DIGITAG
Digital Television Action Group

analysys mason

ROADMAP FOR THE EVOLUTION OF DTT – A bright future for TV

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1 Executive summary

PURPOSE OF THE REPORT

This report has been written to describe the future technology roadmap of digital terrestrial TV (DTT), with a focus on European countries. The main purpose of the report is to show that DTT standards are developing in order to meet the expected evolution of services and user requirements.

IN THE REPORT

The report identifies three types of DTT technologies: **core to DTT**, central to the provision of traditional linear TV; **complementary to DTT**, used to provide non-linear, on-demand services via 'hybrid TV'; and **mobile DTT** to devices such as smartphones and tablets. The report provides clear roadmaps for these evolving standards.

EVOLVING STANDARDS

Core DTT technologies available today offer broadcasters and consumers increased choice and quality. **Channel formats** are improving and evolving the quality of the video experience (SDTV, HDTV and UHDTV). **Encoding standards** are offering greater gains in capacity (MPEG-2, MPEG-4 and HEVC). Finally, the next generation of **broadcast transmission standards** (DVB-T2) is available increasing the capacity to offer new services.

In addition to the status of development of news standards, the speed of take-up is influenced by three drivers: the DTT **market characteristics**; the **key players** in a market and whether they are following a pay-tv or free-to-air(FTA) business model; and **regulation and policy within a market**. Migration to new standards needs to show a clear benefit to the viewer. There also needs to be clear support and national coordination, similar to digital switch over which protected the viewer.

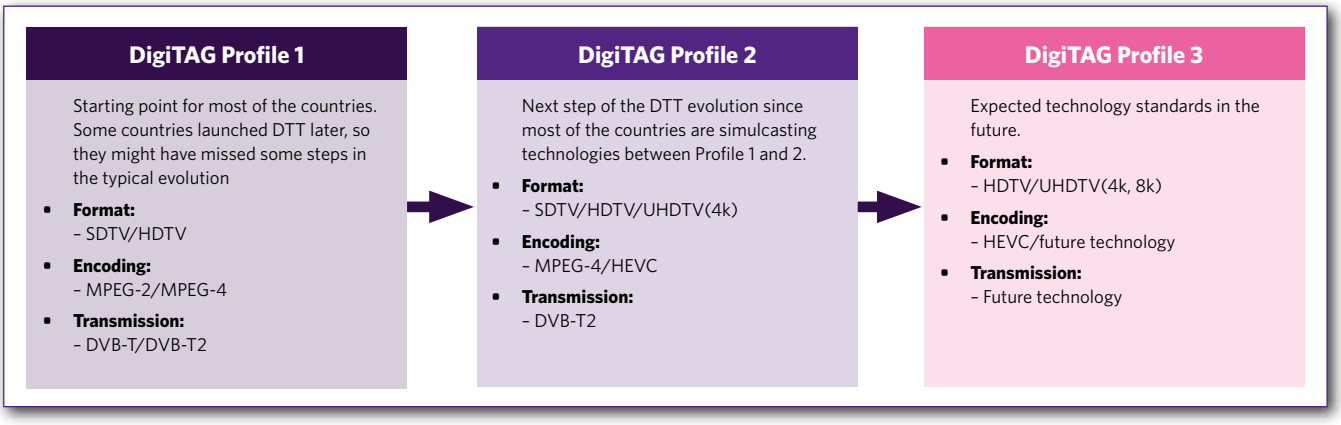
The report discusses the various stakeholders in the DTT market – broadcasters, operators, manufacturers and consumers who influence the speed of adoption of DTT standards.

Market migration is led by viewers' demands for innovation, increased quality and the highest standard of viewing experience. **Vertical integrated markets (pay-tv)** have been shown to move faster towards DTT, while **horizontal integration (FTA)** may take longer.

Nearly all countries in Europe have migrated their terrestrial television platform from analogue to digital technology. Viewer satisfaction with the digital terrestrial television (DTT) platform is high with 43% of households using it to access their primary television services. Yet despite the completion of digital switchover, DTT continues to evolve. Analysis of European markets today shows a developed DTT ecosystem with strong adoption of DTT technology. Nine countries have been analysed in this report, including the four largest economies in Europe.

The majority of European countries have completed their digital switch over (DSO) with DVB-T as the main broadcast transmission standard. Markets around Europe are now migrating or planning their migration to DVB-T2. Markets where DSO has not yet taken place or which have little DVB-T penetration are moving to DVB-T2 in the first instance.

DTT content is today mainly SD with an increasing number of channels available in HD. MPEG-2 is the predominant encoding standard although many countries have established MPEG-4 ecosystems with the majority of new consumer equipment MPEG-4 compatible. HbbTV services for hybrid TV sets are being deployed by broadcasters across Europe.



ROADMAP FOR THE FUTURE OF DTT

In order to describe the future roadmap for the evolution of DTT, the report defines three simple stages through which a market evolves based mainly on the technologies core to DTT, the 'DigiTAG Profiles'. Each Profile shows a different level of development in terms of DTT channel format, encoding and transmission standards. The evolution through the Profiles may vary by country.

The report groups countries into three typologies based on their DTT technology adoption. These country typologies show possible models for market development; Early adopter/innovative, countries which have the right conditions to quickly migrate to new standards; Early majority, countries where conditions are favourable for the migration to new Profiles, though not to the same extent as for early adopters and Late majority, countries that evolve towards new standards at a slower pace.

Based on the technology profiles and on the country typologies this report predicts that consumer demand will see a transition to new standards taking between 3 and 12 years. Early adopter markets are likely to take between 3 and 6 years to move from Profile 1 to Profile 2 and Late majority countries may take between 8 and 12 years to make the same transition.

Most countries are likely to fully adopt Profile 2 between 2017 and 2026. This adoption will be led by consumer demand and expectations for HD and UHD TV. Profile 3 and more advanced transmission and encoding standards as well as resolutions up to 8k, are predicted to occur from 2023 and into 2030 and beyond. Some countries may decide to skip an intermediate step. In particular, this could be the case for countries with a relatively small number of DTT households and/or with a regulator-driven regime.

A BRIGHT FUTURE FOR DTT

DTT will remain the pre-eminent television viewing platform in Europe for the foreseeable future. It provides viewers with significant benefits including universal coverage and free-to-air services. Linear television continues to grow while non-linear and ancillary screens complement traditional viewing. DTT platform development is underway but will require the ongoing support of governments, industry stakeholders and viewers.

The DTT platform is currently jeopardized by the scarcity of radio-frequency spectrum. The re-allocation of the 700 MHz band will reduce the total spectrum available for DTT by an average of 30%. Yet, to remain competitive and sustain the adoption of new technologies, the DTT platform will require continued access to sufficient spectrum especially during migration periods. A clear spectrum allocation is necessary to provide security and stability, promote innovation, and assure long-term investments for industry stakeholders and viewers.

The DTT industry continues to work to ensure it meets consumers' expectations to 2030 and beyond. Despite different DTT technology adoption roadmaps across countries, current efforts and achievements ensure a clear future roadmap for the next 10-20 years.

The DTT platform remains a strong TV distribution platform with a bright future.

2 Introduction

This report was co-authored by DigiTAG and Analysys Mason to provide a reference when discussing the future of Digital Terrestrial TV (DTT). This report provides a roadmap for the future development of DTT technologies in the main European markets.

The report is structured into four main parts:

The report gives an overview of the main drivers that will determine the adoption and growth of DTT technologies, and sets out a roadmap for the evolution of the DTT technology ecosystem in Europe up to 2030 and beyond (Section 3). The discussion touches on channel formats, encoding, transmission standards, hybrid standards and mobile DTT technology.

Section 4 characterises the current situation of DTT in Europe, focusing on the four factors identified in the previous section. Nine European countries are used as the basis for this study.[1]

Section 5 describes the potential future of the DTT market in Europe based on 'DigiTAG Profiles' which define three stages of technology adoption in a country. The Profiles describe how the technology drivers influence the growth of the market and in which three phases the market can be categorised: 'early adopter/innovative', 'early majority' and 'late majority'. Using these typologies, the report gives an overview of how countries will develop in the future, and presents a clear roadmap for the roll-out and migration of DTT.

The last section provides conclusions related to the present role of the DTT platform, and its expected evolution over the coming 15 years.

[1] France, Germany, Italy, Netherlands, Norway, Poland, Spain, Sweden and the UK.

3 Drivers for the evolution of Digital Terrestrial TV technologies

There are four main drivers which will determine the way that DTT evolves over time, and the speed with which it is adopted (Figure 1):

- Technology
- DTT market
- Key players and market structure
- Regulation and policy

3.1 Roadmap for DTT technology (supply)

Using the standard seven-layer OSI model, this report identifies three key types of DTT technology (Figure 2):

- **Core to DTT** – technologies that are central to the provision of traditional linear TV services via the DTT platform
- **Complementary to DTT** – technologies that are related to the provision of non-linear, on-demand TV ('hybrid TV'), as a complement to traditional services
- **Mobile DTT** – technologies that enable TV services to be viewed on mobile devices

For each type of technology, there will be developments at three different levels: (a) the format of the TV channel, e.g. SD, HD and UHD resolution; (b) the encoding technology, e.g. MPEG-2, MPEG-4 and HEVC; and (c) the transmission standard, e.g. DVB-T and DVB-T2.

3.1.1 Technologies Core to DTT

This category relates to technologies which increase the linear TV experience and have been developed to meet the demand from consumers for enhanced image quality. Market pressures also dictate that broadcasters must use the most efficient compression and encoding standards to deliver more content and services. Whilst regulators are concerned with ensuring that these services remain within the constraints of the defined allocations of terrestrial spectrum.

For technologies Core to DTT, we can expect the following developments in format, encoding and transmission:

- **TV channel format**. Technically, resolution is measured in terms of pixels, lines and frames, commonly referred to by the industry as SD, HD and UHD (4k and 8k). Higher resolutions require significant increases in capacity (UHDTV requires up to 20× more capacity than SDTV), and therefore the move to higher resolutions must be accompanied by a complementary evolution in modulation and encoding technologies.
- **Encoding technology** refers to the compression technology used for DTT. This includes the increasingly efficient standards MPEG-2, MPEG-4 and HEVC. A gain of 5–10% is expected for MPEG-2 within three to five years,

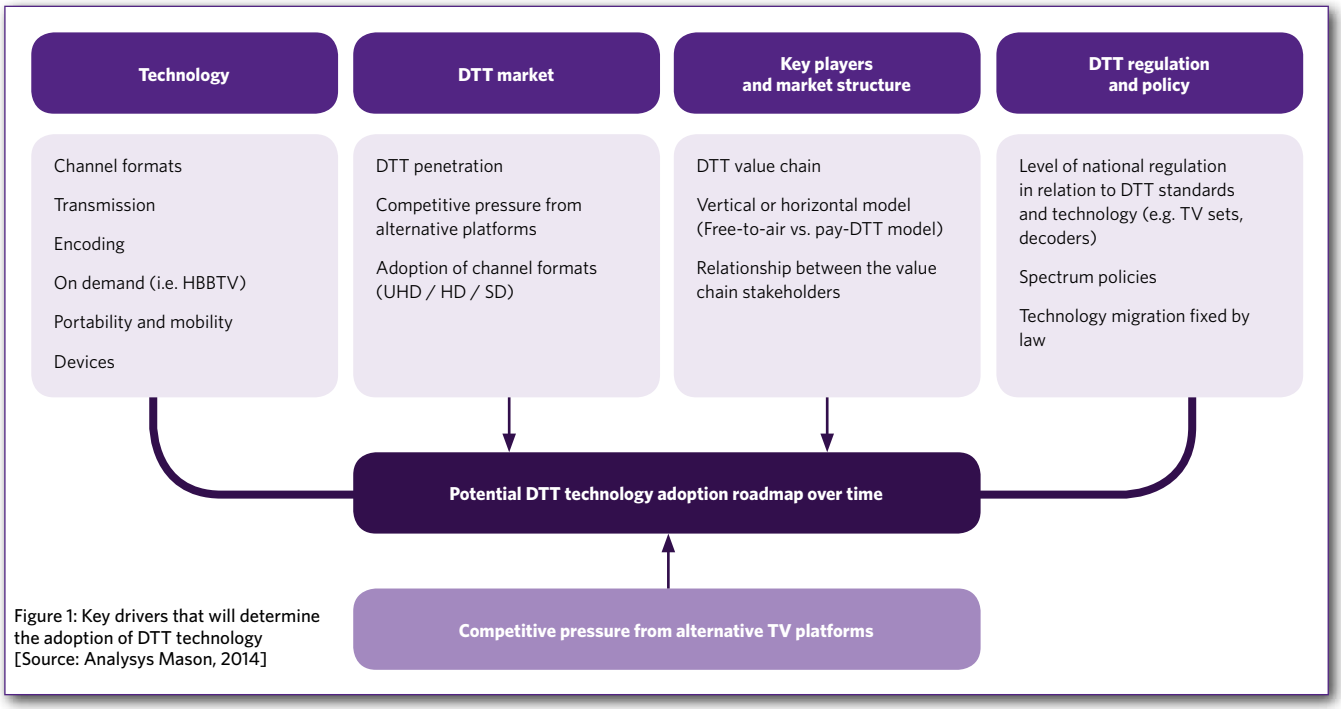


Figure 1: Key drivers that will determine the adoption of DTT technology [Source: Analysys Mason, 2014]

