Commission of Ireland (BCI) is responsible for providing the framework for a commercial rollout of DTT in 2007 and the Commission for Communications Regulation (ComReg) is responsible for providing the radio frequencies for DTT.

Commercial rollout of DTT is expected to commence within the next 6-12 months and commercial DTT services are expected to be available by the time the DTT trial ends.

On 16 August 2006, Ireland launched a Digital Terrestrial Television (DTT) Trial. This is the first such trial of its kind in Ireland and was launched at the instigation of the Minister for Communications, Marine and Natural Resources. It is planned that this trial will continue over a two-year timeframe, during which time DTT broadcasts will transmit from the Three Rock site in Dublin and the Clermont Carn site in County Louth.

The trial was initiated as a means of enhancing stakeholder interest in digital TV, particularly in the light of developing broadcast markets within Europe and the EU expectation of a shutdown of the analogue terrestrial TV platform by 2012.

The DTT trial network comprises two main parts – an encoding and multiplexing centre and a transmission network.

BT Communications (Ireland) is providing a multiplexing and distribution service to the DTT Trial. Multiplexing is the technical service in which television signals are compressed for higher quality reception and more efficient use of broadcast spectrum.

NEC (UK) Limited was contracted to supply and install the transmission and combining systems required for the DTT Trial. DTT transmitters have been installed in two locations – at Clermont Carn in Co. Louth and at Three Rock in South Dublin.

RTÉ Transmission Network Limited, which operates Ireland's internationally co-ordinated high-power broadcast sites, is facilitating transmission from these sites.

The trial is intended to last from August 2006 to August 2008. During the trial, there will be three multiplexes available for standard definition DTT with a fourth multiplex being made available for High Definition TV trials, later in the trial.

The DTT trial consists of three main phases – a soft trial, a public trial and a trial of advanced services – including interactive services and HDTV.

The soft trial, which operated from August 2006 until March 2007, was used to test the stability of the network and the technologies involved, at a network and user level. Content for this phase was provided by the Irish national TV and radio channels – RTÉ 1, RTÉ2, TV3, TG4, RTÉ Radio 1, RTÉ 2 FM, RTÉ Lyric FM, RTÉ Raidió na Gaeltachta and Today FM.

Phase 2 of the trial, launched on March 5 2007, involves a managed public of 500 public participant. During this phase, set top boxes will be distributed to selected trial participants. Additional content available at this stage includes Channel 6, some BBC channels – Eircom/RTE, some channels from Sky and some speciality channels from Chellomedia/UPC. In addition, the new channels are encrypted – mainly to protect rights issues.

In the later stages of the trial it is expected that interactive services and HDTV will be tested. Testing of these services is subject to the availability of suitable receiver equipment and content.

3. Introduction

The DTT trial in Ireland is aimed at introducing the concept of DTT to Ireland including enhancing stakeholder interest in DTT. In this context stakeholders include the public, those interested in the rollout of DTT from a business or technology perspective and those responsible for developing broadcasting policy in Ireland. As part of the trial, it is anticipated that a number of reports will be developed to keep stakeholders informed of progress within the trial and of any interesting developments. This is the first such report and provides information of relevance to the choice of DTT receiver equipment in Ireland.
The process for selecting suitable set top boxes for the Irish DTT Trial provided some useful information on the status of existing set top boxes and other DTT receiver equipment in the marketplace. This paper summarises this information and also highlights an issue in relation to the operability of certain UK set top boxes outside the UK.

4. The developing Market for DTT Receivers

Ireland has about 1.5m TV households. Penetration of subscription cable/MMDS and satellite TV is relatively high – about 70% and, at 51%, Ireland has one of the highest penetration rates of digital TV in Europe[1] . However about 30% of TV households still rely on analogue terrestrial TV only and about 90% of TV households have at least 1 TV which relies on reception from the analogue terrestrial network. It is anticipated that these households will provide the core customer base for DTT.

