GUIDE TO DIGITAL SWITCHOVER

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Introduction

Around the world, countries are migrating their terrestrial television platforms from analogue to digital technologies. Compared with analogue technologies, these new digital terrestrial television (DTT) platforms bring significant benefits to viewers and to the broadcast industry.

Digital switchover (DSO) is the process of launching the DTT platform and switching off analogue terrestrial television platform. National administrations in Europe, Africa and parts of Asia agreed to this process at the ratification of the Geneva 2006 Agreement which put in place an all-digital plan for the use of frequencies in the VHF (173 MHz to 230 MHz) and UHF (470 to 862 MHz) bands. This plan, which entered into force on 17 June 2015, has served as an important impetus for countries to migrate from analogue to digital technologies.

In other regions of the world, including the Americas and Asia-Pacific, planning is underway to complete digital switchover by 2020, if not earlier. In China and India, where many households rely on cable for their primary television services, these governments have opted to digitalise their cable networks prior to the terrestrial networks. As a result, the digital switchover of the terrestrial platform will be delayed.

Lessons can already be learned from countries that have completed the transition from analogue to DTT. Most notably, successful switch overs have allowed the terrestrial television platform to expand its service offering to viewers, thereby encouraging an initial market-led transition to digital technology. However, experiences have varied between countries. Different approaches have been implemented based on local requirements and resources available. In Africa and parts of Asia, pay-DTT platforms have emerged as key stakeholders in the DSO process while in other countries, most notably in Europe, public service broadcasters have driven roll-out of the DTT platform based on an extensive free-to-air television offering.

This DigiTAG Guide seeks to provide an overview of the key issues that need to be addressed when beginning the digital switchover process. It examines the key regulatory, business and technical issues, as well as the management of the analogue switch-off process. It is an updated version of the Guide, first published in 2013, with a special focus on some of the issues relevant to countries in Asia and Africa. However, it will not address activities in China and India since digital switchover has been primarily addressed by cable networks in these countries.
**Why countries are undertaking digital switchover**

All over the world, countries are converting their analogue terrestrial television platforms to digital. After decades of analogue television, digital is being introduced and the analogue platform shut down.

Yet the switch to digital television is no easy feat. Digital frequency plans must be put in place and coordinated with neighbouring countries, viewers must change their television reception equipment and many transmission sites must be upgraded over a relatively short period of time.

The cost of the process can be high, depending on the size of the country and the number of viewers affected by analogue switch-off. It is for this reason that the process has been most successful when managed in coordination between all broadcast industry stakeholders, including broadcasters, manufacturers and network operators, national regulators and governments.

Together, tremendous benefit can be achieved through digital switchover. These benefits include an increase in efficiency in the use of spectrum and the launch of new services for viewers, which in turn, helps to secure the future of the terrestrial television as a viable economic platform. As countries increasingly adopt digital TV technology, analogue TV will become obsolete, making its maintenance difficult and costly.

**SPECTRUM EFFICIENCY**

Digital technology offers greatly increased spectrum efficiency on the terrestrial television platform.

In a given frequency channel, intended originally to broadcast one analogue TV service, digital permits between 4 to 22 digital television services to be accommodated, depending on the technology used and the quality of services desired. Viewers have nonetheless been able to access many more and new television services.

With the inevitable pressure on the scarce resource of frequency spectrum, more efficient use means that some capacity, the so-called digital dividend, has been made available for new types of services. In Africa and Asia, the digital dividend will allow for the launch of mobile telecom services using frequencies in the 700 MHz and 800 MHz (694 to 862 MHz) bands.

**SECURING THE FUTURE OF THE TERRESTRIAL PLATFORM**

Traditionally, the terrestrial platform has been the cornerstone of free television services. National and local broadcasters depend upon the terrestrial platform to reach their viewing public.

Despite the availability of many other television delivery platforms such as cable, satellite and IPTV, the importance of the terrestrial platform remains. It is one of the only television platforms to offer viewers access to local content. Services are generally offered either for free or for a modest subscription fee, depending on the service package selected.

In many countries, the launch of digital technology has helped revive the terrestrial television platform. The availability of a new multichannel service offering, often freely available, has enabled the terrestrial platform to successfully compete with other methods of delivery. New broadcasters have entered the market, increasing competition and viewer choice. It has also enabled governments to put in place the necessary regulations to ensure the availability of local content, media pluralism and viewer protection.

In many European countries, broadcasters have offered new content in a multi-channel approach while broadcasters in the United States, Japan and Australia have concentrated on offering high-definition television services. In Africa, pay operators have emerged as key stakeholders on the DTT platform and offer extensive, and competitive, pay-DTT packages while in Asia, plans are underway to offer extensive free-to-air services.

**OBsolescence of analogue equipment**

As the demand for analogue services and products decreases, manufacturers will no longer produce professional and consumer analogue equipment. Prices will increase as it will no longer be possible to benefit from economies of scale. The equipment in use will need to be maintained yet few technicians will be trained to do so.

Instead, analogue equipment will become increasingly difficult to source and expensive to maintain. Technical innovation will stop since resources will be diverted away from research and development of analogue equipment towards the growing market for digital products. Countries that do not undertake digital switchover will find it increasingly difficult, and expensive, to source and repair analogue equipment.
Status of digital switchover around the world

The status of digital switchover is changing rapidly. In 1995, the United States became the first country to publish a DTT standard, known as ATSC. It was soon followed by the development of the DVB-T and ISDB standards in 1997 and 1999. Since then, countries around the world have launched their DTT platforms based on using one of these three standards. China has its own digital terrestrial TV specification ‘DTMB’, which was standardised in 2006.

