TNO Information and Communication Technology

TNO-report

33571

Digital broadcasting and standardisation in the Dutch cable market, state-of-affairs 2004

Brassersplein 2
P.O. Box 5050
2600 GB Delft
The Netherlands

www.tno.nl

T +31 (0)15 285 70 00
F +31 (0)15 285 70 57

Datum	February, 2005
Auteur(s)	Dr. A.G.D. Leurdijk Ir. ing. D. van Smirren Dr. Ir. R. Ait Yaiz drs. M. Poel with: dr. R. Hawkins & ir. A.H. van den Ende
Aantal pagina's	47
Aantal bijlagen	3

Table of Contents

1 Introduction

Compared to other European countries the penetration of digital television in The Netherlands is relatively low, with just over 10 percent of Dutch TV households receiving digital television in 2003. Of this 10 percent 84 percent receives digital television via satellite, 12 percent via cable and four percent via digital terrestrial television (see appendix A).

There are a number of reasons for the slow digitalisation of digital broadcasting in the Dutch market. One of the main reasons is the high penetration of cable television in The Netherlands. More than 90 percent of Dutch households is connected to cable and receives over 30 analogue TV and radio channels for a – compared to other European countries – moderate price[1]. This large offer of television channels makes it difficult for digital platform operators in the Dutch market to deliver added value to consumers, especially compared to for instance platform operators in the UK. In the UK the introduction of satellite and later digital terrestrial television meant a considerable improvement for those households that up till then could only receive four to six terrestrial analogue channels. By the end of 2004 more than 50 percent of UK television households had switched to digital reception. For Dutch households extra choice of channels is not a very big incentive for a switchover to digital TV because most households already have access to a large number of analogue channels. Digital satellite is therefore mainly attractive for households in remote areas without cable networks, such as rural areas and for households that wish to receive the large number of foreign channels, for instance Turkish and Moroccan households that watch channels from their former home countries through satellite. Digital terrestrial television is of interest in remote areas, such as camping sites and for its potential of mobile reception, but is increasingly also presented as a (cheaper) alternative for cable and satellite TV. At present digital terrestrial television is still only available in the west of The Netherlands.

The Dutch market for digital broadcasting is clearly still in its infancy, but like other European markets cable, satellite and terrestrial platform operators do compete with each other and 2004 showed a number of new market developments. Some of the main cable operators started offering their analogue subscribers free digital packages, which means that customers only need to acquire a set top box (STB) in order to receive digital television. The incumbent telecom provider KPN began a marketing campaign for digital terrestrial television (DVB-T) and a number of public and commercial broadcasters announced the introduction of new digital channels. To what extent these new offers will lead to a substantial growth in the number of digital households is not yet clear.

[1] In 2002 the average price for a standard package of 31 TV channels and 34 radio channels was €11,20. Since then prices have risen considerably. UPC for example has raised its price for a standard package to €15,59 and Essent and Casema have introduced a standard tariff of €14,95. Due to contractual agreements the cable companies have not yet been able to harmonise their tariffs in all municipalities.

Another potential reason for the slow take up of digital television of a more technological nature is that the equipment needed for digital and interactive television runs on a number of different, often proprietary, technological standards. This means that there is no universally available STB, based on open standards[2]. Open standards are generally seen as favourable, because they contribute to freedom of choice for consumers and an open market for information and service providers. A universal, open standard enables the production of universal STBs in different models that consumers can buy in the shop and on which they can receive all interactive services. This enables them to switch to a different platform operator without having to buy or rent a new STB. A universal open standard is also claimed to stimulate content production, as content producers do not need to adapt their content to different formats that can run on a variety of STBs, each with its own particular middleware. This saves time consuming and costly procedures. Finally, standardisation is profitable for consumer electronics manufacturers who can more easily achieve economies of scale. Nevertheless there are also a reasons why standardisation is or can not (yet) be accomplished, for instance because of the legacy of proprietary standards in the market or because a particular standard has not yet been fully developed or sufficiently tested.

This report will focus on the debate on (lack of) standardisation as one of the obstacles to a large-scale introduction of digital broadcasting in the Dutch market. A core question in the debate around standardisation is whether governments should mandate or promote open standards (e.g. MHP for interactive services).

By focussing on standardisation and interoperability issues, this report will not deal with all other explanations for the slow take up of digital television in the Dutch market, such as tariffs, copyright issues and switch-off policies. It will attempt to establish the relative weight of the standardisation issue and will briefly mention some of the other hindrances – as reported by stakeholders - but not deal with them in any depth. It will concentrate on developments in the cable sector as the dominant network for broadcasting in the Dutch market, but where relevant it will mention other network providers as competitors in the market that also affect developments concerning standardisation.

The European Commission has stated that all market players should aim for open standards, which guarantee interoperability (COM (2004)541). In Dutch policy documents concerning cable infrastructure and digitalisation the Dutch government has also stated that cable companies and other stakeholders should aim for an open standard for digital and interactive television. Up till now this has not yet been accomplished.

For this reason the Dutch Ministry of Economic Affairs has asked TNO to produce a quick scan of the current state of affairs concerning standardisation issues in the Dutch cable market and of different stakeholders' strategies. The report will provide technical and market data as well as arguments that aim to enable the government to determine future policies concerning standardisation.

[2] A technological (hard- or software) component is an open standard when it is approved by the appropriate standardisation organisations: European Committee for Standardisation (CEN), European Committee for Electrotechnical Standardisation (CENELEC) and European Standards Institute (ETSI). Open standards are published and available to everybody, subject to licencing and payment or royalties for use of intellectual property.

1.1 Research questions

The quick scan will attempt to answer the following questions

1. *How do market strategies of cable and other stakeholders affect developments concerning standardisation and interoperability?*

2. *For which parts of the digital platform are standardisation and interoperability lacking?*

3. *To what extent does a lack of standardisation and interoperability hinder the introduction of digital television in the (Dutch) market and what are other bottlenecks for digitalisation?*

4. *What are arguments in favour and against a (mandatory) open standard?*

5. *What policies could stimulate the introduction of open standards?*

1.2 Methodology

A combination of different methods was used to answer the main research questions:

Through desk research data were collected concerning general developments in the market, the debate on standardisation on a European level and in a number of leading European countries.

Information on the present situation in the Dutch market was gathered through desk research, face-to-face interviews, interviews by telephone and an email questionnaire (see Appendix B). In this way we collected information about the strategies and views on standardisation of the following stakeholders:

- The three main cable operators in the Dutch market (UPC, Casema, Essent), as well as other smaller cable companies that offer digital television (Cai Westland, Multikabel).
- Competing digital platform operators: satellite (CanalDigitaal) and digital terrestrial television operators (Digitenne, KPN)
- Public (NOS) and commercial broadcasters (RTL Nederland, SBS6 and MTV)
- Television producers (Endemol, Eyeworks)
- Consumer Association (Consumentenbond)
- Manufacturers (Panasonic, Samsung)
- Platform Interactieve Digitale Televisie

From two stakeholders we did not receive a timely response, so their views could not explicitly be taken into account. Because the report intends to provide a general overview of the state of affairs and because other sources were consulted as well, this has not led to major omissions.

Finally the analysis of the current market situation and a number of policy options were tested during a workshop with five senior TNO experts on digitalisation and standardisation issues.

1.3 Outline of report

In Chapter 2 the constituting parts of the digital platform and their functions are identified. Subsequently the importance of standardisation and interoperability and the way in which these concepts interrelate is explained. Chapter 2 also identifies the standards used at present (end 2004) in the Dutch market and the extent to which they enable interoperability with other providers of digital services. Also some of the main trends in European markets are signalled.
In chapter 3 we discuss the strategies of platform operators concerning the introduction of digital television and more in particular concerning standardisation and interoperability. This is complemented by different stakeholders' views on the introduction of open, non-proprietary standards (DVB-MHP). It deals not only with the views of platform operators, but also with those of other stakeholders such as broadcasters, consumer electronics manufacturers and the national consumer organisation.
Finally chapter 4 contains a discussion of policy options concerning the support of open standards and interoperability, the relative weight of standardisation issues in relation to other barriers for digitalisation as well as alternative policies that could stimulate the market for digital television. Chapter 5 provides a management summary with the main conclusions and policy options.

2 Components and standards of Digital Television Platforms

2.1 Introduction

This chapter presents an overview of the technological components of digital television platforms. In particular, it will focus on the parts that are essential for content providers to deliver their content to consumers. It will discuss the level of standardisation and interoperability that is currently available in the market. It will focus on the technological dimensions and not deal with regulatory or commercial issues concerning interoperability and standardisation.

In the days of analogue television, interoperability meant a single technology using a single network and a universal receiver able to receive all national terrestrial broadcasts. Today's digital environment is much more complicated as it consists of a host of different technologies in networks, devices and services. The easiest way of achieving full interoperability of networks, devices and services is to secure that constituting elements are all be based on the same hardware, middleware and software standards. All components would then be able to communicate with each other and consumers would be able to receive all available services in the same way through all networks and on all devices. This is realised for some components of digital platforms, in particular those which are technologically fully developed and which all market players have agreed to adopt. However, due to continuous technological innovations and commercial interests this is not the case for all components of digital platforms. This chapter identifies in which parts of the TV chain standardisation issues arise.

To start with we will first look in paragraph 2.2 at the digital TV chain. In paragraphs 2.3-2.10 we will distinguish the domains and interfaces in which standardisation and interoperability issues can arise and analyse the relation between interoperability and standardisation.

2.2 The digital TV chain

Digital television has a number of advantages over analogue TV. By using digital techniques, the description and transport of these signals is much more efficient. Within the transmission bandwidth needed to transport a single analogue TV channel, five digital TV channels can be transmitted.
It is also much easier to protect the content by encrypting the signal. In that way, only authorised consumers can view the particular content. As the standard analogue TV sets cannot handle digital TV signals, a STB has to be used to convert the digital TV signals into an analogue signal.

Figure 2.1 shows an overview of the different domains and players in a digital TV chain.

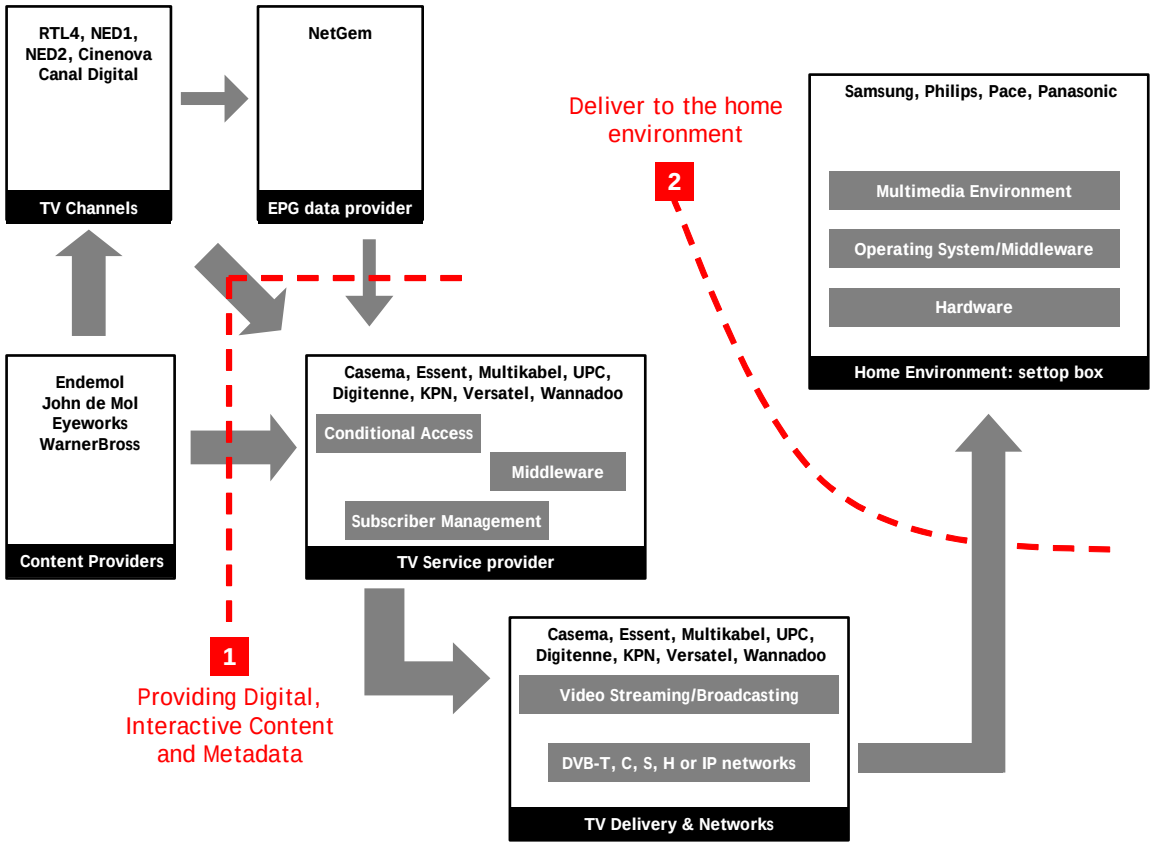


Figure 2.1: Relational overview of the TV chain

Three main domains can be distinguished:
- the domain of the (interactive) content / programme and metadata (EPG) providers;
- the domain of the service and delivery network provider;
- the home domain with the in-home equipment (STBs).