Ireland is one of the last countries in Europe to start rolling out Digital Terrestrial Television (DTT) – all EU-15 have commenced - and it is useful to see how DTT receiver equipment has developed elsewhere. Throughout Europe, the standard used for DTT is the ETSI (independent standards body) developed DVB-T standard. Most set top boxes in Europe comply with this standard to some degree. However there are a number of variations to the standard which means that set top boxes working in one country may not work in another country. In addition, manufacturers have a choice of middleware which is used in the DTT receiver to provide enhanced services such as teletext or interactive services. For DTT there are 2 main middleware standards – MHEG and MHP (See annex 2).

The U.K. was first to enter the DTT market in 1998, deploying a DTT network utilising MPEG 2 (a compression standard) multiplexing and a 2k (processing power measure) carrier system. Although slow to take off, the market expanded rapidly with the development of Freeview in 2001. Low cost set top boxes (STBs in the UK start from about £25) were developed to encourage the maximum take up of DTT. These boxes are

[1] Reference ComReg Quarterly report, www.comreg.ie.

manufactured in accordance with the D-Book – a manufacturers handbook for the UK which is based on the DVB-T standard, but fine tuned for the UK market. UK DTT receiver equipment uses a UK middleware standard – MHEG, which was developed before the more advanced MHP middleware product became available. To date, circa 10 million low cost set top boxes have been sold in the UK. The success of DTT in the UK has led to the development of more sophisticated DTT receivers including integrated digital televisions (iDTVs – televisions with a 'built-in' DTT receiver) and personal video recorders (PVRs). It is likely that the huge success of DTT in the UK will complicate how DTT can be developed in the future as new services such as high definition TV or interactive services require upgrades to both the existing UK DTT networks and receiver equipment.

In Europe, DTT receiver equipment is manufactured in accordance with the E-Book- a manufacturers handbook for Europe based on the DVB-T standard, and differing in some technical respects to the UK's D-book. MHP is the middleware of choice in most countries, but issues over licensing of this middleware has caused confusion and slowed up the development of the MHP market. Throughout Europe, the development of DTT in general, has been slower than in the UK and has only started in earnest in recent years. However, recent technological developments – such as higher compression techniques, MPEG 4, which offers the potential for more content - and the growth of high definition TV, has renewed interest within Europe.

The choice of DTT technologies in Ireland is likely to depend on the availability of suitable set top boxes in other markets. However, other factors, such as future trends in DTT technologies and the perceived business case for DTT - is DTT an alternative TV platform only, a platform which can be used to provide high definition TV services or a potential platform for interactive broadband services – are also important.

5. Receiver Equipment for the DTT Trial

In developing a DTT trial network, DCMNR decided to provide for a range of technologies to maximise testing on the network and to provide for the trialling of innovative services. For example, the network uses both MPEG 2 and MPEG 4 compression techniques, with the latter providing scope for testing more content or HDTV.

In choosing suitable receiver equipment for the DTT trial the Department had a number of aims:

1. The first of these was to identify readily available, cheap and basic set top boxes capable of being used in Ireland for DTT.
2. The second aim was to identify more sophisticated receiver equipment, capable of trialling new advanced services – such as encrypted services, high definition television or interactive services.

3. A third aim was to identify the availability of set top boxes for those with accessibility issues and which provided, for example, functionality to receive audio description services.

DCMNR consider that, in an emerging market, the availability of cheap and readily available consumer equipment is vital. In this regard, the search focussed on set top boxes rather than more sophisticated receiver equipment such as Digital Televisions or personal video recorders. The search for basic set top boxes, concentrated on the UK market. Currently set top boxes are available in the UK from about £25. In order to ensure that these boxes would work in Ireland, DCMNR requested the DTG[2] to conduct tests on a suite of UK set top boxes (Annex 1). Testing of about 90 UK set top boxes revealed that very few would work properly in Ireland. Some of the more significant problems associated with these boxes included:

1. The older 2k boxes could not work on an 8k network.
2. Some boxes did not recognise the existence of a network with a non UK Network Identifier,
3. Of those that recognised the Irish network, many were unable to identify the correct Channel Numbers, for example, some of the boxes defaulted the channels to channel numbers starting at 800 and
4. Other boxes had clock problems.