Around the world, nearly all countries have formally adopted a DTT standard and most have launched DTT services. In North America, Europe and some parts of Africa and Asia, analogue switch-off has been completed. Most other countries have targets to complete the process between 2015-2020.
Regulatory issues

Before a DTT platform can be launched, national administrations should first put in place the necessary regulatory framework. Regulatory regimes must address the DTT service and frequency licensing issues, receiver specifications, and the management of analogue switch-off. However, they are also influenced by the international and regional agreements which have been signed by national administrations.

In some countries, the launch of the pay DTT platform has enabled governments to put in place rules necessary to regulate the broadcasting sector which had been lacking in the analogue environment.

INTERNATIONAL AGREEMENTS
International obligations determine how countries use and share frequencies. Under the auspices of the International Telecommunications Union (ITU), a specialized agency of the United Nations, national administrations meet every four years at the World Radiocommunications Conferences to update the Radio Regulations. In addition, countries in Africa, Europe and parts of Asia attended a Regional Radio Conference in Geneva 2006 and signed up to the ‘GE-06’ Agreement which put in place the frequency plan for an all-digital environment for ‘ITU Region 1’.

Radio Regulations
The World Radiocommunications Conference (WRC) reviews and updates the Radio Regulations, the international treaty governing the use of radio-frequency spectrum and satellite orbits. Traditionally, the Radio Regulations have reserved the frequencies in the UHF bands IV and V (470 to 862 MHz), for broadcast services. However, since 2007, national administrations have begun making changes to the service allocations in the UHF broadcast bands.

At the WRC meeting held in 2007, national administrations representing the Americas (ITU Region 2) and parts of Asia and the Asian-Pacific (ITU Region 3) agreed to provide mobile services with equal ‘co primary’ allocation status with broadcasting in the 700 MHz and 800 MHz bands (from 698-862 MHz). By the completion of the WRC meeting in November 2015, national administrations in Europe, Africa and parts of Asia (ITU Region 1) and are expected to update the Radio Regulations to provide a similar co primary allocation status in these bands. Already in 2007, national administrations in ITU Region 1 decided to give co-primary allocation status to mobile services in the 800 MHz band (from 790-862 MHz) as of 17 June 2015, with many countries having already done so. At the WRC in 2012, national administrations in ITU Region 1 agreed to harmonise the use of the UHF band in the 700 MHz band (from 694-790 MHz) with mobile telecom services to have co primary allocation status after 2015.

Proposals have been put forward to provide co-primary allocation status in the full UHF band (470-862 MHz) at the upcoming WRC to be held in November 2015. However, to ensure the viability of terrestrial broadcasting services, many national administrations, most notably in Africa and Europe, have indicated that they will reject this proposal.

Geneva 2006 Agreement
After working for more than forty years under the analogue TV plans, national administrations in Europe, Africa and parts of Asia agreed to a new plan to regulate frequency usage in an all-digital environment. The Geneva 2006 (GE-06) Agreement covers frequency Band III (174-230 MHz) and Bands IV/V (470-862 MHz) for digital radio and television services using the DVB-T and T-DAB standards. This plan completely replaced the Stockholm 1961 Agreement for Europe and parts of Asia and the Geneva 1989 Agreement for Africa.

GE-06 took into account over 72,000 requirements from 108 countries for the transmission of digital services. In general, it allocates three T-DAB and one DVB-T “coverage layers” in Band III and seven to eight DVB-T “coverage layers” in Bands IV/V.

The agreement set 17 June 2015 as the date after which countries will no longer be required to protect the analogue services between neighbouring countries against interference, and will be able to freely use frequencies assigned for digital services. This date is generally viewed as an internationally mandated analogue switch-off date, at least along national borders. The date 2020 has been set for the end of the transition period in some African and Arab countries for analogue services in Band III.

Because not all countries in Africa and Asia have been able to switch-off their analogue terrestrial television services by 17 June 2015, it has been necessary to negotiate temporary frequency usage agreements with neighbouring countries. For example, South Africa needed to coordinate frequency usage with neighbouring countries so it could continue to broadcast analogue services on the terrestrial platform without the risk of interference. However, for many other African countries, interference on the UHF band is less of a concern since broadcast services use the VHF band.

While many countries in Africa have not completed digital switchover by 17 June 2015, this date has served as an
impetus to begin digital switchover. In the month of June 2015, two countries (Botswana and Zambia) launched their DTT platforms while several others announced their switchover plans (Angola, Gabon, South Africa, Zimbabwe).

REGIONAL AGREEMENTS
Regional organizations have provided recommendations and, in some cases, obligations to their member-states on such topics as the DTT standard to adopt, the date for the completion of analogue switch-off, the funding of digital switchover help schemes and the technical conditions for the use of certain frequency bands.

Regional organizations have been actively involved in helping their members with digital switchover in southeast Asia (ASEAN), Europe (European Union), Southern Africa (SADC), Western Africa (ECOWAS) and Eastern Africa (EAC). In addition, the African Telecommunications Union (ATU) has provided guidance to its members.

ASEAN
The Association of Southeast Asian Nations (ASEAN) has endorsed the DVB family of standards for the DTT platform and encouraged adoption of the second generation terrestrial standard DVB-T2. It has also developed a common specification for DVB-T2 receivers. Members have been encouraged to complete analogue switch-off by 2020, a date which many are planning towards.