The upper left part of the figure shows the content and media services that are produced. These can be traditional TV programmes, but also interactive programmes or content intended for reception on a mobile device, e.g. a UMTS mobile phone. The classical broadcast chain takes care of bundling TV channels and other content into a digital stream that reaches the consumer. In the middle of the figure are network providers that are responsible for delivering content over networks to end users and providers of relates services such as conditional access or subscriber management services. These roles can be (and often are) performed by the same players. In the home domain consumers need a decoder or set-top box (STB) to extract TV channels from this stream and to view them on a television device. The same STB can also have a connection to a return channel, which enables interaction between consumers and for instance content providers. The return channel can be an in-built return channel that uses the same network as used for delivery of the content, but it can also be a different and separate network.

Standardisation and interoperability issues can arise in each of the domains, for different components of the digital TV platform and between different players in the digital TV chain, with varying implications. Standardisation and interoperability issues arise for instance between content providers and network operators in case content providers want to deliver interactive programmes to viewers. Having one, open standard

for delivering interactive programmes and determining which subscribers are entitled to receive the programmes would be easy, but it is not a prerequisite for interoperability between content providers and network operators. Interoperability can in these cases also be realised by other means. Instead of full interoperability by using one technology or standard, proxies can be used such as integrating different technologies into one product (e.g. different CASs in one STB) or simulcasting in different standards to different receiver populations.
For manufacturers standardisation is favourable in order to accomplish economies of scale and lower prices for consumers by producing STBs according to one standard for all relevant components. For consumers it can be favourable to be able to be able to buy a STB in the shop that fits to all digital delivery networks and is open to receive programmes and services from all content providers. But there can be (sound) reasons for other outcomes given the state of technological developments or stakeholders' commercial strategies.

2.3 Components of the digital platform

A digital television platform can be seen as a distributed system, i.e., its components can be found at the provider, at the consumer's home, and in the transport network. Together these components take care of sending digital TV (provider), transporting it to the consumer (network), and viewing it on a TV set (consumer).

A digital television platform can also be seen as a system consisting of a number of interconnected and intercommunicating layers. Figure 2.2 shows the general architecture of a digital platform.

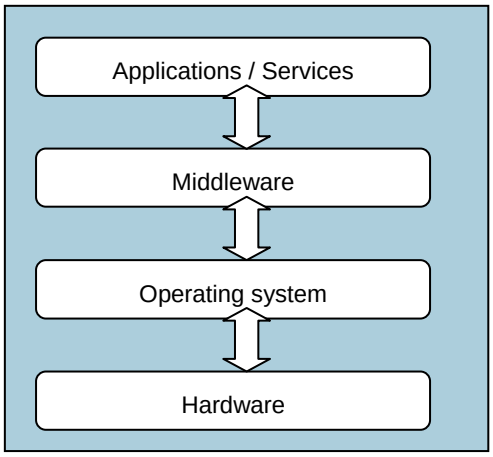


Figure 2.2: Architecture of a digital platform

These layers are situated in the consumer's STB as well as in the provider's systems.

The hardware is the operational computing and physical part of the platform. Two software layers are situated on top of the hardware. The operating system (OS) provides the hardware with basic intelligence. The operating systems running in the set-top boxes and in the head-end at the provider are known as 'Embedded operating systems'. They are optimised for specialised hardware (e.g., set-top box hardware), or for a specific application. Examples of operating systems that are being used in the Netherlands are VxWorks, MS CE.NET and pSOS. The second software layer is the middleware, which

facilitates services and applications by providing a standard (software) platform on top of the operating system. The middleware provides applications on different hardware systems with identical environments/interfaces. Consequently, application developers do not have to take product-specific implementations into account.

The applications/services layer provides a service for the user of the platform. In case of a user, these services can be interactive television services. In case of a cable operator, these services can be, for instance, control and management applications. In the digital platform, different functionalities can be distinguished. On the lowest level, the distribution of the digital signal takes place, i.e. the transmission at the providers' side, multiplexing in the intermediate network, and reception and de-multiplexing at the consumers' side.

On top of the hardware, the Conditional Access System is situated in the set-top box, and the Subscriber Management System (SMS) is located at the provider.
Besides television signals, the digital stream of data can also distribute other information such as the Electronic Programme Guide (EPG), which is facilitated by the operating system or by the middleware. The distribution of complex (interactive) services or applications requires additional functionality that can be provided by the middleware, both in the set-top box and at the provider side.

At the lowest level there are no standardisation issues as all distributors and all hardware (STBs digital TV receivers) use the DVB standard. Standardisation issues do arise at the level of the Conditional Access System and at the level of interactive applications. Each of these components will be discussed in the following paragraphs.

2.4 Distribution

The basis of the digital broadcast chain (in Europe) is standardised by DVB. Satellite receivers, cable receivers, and terrestrial receivers all make use of this set of standards. On the distribution level there are no standardisation or interoperability problems, as all network operators use the DVB standard. There are differences in the compression rates, composition of packages and the way in which channels are mixed within a multiplex for each digital platform. Different companies carry out this process for each of the platforms (cable, satellite, terrestrial). These differences however do not form an obstacle for broadcasters to provide digital channels to different platforms.

2.5 Conditional Access System (CAS)

Digital distribution of programmes implies that everyone with the right devices (e.g., a STB) can receive this digital stream. In order to be able to let users view content based on their subscription, a Conditional Access System (CAS) is added to the basic digital television platform. A CAS makes it possible to restrict access to content to authorised users. For example consumers that have subscribed to channels or bouquets, but also Pay-per-View services which offer viewers the possibility to order individual programmes and obtain the rights to view these programmes.
By means of encrypting the signal, the CAS prevents non-authorised users from accessing the programmes and services transmitted by the provider. When a user subscribes to a service, this user receives a smartcard that should be inserted in the set-top box. This smartcard contains the information needed to decrypt the encrypted signal, making it possible for the user to view the programmes.

While DVB defines the way in which distributors transport their TV signals, this set of standards leaves the possibility for distributors to add a Conditional Access System (CAS). This means that distributors can select an encryption technology of their own choice for protecting their content. When a CAS is used, the STBs of subscribers should contain the technology that can decrypt the content. Platform owners' freedom in selecting an encryption technology seems to imply that these STBs are proprietary. However, this is avoided by strictly separating the conditional access functionality of STBs from their remaining functionality. The part of the STB handling the conditional access is referred to a Conditional Access Module (CAM). These modules can be realised as a PCMCIA module, or as built-in modules in case of widespread CAMs.

In case multiple CASs of different providers are needed in a STB, there are three possibilities to handle the conditional access:

1. The service providers use the same CAS technology. In that case, it suffices to use different smartcards to view programmes of different providers.
2. The service providers use Simulcrypt. In this case, the keys needed to decrypt the MPEG-2 stream are encrypted using different encryption algorithms (e.g., Irdeto and MediaGuard) and transmitted in parallel to the consumer. The CAS in the set-top box decrypts the corresponding keys, which can then be used to decrypt the MPEG-2 stream. The set-top box needs to support at least one of the parallel used CASs. Compared to STBs, which only support one proprietary CAS, this increases consumers' choice of service providers, but it still may cause a 'lock-in' for the consumer.
3. The STB contains a common interface (CI), which is the interface between the STB and the CAS module. A common interface makes it possible to use different CAS technologies on the same STB. In that case, the consumer can acquire the required PCMCIA Conditional Access Module (CAM). The smartcard is then inserted in the CAM, which in its turn is inserted in the STB. From a consumer's point of view, the CI-option is more expensive, but also provides more flexibility regarding the choice of CASs and thus to the choice of service and content providers.

2.5.1 Subscriber Authorisation System

The Subscriber Authorisation System (SAS) is part of the CAS and gives authorisation to individual subscribers or groups of subscribers in order to receive information from the provider. This is done by publishing authorisation keys to these subscribers. The authorisation keys are encrypted and transported in the Entitlement Management Messages (EMM) or in Entitlement Control Messages (ECM).

2.5.2 Subscriber Management System

The Subscriber Management System (SMS) is a system with which a provider can manage subscribers' data. The SAS and SMS communicate with each other in order to identify which subscribers are granted which rights. The SMS provides an interface that enables communication with the SAS. Although necessary for the CAS, the SMS is not a part of the CAS. Moreover, multiple CASs can work with a single SMS, and multiple SMSs can work with a single CAS.

The SMS and SAS in co-operation with the CAS, manage the authorisation of consumers' access to content. Pay-TV operators or other third parties can also provide their own CAS. However, this requires the STB to support multiple CASs, which is only the case if the STB has a 'Common Interface' (multicrypt). For third parties to manage and control subscriber data it is not essential to run their own CAS. Provided

that a standardised interface is used, third parties can organise their own SMS and link it with the operator's CAS.

2.6 Middleware, Application Programming Interface (API), and interactive services

The distribution of more complex (interactive) services such as Electronic Programme Guides or possibilities to play along in TV games by 'pushing the red button' on the TV screen requires additional functionality in the form of middleware, both in the STB as well as at the side of the provider. Middleware provides the higher layers with an abstraction of the lower layers. As a result, applications and services do not have to address the hardware directly by means of drivers. Instead, applications can make use of an Application Programming Interface (API). This simplifies the design process for application designers.

Middleware provides, for instance, the following functionalities:

- *Execution engine* (VM) with an API for applications and platform services. The execution engine makes it possible to execute software applications in a standardised and uniform environment.
- *Presentation engine* for html/JavaScript applications. Similar to the functionality of a web browser, the presentation engine takes care of the graphical presentation of the application on the screen. The presentation engine only applies to 'light' applications that are written in a presentation language (html), or in a script language (JavaScript).
- *High-level controls* for controlling, amongst other things, the graphical audio hardware.

The API exists of a set of high-level functions, data structures, and protocols. It is a reference for application developers. Some of the functions APIs perform are:

- Starting other applications;
- Uploading content to the memory;
- Navigation over the screen and selection, i.e. control functions for the user interface;
- Communication and input/output control with peripheral devices.

Many current middleware solutions consist of a proprietary virtual machine and API.
There is little compatibility between applications for different STBs as the different middleware solutions use different APIs. But the use of a standardised API is in itself insufficient for achieving interoperability. As middleware is often configured for the hardware and operating system the STB is running on, the use of the same API does not have the same effect on each type of middleware.
In order to avoid middleware 'lock-in' for the application/service provider, efforts are being made on further standardisation of digital television, for instance the DVB Multimedia Home Platform (DVB-MHP). DVB-MHP is an extension of the basic DVB platform. DVB came up with specifications regarding the Multimedia Home Platform (MHP). MHP is a set of rules for an open middleware solution with an open API that is based on SUN's Java VM and HTML. DVB-MHP makes it possible to send interactive applications over the broadcast platform that can be run on STBs.
Although many industrial parties support standardisation of DVB-MHP, its use is not mandatory. Consequently, these industrial players also introduce (partly) proprietary systems for interactive platforms, decreasing the compatibility of their STBs.

However the requirement from content producers to have a clear “interface” to the TV service provider does not imply that all components in the chain need to comply with a specific standard (e.g. MHP). This means for instance that the Open TV platform accepts DVB-MHP applications as input, although the boxes that are used with this platform are not always MHP compliant.