Of the basic boxes that were tested, only 4 were found to work in a satisfactory manner and on further investigation, several of these boxes were no longer being produced.

For the launch of the "soft trial" in August 2006, a basic set top box – from the UK- was identified and circulated to 50 participants – mainly in the Dublin area. The box – a Humax Fox 2T – was found to be easy to use and install and provides basic programme guide information.

For the main public trial, which started on 5th March 2007, a more sophisticated box, capable of trialling advanced or interactive services, was sought.

A search of UK available set top boxes and of set top boxes available elsewhere in Europe highlighted that advanced set top boxes were not readily available and would not be available before March 2007. As the trial was due to be launched in March, the Department approached Humax – who had produced a prototype high Definition DTT set top box for the HD trial in the UK. This box is specified to work with both MPEG 2 and MPEG 4 compression methods, is capable of receiving and decoding HD signals and has a conditional access slot which can be used with a variety of encryption methods. Within a very tight timeframe, Humax worked with the Department to adapt this box for the Irish DTT network in time for rollout in March. Some issues associated with the boxes ability to handle the MPEG 4 transport stream are under test.

[2] The Digital TV Group - a manufacturers interest group set up in the UK and responsible for the development of the D-Book – the Book setting out the specifications for DTT receiver equipment.

It should be noted that the DTT Trial box is very much a prototype rather than an off the shelf set top box. The box has no associated middleware so testing of interactive services will not be possible in the early stages of the trial. It is anticipated that as the trial progresses, advances in set top box technology will mean that trialling of interactive services on different boxes will become possible.

In relation to set top boxes for those with accessibility issues, only one set top box was found – the Netgem I-Player. A small number of these were purchased for testing purposes but since then, the boxes have ceased production in the UK.

A number of points should be made with regard to equipment currently available in the Irish consumer electronic market. Integrated televisions with DTT tuners are available, but the tuners in these televisions may not work in the Irish market when it develops. Televisions for sale may have the UK's 'digital ready' tick (digital) (see www.digitallogo.co.uk) but this means that they are compatible with a UK DTT system, not necessarily and Irish DTT system. One iDTV has been tested on foot of the trial, and it does not function properly.

A further issue that arises relates to 'over the air downloads' – OADs. Set top boxes need to have software upgraded on an ongoing basis. Irish broadcasters and multiplex licensees will need to ensure in the future that they have systems in place to deliver these downloads.

Annex 1: Summary of Digital Television Group Set top Box Tests for the Irish DTT Trial

Background

At the commencement of the Irish DTT trial, it was decided to test the suitability of basic MPEG 2 U.K. STBs for the Irish trial DTT network. These tests were conducted by the DTG in the UK.

As a result of these tests it became evident that many STBs did not perform as expected.

- Many of these failed automatically because the U.K. DTT system is based on 2000 (2K) carriers whereas, the model chosen for Ireland is based on 8000 (8K).
- The displayed on-screen time, date and/or channel number were incorrect in some cases.
- Some STBs expect to see the country_availability_descriptor as GBR and will not decode anything if this is not present

STB manufacturers apply the D-Book specification to STBs destined for the U.K. market. This does not adhere rigorously to the ETSI specification but was adopted at the start-up of U.K. DTT to ease the problems of starting a digital service.

Tests performed

DTG Testing Ltd have a 'receiver zoo' which is used for testing conformity with the D-Book and this consists of 77 STBs and related equipment. A CDR copy of the Irish Transport Stream was recorded, firstly with GBR as the country_availability_descriptor and then with IRL as the Country_availability_descriptor and tested against this 'zoo' for correct decoding. This test was specifically to isolate the U.K. STBs pre-programmed to expect GBR only.