Among ASEAN member states, all countries have adopted the DVB-T/T2 standards apart from the Philippines which has selected the ISDB-T standard.

European Union
Member-states of the European Union agreed to adopt the DVB standards for terrestrial television and have rolled out DTT platforms using the DVB-T/T2 standards. They have also agreed to introduce mobile broadband services in the 800 MHz band under harmonized technical conditions and considerations are underway for a similar use of the 700 MHz band.

The European Commission (EC) has been vigilant in ensuring that its rules governing competition and platform neutrality have been observed in the digital switchover process. The EC is keen that state aid is not used in favour of one method of television reception in unfair and adverse competition with another. It has therefore published guidelines on aid governments can grant to ease the digital transition.

The EC recommended that its members should have aimed to complete analogue switch-off by the end of 2012, although not all succeeded doing so. As of 17 June 2015, all but one country in the European Union completed analogue switch-off.

SADC
Member-states of the Southern African Development Community (SADC) have adopted the DVB-T2 standard in combination with the MPEG-4 AVC video compression standard for their DTT platforms. However, this decision is non-binding and members can adopt an alternative standard so long as they do so within the confines of the GE-06 Agreement. Botswana is the only SADC member to have adopted the ISDB-T standard.

SADC members had initially called for the completion of analogue switch-off by 31 December 2013. While this target had not been achieved, 4 member-states (Malawi, Mauritius, Namibia, Tanzania) completed analogue switch-off by 17 June 2015. Other members have agreed to complete analogue switch-off by June 2016.

ECOWAS
The fifteen member states of the Economic Community of West African States (ECOWAS) have developed a common digital migration plan. In 2013, member states agreed a common minimum technical specification for DTT receivers.

Among ECOWAS member states, the eight member-states of the West African Economic and Monetary Union (UEMOA) have agreed to provide mutual financial and technical assistance for digital switchover. Specifically, the UEMOA has called on national administrations to begin the digital switchover process and helped member-states access funding for the process.

EAC
The East African Community (EAC) has provided its five member-states with recommendations regarding its proposed digital switchover roadmap and financing, analogue switch-off date, and the adoption of the DVB-T/T2 and MPEG-4 AVC standards. It also recommended that member-states remove import taxes on DTT set-top boxes.

ATU
The African Telecommunications Union (ATU) is a specialised agency of the Organisation of African Unity, which focuses on communication issues. It has called on governments to put in place the necessary measures to allow for digital switchover, including the necessary legislative framework, the funding of DTT networks, and the launch of information campaigns.

At the World Radio communications Conference in November 2015, it will advocate a “no change” policy regarding frequency allocations below 694 MHz.
NATIONAL REGULATION

National administrations must establish the regulatory framework for digital switchover within the confines of international and regional obligations. The framework must address such issues as the DTT frequency plan, the DTT standard to adopt, and the licensing regime. These issues will impact the roll-out of the DTT platform and the business models adopted.

The regulatory framework will vary between countries with some national administrations making decisions on DTT receiver specifications, coverage requirements and analogue switch-off dates while other administrations may prefer to leave such decisions to the market.

When adopting a national regulatory regime, national administrations can also decide to put in place measures to better regulate the audio-visual sector. In countries where broadcasters have transmitted television services without a license, regulators may be empowered to shut off these analogue services and require broadcasters to obtain a DTT license. In addition, regulators may decide to implement such measures that guarantee media pluralism and viewer protection when allocating DTT licenses. For example, broadcasters may be required to provide a minimum amount of local content or provide services in local languages.

Developing a national spectrum plan

As a first step, national administrations must decide the quantity of frequencies to allocate to the DTT platform. This frequency plan usually consists of several phases with the first phase incorporating the simultaneous transmission of analogue and DTT services (simulcasting). Other phases may include a transitional frequency plan when some analogue services are switched off and new DTT services are made available, while the final frequency plan will only account for the transmission of DTT services.

Most countries in Asia and Africa have opted to progressively launch their DTT platforms alongside their analogue platforms.

Selection of DTT standard and receiver specification

National administrations in all countries have been responsible for the selection of the national DTT standard. While in Europe countries have agreed to adopt the DVB terrestrial standards, other countries, especially in Latin America, have been active in testing all of the available terrestrial standards. Regional organisations have been important in recommending the use of a similar standard across all member-states. In general, the recommended standard has been adopted in most countries in Europe, Asia and Africa.

Countries have established a national DTT receiver specification for the free-to-air platform, providing guidance on such features as the video and audio compression and interactivity standards as well as the chosen conditional access system if used. The development of a national specification can be completed by the regulator, a national organization (representing the broadcast industry and including input from national regulators) or by a government ministry. Regional organisations have also supported the use of a regional receiver specification.

In establishing a national DTT receiver specification, governments must guard against the inclusion of an overly extensive list of features. In South Africa and Kenya, the communications regulator decided to remove the requirement for the inclusion of a CA system in all receivers so as to decrease the final cost of the free-to-air receivers.

National administrations must also determine the method to adopt to ensure compliance with the receiver specification. Commercial compliance testing laboratories have been set up in some markets.

Licensing regime

Licenses for broadcast services on the terrestrial platform have traditionally been allocated via a beauty contest by the regulator although countries are increasingly adopting auctions for license allocations.