A distinction can be made between ‘local interactivity’, which is concerned with (standards for) applications that are send to the STB in the broadcast stream and provide interactive experiences for viewers, for instance playing along in quizzes and interactivity that requires a return cannel. In case of providing applications on the STB that enable, for instance, pay-per-view or other interactions with content providers (e.g. show the results of opinion polls among viewers as a graph bar in the TV screen), a standardised way to send reactions from viewers back to the content provider and to process them is required. Figure 2.3 shows the functional diagram of interactive services via the set-top box.

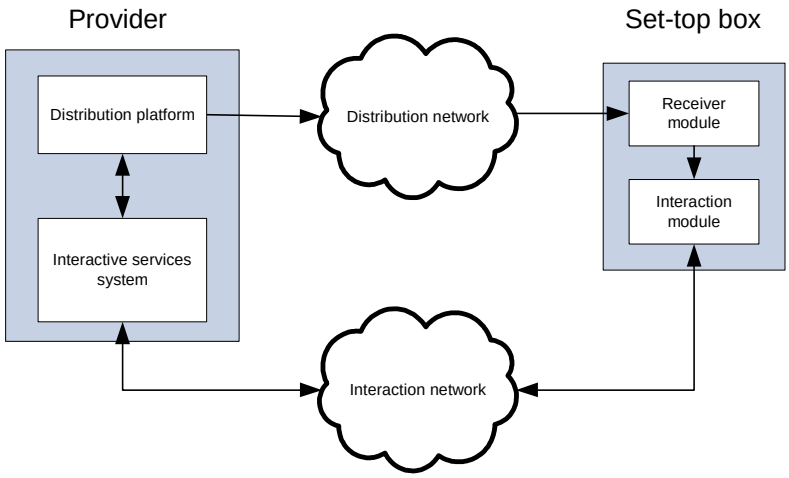


Figure 2.3: Functional diagram of interactive services via the set-top box

The STB is not necessarily involved in the interaction network. Alternatively, the subscriber can interact with the provider through, for instance, POTS (telephony network) or a mobile network.

In order to be able to set up an interaction network between the subscriber and the provider, additional functionality is required at the provider’s side. An interactive service platform is needed to process the messages and to manage the distribution platform.

The SMS in the distribution platform registers requests for content. When granted, the requested content will be inserted in the digital transport stream to the consumer. Moreover, the interactive service platform will also have to communicate with content providers in order to retrieve the requested content and to provide billing information to the customer.

DVB has specified the interaction channel (IC) – part of the DVB-MHP standard - for interaction purposes between the provider and the subscriber. The interaction channel consists of a ‘Forward Interaction Path’ (FIP) and ‘Return Interaction Path’ (RIP). The RIP follows the interaction channel of the interaction network from the subscriber to the

provider. The FIP is the path from the provider to the consumer, and can follow the interaction channel in the interaction network, or the distribution channel in the distribution network. The advantage of the former option is that it creates a ‘one-to-one’ communication channel between the provider and the subscriber.

Providing access for third parties to such a network requires the platform operator to provide access to the data carousel, and to correctly handle the return traffic that comes back through other channels or infrastructures. The use of the Internet as an interaction network increases the technical accessibility of STBs for third parties that provide interactive services. Potentially, this type of access can be an issue if the platform operators own the set-top box.

2.7 Electronic Programme Guide

An important service offered by most platform operators, as part of their digital packages is the Electronic Programme Guide (EPG). EPGs can provide:

- A programme guide providing a list of available programme titles, in combination with information about date and time of broadcasting. Programmes can be sorted and ranked in a number of ways, e.g. thematically or by channel.
- A list of all channels available to the user.
- A list of programme reservations together with reminders.
- The means for parental locks. Parents can lock channels depending on their rating.
- The means to receive short messages from the TV platform operator.
- The means to acquire viewing rights based on pay-per-view.
- The means to view content in the selected preferred language.

The layout of the EPG can be determined by the STB manufacturer or by a third party. In the first case, the EPG is often simple, and part of the operating system of the STB. The box has an EPG application with a user interface that is designed by the manufacturer. The service provider only delivers the content and EPG data that are needed. In the latter case, the EPG is an application that runs on the middleware in the STB, and has more (complex) functions. The STB manufacturer provides an ‘open’ STB and the service provider delivers both data and applications, and is thereby in control of the interface.

Because of its commercial importance all market players seek to have influence on their position on the EPG and on the EPG’s layout and ‘look-and-feel’. Having more than one EPG on a digital platform from which users can choose is also an option. This option requires standardisation, a particular configuration of middleware in STBs and sufficient hard disk capacity in the STB. According to platform operators this would be a complex and costly option.

2.8 Other components of set-top boxes

Optionally, a STB may contain components other than the ones described in the previous sections. Examples of these optional components are:

- *Connections to a PC*, which makes it easier to update the software of the STB, and to edit the program list. Often, this connection is a RS-232 connection, and

sometimes STBs have an Ethernet connection. The latter makes it possible to directly connect the STB to the Internet.

- *Modem*, which makes it possible to directly connect the STB to the Internet through cable. The modem can be used to update the firmware of the STB, but also to provide a return channel to the consumer. In Europe and in the Netherlands, the cable modem follows the EuroDOCSIS standard.
- *DVD recorder*, which makes is possible to record content on a DVD. The main difference with a separate DVD recorder is that the recorder can now co-operate with the EPG in planning the recordings.
- *Hard disk*, which provides the same capabilities as a DVD recorder, except that content is now recorded on the hard disk. An optional Ethernet connection to the PC makes it possible to transfer the recorded content to the PC in order to view it with the PC, or to store it somewhere else (e.g. on DVD).
- *Multiple tuners*, in order to receive multiple channels with a single STB. This makes it possible to view different channels on different TV sets, or to record another channel than the one that is being viewed.

There are a number of other developments that might influence debates on standardisation issues in relation to digital broadcast platforms. One of these developments is the introduction of Personal Video Recorders (PVR). PVR allow consumers to digitally record programmes and other content from their STB or PC on a hard disk. Using a PVR makes it easier to programme, view and exchange content over broadband networks. Furthermore, a PVR makes it possible to compile personalised TV evenings by selecting programmes from the Electronic Programme Guide. Standardisation of PVRs takes place within the TV Anytime forum. At the moment the integration of the first versions of TV Anytime standards with those for interactive television is studied within DVB-MHP.
Other developments have to do with increasing convergence between PC and TV platforms There is a growing awareness that besides next to STBs, multimedia PCs at home gain importance as receivers of digital broadcasts and other services, because they are increasingly connected to broadband networks (cable, xDSL, fibre). As multimedia PCs can often be connected to a TV set, content downloaded on the PC can be viewed on for instance the TV in the living room. It should be noted that such scenarios will not spread rapidly as in-home infrastructures that comprise multiple devices are still very complex (i.e. too complex for average consumers).

Developments are also taking place in the area of mobile reception. TV content can be delivered using terrestrial broadcast networks like DVB-T (Digitenne and KPN in the Netherlands), and although less frequently, even through mobile networks like GPRS and UMTS. The DVB-T concept makes it possible to receive TV content on moving devices, e.g., the TV on the back seat of a car, or at places where reception of TV content over satellite or cable is not possible and/or desired.

2.9 Current standards for digital platforms in Dutch market

As can be concluded from the previous paragraphs standardisation and interoperability issues can be related to a number of elements of the digital platform. In this section the standards used in the Dutch market and the level of interoperability will be discussed[3].

[3] Data are from December 2004

2.9.1 Transmission and reception of digital signals

On the distribution level, there are no standardisation or interoperability issues, as all the platform operators use the DVB standard. The cable operators use the cable variant (DVB-C), CanalDigitaal uses the satellite variant (DVB-S), and Digitenne and "KPN Digitale Televisie" use the terrestrial variant (DVB-T).

2.9.2 Conditional Access System (CAS)

Interoperability issues may arise on the level of Conditional Access Systems as the platform operators in the Netherlands use different technologies. For instance, the cable operators in the Netherlands (will) use Irdeto, MediaCipher, Nagra, PowerKey, and/or Viaccess for their CASs. These technologies are not interoperable, meaning that a STB supporting one these CAS technologies cannot be used if the platform operator uses another CAS technology.

As mentioned in paragraph 2.5, one of the solutions for accomplishing interoperability is the use of Simulcrypt. This is for instance used by CanalDigitaal that uses both Irdeto and MediaGuard for its CAS in order to remain compatible with older STBs. Negotiations are also taking place between the different cable operators in order to support multiple CAS technologies on a Simulcrypt-basis.

2.9.3 Subscriber Management System (SMS)

The digital television platform operators in The Netherlands use different Subscriber Management Systems, e.g., Sigma Systems, Redback Networks, and Convergys, but this has little or no consequences for customers.

2.9.4 Middleware and Application Programming Interface (API)

The STBs that subscribers to cable companies' (Essent, Casema, CAI Westland and Multikabel) digital packages can buy in the shops are simple models without middleware.

The digital television operators in The Netherlands that offer (or offered) STBs with middleware use proprietary middleware, for instance OpenTV, Liberate, MediaHighway, and EuroMHEG. These middleware solutions are not interoperable; meaning that applications designed for one of these middleware solutions cannot be run on other ones.

In The Netherlands, UPC is considering a migration to OpenTV, which is MHP-compliant middleware. This compliance implies that all MHP applications can run on STBs with OpenTV middleware. Contrary to MHP, Open TV is a proprietary technology, which means that its development and its licence conditions are not necessarily open and transparent.

Electronic Programme Guide (EPG)

Currently, EPGs are based on the Event Information Table (EIT) of the DVB Service Information (DVB-SI), while their layout is determined by the operating system of the STB[4]. As this is the model used by all Dutch platform operators, no interoperability issues arise on this level. This might change when platform operators want to offer more complex EPGs for which middleware is required, and if broadcasters or other third parties wish to offer their own EPGs on customers' STBs via operators' digital platforms.

[4] Next to DVB-EIT, CanalDigitaal also uses the MediaHighway middleware for their EPG

Connection to PC, cable modem, DSL modem
There are different solutions for the connection of STBs to PCs in the Dutch market, i.e., RS-232 and USB. Sometimes, an Ethernet connection is also available. No standardisation issues arise with respect to PC-connections as all PCs have at least RS-232 and/or USB connections. Moreover, modern PCs often also have an Ethernet connection.

The only type of modem used in STBs in The Netherlands is the cable modem. This modem follows the European EuroDOCSIS standard. As long as all cable operators use this standard, no interoperability issue will arise on this level.

Figure 2.4 shows, for the main operators of digital platforms in The Netherlands, which standards and/or technologies they use for each of the constituting parts of the digital platform.

	Distribution	CAS	SMS	Middleware	EPG	Modem
Essent Kabelcom	DVB-C	Irdeto	Wizard	none[5]	DVB-SI / EIT	none
Casema	DVB-C	Irdeto[6]	Wizard	none[7]	DVB-SI / EIT	none
Multikabel	DVB-C	Irdeto			DVB-SI / EIT	none
UPC	DVB-C	MediaCipher[8]		Liberate[9]	DVB-SI / EIT	EuroDOCSIS
CAI Westland	DVB-C	PowerKey	Redback Networks	none	DVB-SI / EIT	none
CanalDigitaal	DVB-S	Irdeto MediaGuard	Entriq Integrated Business System	MediaHighway	DVB-SI / EIT MediaHighway	none
Digitenne KPN TV	DVB-T	Conax	Convergys	EuroMHEG		none

Figure 2.4: Technologies used for digital TV platforms in The Netherlands

2.10 Status of MHP developments in other European markets

In this section, the most important developments in Europe regarding the introduction of MHP are highlighted[10].

Belgium
In 2002, the Flemish broadcaster VRT performed an Interactive Broadcast trial. Building on the knowledge gained from this trial, a consortium consisting of "Vlaanderen Interactief", the Flemish government's e-government project, and various

[5] Earlier models dating from the first launch of digital TV by cable operator Essent contained proprietary middleware.
[6] Casema has used Viaccess for the CAS in the past.
[7] See footnote 4: ibidem.
[8] UPC intends to migrate to Nagra for its CAS.
[9] UPC intends to migrate to OpenTV for its middleware.
[10] The information presented here is mainly extracted from the September 2004 update of www.mhp.org. Data on the UK are collected from broadcasters' and platformoperators websites.

research centres examined how a democratic interactive digital television (IDTV) platform could be adopted on a massive scale by the Flemish population.