Minimum Performance

For each stream, each receiver was rescanned and the following tests were performed:

- Check the receiver stores the expected TV and Radio services
- Check the Logical Channel Numbers (**LCN**) are correct.
- Check that the TV services are received correctly.
- Check that the Radio services are received correctly.
- Check that the subtitles are displayed correctly.
- Check EPG data is present and appears correct.
- Check time is displayed correctly.

For receivers storing the services on LCN numbers other than expected, an "OK" (but not "PASS") result was recorded. Other problems were regarded as a failure. An 'OK' result is deemed unsatisfactory for STBs operating close to Northern Ireland where channel numbering confusion can arise.

A PASS was awarded only to STBs which performed *all* the tests correctly.

Results

The following set top boxes and personal video recorders were found to operate satisfactorily using the Irish DTT trial transport stream with MPEG 2 compression. All other boxes tested did not. Generally, iDTVs have not been tested. Some of the operational boxes are no longer being manufactured.

Operating Boxes/PVRs

Receiver	**Model**
Sagem	ITD60
Sony	VTX-D800U
Nokia	121T
Ferguson	TUTV
Nokia	Mediamaster 221T
Philips	DTR100
Humax	F2FOX1
Sony	KD32DX51U
NetGem	I-Player
AstraTec	TOPD2

Annex 2: DTT Middleware Standards in Europe

Background
Network equipment designers have been targeting the streaming of entertainment services to the home for some years now. To do this, they needed to design gateways that support digital television, DVD video, MP3 audio, interactive services and more.
Middleware is the term given to the Applications Programming Interface (API) software installed in the STB in order to do this. It is the software that controls the application seen on the TV screen e.g. how the Programme Schedule is represented, Teletext etc.
Proprietary interactive solutions exist such as OpenTV, Mediahighway and Liberate. OpenTV has widespread use on cable, satellite and is used by BSkyB and UPC. Mediahighway was originally used by Canal+ for VOD applications and is now owned by NDS and Liberate is used by NTL cable.
The most common DTT middleware products are MHEG and MHP. Ultimately, the ideal is the development of an international open standard that will work across any platform. The software application may be written only once and work on all digital delivery platforms e.g. satellite, DTT, cable.this has obvious advantages for consumers and consumer equipment, however currently there is no such standard.

MHEG
When DTT was launched in the U.K. in Nov 1998, the **Multimedia-Hypermedia** information coding **Experts Group (MHEG)** of ISO-IEC had delivered an open-standard international specification for interactive television presentation. It appeared as an ISO standard ISO 13522-5 and was part of the DAVIC standardisation work done in the preceding years. ISO defines a family of MHEG standards from MHEG-1 to MHEG-7 that allow multimedia data to be distributed across a variety of transmission platforms e.g DTT, cable, satellite. MHEG-5 is the current standard for the U.K. DTT services and enables low-resource STBs to be used, mainly from the cost point of view. Resources in this case refer to the processing power of the computer chip used in the STB and the capacities of memory chips employed for storage.

Being an international standard, it can be used by competing manufacturers of receiver equipment and was first used in the U.K. DTT market where more than 10 million units are now in use.

STBs with MHEG as the resident middleware can be produced at low cost and this approach has encouraged the proliferation of DTT in the UK. There have been a number of improvements (called profiles) made to the original software and the current version is known as MHEG-5.

MHEG-5 is software in the STB that interprets information delivered by the programme supplier or the network provider and presents it on screen as video, audio, text and graphics. Teletext is a well-known example of on-screen information containing text and graphics but, with MHEG-5, there are greater opportunities to present it with a more

pleasing appearance and with additional features. Rather than wait for the transmission to present the information the viewer requires, the information is built up in a 'circular' file called a carousel (known as Digital Storage Media Command and Control **DSM-CC**) from which data is drawn and can be updated rapidly on screen, as required.