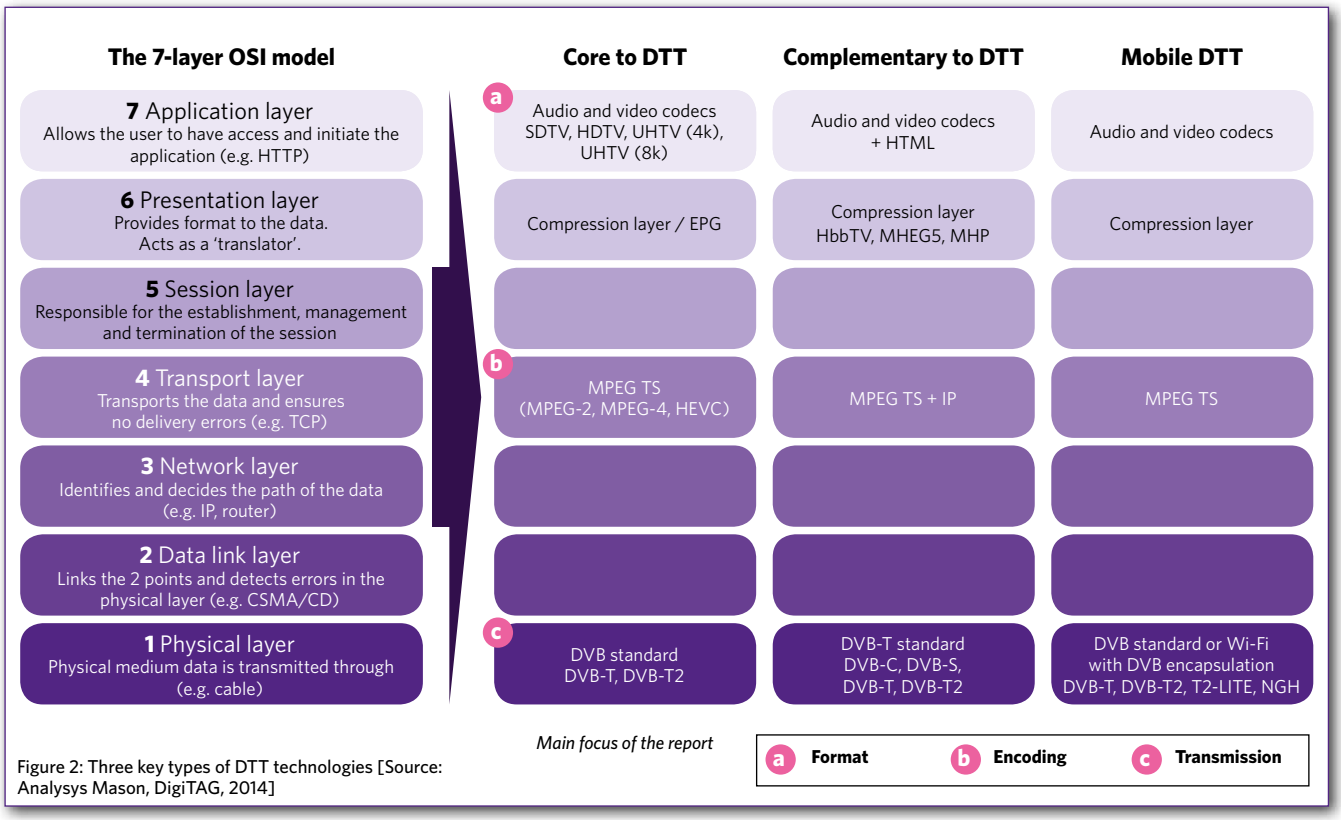


Figure 2: Three key types of DTT technologies [Source: Analysys Mason, DigiTAG, 2014]

and 10–20% for MPEG-4. In the long term, the move from MPEG-4 to HEVC would represent a bitrate improvement of 30–50%. Future encoding technology beyond HEVC could also support a similar gain in bitrate.

- **Transmission standard** includes DVB-T and the improved extension of the standard that is DVB-T2. DVB-T2 increases the capacity (Mbit/s) available in existing DTT multiplexes. In practice, DVB-T2 can increase capacity by a factor of 1.5 or more depending on the transmission mode.

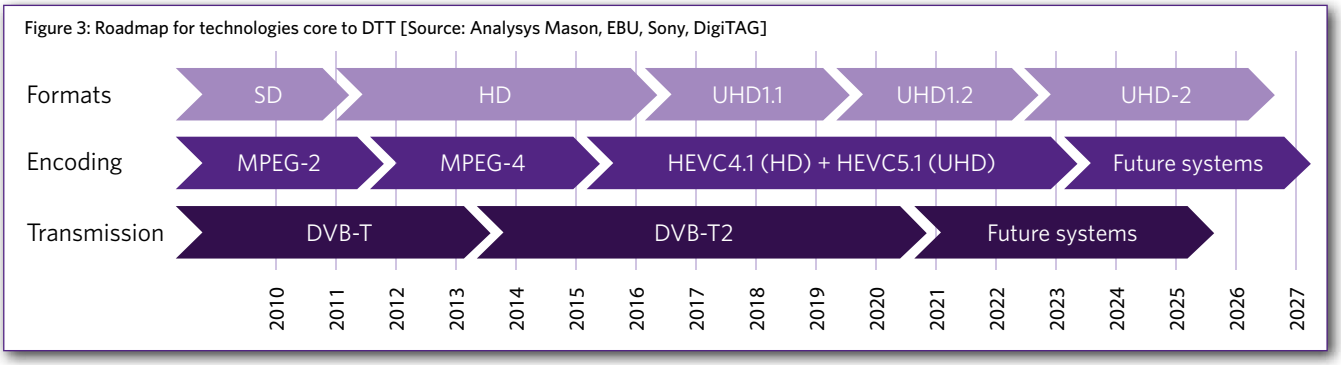
Figure 3 shows the expected roadmap for the adoption of these core DTT standards in Europe, although the standards are shown to progress in a linear fashion it is likely that to protect consumers and ensure a smooth transition simulcasting of old and new standards will occur.

The Core DTT technologies available today already offer broadcasters and consumers choice and quality. Looking at the roadmap for the evolution of these technologies in the future; channel formats are improving and evolving, increasing the quality of the video experienced (SDTV, HDTV and UHDTV). Encoding standards are offering greater gains in capacity (MPEG-2, MPEG-4 and HEVC). New broadcast transmission standards have been developed such as DVB-T2 which increases the capacity to offer new services benefiting viewers.

3.1.2 Technologies complementary to DTT

DTT networks alone are not suitable for on-demand services as they are one-to-many networks optimised for a cost-efficient delivery of the same content to large audiences, over large territories. In response to the strong growth of on-demand and non-linear TV services, the DTT industry has worked to evolve the platform to include standards for services classified as 'complementary to DTT'.

Figure 3: Roadmap for technologies core to DTT [Source: Analysys Mason, EBU, Sony, DigiTAG]



The development of hybrid TV standards, which combine DTT with fixed broadband networks, allow the seamless consumption of both linear and non-linear services. The coexistence of broadcast and broadband networks enables the delivery of the full range of services to all users on all devices. A convergence of broadcast and mobile broadband networks which would duplicate capacity and require unnecessary high investments is then not necessary for the delivery of both linear and on-demand services.

A number of standards for hybrid TVs are available, including MHEG-5, MHP and HbbTV:

- **MHEG-5** was the first standard developed for non-linear TV, and is used by Freeview in the UK. It is a licence-free, public standard for TV middleware to send and receive data for interactive TV. It allows a wide range of TV-centric interactive services to be deployed.

- **MHP** was developed in 2000 and went through three releases (MHP 1.0 to 1.2) until 2008, when it merged into a pre-existing global standard called GEM (Globally Executable MHP). The latest version, GEM 1.2, continues to evolve.

- **HbbTV** is a relatively recent ETSI standard adopted by many European countries. It is able to provide seamless TV services delivered via broadcast, with additional services delivered via broadband. HbbTV allows consumers to access video on demand and catch-up services on the free-to-air platform.

For consumers, the investment required for hybrid TV is a one-off payment for a set-top box (STB) alongside broadband subscription. Figure 4 shows the expected roadmap for the development of hybrid TV standards.

Standards for services complementary to DTT are already available. There is a clear roadmap of development for MHEG-5, GEM (MHP) and HbbTV. These technologies enhance the functionality of the DTT standard, benefiting consumers and adding further flexibility and additional on-demand services to the DTT platform.

3.1.3 Technologies for mobile TV

The DTT industry has developed two new TV transmission standards which enable DTT audio visual content to be received on mobile and nomadic devices such as DVB-T2 Lite and DVB-NGH. It should be noted that these advances are delivered through DVB-T2 modulation technology and are not supported by DVB-T; for this reason, the adoption of mobile TV standards will depend on the availability of DVB-T2 within a country.

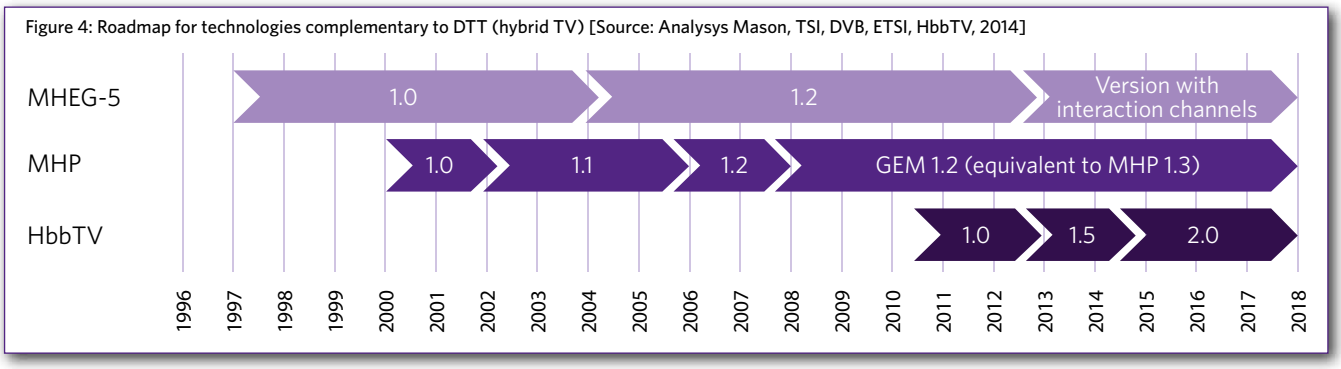
- **DVB-T2** Lite provides an efficient new platform for broadcasting mobile TV. The standard is a subset of DVB-T2 specifically designed for mobile and handheld reception, and offers a maximum bitrate of 4 Mbit/s. From a more technical point of view, a combination of DVB-T2 Lite with DVB-T2 can be achieved by means of Future Extension Frames (FEF).

- **DVB-NGH** (new generation handheld): DVB-NGH is based on DVB-T2 and allows for more flexible and efficient allocation between DVB-T2 frames and NGH frames than DVB-T2 Lite. This development of the standard offers more efficient delivery, more content and greater efficiency than DVB-T2 for handheld reception.

DTT services can currently be accessed on mobile handsets using special USB adapters making use of Wi-Fi connectivity using DVB Generic Stream Encapsulation (DVB-GSE) with DVB-T2. These options have been developed to explore mobile integration.