In the analogue environment, the broadcasting service license and the frequency license were allocated to the broadcaster. However, with the move to digital technology, the role of operating the broadcast network has been separated from the role of the broadcaster, generally defined as the television service provider. Broadcasters may decide to privatize their broadcast network infrastructure or to build a DTT network together with a commercial operator, as has been the case in Nigeria.

The task of rolling out and managing the DTT network has, in many countries, been allocated to a separate entity. In Africa, this has often taken the form of a Public-Private Partnership (PPP) whereby private funds are used to roll-out the DTT network but with public service objectives and with certain concessions from the government such lower tax regimes. In other cases, the network is jointly owned by both a public and private entity. Some countries, such as Kenya and Tanzania, have licensed several DTT network operators so as to increase competition.

The system for allocating frequency licenses is in the process of change. While nearly all regulators continue to allocate frequency licenses via so-called ‘beauty contests’, some have begun introducing spectrum auctions for frequency allocations. In Thailand, the auction of broadcast service licenses on the DTT platform allowed the National...
Broadcasting and Telecommunications Commission (NBTC) to generate €1.12 billion. Administered Incentive Pricing (AIP) is used by some regulators as a tool to promote efficiency in spectrum usage. Through such AIP, the regulator sets a price for the use of the spectrum at a level reflecting spectrum scarcity.

National administrations must also determine the measures to employ to guarantee service plurality on the DTT platform. In general, rules are established to limit the number of multiplexes or services that a single operator can provide. Regulators will also determine the duration of the license as well as the process for license renewals.

**Other issues for regulators to consider**

In preparing the regulatory framework for the DTT platform, national administrations must decide whether to legislate on such issues as DTT coverage requirements, date for analogue switch-off and whether to mandate that all new TV sets include digital tuners.

**• DTT coverage requirements**

National administrations will need to decide how much of the population will be able to access the DTT platform. Because the DTT platform is traditionally the only platform to provide free television services, most administrations opt for near universal coverage. However, doing so is not always feasible.

The cost of providing universal coverage can be very high, especially for countries in Africa, which encompass large territorial areas. The cost of rolling out the DTT network to the last 10% of the population can be more costly than to the first 90% of the population. Greater amounts of funding are needed to build a DTT network in a mountainous terrain compared with a flat terrain. In addition, countries with large territories may not find it cost-efficient to provide services in rural areas. It is for this reason that some opt to supplement their DTT coverage with other distribution platforms such as a satellite service. In South Africa, DTT coverage will reach 88% of the population while the remaining 12% will access digital television services via satellite. Similarly, DTT coverage in Kenya is only available to 58% of the population although plans are underway to expand the DTT network.

In countries where electricity is not universally available, governments may opt to limit DTT network roll-out. However, network operators have been adept in building transmission sites that are able to generate their own power supply, generally through the use of renewable energy sources. Similarly, manufacturers have also developed receivers that also make use of renewable energy sources. Viewers may also decide to use smaller receivers, such as tablets or smart phones, to access television services.

**CASE STUDY: LICENSING DTT NETWORKS IN THAILAND**

The National Broadcasting Telecommunications Commission (NBTC) licensed four public service broadcasters to serve as network operators for the commercial DTT platform. Each public broadcaster has been allocated one multiplex with the exception of the Royal Thai Army Radio and Television, which has been allocated two multiplexes.

The broadcast network operators are required to follow a timeline for the roll-out of the DTT network. Within the first year of launch, the DTT platform must reach 50% of the population until it progressively reaches 95% of the population by the fourth year. In urban areas, the network must provide portable indoor reception. Broadcasters with service licenses on the DTT platform are able to select which DTT network operator will transmit their services.

The four network operators have agreed to share common facilities including towers, antennas and combiners.

In Africa, the penetration of television sets is relatively low with most owned by urban dwellers. In Uganda, it is estimated that 60% of all television sets are located in the region of the capital city Kampala where digital switchover has been completed. It is for this reason that some governments have opted to roll-out DTT networks primarily in cities. For example in Zambia, the roll-out of the DTT platform has focused on the cities along the national railway line between Livingstone and Chiilabombwe as well as the provincial capitals.

The table shows the coverage of the DTT platform in various countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>DTT population coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>90%</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>99%</td>
</tr>
<tr>
<td>Japan</td>
<td>95%</td>
</tr>
<tr>
<td>Kenya</td>
<td>58%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>98%</td>
</tr>
<tr>
<td>Namibia</td>
<td>70%</td>
</tr>
<tr>
<td>Senegal</td>
<td>90%</td>
</tr>
<tr>
<td>South Africa</td>
<td>88%</td>
</tr>
<tr>
<td>Spain</td>
<td>98%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>25%</td>
</tr>
<tr>
<td>Thailand</td>
<td>95%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>98.5%</td>
</tr>
</tbody>
</table>

**• Analogue switch-off date**

Many national administrations have been responsible for setting the deadline of when analogue switch-off must be completed in their country. Generally, the communications
regulator, together with the broadcast industry, will determine and plan the process for doing so and ensure that switch-off is completed by the government-set deadline. Maintaining consensus between the various DTT stakeholders has been key in ensuring a successful digital switchover process and limiting confusion among viewers.