MHEG-5 implements interactive TV applications such as:

- Electronic Programme Guide (EPG) i.e. presenting standard programme schedule information transmitted in the DTT system and allowing the user to tune to a chosen channel from the on-screen presentation. This allow the Broadcasters to provide a consistent EPG rather than rely on STB manufacturers implementations.
- Digital Teletext and Information Publishing
- Simple games involving the use of the remote control as the interactive mechanism with the television.
- Multi-view i.e providing a facility to switch between video streams running in the same multiplex e.g. different views of a tennis or football match. Similarly, MHEG-5 allows audio channels with different content to accompany a single video stream e.g. audio description channels, alternative language tracks etc.

MHEG-5 allows only one application to run at any one time. The launch of a new application therefore closes the preceding one. The current U.K. implementation does not offer a 'return-channel' via a telephone or broadband connection. True interactivity with a remote network server / Internet *cannot* be provided with this middleware.

MHEG-6 extends MHEG-5 by adding a JAVA API (a widely used form of programming language software) to perform data processing on the Service Information transmitted by the Broadcaster within the DTT signals for ease of on-screen presentation of Electronic Programme Guide **(EPG).** It also makes provision for a telephone return channel, allows CA modules to be used and an improved way of storing (or caching) relevant off-air information. It is backwards compatible with MHEG-5 and is used for supporting Common Interfaces for pay TV, particularly the Humax PVR920T. The current standard remains as MHEG-5 and there is little consumer pressure to demand interactive features that would need MHEG-6.

In Sept 2006, a new group, **IMPALA** (International MHEG Promotion Alliance) was launched at the International Broadcasting Convention in Amsterdam with the intention of promoting MHEG in Europe. The founder members are Strategy and Technology (S&T), Cabot Communications and EchoStar Europe who were also the primary companies behind MHEG at the start of the U.K. DTT.

A further significant development is the DTG announcement (Sept 2006) that a new working group has been set up to define and deliver a specification for a broadband return path for interactive television on the U.K.'s Freeview platform (www.dtg.org.U.K./news). This will allow content providers to offer viewers a new range of interactive applications including voting, games, chat-like services and home-shopping services.

New Zealand has decided to adopt the U.K.'s Freeview model for their proposed DTT platform to be launched in 2007. Strategy & Technology (S&T), the U.K.-based interactive TV specialist company has won an order from the New Zealand Freeview consortium of free-to-air broadcasters to build an end-to-end interactive solution. S&T was one of the original companies involved in developing MHEG for the launch of Freeview in the U.K.

EuroMHEG is intended as an extension of the U.K. MHEG-5 profile and extends the MHEG-5 specification particularly with regard to supporting on-line interactivity. This specification might be used to provide for a migration path to interactive services.

MHP

A consensus for the format of interactive applications such as EPG and Information Services was not being formed in the early years of digital television and it was realised that major fragmentation could take place in the market with no clearly defined standard being adopted. In response to this, the DVB Project developed a new specification for an open standard platform for interactivity and multimedia services. This is known as the DVB Multimedia Home Platform **(MHP).** It also targeted transmission over any DVB network but also included a wide variety of terminals including high- and low-end STBs, integrated digital TVs (iDTV) and multimedia PCs.

Three profiles are available in MHP:

- Enhanced Broadcast – where applications and data are delivered by the Broadcaster to enhance the viewing experience but where there is no return channel e.g. a telephone. It is local interactivity between the viewer and the television e.g. EPG and Information Services.
- Interactive Broadcast – where a telephone return channel is provided so that data can be bi-directional and interactivity has the traditional meaning for e-commerce or tele-voting. DVB has defined an optional content format called DVB-HTML for this and subsequent MHP profiles.
- Internet Access Profile – an improved version of the above which provides access to Internet services such as WWW and E-mail.

The first profile is similar to MHEG-5, does not offer a telephone return channel and allows local interactivity between viewer and screen only. It should be noted that the second and third profile, although available in European set top boxes is not being fully utilised.

At the moment, MHP seems to be the middleware favoured in European countries outside the UK. It is heavily supported by the EU, EBU and DVB, and is an EU recommended standard, particularly for countries commencing DTT operations in a 'green-field' scenario. However controversy over licence fees being demanded by patent holders for the use of this middleware has affected its development.