Currently the VRT is co-operating with the Flemish cable operators in an MHP trial. VRT provides interactive services such as MHP-enhanced teletext, whereas the cable operators complement this offer with an MHP-based EPG, video-on-demand (VoD), and communication services such as email and chat.

Germany
Interactive digital television using MHP is well established in Germany, as a number of broadcasters including ARD, ZDF, and RTL all base their interactive services on MHP. Among the interactive services created by the broadcasters were services related to the coverage of major sports events such as the Tour de France and Euro 2004.

Italy
The Italian government has made a subsidy available to ensure the supply of 900.000 MHP-enable STBs. At the end of the third quarter of 2004, approximately 385.000 MHP-enabled boxes where active in Italy.
Currently, various trials on interactive television are taking place, including one trial in 4000 households using GPRS and ADSL as return channels.

Spain
In the beginning of 2002, leading manufacturers and broadcasters signed an agreement for the implementation of MHP. By the end of 2003, Catalunya did a small trial on digital terrestrial television with MHP interactive services. After this trial Catalunya launched, in July 2004, free to air services in north-east Spain, enabling 170.000 homes to receive Catalunya's four digital channels as well as an interactive MHP data service channel. The MHP interactive applications that are offered include an EPG, weather forecasts and interactive advertising.

Sweden
In October 2002 the Swedish public service broadcaster SVT signed the NorDig[11] migration plan, which aims at migration to a common API for the whole Nordic region. SVT has taken a next step in the NorDig migration plan by launching a new platform based on MHP early 2004.

United Kingdom
More than 55 per cent (13.7 million) of the households in the UK receive digital television, either by satellite (DVB-S), via terrestrial television (DVB-T) or by cable (DVB-C). With this high penetration, digital TV platform operators are working towards the switch-off of analogue television, which is planned to take place no later than 2010.
The digital platform operators in the UK already provide interactivity. A variety of standards is used; satellite operators use OpenTV and DVB-T operators use MHEG-5. This diversity in middleware/API is disadvantageous for the content producers and/or content providers, as they have to redesign their interactive applications for each target middleware. As a work-around, different solutions have been developed that can be used for the design of interactive applications and for their automatic translation to the target middleware. Examples of these solutions are BBC's Data Model / Publication

[11] NorDig is cooperative organisation that consists of Nordic broadcasters and telecom operators.

Engine, Chello Mistral, and Launchalot's LOIS. The disadvantage of these solutions is that they slow down the convergence of the different middleware platforms to a set of interoperable middleware platforms.

2.11 Conclusions

Most components of distributing digital television and STBs are sufficiently standardised. UPC, Casema, Essent, Multikabel, Digitenne, KPN Digitale Televisie and CanalDigitaal all use DVB for distribution of digital TV.

Standardisation issues do arise on other levels of the digital platform, notably CAS and middleware, with varying implications. On the level of the CAS, which determines to which services subscribers are entitled, different systems are used. Currently the main cable companies, except UPC, are discussing the possibility of using Simulcrypt.

On the level of middleware there is no common standard. Apart from UPC no cable operator currently offers interactive services. The use of interoperable implementations of a common open standard for interactive services by all parties in the digital TV chain would ensure that all customers can receive the same interactive services. However, the use of interoperable implementations of a single open standard is not the only way of making interactive services available for all consumers. For instance, content converters can be used that convert applications and services designed for one middleware platform to another one. Furthermore, some proprietary middleware solutions are MHP compliant, making it possible to process both interactive content produced for the proprietary middleware as well as interactive content produced for MHP. These solutions might however be more costly than a single, open and non-proprietary standard.

3 Stakeholders views on standardisation

3.1 Introduction

Stakeholders' views on the importance of standardisation are closely related to their role in the digital value chain and to their digitalisation strategies. The EC report on standardisation reported that broadcasters and consumer organisations favoured – mandatory – open standards, whereas especially platform operators with a legacy of proprietary standards were more in favour of having the market determine the outcome of standardisation processes (European Commission, COM (2004) 541 final). In this chapter we will look at Dutch stakeholders' strategies concerning the introduction of digital television and their views on standardisation and interoperability

Digital platform operators but also most other stakeholders in the Dutch market consider the launch of new digital channels as the first phase in a gradual rollout of digital television in the Netherlands. Combined with other features such as better quality of sound and image on HDTV, LCD and plasma screens, these are expected to attract more consumers to digital television. Instead of offering a complex and extensive set of new and interactive services most digital platform operators now consider a simple offer consisting of a large and relatively cheap digital package and a simple plug-and-play STB as the best way to market digital television.

Increasing viewers' control over when they want to view programmes and adapting programme offers to personal profiles by means of EPGs and Personal Video Recorders (PVR) are considered as a second phase in marketing digital broadcasting. EPGs are seen as an important instrument to inform viewers and guide them through a growing number of digital programmes and channels. STBs currently available in the Dutch market only support simple EPGs with no or very few interactive functionalities. Most stakeholders claim that EPGs, first the simple ones and later more complex ones, will definitely be used and valued by consumers. Especially when viewers can use the EPG to record television programmes on STBs with hard disk capacity or PVRs.

Interactive applications are considered as a third phase in the market proposition of digital television. At present there still is a lot of uncertainty as to a) whether viewers value interactivity b) whether there are sound business models for digital channels and interactive services, especially as long as only few households posses STBs that support interactivity and c) which standards for interactive broadcasting will become dominant.

All stakeholders agree that standardisation and interoperability are important in developing a market for digital and interactive television. Standardisation enables large-scale production of STBs by manufacturers and large-scale production in its turn will lower STB prices and make them more attractive for consumers. At the same time it will become easier for platform operators to invest in STBs and for producers and broadcasters to invest in interactive content. It would also enable a retail model in which consumers can buy STBs in consumer electronics shops.

Different stakeholders however hold different views on the way to accomplish standardisation and interoperability.

3.2 Cable operators (DVB-C)

Cable operators deliver content from broadcasters and other service providers through their networks to end customers, both consumers and businesses. They also offer services like Internet access, telephony and they sometimes own and distribute their own TV channels. Cable operators in The Netherlands already offer digital services and their networks are largely ready for digital distribution. The three main cable companies Essent, UPC and Casema and the smaller Multikabel and Cai Westland all offer a number of digital packages and some extra services. Their marketing strategies vary.

3.2.1 Different strategies

After a largely failed first introduction of digital packages in 2000/2001 cable company Essent relaunched digital broadcasting in 2003 and Casema in 2004.
In 2003 Essent introduced a digital package containing a large number of digital channels for a relatively low price in combination with a simple STB that customers can buy in the shop[12]. Casema introduced a similar offer late 2004 but in a different form that was subsequently copied by Essent. Both cable operators now offer all customers the digital version of all analogue channels in the standard package (approximately 35 television channels and 30 radio channels), for no extra costs, apart from the costs they already pay for the cable connection in combination with the analogue standard package (approximately €15 per month). On top of this basic tier, customers can subscribe to an extra package of TV and music channels for approximately €8,- per month and a number of premium channels for different prices. In order to finance this stimulus to a switchover from analogue to digital, the cable companies introduced a general rise in their subscription fees. In this way all customers, both analogue and digital, contribute to the switchover costs.
The strategy of both cable companies is based on the philosophy that consumers value simplicity and comfort and are not prepared to spend a lot of extra money on digital television. This implies a choice for a simple, 'plug-n-play' STB that consumers can use immediately, without having to learn and master complex hardware and software. It also means that these cable companies have opted for a STB that is not suitable for interactive services. The models currently available in the shops and fit to receive the digital packages offered by Essent and Casema only provide a simple EPG. By the end of 2004 Essent had almost 40.000 subscribers and Casema approximately 24.000.

CAI Westland's digital offers is called CAIWAY DTV and consists of a basic package of 45 digital channels and an EPG or a premium package with another 45 channels extra and a discount on the STB. CAI Westland does not offer interactive services either. Consumers buy a STB in the shop. CAI Westland has approximately 1000 digital customers (of ca 80.000 in total).

With this strategy the cable operators hope to increase the number of subscribers by appealing to different viewer tastes simultaneously: those who appreciate better image and sound quality but do not necessarily wish an extra choice of channels and those who are also or mainly interested in the extra choice of digital channels.

[12] The new offer seemed to attract more consumers and led to a faster growth of customers than earlier attempts at the introduction of digital televsion. Essent's intended growth rate was not fully realised however, partly due to problems in the production of STBs which slowed down the pace in which households could be connected.

The introduction of digital packages is seen as a first phase in the switch over to digital reception. A second phase that cable operators identify is the introduction of Personal Video Recorders (PVR) and similar systems in combination with Electronic Programme Guides. The introduction of interactivity is only seen as a third phase.
Essent and Casema expect that a successful introduction of interactive services will still be some years ahead. This is partly due to the relatively late and slow introduction of digital television in the Dutch market, but also to a more general lack of enthusiasm for interactive television from viewers. They ended earlier VOD services and do no longer invest in interactive services. Combinations of television and SMS messages currently provide simple forms of interactivity. For the near future these cable operators see chances for interactivity provided via IP-based platforms, i.e. via combinations of computers and TV sets. Especially now more and more consumers have wireless routers and PCs, which are constantly connected to the Internet. This makes it possible to have a computer and modem in one room, for instance the study, and watch television in the living room, without the nuisance of having to hear the sound of the PC or having to switch it on before being able to watch TV.

The only cable operator that currently provides interactive services is UPC. UPC's digital offer consists of:

- a standard package of approximately 60 channels
- EPG
- My service (subtitling in different languages, channel lock, email etc.)
- Interactive (extended Teletext service)
- NVOD (approx. €3 per film)

A STB is rented from UPC and its price is included in the digital subscription fee of €14,95.

UPC has an installed base of approximately 57.000 digital subscribers (end 2004). In households connected to UPC's digital network there are two types of STBs: the largest number of UPC subscribers uses the Motorola STB with proprietary standards for CAS and middleware, a relatively small number of households (in the former Mediakabel/Mr Zap area) possesses an older model STB without cable modem and return path.

UPC has not marketed this digital offer aggressively over the past few years. Currently UPC is seriously considering a relaunch of its digital offer and to invest in a new generation of STBs. UPC thinks large scale investments (subsidies) for STBs by platform operators are imperative to fasten the take-up of digital television and to reach a substantial amount of digital subscribers. In this strategy investments in STBs have to be recouped through revenues generated by subscribers to digital packages and added services. If this new strategy will be adopted, UPC will then also gradually offer more services such as a more intelligent EPG and Vide on Demand services.
UPC expects to be able to offer several models of STBs, for instance with and without hard disk storage capacity and PVR-functionalities. Subscribers can for instance rent simple models for their bedroom TV's and more intelligent STBs for in the living room.
If UPC decides for a new impulse in its efforts to turn customers to their digital TV packages, channels and services, it will migrate to a different STB which runs on different standards. UPC intends to use open standards that support interoperability with other standards. For the Conditional Access System UPC will use Nagra. Middleware will be based on an open, but proprietary standard (Open TV).

3.2.2 Cable companies' views on standardisation and interoperability

For most cable companies the main issue is not the implementation of one standard by all platform operators, but the use of open standards that support interoperability.

Platform operators each operate their own Conditional Access Systems. This is seen as essential because only in this way can they sufficiently protect their encryption mechanisms. Cable operators try to reach an agreement on using Simulcrypt and a Common Interface for Conditional Access Systems in STBs, in order to guarantee interoperability. Customers can then keep using their STB if they move to an area that is provisioned by a different cable company.
The 150.000 to 200.000 STBs that households acquired earlier, before Essent and Casema launched their new strategies, are based on a proprietary Conditional Access System and have no Common Interface.

Concerning the middleware in STBs cable operators do not consider MHP to be the only way to reach interoperability among platforms or between content providers and platform operators. Other standards, even proprietary ones, may also accomplish interoperability, as long as soft- and hardware requirements are publicly available.
Interoperability requires communication between platform operators on issues such as the use programmable processors and middleware and self-provisioning STBs that can automatically perform registration procedures etc.

According to some stakeholders MHP is not yet sufficiently developed to allow interoperability, especially not on the more complex layers of the system.

Cable operators consider the main User Interface and Electronic Programming Guide as the gateways to customers that they will provide and are responsible for. Other applications can be delivered by third parties.