The table shows the analogue switch-off date in various countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Date</th>
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<tbody>
<tr>
<td>Australia</td>
<td>2013</td>
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<tr>
<td>Finland</td>
<td>2007</td>
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<tr>
<td>France</td>
<td>2011</td>
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<tr>
<td>Germany</td>
<td>2008</td>
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<tr>
<td>Ghana</td>
<td>2017</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2018</td>
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<tr>
<td>Italy</td>
<td>2012</td>
</tr>
<tr>
<td>Japan</td>
<td>2011</td>
</tr>
<tr>
<td>Kenya</td>
<td>2015</td>
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<tr>
<td>Malaysia</td>
<td>2020</td>
</tr>
<tr>
<td>Mauritius</td>
<td>2013</td>
</tr>
<tr>
<td>Namibia</td>
<td>2015</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2006</td>
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<tr>
<td>Nigeria</td>
<td>2016</td>
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<tr>
<td>Poland</td>
<td>2013</td>
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<tr>
<td>Russia</td>
<td>2018</td>
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<tr>
<td>Rwanda</td>
<td>2014</td>
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<tr>
<td>South Africa</td>
<td>2017</td>
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<tr>
<td>South Korea</td>
<td>2012</td>
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<tr>
<td>Spain</td>
<td>2010</td>
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<tr>
<td>Taiwan</td>
<td>2012</td>
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<td>Tanzania</td>
<td>2014</td>
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<tr>
<td>Thailand</td>
<td>2020</td>
</tr>
<tr>
<td>Uganda</td>
<td>2015</td>
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<tr>
<td>United Kingdom</td>
<td>2012</td>
</tr>
<tr>
<td>United States</td>
<td>2009</td>
</tr>
<tr>
<td>Vietnam</td>
<td>2020</td>
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</table>

**Mandating the digital tuner**

Some countries have opted to adopt national legislation requiring that consumer product manufacturers include a digital tuner in all television sets sold after a certain date. In the United States, the government made tuner mandation a cornerstone of its digital transition policy and required all television sets sold after March 2007 to include a digital tuner. However, a similar attempt to ban the import and sale of analogue television sets in the Ivory Coast met with resistance.
Digital switchover brings new opportunities to the broadcast industry as well as to viewers. Most notably, the launch of the DTT platform increases market competition, whether for the provision of broadcast services in a multi-channel environment or for the delivery of such services. This, in turn, translates into more efficient use of resources and lower costs.

In many countries, the DTT platform has allowed new entrants, such as broadcasters and service operators, to enter the broadcast market while incumbent broadcasters have generally increased the number of programme services they offer. As a result, viewers have benefited from wide-range of new services. Manufacturers have benefited from increased sale of the digital receivers to access the new television services. Broadcasters and service providers have been able to implement new business models for the delivery of their services.

But the service offering varies between markets. Some markets have launched extensive pay-DTT platforms while other markets have replaced the existing free-to-air offering. The business model adopted will be influenced by such market drivers as the size of the terrestrial television market, consumer habits, and the funding available to launch new services.

Business models will also be impacted by the technology adopted for digital switchover. For example, countries that have only recently begun digital switchover can benefit from such new technologies as DVB-T2 which, in turn, enables an efficient use of spectrum and allows providers to augment their service offering.

**DTT SERVICE OFFERINGS**

The migration from analogue to digital technology on the terrestrial television platform makes it possible for broadcasters and operators to offer viewers services that had not been possible in an analogue environment.

Countries have launched different types of services depending on the needs of their market. In general, countries with a high penetration of terrestrial broadcast services have replicated and improved the existing offer on the analogue platform. As a result, viewers have a much wider choice in the number of television channels available, whether for free or as part of a pay platform. This has been the case in most parts of Europe, Africa and Asia. In other countries, such as the United States and Australia, broadcasters have made their channels available in high-definition (HDTV) and introduced multi-channel sound to accompany the improved video quality.

The DTT platform has also made possible the launch of new ancillary services such as electronic programme guides (EPG), personal video recorders (PVRs), interactivity, and enhanced Teletext. The adoption of interactive standards, such as HbbTV, allows for a combination of broadcasting and broadband technologies to expand service offerings. In Kenya, the telecom operator Safaricom has launched a DTT receiver that also provides an Internet connection.

The DTT platform provides flexibility in the robustness of reception of television services. Depending on the reception mode selected by DTT planners, it is possible for viewers to watch television from a portable, handheld device or using a small indoor antenna. In some countries, the penetration of smartphones and tablets is increasing rapidly. These devices can be used as a means for users to access television services so long as providers offer handheld reception.

In Africa, national administrations can try to leverage regional coordination in the development of content. As a leading content producer in the world, Nigeria can help develop pan-African content that can be used by other countries, especially in English-speaking countries where content is lacking on the DTT platform. The pan-African pay-DTT operators StarTimes and MultiChoice have successfully benefited from regional harmonisation to implement their turn-key DTT service solutions in many countries.

**DEFINING KEY MARKET DRIVERS**

The services offered on the DTT platform and the corresponding business model adopted will depend on the demand of the given market. This demand will be influenced by such market drivers as the size of the terrestrial television market, consumer habits, and the funding available to launch new services.

**Size of the terrestrial platform market**

Countries where many households access television services and rely on the terrestrial platform for their primary television viewing will be attractive markets for DTT service providers. With the potential for a large market, service providers will be prepared to invest in networks and services to attract these viewers. Revenue can be generated from a television ‘licence fee’, direct payment for a pay services, or indirectly from advertisements.