Mobile DTT standard development can in the future benefit consumers and broadcasters by allowing DTT to be integrated with mobile handsets and devices such as tablets. DTT content can be accessed today in some countries on mobile handsets through Wi-Fi connectivity.

Figure 4: Roadmap for technologies complementary to DTT (hybrid TV) [Source: Analysys Mason, TSI, DVB, ETSI, HbbTV, 2014]



1 Although the DVB-T standard was mainly developed for stationary reception, reception of DVB-T on the move is also possible with appropriate modulation parameters (as deployed in Germany).

3.2 The DTT market

In each country there are a number of important market factors that determine the future roadmap for the adoption of DTT technologies: the level of DTT penetration, the degree of competition from other TV distribution platforms, the penetration and usage of different consumer devices, and the consumption and usage of linear and non-linear TV. Other factors affecting the speed of technology adoption include environmental (socio-economic) factors such as:

- **DTT penetration and number of households**: High DTT penetration in a large country will result in a large number of DTT households that will need to be migrated, which is likely to require time and large investments. Lower penetration in a small country is likely to result in faster migration, although it might require support from stakeholders (e.g. the regulator).
- **Number of DTT channels**: The higher the demand for DTT channels, the greater the likelihood that it will be in the interest of players and the regulator to move to newer, more efficient technologies.
- **Share of HDTV**: The higher the share of HDTV, or pressure to move to HDTV from competing TV platforms, the greater the likelihood that it will be in the interest of DTT players and the regulator to move to more encoding and/or spectrum-efficient technologies.
- **Adoption of HDTV sets**: The higher the rate of HD-compatible sets, the greater the likelihood that it will be in players' interest to innovate in light of the larger audience that can be potentially reached.
- **Importance of non-linear TV**: With the growth of non-linear TV, linear TV has to be innovative to be competitive and attractive. This increases the need to provide non-core services such as HDTV and UHDTV to compete against other TV platforms, in particular IPTV and digital cable TV.
- **Take-up of connected TVs:** The higher the penetration of connected TV sets, the more important it is for terrestrial TV to develop non-core DTT services such as on-demand TV.
- **Adoption of mobile TV**: The higher the availability of mobile devices in the market, the more important it is for terrestrial TV to offer relevant services to non-core DTT devices; such as complimentary services to second screens or relevant additional short-form suitable for consumption on mobile devices.
- **Economic impact on viewers**: any technology migration and adoption also depends on the purchasing power of viewers within a market.

Figure 5 shows how the TV market is becoming more competitive due to different TV platforms. DTT is evolving

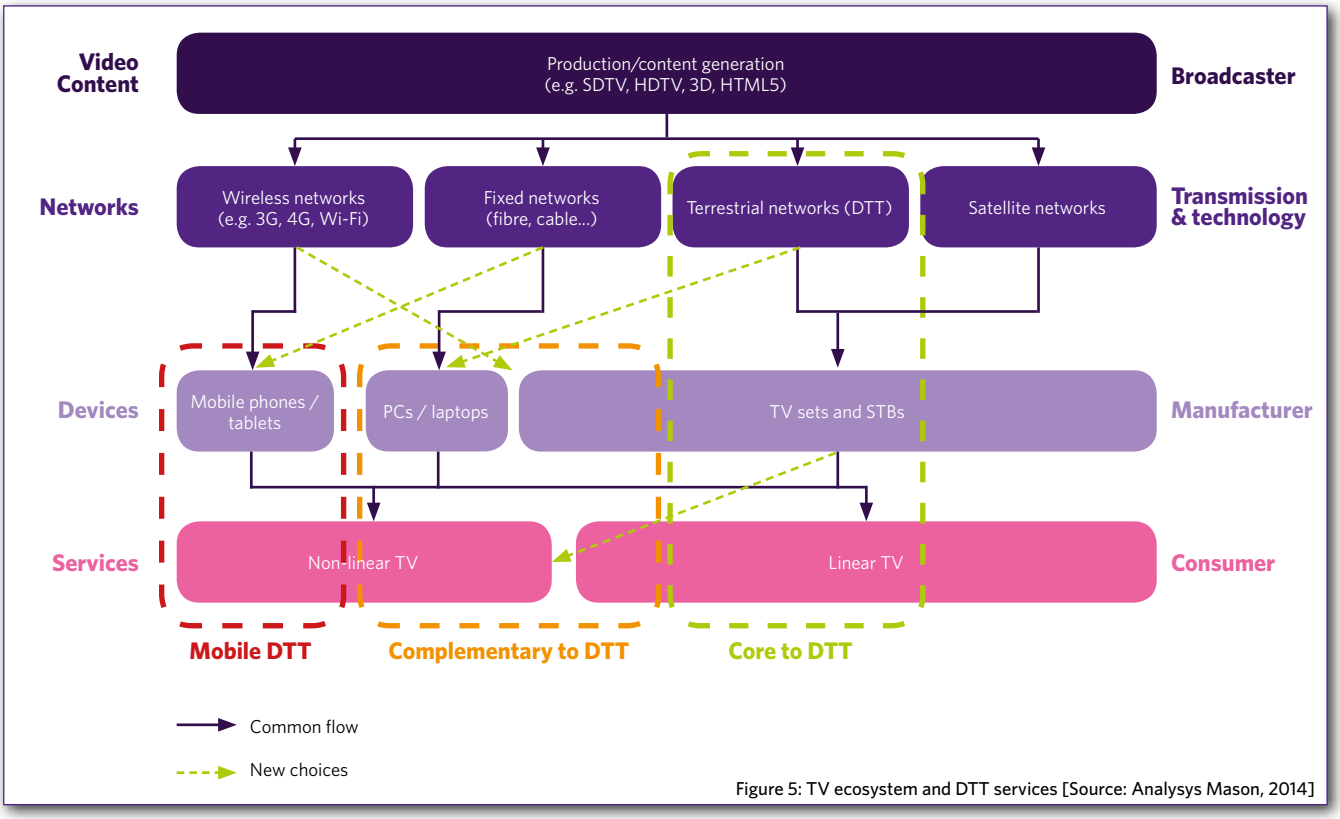


Figure 5: TV ecosystem and DTT services [Source: Analysys Mason, 2014]

from a model based purely on linear TV services, standard TV sets and STBs, to a model providing non-linear services, as well as mobile TV services to devices such as smartphones and tablets. These types of business model are discussed in more detail later in this report (Section 4). In this way, the DTT platform is adapting to the growth of changing viewing trends and the rise of viewing on new devices. It also shows how the key players in the market influence the different parts of the DTT ecosystem.

In response to changing markets trends, demands and needs the DTT platform remains agile and ready to respond to the market. DTT is transitioning from being a purely linear model to one which can provide non-linear services available on all types of devices.

3.3 Key players and market structure

There are four groups which influence the take-up of DTT in a market:

- **Viewers** benefit from innovations that provide more choice and higher quality. Technology adoption at all times should benefit consumers and migration plans should be clear to ensure the least disruption. Players in the value chain may subsidise new equipment in order to accelerate take-up. New technologies are not the goal although improvements to services and content which add to the viewing experience are driving the development of these new technologies. DTT offers viewers clear benefits:
    - DTT allows for efficient delivery of free-to-air content to large audiences with a guaranteed quality of service
    - DTT provides near universal coverage (over 98 % population)
    - DTT is the cheapest platform to deploy and provides ease of use to the viewer
    - DTT ensures public service content to all members of society to sustain broader content choice promoting cultural diversity
- **DTT broadcasters** are supportive of the DTT platform thanks to its minimal fragmentation and its unique household reach. Incentives to innovate come from the broadcasters' desire to meet consumer demand for additional content and better quality of service. However, DTT broadcasters are increasingly facing competitive pressure from alternative platforms and delivery channels. In addition, their decisions are constrained by recent reductions in terms of funding (especially from advertising) which are due in part to these new platforms and delivery channels. Broadcasters also need to consider the cost of migration and simulcast with regard to new standards and the availability of spectrum which in some countries can be the catalyst for adopting new more efficient technology standards due to lack of spectrum. In particular, DTT is the only platform which offers public services broadcasters the ability to fulfil their obligation to make their content universally available.
- **Network operators** have invested heavily in DTT in Europe. They have a clear roadmap for the future of DTT. Network operators are working hard to ensure the future of DTT promoting within each country network renewal and development.
- **Manufacturers** continue innovating and releasing new products. There is increasing demand for TV sets with larger screens, better resolution and increased functionality. This demand is influential in reducing the lifecycle of TV equipment.

The roadmap for DTT is influenced by key players following a **vertically integrated** business model, or a **horizontal model**;

A **vertically integrated** pay-DTT model is likely to favour a more organised migration between standards. It is driven by the commercial interests of vertically integrated pay-tv operators who are focused on revenues from consumers and commercial subsidies.

In contrast, a **horizontally integrated** model based on FTA services is likely to favour a slow transition to new DTT technologies as these markets are driven by Public Service Broadcasters (PSBs) whose focus is on serving the best interest of the viewer. In this model the leader of innovative content tends to be the PSB for example the BBC, UK and RTVE, Spain.

There is no correct or incorrect business model: on the one hand, vertical integration tends to move the market forward at a faster pace, benefiting broadcasters and consumers. Horizontal models, though slower, can also protect consumers and benefit regulators in terms of enabling clear, long-term migration plans.

The various stakeholders in the DTT market – viewers, broadcasters, operators and manufacturers influence the speed of adoption of DTT standards.

New standards are not the goal of DTT development. The aim is to improve services, content and to allow viewers to watch this content on new devices.

Vertical integration (exemplified by the pay-tv model) has been shown to move markets faster towards DTT, while

horizontal integration (as in the FTA model) may take longer, but may be more appropriate to certain types of market and might better protect consumers.

3.4 DTT regulation and policy

The level of national regulation in relation to DTT standards is an essential factor ensuring stability for broadcasters and consumers during adoption and migration to DTT standards. Regulation can take a variety of forms including spectrum policies, licensing of DTT channels, and the mandatory migration to certain technologies.

In general, regulation can assist market development in two ways 'market driven' or 'regulator assisted', although in reality there may be a mix of the two;

Under a **market-driven approach**, (natural product lifecycles) the regulatory authority does not position itself as the final decision maker. The regulator works as a facilitator, gathering the views of all stakeholders and promoting discussion on the future of DTT through public consultations. In this case the industry as a whole takes a joint decision to move forward with DTT, and coordinates the migration to new standards.

With a **regulator-assisted approach**, (mandated, typically accelerated product lifecycles) the authority represents the focal point that is entrusted with the responsibility of taking decisions. Public consultations still represent an important step in the decision-making process, but these are seen as more of an informative guide. In this approach, the regulator is asking for opinions from stakeholders to support its decisions, rather than encouraging them to take a shared position.

Migration to new standards needs the support of all of the players in a market and national coordination, similar to what was seen for the DSO. Future migration in DTT technology will need coordination and management.

Regulators and policy makers play an important role in the adoption and migration of DTT technologies, although their approaches may differ. National regulators play a role in both market-driven (natural product cycles) or regulator-assisted approaches (mandated, typically accelerated product cycles), in the latter they are key to pushing the market forward.

4 The current situation – DTT in Europe

This section reviews the current situation of DTT in a selection of nine European countries[2] , in particular looking at how the four main drivers for the adoption of DTT standards described in the previous section; technology, market conditions, market players, and regulation and policy are playing a part in European markets today.

4.1 Status of DTT technology

4.1.1 Status of technologies core to DTT

CHANNEL FORMAT

Most DTT content provided in the study countries is in SD, though an increasing number of channels are already available in HD (see Figure 6). The UK already has a 68% household penetration of HDTV sets (one of the highest in Europe). It is expected that HDTV set penetration will continue to increase in all countries, leading to a demand for higher-quality content in HD.

Migrating from DVB-T to DVB-T2 facilitates the possibility of upgrading all programmes from SD to HD. Broadcasters and network operators, looking to the future, have also been showcasing UHD during special events (e.g. the BBC during the summer of 2014 at the FIFA World Cup in Brazil and at the Commonwealth Games in Glasgow or RTVE /Abertis during the Mobile World Congress, Barcelona, 2013).

ENCODING TECHNOLOGY

As shown in Figure 7, most countries in Europe still use the MPEG-2 standard, although many – especially the leading economies – have an established MPEG-4 ecosystem. The majority of new consumer TV equipment sold is MPEG-4 and backward compatible with MPEG-2.