There are notable differences between UPC's strategy on the one hand and Essent, Casema, Multikabel and CAI Westland's views on the other. UPC considers investing on a large scale in STBs that support interactivity. It intends to use an open, but proprietary standard, which is not MHP. The other cable companies do not intend to invest in STBs or interactive services in the short run. As a consequence of this delay in providing interactive services via the broadcast platform and considering these cable companies' vision that STBs will increasingly be connected to PCs and the Internet, the introduction of MHP is not among their main priorities. These cable companies suggest that PC or mobile phone related, and IP-based platforms might have become dominant platforms for interactivity by the time digital interactive television services reach a mass market. In their view establishing a mandatory standard would obstruct other market developments.

Although inspired by different business strategies none of the Dutch cable companies are in favour of regulatory intervention by the government. They believe that standardisation should be a market and industry driven process. All cable companies consider competition between infrastructures as the best way to guarantee a diverse and high quality offer.

3.3 Satellite (DVB-S)

CanalDigitaal
CanalDigitaal is the main supplier of satellite TV in The Netherlands. Part of their customers subscribes to Canal+'s premium channels, which until recently was a CanalDigitaal subsidiary. Others only wish to receive free-to-air channels and pay a small administrative fee. There is also a substantial number of households that mainly watches satellite channels from other satellite providers and have no CanalDigitaal/Canal+ subscription. CanalDigitaal switched from analogue to digital television in 1996. They adopted a retail model in which a number of different STBs can be bought in consumer electronic shops. STBs suitable for reception of CanalDigitaal channels run MediaHighway middleware and contain an EPG, but do not support other interactive services. It currently has 680.000 digital subscribers.
CanalDigitaal considers DVB-MHP a reliable standard, and endorses the view that content providers for interactive TV are hindered by a lack of standardisation. At the same time it thinks that the implementation of DVB-MHP in STBs is still too complex and costly. It foresees that the variety of STB models will increase with for instance STBs with dual tuners or additional hard disk capacity and is involved in discussions with manufacturers on these matters. CanalDigitaal sees no role for government policies on the matter of standardisation and interoperability but thinks the market will solve these issues as soon as this suits the interests of market players. Moreover it is a matter that will not be decided on a national but on a European or international scale.

3.4 Digital Terrestrial TV (DVB-T or DTT)

In The Netherlands the Digitenne Consortium operates a platform for Digital Terrestrial Television. Since April 2003 an offer of 22 TV channels (and three premium channels) and 17 radio channels is broadcast to digital receivers. The area in which Digitenne is available is slowly expanding. Currently Haarlem, Amsterdam, Almere, Alphen aan den Rijn, Utrecht, The Hague and Rotterdam are covered. For nation-wide coverage Digitenne depends on the outcome of European wide frequency planning.
In areas where Digitenne is broadcasting, the amount of available bandwidth is limited, allowing only around 25 channels to be broadcast. Only by reducing TV quality some bandwidth can be made available for extra channels, but this is not considered a realistic way to increase the number of channels.

Currently Digitenne operates an MPEG 2 platform for video encoding. By changing to MPEG 4 part 10 (AVC) a serious step could be made that can approximately increase the number of channels by a factor 2. However the increasing number of customers with MPEG 2 STBs will make it more and more difficult to make this step.

Mid 2004 KPN started its own Television Service (KPN-TV) for which KPN made a wholesale deal with Digitenne. Therefore the television and radio channels KPN offers are the same as those offered by Digitenne, but STB, pricing and marketing differ.

3.4.1 Digitenne
Digitenne started their TV services with a dedicated Digitenne STB in April 2003. Currently they have left that approach. A range of STBs, approved by Digitenne as fit for reception of its channels, is now available in consumer electronic shops. Since Digitenne uses standardised DVB-T technology in combination with the CAS from

Conax, STB manufacturers can make their own decisions in offering a STB for Digitenne. Next to simple STBs, also more advanced STBs with Personal Video Recorders are available.

Currently Digitenne has around 50.000 subscribers.

3.4.2 KPN

KPN started in 2004 with its KPN TV offer. TV and radio channels are the same as in the Digitenne offer, but STBs and pricing are different. If customers also buy telephony and Internet from KPN, the price for a digital TV package is €7,95 per month. For customers that do not buy other products from KPN, the price is €13,95 per month. KPN's mission in this arena is price competitiveness.

Contrary to the Digitenne approach, KPN made the choice to deliver the STBs themselves. For the start of KPN TV it uses Samsung boxes. Customers can choose up to a maximum of three boxes per subscription. Further they can choose between single and dual tuner STBs. The latter allows people to record programmes on their VHS recorder, while watching a different channel on their TV set, or connect a second TV set to the STB.

Although KPN generally favours an open business model, it chose for offering its own STB because this allows them to have influence on the user interface and EPG. The latter is particularly important in relation to pricing and advertising content. This approach allows KPN to subsidise the STB. KPN sees both issues as very important for a company that is entering the TV market. In the future the range of STBs will be extended with more advanced boxes, containing for instance a hard disk for video recording.

KPN foresees that there will remain a wide spectrum of specific technological solutions for a while. A single STB (from a consumers' point of view) that is compliant with different types of infrastructures can in their view not be more than a long-term goal in this arena.

In addition to extending their DVB-T based services, KPN will also start services based on IP. For these services KPN can use its own DSL network, as soon as this is upgraded to ADSL2+ or VDSL. It is also KPN's intention to start services via the cable infrastructure.

KPN would like the government to look into the barriers that newcomers face in getting access to cable networks. It would also appreciate an active attitude of the government regarding the switch off of terrestrial analogue television, as this would create a level playing field for platform operators.

3.5 Broadband and IPTV

A few years ago broadband and IP meant services for the PC, and indeed a lot of broadband services have been developed. In this report we focus on TV services, delivered via broadband networks (cable and DSL). KPN and Versatel are the two main telecom operators that have announced to introduce IP TV via broadband networks (DSL, fibre).

Compared to traditional broadcasting, broadband/IP TV is even less standardised. Sometimes “IP” is claimed to be the only universal standard that is required, but this is not the case. Of course IP covers a very important part of the chain: the actual transport of data, but much more components and parts of the digital TV chain need to be taken into account to get actual services running. Telecom operators that start IP TV services have to make their own choices concerning the type of videocodec (MPEG2, WM9, AVC), the type of video-encoders, middleware, conditional access and STBs. Offering IP TV over a DSL or fibre network that is also simultaneously used for (IP-)telephony and Internet services, requires additional management of the broadcast transport stream and additional devices in the customers’ home. Customers not only need a STB, but also advanced modems (or Residential Gateways)[13]. An example is Wannadoo that introduces the Live Box as an advanced modem for ADSL, delivering Internet and IP telephony (now), and TV (future).

Telecom operators as new entrants in the TV market want to be flexible in organising their service offer and in the choices they make concerning the selection of the STB, modem/gateway, and middleware. DVB-MHP is in this IP world not a standard that is seen as important. Moreover, having to comply with a particular standard would limit these companies’ possibilities for choosing their own STB, for instance a cheaper one without advanced middleware, and one that does not require high investments from operators or could only be sold at a relatively high price to customers.

3.6 Broadcasters

Broadcasters provide content for digital channels. From the perspective of broadcasters standardisation is important because it lowers their production costs. Standardisation is an issue for broadcasters in relation to CASs, EPG and middleware (APIs). In relation to the Conditional Access System the question is mainly if broadcasters can have direct access to their viewers by controlling conditional access systems or attaching their own Subscriber Management Systems to a cable companies’ CAS. For free-to-air (FTA) broadcasters the CAS is less of an issue than for pay TV operators, though in the long run FTA broadcasters might find the collection of data concerning customers’ viewing behaviour a worthwhile asset.

Concerning EPGs the issue at stake is to what extent broadcasters can influence their position on EPGs programme and channel listings and the EPGs ‘look-and-feel’. Broadcasters might also want the option to offer their own EPG.

Both issues are primarily a matter of business models and broadcasters negotiating the terms of access to cable networks. At the same time – as long as broadcasters’ access to cable companies’ CAS is technologically impossible or impractical and as long as STBs can only support one EPG, technological issues can present an extra hindrance to an open and competitive market.
Thematic channel providers stress the importance of having STBs with multiple tuners that allow connections to different TV sets on which different channels can be watched, especially because thematic channels are often watched in (children’s) bedrooms.

Technologically more complex are standardisation issues in relation to interactive services. In the current market situation broadcasters that would like to enhance their

[13] There is no clear definition for the exact functionality between STB, residential gateway or advanced modem.

television programmes with interactive services would have to provide this service for each of the main distribution platforms (cable, satellite and terrestrial) and for different cable operators in a different format. Lack of standardisation in this field is one of the factors that hinder broadcasters' willingness to produce interactive services.

3.6.1 Free-to-air broadcasters

Broadcasters generally subscribe to the view that the introduction of digital channels is a first step in convincing viewers to switch to digital television and that the introduction of interactive services is a next phase.
In December 2004 the public broadcasters launched four new thematic digital channels, partly spin-offs of earlier Internet channels, and there are plans for more new digital channels.
Public broadcasters are also working on a plan for digital switch-off in which they aim at a region by region switch-off of the terrestrial analogue signal. This process is planned to start 2005 and to be completed in 2007. This plan will be discussed in a Taskforce with representatives from the main stakeholders and will be presented to the government.

Commercial broadcaster RTL Nederland has announced a digital channel and the other main commercial broadcaster SBS is debating the launch of new channels in 2005. International thematic channels like MTV and Discovery Channel launched a number of digital channels for specific target groups. Distribution of digital channels does not present any technical problems, as all cable operators and other platform operators employ the DVB standard. Terms of access are negotiated between cable operators and broadcasters. If there are problems in reaching an agreement these are mostly the results of disagreement on financial and other conditions and not due to technological interoperability.

Presenting programme information in *Electronic Programme Guides* is an issue that does raise some standardisation issues. The way information about schedules and programmes is supplied and presented varies for each of the different digital platforms.
The simple STBs currently available in the retail market and used by subscribers to Essent, Casema, Digitenne and CanalDigitaal contain an in-built EPG with limited functionalities. Data to fill this EPG are provided by broadcasters or collected by the platform providers themselves and added to and distributed simultaneously with the digital broadcast signal. In neither of both situations can broadcasters determine the presentation of these data.
This fundamentally comes down to the question who controls the EPG. Will there be one EPG, supplied and controlled by the platform operator that is automatically installed (and updated) in customers' STBs? Or will customers be able to choose between a number of EPGs, of which some could be provided by broadcasters or other market players? If market players agree that one EPG is preferable – for example to prevent confusion by offering customers too many options – the conditions regarding position and presentation of broadcasters' programme information need to be negotiated between platform operators and broadcasters or other content providers.

Broadcasters would like to be able to control the presentation of the information on EPGs and be able to respond to sudden changes in programme schedules, in case of calamities for instance. Also the context in which programme information is presented and the 'look-and-feel' of the EPG are important. There have been some initiatives of commercial and public broadcasters to collaborate in developing their own EPG, but

these have not led to any concrete results. In order to deliver timely, correct and complete data for EPGs broadcasters also have to streamline and automate the in-house production of these data; a process on which broadcasters are working, but which is not yet completed. The public broadcasters and the main commercial broadcasters have EPGs on the Internet. These are seen as a basis from which formats for other platforms could be developed.

With regard to *standardisation of middleware* broadcasters support *MHP* as the only well tested, multifunctional, transparent and reliable standard that enables interactivity. Important is also that licence costs are fair, non-discriminatory and transparent and thus more predictable and controlled than those of other middleware standards, even if the owners of these standards make their specifications publicly available. However, none of the main public and commercial Dutch broadcasters currently develops interactive applications for digital television. Broadcasters do enrich their programmes with different forms of interactivity, but use other platforms for response, such as (mobile) phone, SMS or Internet.
Users value these forms of interactivity and some of them have proven business models. For interactivity that is completely integrated in programmes, broadcasters still consider MHP as the best standard. Viewers will then receive the services in the same way and will be able to respond directly by pushing a button on their remote control. For some actions, especially those requiring immediate responses, such as participating in game shows or responding to offers in interactive commercials, this is seen as the most ideal form to invite viewers to interact. Some broadcasters also think that offering interactivity in this way might lead to participation of other viewers than those already familiar with responding by other means, because it might better fit their viewing habits. For some viewers, participation by SMS, phone or Internet is too much of an effort; others might not possess a mobile phone or Internet connection or use these only for different purposes.