In Africa, service providers will determine the size of the market by the total number of television sets in the country. Figures are difficult to confirm, but it is estimated that less than 30% of households own a television set. Of these television households, 70% are estimated to be in urban
centres. The number of television households vary between countries. The largest market is Nigeria with 26 million television households while South Africa and Kenya have 7 million and 4 million households with a TV, respectively. The markets in Rwanda and Malawi are significantly smaller with only 192,000 and 150,000 households.

The lack of electricity in many parts of Africa has hindered the penetration of television sets. It is for this reason that battery-charged or solar-powered DTT receivers should be an option for accessing television content.

In Asia, the television market is significantly larger. There are an estimated 50 million television households in Indonesia, 20 million in Vietnam and 22 million in Thailand, of which 46% rely on the terrestrial television platform.

When a large percentage of the population uses the terrestrial television platform, broadcasters are likely to take advantage of the DTT platform to increase their television service offering. This has been the case in many European countries where broadcasters have used the DTT platform to increase their service offering compared with the analogue terrestrial platform. This model will also be utilised in Thailand where the NBTC has allocated a total of 48 licenses for the provision of television programme services. Similarly, the public service broadcaster SABC in South Africa has increased its television service offering with the launch of the DTT platform. It currently plans to offer 5 television programme services at the launch of DTT platform although it has previously indicated plans to offer up to 18 new television services.

In contrast, countries with the least successful DTT platforms have been those that provide little more than the replication of the few TV programme services of the analogue terrestrial platform. In Malawi, the government turned off its DTT platform in January 2014 after less than one month of operation after only 3 broadcasters decided to join the platform, making the network overly expensive to operate. The platform could accommodate up to 20 broadcast services but broadcasters had little interest in joining. The DTT platform has since re-launched with a 12 television service offering. Uptake has been more successful following the decrease in the price of DTT set-top boxes and the publication of information regarding analogue switch-off.

Limited success has also been noted in countries that have significantly delayed launching their DTT platforms. In these countries, viewers have converted to other multi-channel television delivery platforms, such as cable or satellite, prior to the launch of the DTT platform, given the limited appeal of the analogue terrestrial platform.

**Consumer habits and profile**
The consumer profile and habits in a given market will impact the type of services that the DTT platform will offer. The amount of disposable household income will determine whether it is possible to subscribe to a pay television service. In countries with a growing middle-class, households are likely to be enthusiastic to subscribe to pay television service and growth likely to be strong. This has been the case in Vietnam where subscriber growth for pay television services is forecast to remain strong.

The low penetration of pay television services can provide for new market opportunities. In many African countries, the media groups StarTimes and MultiChoice have launched successful pay-DTT platforms to attract viewers with their low-cost service offerings. These two groups are present in over 10 countries and have been able to leverage their DTT know-how across the continent. As part of their service offering, both groups have made a wide-range of television packages available, including low-cost packages, as well as offering DTT receivers at reduced prices.

**Funding available**
The lack of funding to roll-out a DTT network has impeded many countries from launching their DTT platforms. Several countries in Africa have highlighted that the lack of the necessary funds has prevented progress with digital switchover.

It is for this reason that many African countries have entered into Public-Private Partnership for the roll-out of the DTT network operated by the public service broadcaster. Often, these networks are jointly owned by the foreign investor and the public service broadcaster. The Chinese company StarTimes has rolled out DTT networks in several countries, often with loans provided by Export-Import (Exim) Bank of China.

Alternatively, in Ghana, the government opted to award the contract to roll-out the national DTT network to a local network provider. The cost of the network roll-out will be financed by the sale of frequency licenses.

The government in Ghana has estimated that the roll-out of its DTT network will cost $83 million while roll-out of the DTT network in the Ivory Coast will cost $54 million. The cost of digital network will vary by country, depending on its size and the coverage requirements.

**BUSINESS MODELS IMPLEMENTED**
Traditionally, the terrestrial television platform has been the only television delivery platform offering free television services. It is available in a horizontal retail market, allowing viewers to choose their TV receiver products without any input from the platform operator. Nearly all television sets include a tuner for terrestrial television.
As a result, the business model for the DTT platform must accommodate the benefits and limitations of a horizontal market. While many receivers are available in an open market, operators cannot control all technical features although the adoption of a national technical specification, fortified by a conformance regime, can help ensure some degree of control over the receivers available on the market. However, it can be difficult to convince the public to upgrade or swap receivers out of the market in order to accommodate service upgrades.

Both free-to-air and pay business models have been adopted on the DTT platform, with many countries offering a combination of both models.

**Launching a free-to-air DTT platform**

In the United Kingdom, a consortium of the public service broadcasters, together with the satellite operator BSkyB, launched the first free-to-air DTT platform Freeview, in October 2002. This platform has been a resounding success, used by over 19 million households.

For the one-off cost of a DTT receiver, viewers can access a significant offer of free-to-air services including over 40 television channels, some of which are available in HD. Key factors for success have been the widespread and robust signal, easy installation, and the low-cost of DTT receivers in the open horizontal marketplace. This free-to-air model has since been replicated in many countries around the world with much success.

Similarly, Thailand has launched its DTT platform with a significant free-to-air television offer. While the current analogue terrestrial platform offers 6 television services, the free-to-air DTT platform will offer 48 television services of which 24 will be commercial services and 24 will be community and public services. Among these services, viewers will be able to access 7 continuous news services, 3 children services, 7 general entertainment services in standard-definition and 7 general entertainment services in high-definition. The public service broadcasters will offer 4 high-definition services.