We would expect MPEG-4 and HEVC to gain ground due to:

- migration to DVB-T2, which will trigger the replacement of decoders and TV sets with more advanced models, increasing number of channels moving to HD, which is usually implemented with advanced encoding standards
- the need to address the capacity limitations of existing multiplexes

Devices available today are compatible with next generation standards which will allow for the faster and easier transition to new technologies, for example new devices which include DVB-T2 and HEVC. This also affords the device some form of future proofing benefiting the consumer.

TRANSMISSION STANDARD

As Figure 8 shows, the transition to DVB-T has successfully been completed in all major European markets.

The UK, Netherlands, Italy and Denmark are among the markets which have DVB-T and DVB-T2 (DVB-T2 was introduced after many of the major countries in Europe had started their transition to DVB-T). As a result, although some of these countries have implemented DVB-T2 networks they still have DVB-T as well and are in the middle of planning a full transition to DVB-T2.

Some countries which are still in the transition to DSO are

Channel format	France	Germany	Italy	Netherlands	Norway	Poland	Spain	Sweden	UK
# of national channels	38	12-35	124	24	44	24	26	57	89
inSD	27	12-35	109	24	37	22	20	47	77
inHD	11	0	15	0	7	2	6	9	12
FTA channels in SD	18	12-35	84	3	1	22	19	7	75
Pay TV channels in SD	9	0	25	21	36	0	1	40	2
FTA channels in HD	10	0	4	0	3	2	6	2	12
Pay TV channels in HD	1	0	11	0	4	0	0	7	0
Take up of HD channels	28% / 72%	0% / 100%	12% / 88%	0% / 100%	16% / 84%	8% / 92%	23% / 77%	16% / 84%	13% / 87%

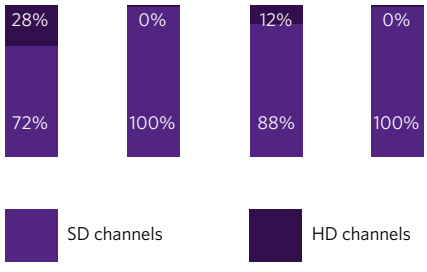


Figure 6: Channel format in selected European countries [Source: Analysys Mason on DigiTAG, Ofcom and BBC (National channels only)] *Germany has 12-35 channels depending on the Bunderslander region

[2] France, Germany, Italy, Netherlands, Norway, Poland, Spain, Sweden and the UK.

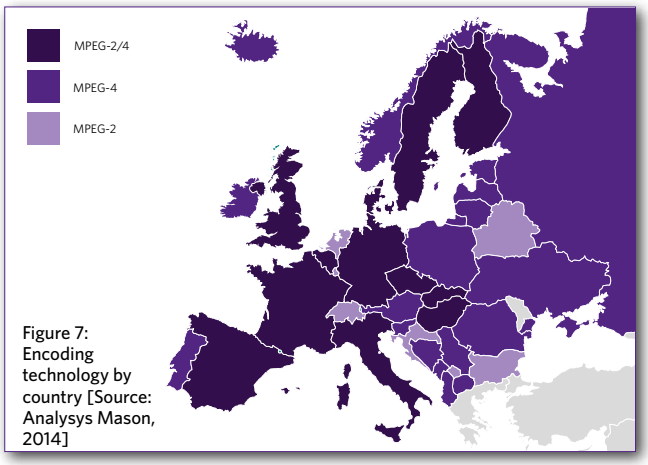


Figure 7: Encoding technology by country [Source: Analysys Mason, 2014]

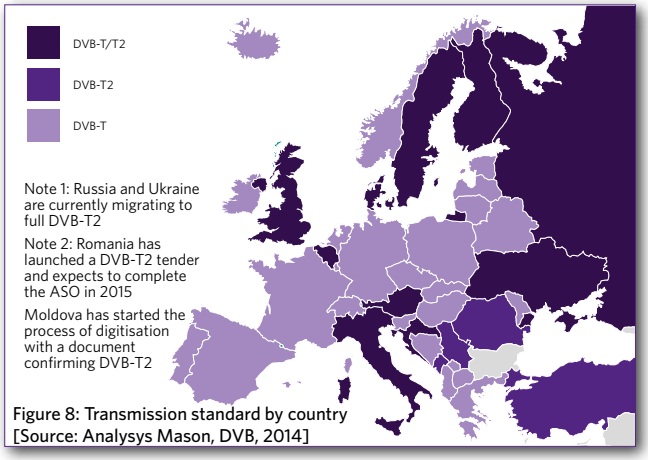


Figure 8: Transmission standard by country [Source: Analysys Mason, DVB, 2014]

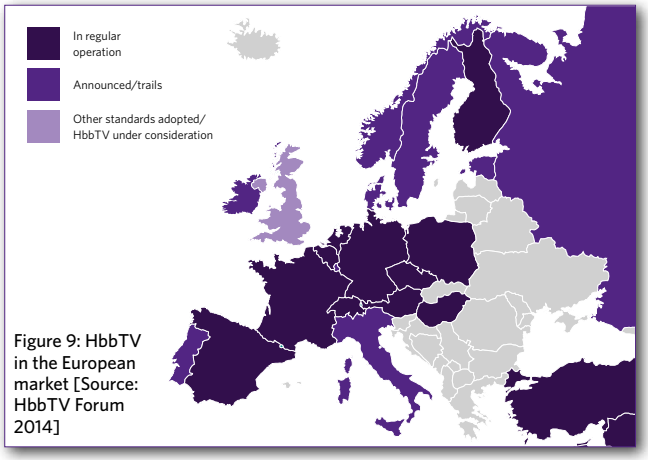


Figure 9: HbbTV in the European market [Source: HbbTV Forum 2014]

exploiting the opportunity to move directly to DVB-T2; these include Romania, Russia and Turkey. Figure 10 shows the transmission standards used by European countries.

4.1.2 Status of technologies complementary to DTT

As mentioned in Section 3.1.2, many European countries are adopting HbbTV for on-demand and non-linear TV services consumed via hybrid TVs. Figure 11 shows the status of HbbTV roll-out across Europe.

In Spain, RTVE which covers 98.5% of the Spanish population, now reaches more than 700,000 homes (number of connected hybrid devices) with its 90,000 hours of HbbTV services, which were soft-launched only eight months ago. In Germany HbbTV services have been available since 2009. ZDF's HbbTV platform generates over 2.5 million views per day and ten million HbbTV-enabled TV sets have already been sold in Germany. In Italy it has also been announced that there will be a gradual transition to HbbTV service away from MHP.

In terms of supply, a growing percentage of connected TV sets for sale in Europe support HbbTV, providing access to on-demand services and potentially allowing manufacturers to develop more consumer-friendly EPGs. The inclusion of HbbTV in the DTT standard is ensuring that the platform continues to respond to changing consumer viewing trends in Europe.

4.1.3 Status of mobile TV technologies

As described in Section 3.1.3, mobile TV technologies for nomadic and mobile services and devices have been developed, namely DVB-T2 Lite and DVB NGH. The DTT platform is now ready to react to the growth within this sector in the future. Recent trends in smartphones sales show an expected increase in the resolution of handset screens, which will also encourage the take-up of mobile TV (Figure 10).

The consumption of TV continues to be on the main TV set in the living room, the growth of smartphones and

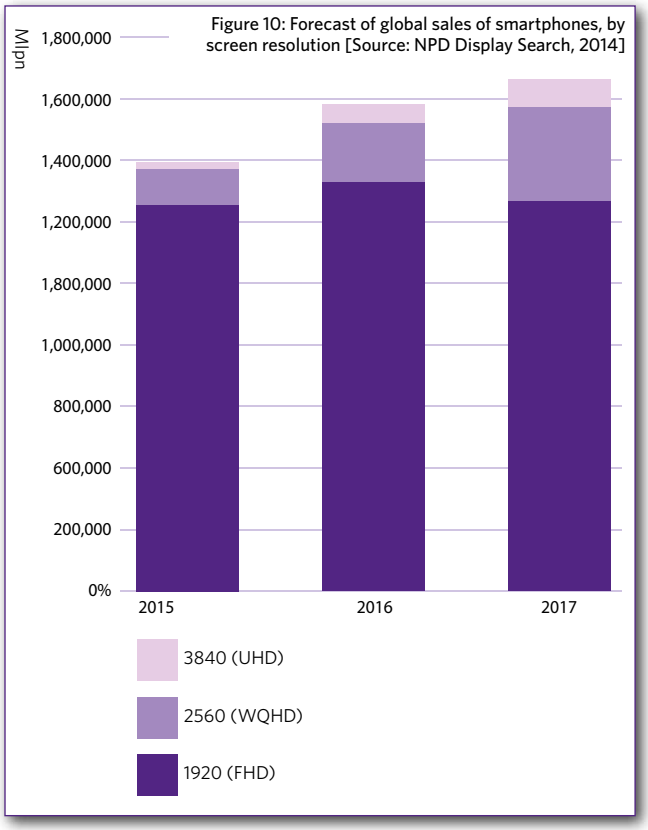
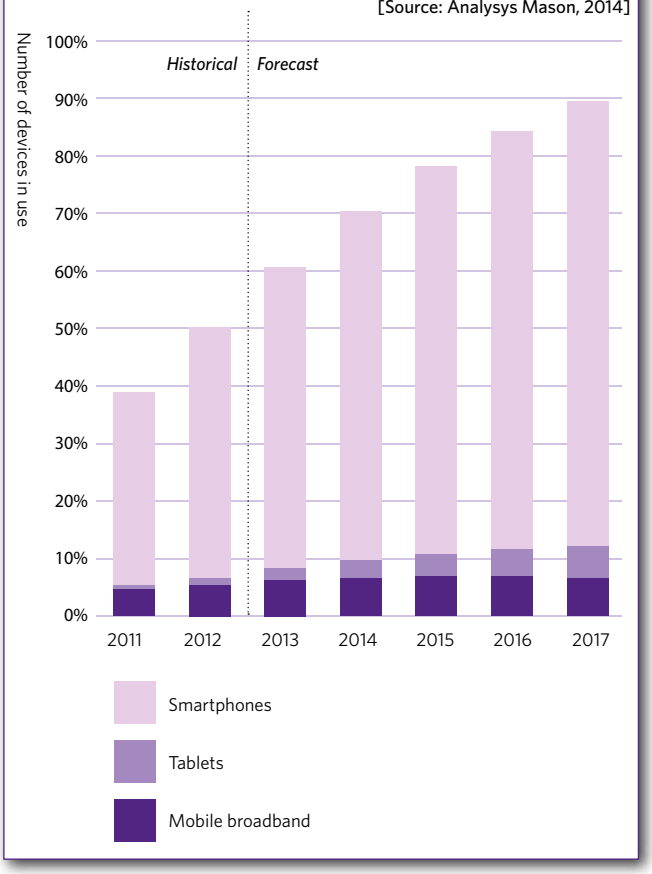


Figure 10: Forecast of global sales of smartphones, by screen resolution [Source: NPD Display Search, 2014]

Figure 11: Number of Internet-enabled mobile devices in Europe
[Source: Analysys Mason, 2014]



tablets enables the viewer to view complementary content on secondary screens. This brings more opportunities to watch, for example in the bedroom typically by extending the fixed broadband connection using Wi-Fi. In Europe, the number of sophisticated mobile devices such as tablets and smartphones has grown significantly in the last five years and this trend is forecast to continue.

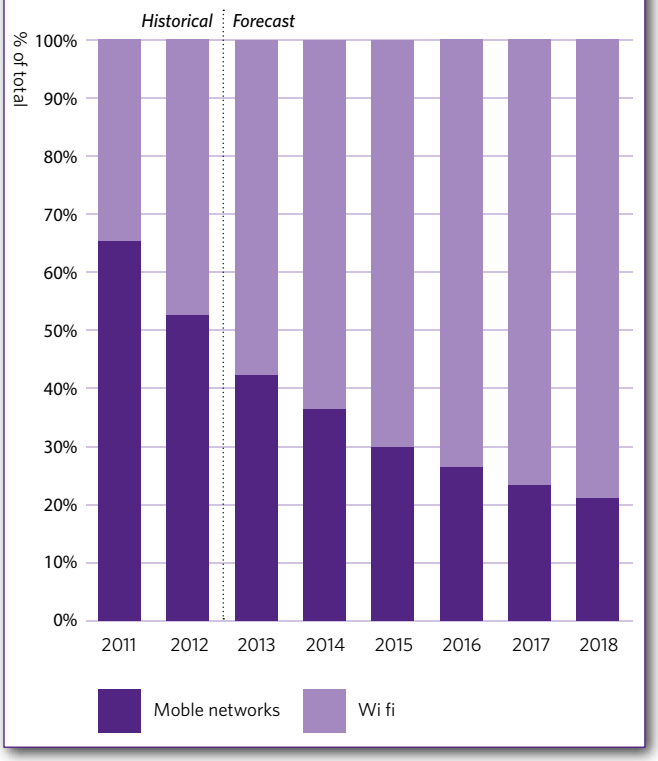
Analysys Mason forecasts that the number of tablets and smartphones in Europe will increase by 12.2% per annum until 2017. Of these devices, tablets will experience the highest growth, at a CAGR of 34.2% over the period 2012–2017. The total number of Internet-enabled mobile devices in Europe is forecast to reach approximately 890 million by 2017, and of these, smartphones will represent 85%.