Other potential routes of migration to interoperability are seen in

a) The development of PCF, a system developed by the DVB group that can translate interactive applications to any kind of middleware. PCF might also enable a more fluent transition to MHP because it can translate interactive content to middleware in both old and new STB-models. STBs working on other standards can gradually be replaced by MHP based STBs.
b) STBs with programmable middleware

Broadcasters consider IPTV as another potential means for distribution of digital TV that also enables interactive applications. Broadcasters that want to make their programmes or other audio-visual content available on the Internet however, also face standardisation issues. Internet users for example have different players for audio-visual content. The most common ones are Real Player and Windows Media Player. Broadcasters need to offer their content in at least these two standards, which also means extra efforts and costs. There are many different standards available and in that sense the Internet world seems to be even more chaotic than the broadcast world.

The public broadcasters are in favour of a mandatory open standard, but do think provisions are necessary to prevent harm for companies with an installed base of STBs containing proprietary standards. The position of commercial broadcaster RTL is somewhat more modified as RTL's mother company also has interests in countries with a large installed base of proprietary STBs. A variable policy approach, based on a

difference between so called ‘green field markets’ and markets with a large installed base, is suggested as an option to explore.

Another issue of importance to commercial channels is how responses to interactive services are generated and which party collects these. Direct access to customers’ responses and ways to interact directly with customers or to cash payments are of importance. This requires a return path and, in case an in-built return path is used, access tot the network operators’ SMS systems or a link of one’s own SMS to the cable operators CAS also becomes important. Again the development of these services becomes easier and more cost efficient if similar systems can be developed and used for the whole market and do not need to be adapted to each network operator’s specific situation.

3.6.2 Pay TV Channels

CineNova and Canal+ offer their films and sports channels to digital platforms of cable companies. Canal+ distributes its channels also to satellite operator CanalDigitaal and Digitenne. Customers can buy a STB fit for reception CanalDigitaal and Canal+ channel in the consumer electronics. On cable networks Canal+ makes use of cable companies’ STBs and CAS.

CineNova welcomes digitalisation because it might offer future possibilities for more windows to sell its products (films) through for instance VOD. It is not active in the field of interactive films or programmes.
CineNova does not consider itself a leading actor in the market in the sense that it attempts to influence the use of standards. The company follows market developments. It does observe a lack of a leading vision in the Dutch market as well as co-operation on the side of platform operators (both cable companies and telecom operators).

In general issues concerning access to CAS, SMS and EPG and control over billing mechanisms are important for Pay TV Channels.

3.6.3 Television Producers

Television producers, like broadcasters and most other stakeholders, see digital channels as a first phase in the introduction of digital television. They do not think that television as an entertainment and relaxation medium lends itself very well to interactivity, especially not to more advanced forms of interactivity that require a very active viewer participation.
Although some television producers, like Endemol, Eyeworks and Idtv, have produced interactive television programmes (Idols, Big Brother, Zo Vader zo zoon), most consider interactive television as a phenomenon that is still in an early stage. Simple forms of interactivity can already be realised by (mobile) telephones, SMS and Internet. Pilots with more complex forms of interactivity have not been particularly successful.

The proliferation of distribution channels and on demand services widens the possibilities for television producers to directly deliver their programmes and content to consumers instead of having to use broadcasters as their intermediary channel to consumers. In this sense television producers have an increasing interest in access conditions to digital networks, both technological as well as commercial. At the same time producers also take into account the conflict of interests that might rise with broadcasters, i.e. their principal commissioners. If television producers would directly deliver their content to consumers they would operate as broadcasters’ competitors.

Nevertheless television producers do explore a variety of different distribution and business models, as many of them can not survive on commissions from broadcasters only. At this moment in time future market relations have not yet fully crystallised.

In general television producers, like broadcasters and owners of (pay) television channels, are in favour of non-proprietary and open standards because these reduce the costs for distributing and producing digital and interactive content.

3.7 Manufacturers

In The Netherlands a number of manufacturers provide set-top boxes for reception of digital TV. Among them are Nokia, Panasonic, Samsung, Philips and Topfield. Most of the STBs that are sold in The Netherlands are meant for reception of DVB-C/T/S, and can be seen as STBs with basic functionality. For this report Panasonic, as a provider of a STB with basic functionality, and Samsung (Telecommunication Network Division of Samsung Electronics Benelux) as a manufacturer that is also active in the domain of IP-based services were interviewed.

Manufacturers deliver the equipment that consumers need to receive digital TV. In the cable domain, two of the three main cable operators have adopted a business model in which the STB can be selected by the consumer. Other operators provide the STB as part of the customers' subscription to digital TV. But even in the cases where the consumer can choose his or her own set-top box in the shop, cable operators sometimes start specific actions to push one particular STB. For Digitenne, a DVB-T provider – a number of different STB are available that carry a sign 'fit-for-reception of Digitenne'. For KPN TV (DVB-T) only one manufacturer is selected. For DVB-S customers can also buy a number of different STBs in the shop.

Manufacturers increasingly develop and provide STBs for IP platforms, delivered over DSL or fibre. When using an IP network the entire TV delivery chain needs to be designed and integrated on top of the DSL or fibre network whose architecture was originally built to support other services (Internet, telephony). To receive IP TV customers need to acquire an IP STB instead of 'classical' broadcast STB. Since competition of IP TV providers and traditional providers is just starting, open standards will only be used in parts of the chain. The STB is not one of these, i.e. for IP STBs no standards exist that can make the box independent of the platform of the operator.

In the Dutch case, the main players adopt all kinds of triple (or multi) play offers for customers. Telecom operators that start delivering TV services via a DSL infrastructure enter a domain where 'classical' (interactive) broadcast standards like DVB-MHP do not provide the solutions they need. For manufacturers this means that they are more involved in delivering (parts of) the delivery chain, including the STBs.

3.8 Consumers' Association

The Dutch Consumers' Association (Consumentenbond) considers the fact that other TV providers, next to cable and satellite, are entering the market as a potentially positive development. Consumers can in theory profit from interesting content offers for lower prices. However, this positive development is overshadowed by some serious worries. The Consumers' Association emphasizes strongly that current trends do not

lead to an open and transparent market that benefits consumers' interests. The main worries of the Consumers' Association are:

1) Consumers have to deal with a lot of technology in the home, often without a clear understanding of consequences and functionalities.
   There is not such a thing as simply buying a 'digital TV'. Besides the monthly fee, set-top boxes are required. Although it is positive that consumers can sometimes choose which box they buy, it is still complex to understand differences between boxes with single tuner, dual tuner, hard disk recorder etc.

2) The pricing and the actual offer itself are very diffuse and sometimes unfair.
   Sometimes the set-top box is part of the subscription, sometimes boxes need to be bought separately, sometimes digital TV is an offer on its own, sometimes it is only sold (even for free) in combination with analogue television, sometimes prices depend on other products (telephony, Internet) that are acquired from the same provider.
   In the consumers' organization's vision this is not a situation in which consumers have sufficient and clear insight in the (financial) consequences of their choices. For the consumers' organization this is especially serious since consumers are very much bound to the provider they have chosen. After they have subscribed and bought a specific set-top box for a specific infrastructure (cable, terrestrial, DSL, satellite), they are more or less dependent on the provider and its pricing strategy.

3) Dependencies between infrastructure and services and between different services 'force' consumers to accept package deals, and limit freedom of choice.
   The c*urrent trend is that platform operators try to sell a total package of telephony, Internet and TV to consumers (triple play). Benefits for the consumer only exist if they buy all products from the same provider. The choice for a TV service is directly related to a choice for infrastructure. As a consequence, consumers are locked-in by technology.*

In the perception of the Consumers' Association these issues do not only damage the interests of consumers, they also form an obstacle to the introduction of digital TV in The Netherlands. Digital TV already has a slow start in The Netherlands due to the high penetration and quality of the analogue cable offer. A fragmented and non-transparent market for Digital TV is in the vision of the Consumers' Association something that should be avoided.

According to the Consumers' Association, the government should obtain a supervisor role for the Digital TV market. Consumers should be able to have a free choice for TV and TV services, and should be able to switch to another provider without the need to also change Internet provider or telephony provider. The current trend from operators to provide 'total packages' via their infrastructure makes it difficult for consumers to actually apply their basic right, i.e., to buy what they want and to move to other providers if they have a better offer.

The government should make sure that the Digital TV market is open and transparent and that it allows for real and fair competition, based on clear conditions.

3.9 Conclusions

Most stakeholders consider the introduction of digital channels as a first step in introducing digital television in the Dutch market. In this field there are no standardisation and interoperability problems as the distribution of digital channels is standardised (DVB) and access to CASs by the most active broadcasters and Pay TV companies is commercially negotiated with platform operators.

Lack of standardisation does become an issue as soon as interactive services are provided. Most platform operators do not yet provide interactive services that require an in-built return channel. Results of market research into consumers' interests in interactive television have not produced very optimistic results. Most stakeholders therefore do not yet experience the lack of standardisation in middleware for interactive services as a very acute problem. Only UPC offers a number of interactive services and is considering a relaunch of its digital offer in 2005, which will also entail the introduction of STBs that support interactive services. Broadcasters and television producers have produced interactive programmes, but these contain mainly simple forms of interactivity (betting, voting) for which other networks, such as mobile phone, SMS and Internet, are used as a return path.
All stakeholders do foresee a growing interest in interactive services for the future, but forecasts on when these services will gain market potential vary.

Current EPGs are simple models, often part of the STB and without interactivity. The models used by Essent, Casema and Digitenne are part of the hardware. The main issue concerning EPGs is not standardisation but the question who controls the EPG. Cable operators claim that they are the ones that should collect the information of all broadcasters and compose an EPG, which offers the entrance to the content available on their digital platforms. Position and presentation on EPGs however is of utmost importance for broadcasters. There has been consultation among public and commercial broadcasters on developing their own EPG, but up till now broadcasters have not yet put forward a clear proposal on this issue. Whether cable operators remain the main gateway or whether other parties, such as broadcasters, could also provide EPGs is still undecided. The outcome will be determined by stakeholders' interests as well as by consumers' preferences. In case broadcasters (or other players) would opt for their own EPGs, standardisation of the required middleware becomes important.

Cable operators hold the view that interoperability is important, but that this does not require the use of the same standards by all platform operators. However not all standards support the same STB functionalities. This means that in order to accomplish interoperability one has to adapt the functionalities of services to the lowest common denominator. Producers of interactive content (broadcasters and television producers) are thus not sure that their services will function in the same way on all platforms and STBs and some features might not work at all on part of the platforms and STBs.

There are a number of recent developments that, to a certain degree, diminish the importance of a common shared standard and might make the discussion on MHP redundant. These concern:

– The introduction of IPTV. Cable operators expect to be able to deliver IPTV through their cable networks within the next few years. IPTV is a potential alternative for MHP as a technology that enables interactivity. The market potential

of IPTV is also stimulated by an increasing availability in households of PVRs and wireless networks that connect the television set to the PC.

- Television broadcasts, either through DVB or streaming media, can be enhanced with interactive services for which the Internet is used as a return path. In order to achieve this, television sets need to be connected to a STB, PC or PVR containing a modem and Internet connection. Given the high penetration of PCs in Dutch households (compared to other European countries) this might be a feasible development.
- Tools like PCF might diminish, but not completely solve interoperability problems, as it means that interoperability is restricted to the lowest common denominator.

4 Policy options and recommendations

In this chapter current policies concerning standardisation and interoperability on the European level as well as on a national level will be discussed. This is followed by an evaluation of the relative importance of interoperability and standardisation with regard to further digitalisation. Stakeholders' views on this issue and their suggestions for regulatory or other interventions by the Dutch Government are presented. The chapter will be concluded by some recommendations for further policies.

4.1 EC Regulatory Framework

There has been concern from the European council and several stakeholders about the detrimental effects that a lack of standardisation and interoperability could have on market developments, consumers' freedom of choice, the free flow of information and media pluralism. The European market for interactive TV developed without a European API standard. According to an ETSI study in December 2003 there are at that moment approximately 32 million digital receivers of which 25 million have interactive capability. These digital receivers run on five different API standards (Open TV, MediaHighway, MHEG-5, BetaNova and Liberate)[14].
As a result consumers are unable to buy a standardised, universal receiver and can be locked into using (more costly) receivers containing proprietary API's, without being sure that these can receive all free-to-air and Pay-TV services. Manufacturers of consumer electronics can not realise economies of scales. Broadcasters authoring content have to make extra costs to produce different formats for each proprietary standard and have to negotiate with vertically integrated network operators, in control of proprietary API technologies[15]. This leads to market fragmentation, which might hinder digitalisation of networks, equipment, broadcasting and other digital services.