In other countries, such as the United States and Japan, a free-to-air DTT platform has been launched offering the simulcast of the existing analogue terrestrial platform in high-definition. In Australia, broadcasters initially offered the simulcast of their analogue platform in HD, but later increased their channel offering to increase the appeal and viewer uptake of the DTT platform.

In the free to air markets, revenue has been generated mainly through advertisement with the exception of any viewing licence fees collected. Yet the advertisement market is not elastic. There will be some variation therefore in the maximum number of new services that the television market can sustain. One commercial broadcaster in Thailand, facing high costs with the launch of its DTT service coupled with the payment of DTT license fees, has suspended its two television services.

**Launching a pay-DTT platform**

Many DTT platforms offer pay-TV services. In Africa, it is the dominant business model, offering extensive services that can successfully compete with satellite operators. In these countries, the service operator retains control over the DTT receiver set-top boxes with specific conditional access (CA) systems, and makes them available to the market.

Pay operators can help ease the transition between technologies. In Nigeria, the pay-DTT platform launched in 2010 using the DVB-T standard. However, when the government decided to adopt the DVB-T2 standard, the pay operator StarTimes was able to easily switch set-top boxes for its subscribers. The pay-DTT platform operators have been strong advocates of digital migration, often providing information about the switch-off and helping viewers with the transition.

StarTime and MultiChoice (GOTv) are the two leading pay-DTT platform operators in Africa. Both operate in over 10 countries and have over 7 million subscribers. Their offerings vary between country with StarTimes offering up to 80 television services in Nigeria and 76 services in Kenya and 12 services in Tanzania. The GOTv offering varies from over 40 television services in Nigeria to 21 services in Zambia. GOTv also offers mobile television services in Nigeria.

Payment for these services has been adapted to the African market. StarTimes allows subscribers to make payments via bank transfers, including mobile banking, while GOTv payments are made either online or through an authorised dealer.

**ReceIVER ISSUES**

The launch of DTT platforms around the world has allowed many new receivers to emerge. They include set-top boxes, integrated television sets (iDTVs), USB-based receivers, and handheld receivers. Some receivers provide for HD and SD reception, integrated conditional access systems, PVR functionalities, and broadband access.

It is the role of national administrations, together with the broadcast industry, to define the DTT receiver specification based on the planned DTT service offering. However, ensuring that receivers comply with the receiver requirements will depend on the conformance regime adopted. Some markets may also choose to reserve capacity on the DTT platform to allow for System Software Upgrades (SSU).

One of the key factors for the successful implementation
of DTT platforms in recent years has been the widespread availability of compliant DTT television receivers at prices considered attractive and affordable by most households. This has been highlighted by regulators in Tanzania, Kenya and Rwanda as a key factor in the success of their digital migration.

However, ensuring the widespread availability of DTT receivers at an affordable price can be difficult. To help reduce the price of receivers, some countries have reduced the import duty on DTT set-top boxes, resulting in a 25% drop in the cost to consumers. Other countries, such as Namibia, have subsidised the price of receivers for all consumers.

**Conformance regime**
A conformance regime is essential to ensure that receivers entering the market comply with the DTT receiver specification. Without such a conformance regime in place, non-compliant receivers will enter the market leading to consumers’ confusion and possible protests against non-functioning receivers. This, in turn, will damage the image of the DTT platform. As a result, many countries have put in place a conformance regime that can require either manufacture self-certification or the use of officially designated, independent test centres.

With a self-certification regime, manufacturers certify that their receiver complies with the national specification. However, to ensure success, this type of conformance regime requires an audit process as some non-conformant receivers may enter the market. In Thailand, manufacturers are required to self-certify that their DTT receivers meet the minimum technical requirements. As part of the process, they must submit test reports to be eligible to receive a conformance sticker with the digital television mascot and logo.

A conformance regime that requires certification from an independent test centre obliges manufactures to submit their receivers for conformance testing. This will have the benefit of ensuring that all receivers in the market fully comply with the receiver specification requirements. However, it will lead to greater costs for manufacturers (and ultimately consumers) and require time to be set-aside for receiver testing prior to a product launch.

Once a receiver type has been tested and conforms with the DTT receiver specification, either through manufacturer self-certification or by an independent test centre, the manufacturer is permitted to affix it with a label certifying compliance. This label allows consumers to know that the receiver meets certain receiver requirements.

The chart gives an overview of the conformance testing regime.

To limit the distribution of non-conformant receivers, many countries in Africa have given licenses to authorised vendors of DTT receivers. However, despite this safeguard measure, non-conformant DTT receivers have entered markets creating confusion and wariness among consumers. In Uganda, the Communications Commission has published a list of 35 distributors selling non-conformant receivers.

**System Software Updates (SSU)**
System Software Updates (SSU) provides the broadcast industry with a means for updating the system software (firmware) in DTT receivers via the broadcast transmission channel in a simple and efficient manner that does not place
any burden upon viewers. DVB has developed a standardised approach for system software updates known as DVB-SSU.

As more and more DTT receivers enter homes, it will be increasingly difficult to make changes to the terrestrial platform, without requiring viewers to purchase new receivers. This is particularly the case in an open, horizontal market. However, it can be necessary for broadcasters to add new features to their service offering or manufacturers to correct operational faults in their receivers after quantities of them have been purchased and installed in viewers’ homes. It is for this reason that many countries have established an SSU approach.

Recycling
Governments will need to consider how to manage the recycling of obsolete analogue television sets. Dumping these television sets into a landfill can have environmental consequences given the toxic metals that they contain.