The widespread adoption of more sophisticated devices such as smartphones and tablets has extended the viewers' experience and has led to an explosion in data traffic due to the rising consumption of video content. Analysys Mason forecasts that mobile data traffic in Europe will grow at a CAGR of 34.7% over the period 2013–2017. Traffic from tablets will experience the most rapid growth (CAGR 83% over the period), followed by smartphones (CAGR 45.9%). Most of this data is not carried by the networks of the mobile operators, but is mainly streamed via Wi-Fi.

As shown in Figure 12, this trend is expected to increase steadily in the next five years.

In response to these market trends, manufacturers are integrating technical features into mobile devices that further foster data consumption, such as; larger screens for better viewing of video content (e.g. mobile phones with HD quality), more powerful chipsets and operating systems to support increasingly sophisticated applications, multi-band radio chipsets for maximum 3G, LTE and wifi coverage and higher levels of performance such as battery life, allowing longer sessions. These upgrades will also benefit viewing of DTT via mobile devices in the future.

Figure 12: Proportion of traffic carried by mobile and Wi-Fi networks
[Source: Analysys Mason, 2013]



Today, Europe presents a developed DTT ecosystem with strong adoption of DVB standards. The majority of European countries have completed their DSO by moving to DVB-T some using DVB-T and DVB-T2 jointly and some new markets moving directly to DVB-T2.

DTT content is mainly SD with an increasing number of channels available in HD. Many countries have an established MPEG-4 ecosystem although most still use MPEG-2. In the major European countries the majority of new consumer equipment includes MPEG-4. German broadcasters have stated their intention to start DVB-T2 services encoded with HEVC to portable devices in a roll out which is expected to begin in 2017, covering the whole country by 2022. It is expected that the adoption of advanced encoding standards will increase and more devices with high technology standards will become available in European markets. Improved encoding and transmission standards both provide gains in capacity and allow for new services to be offered, they are not separate evolutions. Future devices must support legacy standards to ensure backwards compatibility.

Hybrid TV sets which include HbbTV are being deployed by broadcasters throughout Europe. Mobile DTT standards have been developed ensuring that DTT is able to provide services to smartphones and tablets in the future. This is only possible if DTT tuners are integrated in smartphones and tablets. It requires CE manufacturers (Sony, Apple, Nokia, Samsung, etc) to make this addition which is not the case in Europe at the current time.

4.2 Status of the DTT market

DTT AND OTHER TV PLATFORMS

DTT is the main TV platform in the primary European markets (43% of European households receive terrestrial television). When looking at current trends within European markets, it is clear that DTT is strongly placed to provide attractive services now and in the future. DTT is at the heart of TV in Europe; where coverage often exceeds 98% of the population and services are primarily free to air. Although differences exist between countries – and between regions within countries – it is the most popular platform in all the key markets, as shown in Figure 13. In addition, when secondary and/or hybrid sets are considered, DTT household penetration is significantly higher. As an example, in Spain, the average is 2.2 TV per household. Figure 13 does not include the secondary and/or hybrid TV sets.

LINEAR VS. NON-LINEAR VIEWING

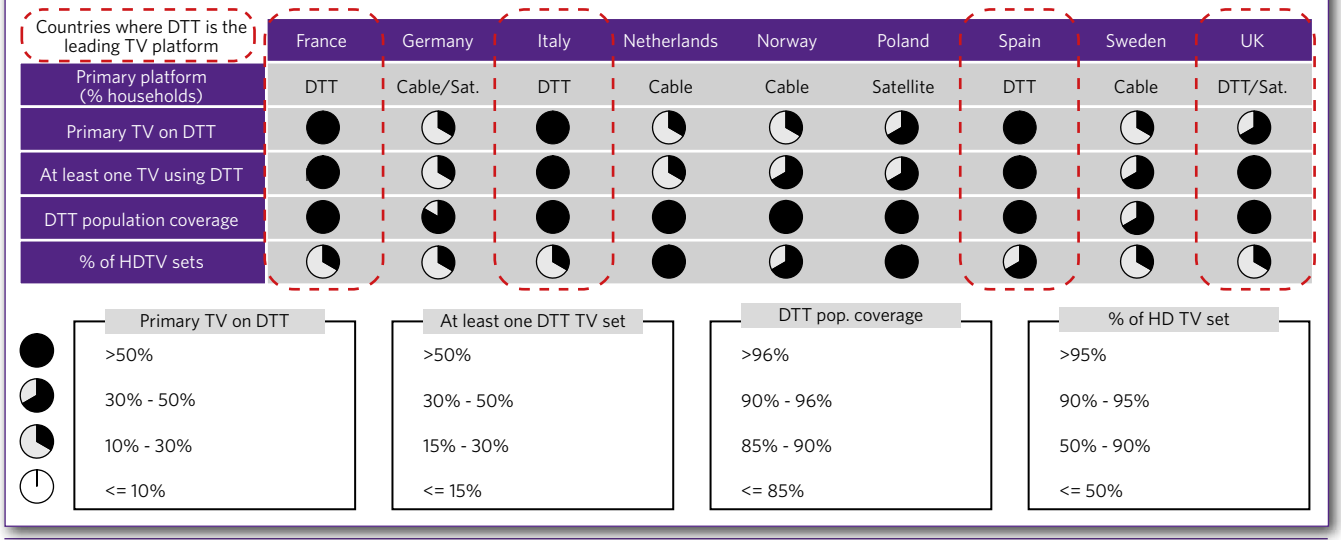
Despite the proliferation of other viewing methods or devices such as tablets and games consoles and the increase in Internet penetration, TV remains a major source of entertainment. Figure 14 shows the high levels of linear TV viewing in five major countries in Europe, amounting to an average of 4 hours per day in 2012.

Linear TV viewing has increased in recent years: in the period 2004–2011 linear viewing has increased by between 3% (Poland) and 11% (France). There are several reasons for this increase, including the improved quality of TV sets (bigger screens) and the popularity of live shows (such as major sporting events).

Viewing times for non-linear services are also growing: in 2011 the average viewing time stood at 13.6 minutes per day (6% of overall TV viewing time), and is forecast to increase to 32.5 minutes per day by 2016 (12% of TV viewing time). In 2012 about 2% of the total TV viewing in Europe was truly on-demand, though there are large differences in the figures between different countries.

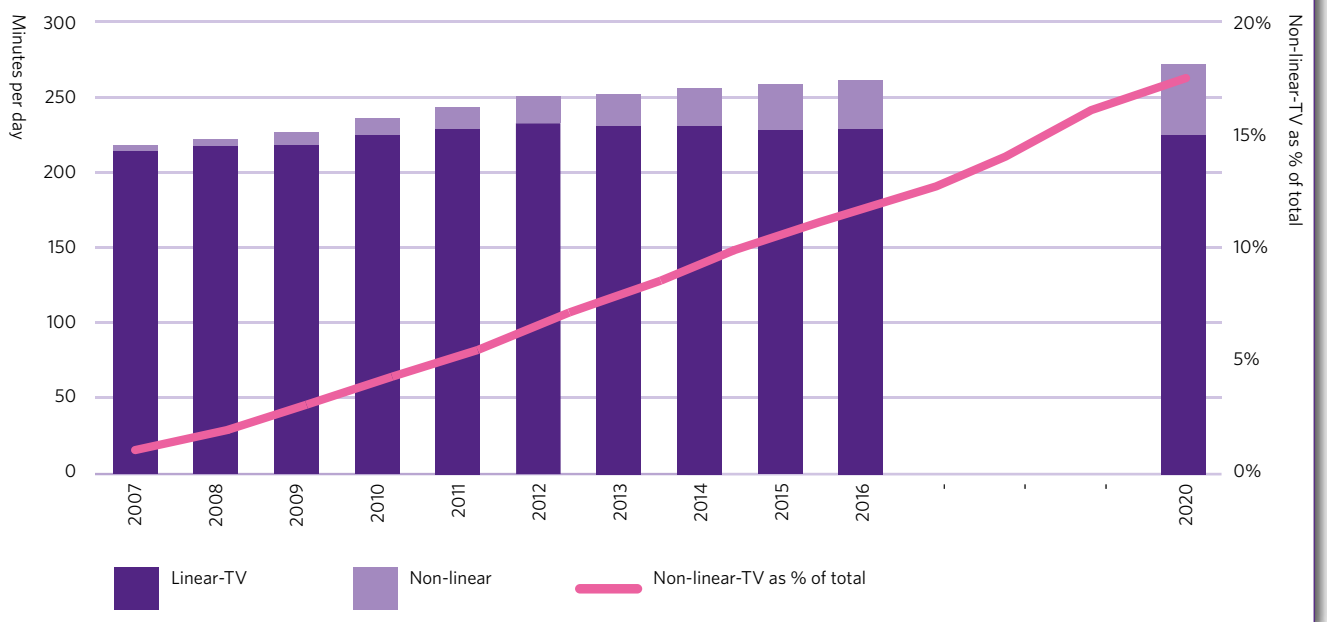
The proportion of consumers viewing over-the-top (OTT) video content in the UK is higher than in other European countries, due to the growth of OTT providers such as BBCI iPlayer, Amazon Prime Instand Video, Netflix and NOW TV. OTT services will grow in importance across Europe and the world as services such as Netflix expand. The majority of non-linear TV is watched over a time-shifted TV (DVR).

Figure 13: Relative performance of the DTT platform in selected European countries [Source: AM, DigiTAG , 2014]



*The information provided does not confirm whether this is HDTV set: 10:80 screen or MPEG 4 + DVB-T2

Figure 14: Linear and non-linear TV viewing in France, Germany, Italy, Spain and the UK [Source: EBU based on IHS – ScreenDigest, 2014]



Other non-linear viewing takes place on video players (DVD/Blu-ray), games consoles and on the Internet. Video viewed on mobile phones only represents a small fraction of non-linear TV viewing time.

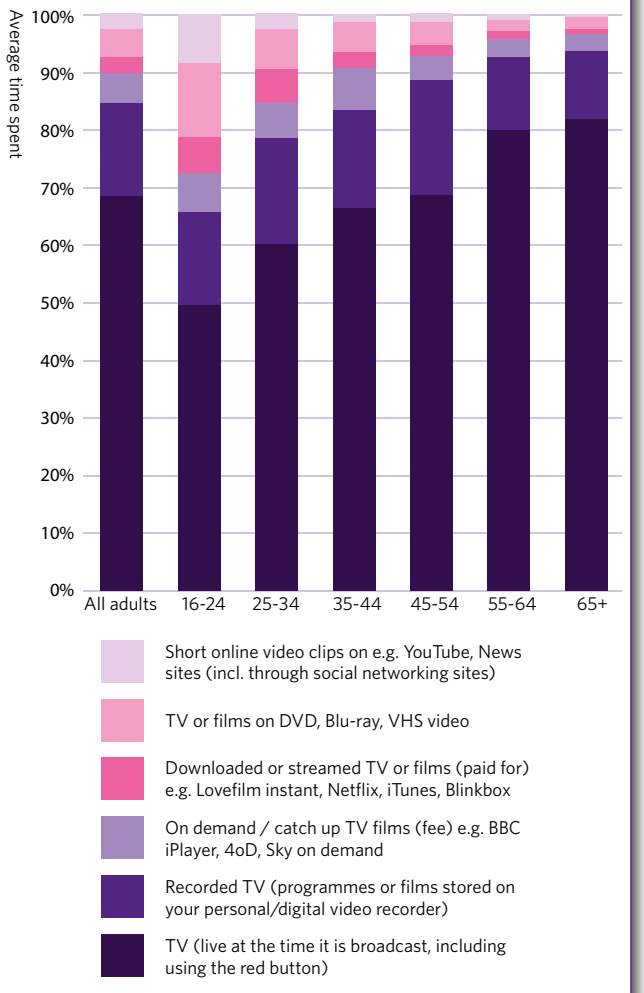
However, the growth of demand for non-linear services so far has not had an eroding effect on linear TV viewing: on the contrary, linear viewing serves as the main entry point for the majority of users, who then also access time-shifted and on-demand services to supplement their regular viewing. In this way, linear and non-linear viewing reinforce each other. The growth of non-linear services has however impacted the viewing of DVDs and videos which has decreased.