In order to ensure an open market and consumer access to interactive television services the EC included a number of articles concerning the interoperability of digital and interactive television in its Framework and Universal Service Directives[16]. Member States are required to encourage the use of open APIs and the Commission is required to examine the effects of Member States' policies[17]. If interoperability and freedom of choice for users have not been adequately achieved in one or more Member States, the Commission may act with the aim of making certain standards mandatory (EC, COM 2004, 541 final).
MHP has been put on the list of standards published in the official Journal of the EC and the Commission stated that the obvious way to achieve interoperability would be widespread adoption of MHP.

[14] ETSI TR 102 282, February 2004, p.11
[15] Communication from the Commission to the Council, the European Parliament, The Europeam Economic and social Committee and the Committee of the Regions on interoperatbility of digital interactive television services. [SEC(2004)1028]
[16] Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive), Art. 17 and 18
Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive), Art. 6, Art 24 and Annex I.
[17] Art 18 of the Framework directive

Following its obligation to monitor market developments the European Commission conducted a consultation among market players on standardisation of APIs in digital receivers in 2004. After receiving input from market players the Commission concludes that there is at present no case for mandating standards (SEC (2004)1028). Instead the Commission suggest a number of 'lighter measures' to promote the deployment of the only open standard available for interactive television services: MHP. These include:

- allowing state subsidies on STBs under certain conditions;
- the installation of a working group to improve the co-ordination of implementing MHP;
- monitoring activities.

The EC will review the issue in 2005.

The communications from the Commission show that it strongly supports open standards, but refrains from imposing mandatory standards on an EU level. The main reasons indicated are the widely varying market situations in Member States and the legacy of STBs containing proprietary standards in some of these markets. Also mentioned are the limited commercial success of interactive services and the lack of formal complaints by market players to regulatory bodies. Although the European Commission reports that broadcasters and consumer organisations and also one big consumer electronics manufacturer are more favourable towards the imposition of open standards it did not seem to find sufficient support from market players and regulators to propose a mandatory standard.

4.2 Dutch Government's policies

The Dutch government has underlined the importance of standardisation and interoperability in subsequent policy papers on cable networks and digitalisation[18]. At the same time the Dutch government has refrained from a mandatory standard and followed the European policies in this matter.
Representatives of the Dutch Ministry of Economic Affairs and of the Ministry of Education, Culture and Sciences have participated in subsequent (relatively low profile and informal) groups in which network providers, broadcasters and manufacturers have met to discuss standardisation issues (the latest initiative is the Platform Digitale Televisie).

4.3 Relative importance of standardisation

All stakeholders underline the importance of standardisation and interoperability even though their views on which standards should be adopted and on how standardisation and interoperability should be accomplished vary. Most, however, also indicate a number of other obstacles to a fast take up of digital television, some of which are considered of more importance than standardisation and interoperability. Some of these obstacles are related to general (economic) developments, other obstacles are related to international or Dutch developments in (digital) TV markets. The major obstacles to a rapid digitalisation that are mentioned are:

- The general stagnation in economic growth.
- The lack of clear killer applications for interactive TV.
- Difficulties in clearing copyrights and/or settling copyrights arrangements for digital distribution of content.

[18] Kamerstukken, Kabel en consument: Marktwerking en digitalisering. Tweede Kamer, Vergaderjaar 1999-2000, 27 088, nr. 2, Vergaderjaar 2000-2001, 27 088, nr 18 en Vergaderjaar 2001-2002, 27 088, nr. 28

- Consumers' lack of knowledge on digital television and its benefits.
- More in particular for the Dutch market: the attractive analogue offer and strict regulation of cable as the dominant platform operator. This regulation is claimed to make it difficult for cable operators to increase revenues and invest in digital services, or to cross subsidise the digitalisation of networks and the introduction of new services through higher prices for analogue television.

4.4 Policy options regarding open standards: the perspective of stakeholders

In the interviews we asked all stakeholders if and how the Dutch Government could stimulate digitalisation in the Dutch market. In this paragraph we will summarise the policy options that have been suggested

4.4.1 Mandatory open standard

Imposing a mandatory open standard is the most far-reaching regulatory intervention. This would make it a legal obligation to use one open standard Application Programme Interface (API) in digital interactive television services and equipment. To qualify as an open standard it must be authorised by a European standardisation body and published in the EU Official Journal. It means that all specifications of the standard would be publicly available on fair, reasonable and non-discriminatory terms. Each content producer and each manufacturer should be able to work with the standards and licences should be available on fair, reasonable and non-discriminatory terms. The MHP Alliance, consisting of a number of broadcasters and a consumer electronics firm supports this regulatory option on a European level. In the Dutch market however this option seems to meet with less support. Although broadcasters and television producers support MHP as a reliable, open, non-proprietary standard, none of the stakeholders interviewed was in favour of the imposition of MHP as a mandatory standard. One of the main arguments against a mandatory open standard is that it affects the legacy of early investors in digital markets. Some also claim that the future of MHP is still insecure; other standards could come up or interactivity might be based on IP (Internet), given the strong growth of broadband connections in European markets. Mandating MHP would make the introduction of new (possibly better) standards difficult. Established platform operators (cable and satellite) with a legacy of proprietary systems are usually against the imposition of a mandatory open standard. They consider the current European Regulatory Framework as a sufficient guarantee for third party access to networks.

Several interviewees expect that MHP has best chances in markets that are on the brink of introducing digital interactive television, because vested interests are not so big yet. Some of these interviewees state that those member states where digitalisation is in an early stage should consider imposition of an open standard.

The Dutch digital market is a relatively underdeveloped market with a relatively slow take up of digital and especially interactive services. Nevertheless, due to the international character of media markets it can not be considered as an isolated market. Some of the main players (UPC, CanalDigitaal) are part of multinational concerns that invest in digitalisation in other European countries as well. Decisions on market strategies and standards are thus taken with regard not only to the Dutch market situation but also to investments and market strategies of the parent companies in other countries.

4.4.2 Other measures to stimulate open standards and digitalisation

Most stakeholders do think some government activity could be useful. A number of 'lighter' and other measures to stimulate open standards are suggested.

- Communicate a positive approach towards digital television by explaining its benefits to consumers, by awareness campaigns and in policy documents
- Subsidise pilots for the development of digital and interactive programmes and services (such as the initiatives of the Flemish government in the Telenet experiments).
- Government as launching customer: use digital television platforms to provide government and public services (e-Government, e-Health and e-Education services)
- Announce analogue terrestrial switch-off date
- Reconsider regulation of analogue cable packages (channels and tariffs) to increase incentives for take up of digital services by consumers
- Tax benefits on buying STBs (digital television sets)
- Co-ordinate talks between stakeholders on all standardisation issues concerning digital television platforms, and not just focus on MHP
- Agree on a label that indicates that a STB is 'Ready for MHP' / 'Tested for MHP'.

4.5 Recommendations

Below, we will present a number of recommendations that are intended to stimulate and (re)orient current policy debates. The cautious formulations are due to the limited scope of the analysis. Within a short period of time we have described the main developments in digital television technologies and markets, and we have interviewed a selection of stakeholders. The focus has been on cable networks, standardisation and interoperability. However, to a large extent, the issues need to be addressed in the context of general policies concerning digital broadcasting networks and obstacles to digitalisation other than standardisation and interoperability.

First of all, policies concerning standardisation and interoperability need to be considered in the context of broader policies on open markets, competition and innovation. Sometimes there is a tension between innovation and competition policies. Platform operators' current commercial strategies to stimulate digitalisation might raise competition concerns, such as cable and telecom operators' triple play strategies or cable operators' bundling of digital and analogue packages. These commercial strategies might have a positive effect on realising policy objectives regarding innovation and digitalisation, but they also raise concerns regarding fair competition and potential 'lock-in' effects for consumers.

Also related to standardisation and interoperability is the issue of third party access to dominant digital television platforms and infrastructures. Obstacles to third party access might be reduced by open standards. However they will probably not be solved by technological means only. With open standards, firms can still refuse to collaborate or to create interoperability with (other) content, services and platform providers. Competition issues might emerge and require (adapted) access obligations such as third party access and interoperability. These obligations do not require open standards per se. If access obligations and/or commercial interests are substantial, firms can manage access and interoperability via interfaces between different (proprietary) standards.

The second recommendation is to strongly link standardisation (and interoperability) issues to an integrated analysis of innovation and market developments, and all relevant bottlenecks. We did not find support for the claim of some stakeholders that the *main*

obstacle to innovation in digital interactive TV services – in the Netherlands – is a lack of standardisation at the level of API or other components of the digital platform (such as CAS). Other obstacles might be more relevant, for instance related to (limited) added value for consumers, copyrights, the commercial strategies of market players and the (dis)advantages of the attractive analogue cable packages.
Further exploration of the relation between the take up of digital television in general and interactive services in particular, is necessary to assess the importance of standardisation issues concerning middleware and interactive services. For instance:

- In which way are the take up of digital TV channels (that do not require an API) and the take up of interactive services (that do require an API) economically and technologically related? Can digital TV become successful by just offering extra digital channels in combination with simple STBs and separate from interactive services that might or might not be offered through IP platforms? Or does the roll out of digital TV in the long run depend on a full offer of digital channels and interactive services? And will the roll-out of digital TV channels and simple STBs present an obstacle to the introduction of interactive services, requiring more complex STBs with middleware?
- Will interactivity be provided by broadcast or IP networks, or a combination of both? Will IP networks substitute or complement broadcast networks, to what extent and in what pace will the convergence between broadcast and telecom networks take place?
- To what extent would open standards reduce the complexities related to interoperability or would other (commercial and access related issues) remain an obstacle for an open market at the level of content and services, even if technological obstacles would have been removed?

All these questions are relevant to improve standardisation and innovation policies to stimulate digital interactive TV services.

The third recommendation, which follows from the above one, is to not mandate MHP or any other open standard. As described in the previous chapters, European policy documents and national stakeholders do not provide substantial support for such a relatively intrusive policy instrument. Several disadvantages and risks have been mentioned. Furthermore, the policy debate on whether or not to mandate open standards (and lighter instruments) needs to reflect the international characteristics of technological and market dynamics. Hence, the European level is the most appropriate level to make any decisions on standardisation. Of course, national cases such as the Netherlands ought to play a role in this European policy debate. This report might facilitate the interaction between national and European policy debates.

The fourth recommendation is to reconsider if scope, role and design of current industry platforms in which standardisation issues are discussed among stakeholders could be widened. Market players and the Dutch government could explore how such a platform is most likely to contribute to the development and roll out of digital television. To increase open standards could be one of the objectives, as well as improving interoperability and the development of new interactive services. Interoperability might also be stimulated via other means than open standards, e.g. via interfaces, facilities to test interoperability etc. The agenda of such a platform could also include interoperability with interactive platforms and services via IP and Internet. The scope of the debate could be widened by not restricting it to one specific infrastructure or platform, but to digital infrastructures and platforms in general. To take an approach that intends to stimulate availability and access to digital services is likely to increase

the number of stakeholders that are willing to contribute. Examples are public and commercial broadcasting organisations, but also public sectors and governments that might use digital platforms for eHealth, eLearning and eGovernment (non-broadcasting services). Additional measures could include pilots (services) and awareness campaigns. The Flemish project on digital television could provide inspiration and (preliminary) lessons.

The fifth recommendation is to explore how public broadcasting organisations (national, regional and local) can be facilitated to contribute to the development of digital and interactive services. Public broadcasters could take a leading role in the implementation of open standards, pilots and campaigns for digital television and interactive services.

5 Summary and conclusions

After a period of stagnation in the roll-out of digital TV in the Dutch market, new market developments are currently emerging. Firstly cable companies introduce digital television on a larger scale than before, applying a number of different business models. Secondly competition between cable companies and telecom operators increases. Both cable companies and telecom operators attempt to attract consumers by offering a 'triple-play-product', i.e. offering (digital) television, Internet and telephony over the same network. Thirdly digital satellite (DVB-S) and digital terrestrial television (DVB-T) also increased their market shares over the past few years and compete with cable operators over digital television households.