MHP Licensing Fees

MHP patent holders have formed a joint-licensing program and nominated Via Licensing, San Francisco, to act as the licensing administrator for the group. Patent holders include Comcast, OpenTV, Panasonic, Royal Philips Electronics, Samsung Electronics, Thomson and Time Warner Cable.

License fees will not be payable before 1st January, 2009 and a number of proposals for fee structures have been released in an attempt to reach agreement from the Broadcasters. The Information below has been taken from the Via Licensing Corporation website, www.vialicensing.com and was released in March 2006.

Licensing Fees for MHP		
Fee Type	**License Fee**	
Consumer Devices MHP services provided by subscription-based provider.	$2 per device $0.25 per subscriber (household) per year. Option: One-time five-year license for $1.25	
MHP services provided by free-to-air broadcasters that do not offer any for-fee services.	Total number of households within reach of MHP services (million) 0 to 0.1 0.1 to 2.5 2.5 to 5.0 5.0 to 7.5 above 7.5	Licensing fee for Broadcaster (originator of MHP service) per year. Free $25,000 $50,000 $75,000 $100,000
MHP services provided by free-to-air broadcasters that also offer any for-fee services (including but not limited to pay-per-view services)	Total number of households within reach of MHP services (million) 0 to 0.1 0.1 to 2.5 2.5 to 5.0 5.0 to 7.5 above 7.5	Licensing fee for Broadcaster (originator of MHP service) per year. Free $50,000 $100,000 $150,000 $200,000

Hardware implications for the STB

The hardware for an MHP STB requires more processing power than a basic MHEG STB. The table below provides information on the variation in requirements as the STB moves from a 'zapper' model to an interactive model. It was argued that the additional cost in providing the processor speeds and the memory costs were significantly greater than for the basic box but in the context of the widespread use of PCs and IT devices, the economies of scale must have had a significant impact on the hardware costs.

Platform	Processor (32-bit)	RAM	Flash / ROM
Basic Zapper.	30 MHz+	1-2 MB	1-2 MB
MHEG-5.	50 MHz+	4 MB	2 MB
Typical system e.g. OpenTV.	50 MHz+	4-8 MB	4 MB
MHP Enhanced Broadcast Profile.	80-130 MHz+	8-16 MB	8 MB
MHP Interactive Broadcast Profile.	80-130 MHz+	8-16 MB	8 MB
MHP Interactive Broadcast Profile + DVB-HTML.	150-200 MHz+	16-32 MB	16 MB
MHP Internet Access Profile.	150-200 MHz	16-32 MB	16 MB

Typical hardware requirements of MHP and other platforms.

Note: The figures above are published by Philips, Sony, Panasonic and Nokia.

Appendix A: Definitions

CANAL+
The France based Canal+ Technologies is an international provider of digital and interactive TV software solutions.

Conditional Access
Conditional Access systems restrict television program access to certain groups of users either because of concerns for privacy or the desire to collect revenue for the service. Providing conditional access requires secure encryption of the program content, secure decryption in a set-top-box for each viewer, and an embedded serial number that is registered in a central conditional access system database.

Digitag
DigiTAG aims to encourage and facilitate the introduction and implementation of digital terrestrial television services using the standards developed by Digital Video Broadcasting (DVB).

DAVIC.
DAVIC was a non-profit Association based in Switzerland, with a membership which culminated at 222 companies from more than 25 countries. It represented all sectors of the audio-visual industry: manufacturing (computer, consumer electronics and telecommunications equipment) and service (broadcasting, telecommunications and CATV), as well as a number of government agencies and research organisations.

Digital TV Group (DTG).
Formed in the mid 90s, originally to facilitate the introduction of digital terrestrial TV in the U.K., the group is the fulcrum of U.K. digital TV. The group is currently focused on digital switchover and the rich media services and products it will help enable. Emerging consumer devices and experiences include high definition TV, mobile TV, video-on-demand, broadband TV and TV metadata (see below).