VIEWING TRENDS BY AGE GROUP

The TV consumption behaviour of the youngest segments of the population provides hints for the likely evolution of the TV market and the demand for new services. The Figure shows the percentage of time currently spent by different age groups in the UK across platforms and ways of viewing. It shows younger age groups spend a greater percentage of time watching non-linear TV however their consumption of linear TV remains above 50%.

Another relevant trend is the increasing number of ancillary screens (e.g. laptops and tablets) used to consume video content or to interact with television programmes. Ancillary screens however do not pose a threat to traditional TV sets as they play a complementary role. Looking to the future, hybrid services are therefore the key to ensuring that younger viewers stay engaged with the DTT platform.

Figure 15: Viewing behaviour by age group [Source: The communications market report, Ofcom, 2014]



[3] See Eurobarometer 414 page 59: http://ec.europa.eu/public_opinion/archives/ebs/ebs_414_en.pdf We assume that the current analogue television with an aerial will migrate to DTT.
[4] In most cases, the STB of pay TV platforms of IPTV or Satellite includes a DTT tuner that enable the consumer to access to the DTT contents.

Some note should also be taken of the changing product lifecycles in Europe. Today we can see that the product lifecycle for TV sets is shortening (although this is truer for secondary screens). The cost of new TV sets which include more advanced standards is still high although competition and discounting brings the price of receivers down quickly.

Despite the increasing number and types of devices (games consoles, tablets, etc.) that can be used to access on-demand video content and online streaming, linear TV will remain the leading medium for the majority of the Europeans at least till 2030 (HLG / OFCOM). Non-linear TV does not pose a threat to traditional TV sets but plays a complementary role.

STATUS OF KEY PLAYERS AND MARKET STRUCTURE

There are a large number of DTT players in Europe, and who have clear strategies involving either vertical or horizontal approaches to the market. Figure 16 shows the main players in the European DTT markets, including the level of integration in terms of licences, content production, transmission and network ownership. In countries such as the Netherlands (Digitenne), Sweden (Boxer) and partially Italy (Mediaset Premium) there is a high level of vertical integration based on the pay-tv model. As discussed in Section 3.3, this approach allows for innovation and faster adoption of new technologies in a market. In fact, unlike horizontal operators, vertically integrated players are committed to DTT as they have higher degree of control over the adoption of new standards.

It can be noted that markets with a horizontal structure are usually characterised by the presence of a strong FTA sector, as in France, Norway, Poland, Spain and the UK, where FTA is the major driver in the market.

In Europe there are both strong examples of players who follow a vertically integrated (pay TV with some control over STB replacement) or a horizontal business model (FTA with natural replacement cycles). Vertically integrated countries include; the Netherlands (Digitenne), Sweden (Boxer) and partially Italy (Mediaset Premium). While markets such as France, Norway, Poland, Spain and the UK have stronger FTA sectors. All of these European markets have clear DTT business models which continue to strengthen the platform.

4.3 Status of regulation and policy

As described in Section 3.4, it is possible to identify two approaches when technology is adopted or markets migrate to new technologies: market-driven or regulator-assisted.

Market-driven - *UK*

The industry in the UK is taking the lead with for example Freeview. Strong consumer marketing campaigns, supported by regulatory intervention which is carried out to support industry initiatives and to protect viewers within the market. Also in the UK broadcasters are creating HD content moving the market forward. New content comes alongside the growing number of devices which are HD enabled in the UK.

Mandatory standards within consumer equipment – *France & Italy*

To assist in the smooth transition to DVB-T2 the French Regulatory, the CSA, has suggested the government prepare for the launch of DVB-T2 and HEVC (not before 2020) by mandating the gradual adoption of those technologies. It argues that if the two technologies are not made mandatory, take-up will be delayed. The Italian government paved the way for DVB-T2 in a law released in April 2012 (Law 44/2012). This law mandated that all TV sets and decoders sold from January 2015 must be DVB-T2-compatible and be

Figure 16: Main players in the main TV markets [Source: Analysys Mason on DigiTAG, Swedish Broadcasting Authority's, Conseil Supérieur de l'Audiovisuel, Ofcom, www.dvb.org, KmmAustria,Telecompaper, 2014]

Increasing level of vertical integration

	Main TV broadcaster	National spectrum license (MUX)	Broadcasting and transmission services	Access to transmission sites and equipment
Italy	RAI	RAI	RAI Way (100% RAI)	RAI Way (100% RAI)
	Mediaset	RTI (100% Mediaset)	EI Towers (Mediaset)	EI Towers (Mediaset)
	La7 (Cairo Comm.)	TIMB (Telecom Italia)	TIMB (Telecom Italia)	EI Towers (Mediaset)
Germany	BR, MDR, NDR, SWR	Media Broadcast (TDF)	Media Broadcast (TDF)	Media Broadcast (TDF)
Sweden	SVT, Kunskpaskanalen	Teracom	Teracom	Teracom
UK	ITV	Arqiva	Arqiva	Arqiva
	BBC, ITV, Channel 4	BBC, D3&4**, SDN, (ITV)	Arqiva	Arqiva
Norway	NRK, TV2, TV Norge	NTV*	NTV/Norkring (100% Telenor)	Norkring (100% Telenor)
France	TF1, FTV, M6	TF1, other broadcasters	TDF	TDF
Poland	Polsat Group, Telewizja Polsat, ITI	Emitel	Emitel	Emitel
Spain	RTVE, Atresmedia Mediaset España	RTVE, Mediaset, Atresmedia, La Sexta	Abertis	Abertis
Netherlands	Ned1	Digitenne	KPN Broadcast Services	NOVEC, Alticom***

* Norges televisjon AS (NTV) is owned by NRK, TV 2 and Telenor **JV between ITV and C4
*** Alticom owns the concrete masts, NOVEC the steel part of the tower Note: Regional players not included

able to support the MPEG-4 encoding standard or beyond.

Figure 17 shows that migration is being assisted in some countries by the regulator, and that plans are in place to ensure that industry players move forward. It should be noted that any migration comes with a cost to the viewer. With DSO governments provided funding to enable low-income households to purchase DTT receivers. Further migration to new technology standards will likely require financial support from governments. Migration therefore must offer clear benefits to viewers.

Regulators and policy makers play an important role in the national technology adoption roadmap. It can be seen in the UK and France that there are two main types of approach to adoption and migration of technical standards: market and regulatory. Both are successful and focus on the benefits offered to viewers. Migration is being led by the regulator in Sweden, Austria, France and Germany. Some markets are going forward with plans to launch DVB-T2 in the first instance: Romania, Russia, Turkey and Ukraine.

SPECTRUM POLICIES

The 700MHz band, also known as 'the second digital dividend', is currently allocated to broadcasting in Europe but is the subject of an international debate concerning its reallocation (total or partial) to mobile services in the future. In this context, some countries (e.g. Sweden, Finland) have already decided to reallocate the spectrum to mobile services and many other regulators have started to consult with stakeholders in preparation for the WRC-15 (see Figure 18). The UK announced in November 2014 their plans to make spectrum in the 700MHz band available for mobile data use. A second digital dividend will reduce the total spectrum assigned to terrestrial broadcasting by on average 30% – an even greater reduction than occurred with the first digital dividend. Under this constraint and in order to remain competitive with alternative TV platforms (i.e. satellite, cable and IPTV), DTT needs to migrate to new higher-quality digital formats, such as HD and later UHD. This will provide higher quality content and along with next generation encoding technologies will use the limited spectrum in a more efficient way. Overall, the migration to new standards is likely to increase the spectrum requirements of terrestrial broadcasting services (in the UHF band) driven mainly by the following factors:
Migration to new digital standards will provide the quality expected within new formats for example;

- the move to HDTV and later UHDTV, which will require higher bandwidth per TV channel and thus more spectrum.
- when both are considered together the migration to higher quality/compression is likely to result in a net increase in spectrum
- in addition, the period of simulcast that is likely to be required when migrating DTT offerings from SD to HD (and later UHD) will also increase the need for spectrum, almost doubling bandwidth use.

Figure 17

Country	Description
Sweden	• *"The Authority's point of departure is that at least three multiplexes must use DVB-T2 at the latest during 2014 and other multiplexes should migrate to the new broadcasting technology during the licensing period that ends 2020."* • The Swedish authority has taken a firm stand in favour of the migration towards DVB-T2 and stated that it will support this gradual transition through annual reviews of the license conditions.
Austria	• The Austrian regulator (KommAustria) has published a digitisation plan to migrate to the DVB-T2 standard in 2016. Migration started in August 2014 with the issue of 2 licenses.
France (January 2013 CSA review)	• The CSA was seeking to launch a dedicated HEVC/DVB-2 MUX to carry UHD channels from 2018 and a further full transition to DVB-T2 by the end of 2020. • The French regulator also proposed the transition from MPEG-2 to MPEG-4 for all multiplexes by the end of 2015. • At the present and in order to accommodate the release of the 700MHz band Frances plans are currently changing
Germany (under discussion)	• Under discussion, the agreement to start the migration to DVB-T2/HEVC from 2016/2017 and completed it by 2019/2020. the release of 700MHz spectrum would be done in parallel.
Romania **Russia** **Turkey** **Ukraine**	• Some of the countries that planned to migrate from analogue to digital later, decided to switch directly to DVB-T2 to avoid having to replace all decoders and TV sets twice. • In Russia and Ukraine, the migration to DVB-T2 has already been carried out. • In Turkey and Romania DVB-T2 migration is currently being planned with strong guidance by the respective regulators

In the medium term the migration to higher quality, despite increased compression, is likely to cause a net increase in spectrum requirements as it creates the need to simulcast more than one DTT technology to support consumer migration. Therefore, DTT will continue to require adequate spectrum in order to facilitate future standard development.

A final decision country by country to allocate 700MHz spectrum to mobile is likely to provide an incentive for national authorities to favour a migration towards DVB-T2 and MPEG-4 standards (or beyond).

Figure 18: Developments in selected countries regarding the use of the 700MHz band [Source: Analysys Mason, 2014]

Country	Development
France	France announced in June 2013 that the 700MHz band will be allocated to mobile. However, the timing remains uncertain and for legal reasons the allocation cannot take place before WRC-15
United Kingdom	Ofcom has now released it's decision to make 700MHz available for mobile data (footnote 5)
Germany	In June 2013, Germany announced its intention to auction the 700MHz band for mobile services along with other bands, including 900MHz and 1800MHz. The German regulator still needs to make a decision at a national level
Italy	The Italian regulator (AGCOM) decided to put on hold the auction of two MUXs in the 700MHz band, waiting to see what the future allocation of these frequencies during the WRC-15 will be
Norway	The Norwegian regulator (NPT) launched a project with the DTT stakeholders to analyse the consequences of a possible migration of TV services from the 700MHz band

[5] Ofcom 'Decision to make 700MHz available for mobile data use' - http://stakeholders.ofcom.org.uk/consultations/700MHz/statement/?utm_source=updates&utm_medium=email&utm_campaign=700-mhz-statement

5 DigiTAG Profiles - DTT technology roadmap

This section is structured into three parts; the first section describes the three 'DigiTAG Profiles'. The second section describes how European markets are grouped into three different typologies. Finally, there is a presentation of the roadmap for countries as they progress through the DigiTAG Profiles.

5.1 Progress through the DigiTAG Profiles

In order to describe the future roadmap for the evolution of DTT, the 'DigiTAG Profiles' define three simple stages through which a market evolves based mainly on the technologies core to DTT. Each Profile shows a different level of development in terms of DTT channel format, encoding and transmission standards, as shown in Figure 18.