Generally broadcasters and cable companies do no longer belief in one killer application for digital television. A number of different assets will persuade different consumers to digital television. For some it might be a large package of extra digital channels, for others it might be premium content or better image and sound quality.
The introduction of digital channels offering consumers extra choice is generally seen as a first stage in the introduction of digital television, followed by more advanced EPGs and interactive services.
One of the main obstacles to a large-scale introduction of digital and interactive television is that it is difficult to proof the added value of digital television. Most Dutch households already have access to attractive analogue packages with large number of channels for a moderate price. Economic stagnation, copyrights issues, lack of a killer application, consumers' lack of knowledge about the benefits of digital TV and lack of interoperability and standardisation are also often mentioned hindrances. This report focuses on the last issue.

Lack of standardisation and interoperability are obstacles of a technological and commercial nature. Although the transmission of digital TV is sufficiently standardised, standardisation issues do arise concerning Conditional Access Systems (CAS) and the middleware (API) required for Electronic Programme Guides (EPG) and other interactive services.

On the level of the CAS that determines to which services subscribers are entitled, different systems are used in the Dutch market. Currently cable companies are discussing collaboration concerning the use of a Common Interface and Simulcrypt.

In order to provide interactive services STB need to contain middleware (e.g. API). Current STBs in the Dutch market either lack this middleware (the simple retail models, used by Essent, Casema, Digitenne, and CanalDigitaal) or contain proprietary middleware, such as the models that UPC's subscribers are renting. Consequently, content producers have to adapt their content for different digital platforms, which requires extra effort and expenses.

Cable companies adopt different strategies in introducing digital television. There are differences concerning a) the pace in which interactive services are seen to become a substantial part of digital television platforms; b) the willingness to invest in interactive services and c) the adopted business model in introducing digital TV. Casema, Essent, CAIW Holding and Multikabel adopt a retail model in which consumers can buy their preferred STB or digital TV set in the consumer electronics shop. UPC considers the

STB as part of its network, in which it is willing to invest in return for revenues from added services.

Generally most stakeholders agree that standardisation and interoperability are important for the following reasons:
- Open and universal standards stimulate content production. It means that content producers (broadcasters, television producers) have access to all technological specifications. If there would be one generally accepted standard, they would not need to adapt their content (programmes) to different standards, which is a costly procedure.
- Open and universal standards offer hardware manufacturers security about technical decisions, and make it possible for them to achieve economics of scale.
- Open and universal standards are favourable for consumers as they can buy a STB of their own choice in the retail and do not need to switch boxes when changing to a different platform operator.

Views differ on how standardisation and interoperability could be accomplished. Broadcasters, television producers and the consumer organisation support DVB-MHP as an open, non-proprietary solution to achieve interoperability. Cable companies, other platform operators and manufacturers adopt a more cautious position and prefer a market led solution.

None of the stakeholders interviewed is in favour of the imposition of a mandatory standard (MHP) for STBs middleware. The main reasons given are:
- DVB-MHP still too costly.
- It affects the legacy of early investors in digital markets.
- The future of MHP is insecure; interactivity might also be based on IP given strong growth of broadband connections in European markets.
- Mandating MHP will make the introduction of new (possibly better) standards difficult.
- Adopting one, universal standard is not the only means to achieve interoperability; there are also other solutions such as transmitting in different standards or using software that translates applications to different middleware standards.

Cable company UPC seriously considers a large-scale investment in a new generation of STBs that support interactivity. UPC intends to run an open, but proprietary standard middleware on these STBs. Other cable companies see the introduction of interactive services as a long-term development, which means that the introduction of MHP is not their main priority. They also see an increasing convergence between TV and PC/Internet through which IP-based interactive services might become more prominent. Moreover cable companies also point to other solutions which increase the interoperability between different standards such as the development of software that translates applications to different middleware standards.

The main differences in strategies and interests currently present in the market are:
- Between those stakeholders that think the market will decide the outcome, and therefore no government intervention is required and stakeholders, in particular broadcasters and television producers that do think the government could more openly support MHP as *the* European standard for interactive television.
- Among platform operators between those investing (or with strong intentions to) invest in interactive services and proprietary middleware and using vertical business

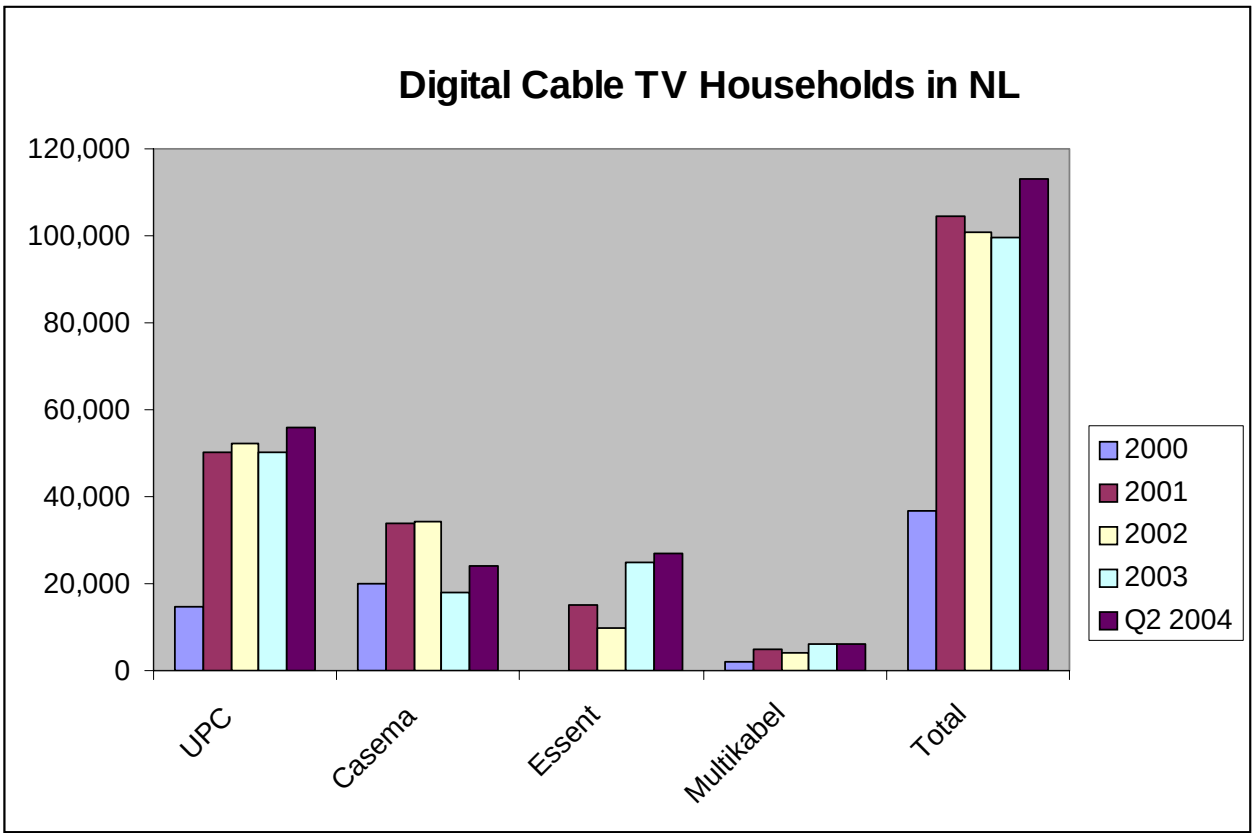
models and those reluctant to invest in interactivity, taking a more cautious position and opting for a retail model and the development of horizontal markets. Even though these latter platform operators do not strongly support the introduction of MHP either, their business models might in the long run lead to a more open, horizontal market.

Instead of imposing MHP as a mandatory standard the interviewees have suggested a number of lighter, non-controversial policy options that could also stimulate further digitalisation. These concern for instance stimulating content production by more government investment in digital services and informing the public on the benefits of digitalisation or supporting regular consultations between all stakeholders, not only on MHP but also on potential alternatives to accomplish interoperability and on other standardisation and interoperability issues. None of these measures seems to be able to result in a radical break through, but each of them might have some important positive effects. And last but not least: standardisation is not an issue that can be solved on national markets, it is determined to a large extent by developments on European and even US and international markets.

Based on these findings the researchers offer the following policy recommendations:

1) Link standardisation (and interoperability) issues to an integrated analysis of innovation and market developments, and all relevant bottlenecks. Lack of standardisation is not the main obstacle to a successful introduction of digital television in the Dutch market.
2) Standardisation issues are related to stakeholders' commercial strategies. It can for instance be profitable for platform operators to stick to proprietary standards, as these are a means to 'lock-in' consumers, or prevent third party access to platforms. Standardisation and interoperability issues are thus hardly ever only a technological issue, but need to be analysed in relation to competition and third party access issues.
3) Do not mandate MHP or any other open standard.
4) Widen the scope, role and design of current platforms in which standardisation issues are discussed among stakeholders, and not restrict them to one type of network (cable) or implementation of one standard (MHP). Developments in the field of IP TV and convergence of telecom and broadcast platforms need to be taken into account as well.
5) Explore how public broadcasting organisations can be facilitated to contribute to or take a leading role in the development of digital and interactive services and in creating public awareness around digital television.

A Number of subscribers to digital cable television



Source: TNO STB, based on corporate information

In addition, at the end of 2003, approximately 585,000 households received digital television via satellite (CanalDigitaal) and 25,000 via digital terrestrial (Digitenne).

Total number of TV households: 7.000.000

By the end of 2004 the total number of digital cable subscribers of the three main cable companies (UPC, Essent and Casema) has risen to approximately 121.000 households.

B Consulted stakeholders

DIGITAL PLATFORM OPERATORS

UPC	Manuel Kohnstamm, Managing Director, Public Policy & Communications and Jeroen Bergman, Senior Vice President Content Acquisition & Strategy
Essent Kabelcom	Bernard Dijkhuizen, CEO Bert Meijerink, General Manager Netwerkbedrijf
Casema	Jos Molenkamp, CEO
Cai Westland (CAIW Holding)	Aart Verbree, CEO and Hans van der Giesen
Multikabel	
KPN	Jan Davids, Strategic Consultant. Strategy & Business Development
CanalDigitaal	Kees Färber, Director Operations

BROADCASTERS

Publieke Omroep	Kees Noort, senior beleidsadviseur technologie, Publieke Omroep
RTL Nederland	John de Jong, Manager Distribution & Business Development Cable
SBS6	Eric Eljon, Manager Communications and special projects and Josbert van Rooijen, head of Promo-department SBS Broadcasting.
MTV	Jochem K. de Jong, Head of Distribution & Affiliates Benelux

Cinenova	Hein Barnhoorn, Marketing Manager
TELEVISION PRODUCERS	
Endemol	Tjabring van Egten and Stan Vermeulen
Eyeworks	Tatiana Lagewaard
MANUFACTURERS	
Samsung Electronics Benelux	Patrick Bosschart, Business Manager Telecommunication Network Division
Panasonic	Ron Wille, Group manager marketing & planning consumer products
OTHERS	
Platform Interactieve Digitale Televisie Nederland	Arie Smits (Teleac), chair of Platform
Consumer Association (Consumentenbond)	Andreh van der Kolk, Head of Product Testing and Alwin Sixma, Campaign Leader
Vecai Dutch Cable Association	Job Wehrmeijer

C References

Digital Interactive Forum (2004). *Response to the commission staff working paper on the interoperability of digital interactive television services*. SEC (2004) 346.

EBU-UER (2004). *Comments by the EBU on the Commission Staff Working Paper on the interoperability of Digital Interactive Television Services* (30 April 2004).

ETSI (2004). *Standardisation Work Programme in support of digital interactive television and the effective implementation of article 18 of Directive 2002/21/EC*, ETSI TR 102 282, v1.1.1 (2004-2). Technical Report.

European Commission (2004). *Communication Staff Working Paper on interoperability of digital interactive television services*. Extended Impact Assessment. (COM (2004) 541 final).

European Commission (2004). *Communication Staff Working Paper on interoperability of digital interactive television services*. (COM (2004) 541 final). [SEC (2004) 1028]

MHP Alliance (2003). *Letter of 5 May 2003. Regarding setting up of new COCOM working group on interoperability*.

MHP Alliance (2004). *Why the EU Commission must act now to achieve interoperability and freedom of choice for users in digital television in Europe.* Joint Statement of the MHP Alliance - the Alliance for interoperability at the level of the consumer (1 March 2004).