DTT Receiver
This is the device that processes the incoming signal from the DTT transmitter and turns it into a format which can be displayed on the TV. It can take the form of a set top box or may be integrated into the TV itself.

The essential role of the DTT receiver is to receive, decode and decompress digital data to produce audio and video signals that can be displayed. It is a custom computer system whose processing power can vary considerably depending on the functionality and sophistication of the receiver.

All receivers use an Operating System to perform its basic functions. Some receivers offer a return path, via a telephone or broadband connection, to allow two-way communication or interaction. This generally requires a built in modem and is not a regular feature of most receivers currently on the market.

DTV
The general term for digital television.

DVB
A European consortia for the standardization and deployment of digital television via terrestrial broadcast and satellite.

Electronic Program Guide (EPG)
An electronic program guide allows the user to scan available channel offerings and tune to current programs by using their remote control to point to specific program listings.

ETSI.
The European Telecommunications Standards Institute (ETSI) is an independent, non-profit organization, whose mission is to produce telecommunications standards for today and for the future.

Interactive Television:
There are at least three levels:

1. Interactivity with the TV set via the remote control e.g. for channel surfing or Red Button for related alternative channel selection.
2. Interactivity with programme content e.g. audience response back to the show, comments, polling etc.
3. Interactivity with content related to what is on TV e.g requesting additional information on an advertised product, purchasing an advertised item etc.

Note: All levels beyond level 1 require a telephone or broadband return channel. The word 'interactivity' in this document refers to all levels beyond level 1.

Metadata.
Data about data. Metadata describes how and when and by whom a particular set of data was collected, and how the data is formatted. Metadata is essential for understanding information stored in data warehouses and has become increasingly important in XML-based Web applications.

MHEG
Multimedia and Hypermedia information coding Expert Group developed this ISO standard for multimedia scripting, display and user interaction. It is suggested as an alternative to HTML and Java for enhanced television.

MHP
Multimedia Home Platform (MHP) is a standard within the DVB for enhanced television. It defines a generic interface between interactive digital applications and the terminals on which those applications execute. It supports many kinds of applications including electronic program guides, information services, synchronous enhancements, e-commerce and secure transactions. It requires a Java run-time engine within the set-top-box, allowing complex applications to be developed.

Middleware
Middleware is a layer of software that runs on top of set top box operating systems (OS) creating a consistent environment to run application software over a wide variety of set top boxes.

MPEG
The Moving Picture Experts Group, a working group of ISO/IEC, has developed international standards for compressed digital video and audio. MPEG-1 provides resolution up to 1/4 of standard definition video, at bit rates up to roughly 1.5 Mbits/second. MPEG-2 provides a family of compression profiles and levels, including ones for High Definition Television. MPEG-4 provides an even higher range of resolution options, plus the ability to include image objects.

OCAP
OpenCable Application Platform is CableLabs middleware specification. CableLabs has selected Sun Microsystems, Liberate, and Microsoft as the primary software authors for OCAP. Going beyond the requirements of ATVEF, this specification includes key components of JavaTV.

OpenTV
A company providing middleware software for set-top boxes and back-end software to support set-top interactivity. They offer various generations of software for set-tops of varying capability. EN2 is the second generation version. OpenTV is a subsidiary of Liberty Broadband Interactive Television, Ltd.

Personal Video Recorder (PVR)
Devices that allow TV viewers to time shift, pause and fast forward (until real time) using hard-drive video storage. Systems like SONICblue's ReplayTV and TiVo also provide an electronic program guide to enable additional features tied to keywords and key programs in the TV schedule.

Set Top Box
An electronic device designed to be connected to a standard 82-channel television receiver to provide additional channels or enhanced capabilities.

VOD

Video On Demand (VOD) refers to a technology that makes it possible for consumers to control the start of a viewed program. For example, by remote control a consumer might pick from an on-screen list of movies and start and pause it at their convenience.