The evolution through the Profiles may vary by country and these can be distinguished using a number of patterns for evolution through the Profiles:

- **Progressive evolution**: DTT evolves through all the technological steps in turn. In particular, this is the case for the early adopters of the digital standard and the countries with a high number of DTT channels (e.g. Italy).
- **Leapfrog evolution**: Some countries may decide to skip an intermediate step. In particular, this could be the case for countries with a relatively small number of DTT households and/or with a regulator-driven regime (e.g. Germany).
- **Starting with MPEG-4**: In some countries, traditional technologies have been coexisting with advanced standards since the launch of DTT. In particular, this is the case in countries with high terrestrial penetration which took longer to migrate to digital and so have more MPEG-4 ready receivers in the market.
- **Launching DTT with DVB-T2**: Some countries have decided to move directly from analogue TV to Profile 2 (DVB-T2). (e.g. Romania, Russia, Turkey and Ukraine).

Large countries and countries with high DTT penetration may evolve gradually and may go through all incremental steps. Additionally, they may take a longer time to migrate to the next profile as they need to convert a larger number of DTT households.

5.2 Country typologies for adoption of DTT technology

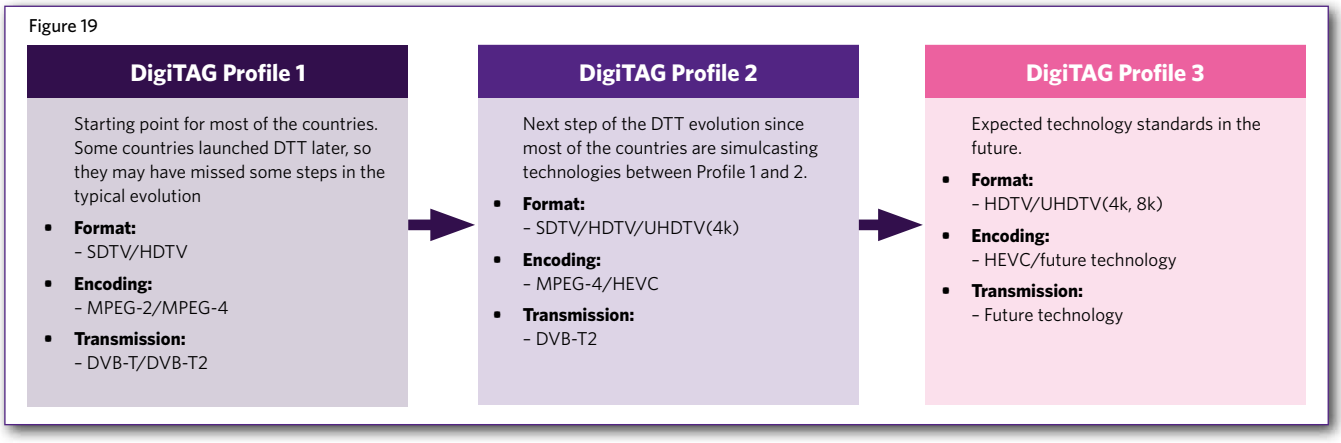
This report groups countries into three typologies based on their DTT technology adoption. These typologies are expected to move along the roadmap at different speeds. Each country has its own specific characteristics, but for the sake of simplification each study country is classified into a single typology.

The decision to place a country in one typology has been carried out after analysis of the status of the four drivers described in Section 3: technology, market conditions, key players, and regulation. Each variable has been studied independently and their combined net impact assessed. As shown in Figure 19, the result is three different typologies: 'early adopter/innovative', 'early majority' and 'late majority'.

- **Early adopter/innovative**: The countries with faster adoption profiles are expected to quickly migrate to new standards once they are available. Usually early adopters are markets with a vertically integrated model, as the decision to innovate will be commercially driven (e.g. Sweden). This is due in part to broadcasters who have control over their customers' STBs are better positioned to influence the adoption of newer technologies.

Early adopter countries include new markets such as Turkey where legacy issues such as those which exist in more mature markets such as UK are less of an influencingfactor. Germany was initially, as a small DTT market, an early adopter/innovative to DVB-T. However, due to spectrum

Figure 19



constraints in a second cycle is becoming an early adopter of new standards (HEVC/DVB-T2). To assist these countries there is often a strong mandatory approach led by the regulator to migration. The presence of a leading player in charge of coordinating DTT stakeholders and promoting new standards can also ensure a market moves quickly.

- **Early majority**: Within this group, countries such as Netherlands, Norway and Spain present favourable conditions for the migration to new Profiles. These markets have a more horizontal model. As a consequence, these countries are expected to form the second wave following the early adopters on the path to the next Profile. Smaller countries, such as Netherlands, do not have the major legacy issues seen in markets such as the UK and do not have the strong regulatory push seen in France & Italy.

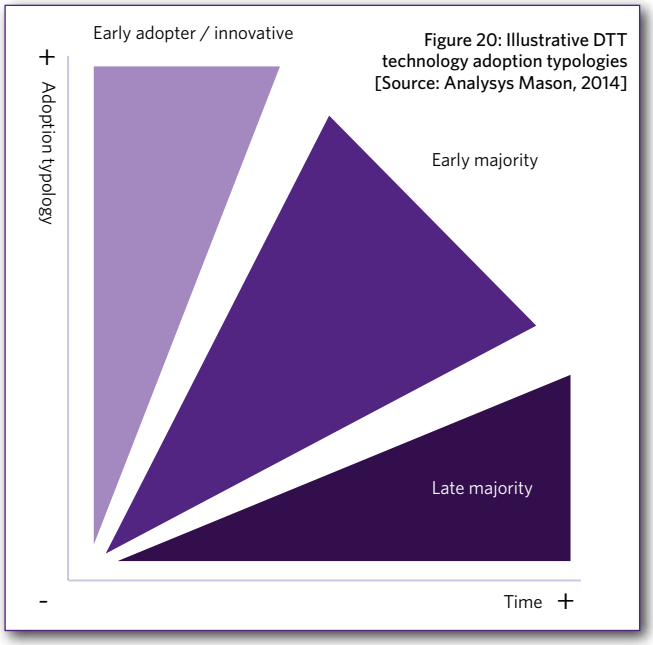


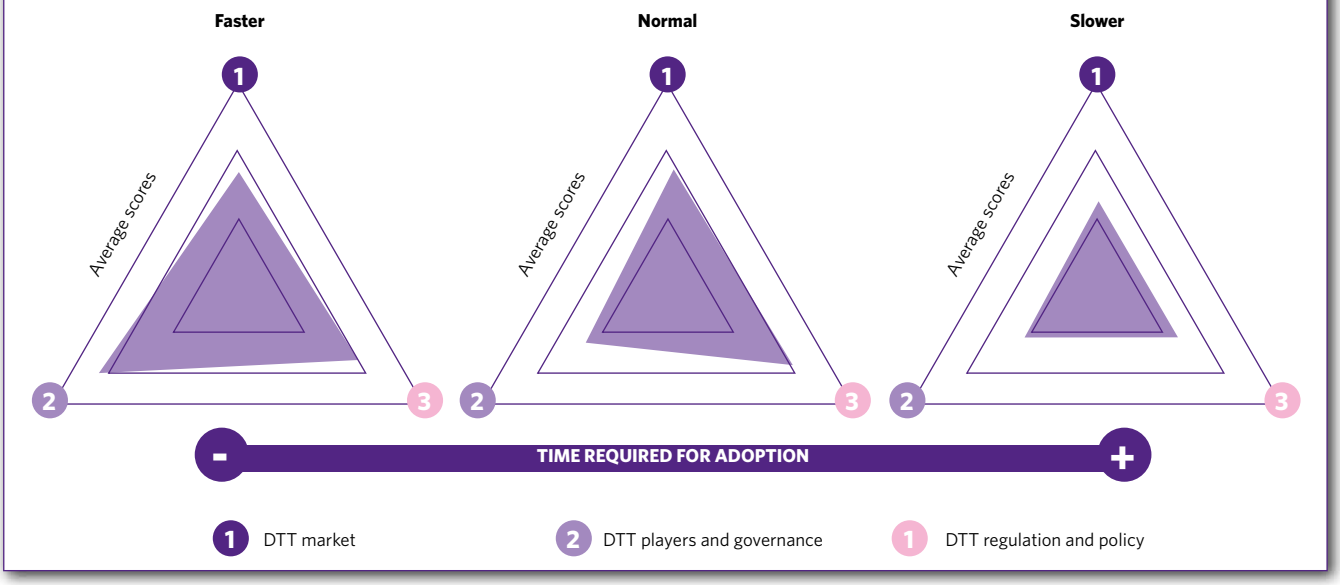
Figure 20: Illustrative DTT technology adoption typologies [Source: Analysys Mason, 2014]

- **Late majority:** These countries tend to evolve towards new standards at a slower pace following the path designed by their predecessors (e.g. Poland which has started roll out of DTT at a later date). This can be a longer process due to lack of investment, large legacy issues, DTT not the main TV platform and level of wealth of consumers being low. This type of approach can follow more natural technology replacement cycles of 8–12 years for TV sets. However, in Poland, after a late start DTT has grown to over 32% of the market. The UK could be considered in this category with regard to new standards due to the aforementioned legacy issue however with strong players in the market a decision to migrate could be pushed through at a greater speed than those countries where socio-economic issues play a factor. Markets which take a 'wait & see' approach to technology can also be placed in this category.

Examples of how the typology of European countries affects the adoption of DTT technology is shown in Figure 20. It is understood that there might be some subjective judgement in each variable and each country; however, despite the simplification, the overall methodology works well at an aggregation level and provides a basic reference for future DTT technology adoption.

Of the three types of country typology; Early adoptor/ innovative, Early majority and Late majority all of the countries in Europe fit into one or more of these groups. Early majority countries include those where favorable conditions exist for a fast adoption of new standards. Early majority countries can be seen to have a slower speed of adoption due to market issues whilst Late majoritiy countries have a slow adoption.

Figure 21: DTT technology adoption by typology [Source: Analysys Mason, 2014]



The majority of European countries are currently in Profile 1 phase. In terms of new DTT technology adoption, this model predicts there will possibly be an even spread of markets in the early adopter and Early majority stages. Fewer countries will be in the late majority phase as there is a trend towards adoption of new technologies to meet consumer demand and as new markets in Eastern Europe leapfrog Profile 1.

5.3 Timescales for the DTT technology roadmap

In this section there is a review of the expected roadmap of DTT towards more advanced standards, and some considerations on the past experience of DSO.

5.3.1 Similarities between the DSO process and the future plans to DVB-T2

In many European countries DVB-T2 has been introduced and in others, the debate on when a migration to DVB-T2 will take place has started in parallel with the discussion on the future of the 700MHz band. It has been shown that some countries are in the process of adopting DVB-T2, leapfrogging DVB-T. For these countries it will likely be the first mass migration to a new TV standard and cannot be used as a benchmark for a timeframe for future migrations. However, a benchmark of a similar process in Europe, digital switch over, can be used as a guide. As shown in Figure 21, this process on average took between two and six years.

National regulatory authorities and broadcasters seem to envisage a timeline for migration from DVB-T to DVB-T2 similar to that for the transition from analogue to DVB-T. It is noteworthy that the Swedish regulator is considering a longer timeframe in light of the softer approach that has been proposed compared to the transition from analogue to DVB-T; broadcasters will be able to decide when to migrate, but the process has to be completed within a final deadline that has already been set.

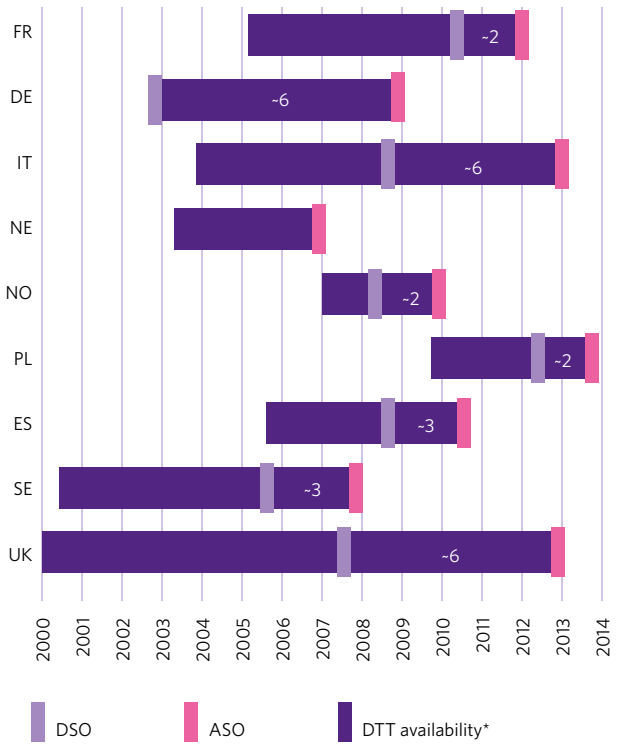
Figure 23 shows the proposed plans from different markets around Europe for their transition from DVB-T to DVB-T2. It shows that Germany, Sweden and Austria have set proposed dates for a switch off of DVB-T and proposed timelines to switch over to DVB-T2. These plans are subject to changes as standards develop and market conditions change however broadcasters are planning for the future.

5.3.2 DigiTAG Profiles – Roadmap to the future of DTT

On the basis of the past experiences discussed in the previous sections and subsection, it is expected that the full transition to future DTT technologies may take between 3 and 12 years, depending on the adoption typologies of the countries involved, this is illustrated in Figure 24.

A country may not proceed at a constant speed of adoption; for instance, the migration to DigiTAG Profile 3 could be slower for countries that are today moving to Profile 2, possibly due to some of the limiting factors not due to technology standards but socio-economic changes over time. In parallel to core DTT standards, countries will evolve to adopt standards for services complementary to DTT and mobile TV as well.

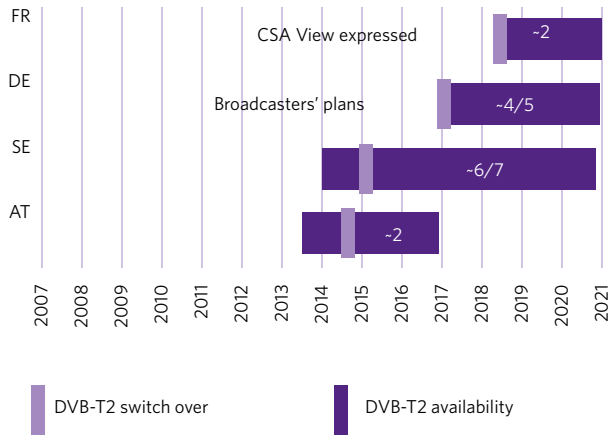
Figure 22: Roadmap for the transition from analogue to DTT in selected countries [Source: Analysys Mason, NRAs, 2014]



Note: DSO is here defined as the moment when the first analogue channel is switched off. DTT MUXs may have already been in existence before migration started.

- The period of 'DTT availability' does not include unsuccessful pioneer platforms such as Quiero in Spain, Ondigital/ITV Digital in UK or Senda in Sweden.

Figure 23: Proposed roadmaps for the transition from DVB-T to DVB-T2 [Source: Analysys Mason, NRAs, 2014]



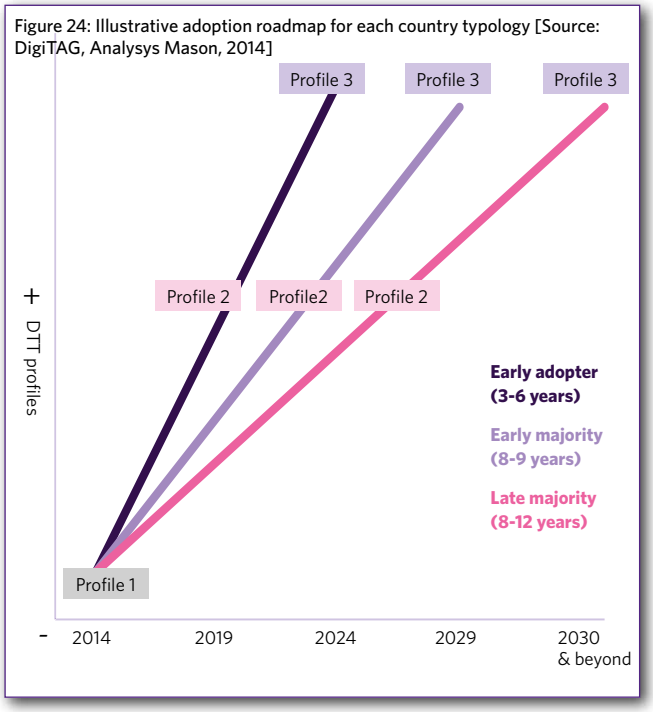
Note: CSA View expressed: Rapport sur l'avenir de la plateforme TNT. Janvier 2013.

The full transition to the next stage of DTT technology, Profile 2 (DVB-T2, MPEG4/HEVC, SDTV/HDTV/UHDTV(4k)) will need a new TV renovation cycle involving different transmission and encoding standards, and may take between 3 and 12 years, depending on country-specific circumstances. It can take an early adopter between 3 and 6 years and a late majority between 8 and 12 years. This transition will be able to meet consumer demand and expectations for HD and UHD TV content.

Most countries are likely to introduce DigiTAG Profile 2 between 2017 and 2026 whilst continuing to develop the platform with to DigiTAG Profile 3 between 2023 to 2030 and beyond.

The spectrum currently allocated to DTT is necessary to sustain the adoption of new more efficient innovative standards and assure long term investments. In order to progress through the Profiles there needs to be clear spectrum allocations for DTT at an international level. This provides security and stability in terms of future of development of DTT for consumers and industry players. The transition to Profile 3 (future technology, HEVC/future technology, HDTV/UHDTV (4k/8k)) is expected to occur between 2023 to 2030 and beyond.

Figure 24: Illustrative adoption roadmap for each country typology [Source: DigiTAG, Analysys Mason, 2014]



Although markets are moving at different speeds through DTT adoption and migration, there is a clear roadmap for DTT technology adoption in each of the major European markets, following the successful definition of the standards by the industry.

In the future it is predicted that DTT will remain a strong platform which offers significant benefits to consumers. Its development will continue with the support of governments, industry players, regulators and consumers, keeping DTT at the forefront of innovation and ensuring it will continue to play a central role in the TV market.

7 Strategy for the Swedish Broadcasting Authority's terrestrial television licensing 2014-2020

6 Conclusions

This report shows that the DTT industry (broadcasters, operators and manufacturers) are working together to develop future DTT standards, to support the increasingly demanding expectations for innovative TV services from consumers.

They are doing so by developing and adopting DTT technologies that offers increasingly high-quality TV formats and complementary on-demand TV services, whilst favoring the interoperability with multiple portable and mobile devices. Indeed by fostering a broad market of receivers based on open standards manufacturers are doing much to push the creative potential of TV services based on Free-to-Air content. The broadcasting industry will be engaged in innovation and investing in development on the platform for the foreseeable future.

DTT Technologies
The core DTT technologies available today already offer broadcasters and consumers choice and quality. Looking at the roadmap for the evolution of these technologies in the future, channel formats are improving and evolving the quality of the video experienced (SDTV, HDTV and UHDTV), encoding is offering greater gains in capacity (MPEG-2, MPEG-4 and HEVC), and finally, the next generation of broadcast transmission standards (DVB-T2) is available to increase capacity to offer new services.

Standards for services complementary to DTT are already available. There is a clear roadmap for the development of MHEG-5, GEM (MHP) and HbbTV. These technologies enhance the functionality of the DTT standard, benefiting consumers and adding further flexibility and additional on-demand services to the DTT platform.

Mobile TV technology standards have already been developed which allow DTT to be integrated with mobile handsets and devices such as tablets in the future.

DTT Market
DTT is for the foreseeable future the main TV distribution platform across EU. DTT is the predominant TV platform in many countries where 250m people rely on it as their main means of TV reception, including larger markets such as UK, France, Spain and Italy. DTT sees even higher penetration taking into account secondary sets and hybrid sets.

Europe presents a successful and developed DTT ecosystem with strong adoption of DTT technology. The majority of European countries have completed their DSO and some are already moving to DVB-T2, while some new markets are starting their DSO directly with DVB-T2.

DTT content is mainly provided in SD, though an increasing number of channels are available in HD. Many countries have an established MPEG-4 ecosystem although MPEG-2 is still in use . In the main European countries the majority of new consumer equipment is MPEG-4, and it is expected that the speed of adoption of advanced encoding standards will increase this number. HbbTV services for hybrid TV sets are being deployed by broadcasters throughout Europe.

In terms of the **status of the market**, despite the increasing number of types of devices (games consoles, tablets, etc.) that can be used to access on-demand video content and online streaming, linear TV will remain the leading medium for most Europeans. Non-linear TV does not pose a threat to traditional TV sets as they play a complementary role.

DTT Key players
The key players in a market need to work together to make the transition to the next level of technology a success. It has been shown that this is possible with the DSO across Europe a success. Innovations within the standards are not the goal per se but must at all times consider the benefit to the consumer by creating new services and offering benefits above those currently available.

DTT Regulation
Regulator assistance of a market can accelerate the speed of adoptions. Regulation and regulatory plans are being made for the adoption of new tranismission standards in the major markets across Europe (e.g. Sweden, Italy, Austria, Germany).

Roadmap for DTT technology adoption
Although markets are moving at different speeds through DTT adoption and migration, there is a clear roadmap for DTT technology adoption in each of the major European markets, following the successful definition of the standards by the industry.

The full transition to the next stage of DTT technology, **Profile 2** (DVB-T2, MPEG4/HEVC, SDTV/HDTV/UHDTV (4k)) will need a new TV renovation cycle involving different transmission and encoding standards, and may take **between 3 and 12 years**, depending on country-specific circumstances. Most countries are likely to fully adopt DigiTAG Profile 2 between 2017 and 2026. To be able to achieve this, the spectrum currently allocated to DTT is necessary.

The transition to Profile 3 (future technology, HEVC/ future technology, HDTV/UHDTV (4k/8k)) is expected to occur **between 2023 to 2030 and beyond**. This means it is necessary to provide certainty to the DTT platform in terms of both spectrum access and needed investments to upgrade the platform.

In conclusion, in the future, as this report demonstrates, **DTT will remain a strong platform which offers significant benefits to consumers**.

Despite different DTT technology adoption roadmaps across countries, current efforts and achievements ensure a clear future roadmap for the next 10-20 years. The DTT industry continues to work to ensure it meets consumers' expectations to 2030 and beyond.

Therefore, **regulators and policy makers are providing the right long term framework, the TV industry is well prepared, with the support of consumers, to ensure the DTT platform remains a strong TV distribution platform.**

DTT has a bright future!

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Version 1.0

Join DigiTAG

DigiTAG is the only organisation that brings together all stakeholders involved in the launch, rollout, implementation and evolution of the DTT platform. Membership is diverse and reflects the different perspectives within the industry.

However, all members share the common interest in promoting digital terrestrial television and safeguarding its future.

DIGITAG'S MISSION

DigiTAG 's mission is to promote and defend digital terrestrial television (DTT) on a worldwide basis bringing together industry players to protect spectrum for broadcasting, regardless of the technical standard used on the DTT platform.

DigiTAG seeks to advance and safeguard the development of digital terrestrial television. It encourages and aims to facilitate the introduction and implementation of national DTT platforms regardless of the business model, regulatory regime or technology adopted.

DIGITAG PRIORITIES

DTT Promotion - Raise awareness of the importance and need for terrestrial broadcasting as a service in Europe and other regions around the world as part of a campaign to protect broadcast spectrum.

DTT Spectrum and Network planning – Co-ordinate the work to align spectrum activities in preparation for WRC 15 and worldwide.

DTT Market Development - Inform the wider market and the members about market developments providing information to help develop new markets and assist in technology migrations in existing markets.

DTT Product and Service Development – Support and enable the evolution of the DTT by producing guidelines to harmonise products and services.

DIGITAG MEMBERSHIP

DigiTAG membership is open to any organisation directly involved in the launch and implementation of DTT services around the world. This includes broadcasters, service providers, broadcast network operators, professional and consumer equipment manufacturers, regulators and other organisations that endorse the objectives of DigiTAG Membership fees are payable each year and vary depending on the size of the organisation.

WHY DIGITAG...

Information: learn the latest news about the DTT industry around the world.

Networking: meet other stakeholders in the DTT industry - broadcasters, regulators, manufacturers, and network operators.

Cooperate: work with other industry organisations to coordinate common positions and recommendations related to DTT services.

Access: participate in DigiTAG events attended by national DTT decision-makers.

Marketing: opportunities to promote member business at events.

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