In New Zealand, where a recycling programme was put in place, the government estimated that it cost approximately US$25 for the safe elimination of analogue equipment.

OPPORTUNITY FOR INTRODUCING NEW SERVICES
The status of digital switchover will impact the possibility of launching new technologies, which, in turn will impact the opportunity for introducing new services. It will be much easier to do so in countries that have either not yet launched their DTT platform or have completed digital switchover. However, such a launch is much more difficult in countries that are currently in the process of completing the roll-out of their DTT platform.

Most countries in Asia and Africa have benefited from a comparatively later launch of their DTT platforms to be able to benefit from the latest technologies available. These markets have been able to launch their DTT platforms using the DVB-T2 and MPEG-4 AVC standards which allow for efficient spectrum usage.

Countries which have launched their DTT platforms at an earlier date will have introduced services using the DVB-T standard. Once the DVB-T2 standard became more readily available, the DTT platforms in these countries may have offered services using both standards, as has occurred in Tanzania. This may create confusion for some viewers who are not able to access all television services on the DTT platform.

Other countries, which have completed digital switchover using the DVB-T standard, may need to consider an eventual migration from DVB-T to DVB-T2.

CONFORMANCE TESTING IN GHANA

The National Communications Authority (NCA) issued the Minimum Specifications for Receivers using the free-to-air DTT platform. The specification calls for the use of DVB-T/T2 demodulation and MPEG-2/MPEG-4 AVC decoding. Standard-definition functionalities are required for all DTT receivers while high-definition functionalities are only required for iDTVs.

All DTT receivers sold in Ghana must pass a conformance test to ensure adherence to the minimum technical specification. Receivers are then affixed with a ‘digital Ghana thumb’ logo so that consumers can easily identify conformant DTT receivers. Already, over 100 DTT receivers have been certified.
Technical Issues

Different standards are available for launching DTT platforms. In general, European, and many Asian and African countries have launched DTT platforms using the terrestrial specifications developed by the DVB Project and standardised by ETSI. In North America, parts of central America and South Korea, the ASTC standard has been selected. The Japanese standard, ISDB-T and its variant SBTVD, has been adopted in Japan and parts of South America.

Recognising that there could be considerable benefits if there were a single global digital TV standard, broadcast organizations representing countries in the Americas, Asia and Europe have established the Future of Broadcast Television (FOBTV) initiative. They seek to work together to develop the next generation of terrestrial broadcasting standards with the aim of making them compatible worldwide. This work is currently on-hold until the ATSC completes its work on its next-generation standard, ATSC 3.0.

This section provides an overview of the terrestrial standards from the DVB Project. These standards are the first generation DVB-T standard, developed in 1997, and the second-generation DVB-T2 standard developed in 2008. The DVB Project has also developed standards for mobile terrestrial television which may be of interest in countries expected to have a high penetration of tablets and smartphones.

**SELECTION OF DTT PARAMETERS**

The DTT platform has a number of transmission characteristics with parameters that can be chosen depending on the needs of a given market. However, the selection of the parameters will result in trade-offs between the reception robustness, coverage area and services available.

With DVB-T, the transmission characteristics that can be adjusted include the network configuration (Single Frequency Networks or Multi-Frequency Networks), the intended reception situation (roof-top, portable or handheld antennas), the modulation, the error-correction code, and the video and audio compression standards.

The table illustrates the different DVB-T2 technical parameters selected in Thailand.

<table>
<thead>
<tr>
<th><strong>Thailand</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DTT Standard:</strong></td>
</tr>
<tr>
<td><strong>Network:</strong></td>
</tr>
<tr>
<td><strong>Channel:</strong></td>
</tr>
<tr>
<td><strong>Tx sites</strong></td>
</tr>
<tr>
<td><strong>Modulation:</strong></td>
</tr>
<tr>
<td><strong>Code Rate:</strong></td>
</tr>
<tr>
<td><strong>Guard Interval:</strong></td>
</tr>
<tr>
<td><strong>Mode:</strong></td>
</tr>
<tr>
<td><strong>Video Compression:</strong></td>
</tr>
</tbody>
</table>

**UNDERSTANDING DVB-T2 AND DVB-T**

Building on the success of the DVB-T standard, DVB-T2 incorporates the latest developments in modulation and error-protection to increase the bit-rate capacity and improve signal robustness. To achieve these improvements, detailed changes have been made to the physical layer features, to the network configuration, and to optimize performance to match the propagation characteristics of the frequency channel.

The DVB-T2 commercial requirements called for a capacity increase of 30% compared with DVB-T in equivalent reception conditions. However, current deployment has allowed for a capacity gain of 67%. Even greater gains will be possible with the use of the HEVC compression standard.

**Physical layer features**

Like the DVB-T standard, DVB-T2 uses OFDM (Orthogonal Frequency Division Multiplex) modulation. The availability of a large number of optional modes allows for the same level of flexibility to suit the specific area of application as with the DVB-T standard. However, the addition of the 256 QAM mode in DVB-T2 allows for the ability to increase the number of bits carried per data cell and together with the benefit from a more efficient improved FEC (forward error correction), this gives a major capacity boost.

Like the DVB-S2 standard, DVB-T2 makes use of LDPC (Low-density parity-check) codes in combination with BCH (Bose-Chaudhuri-Hocquengham) to protect against high noise levels and interference.

As with the DVB-T standard, DVB-T2 makes use of scattered pilot patterns for use by receivers to compensate for changes in the reception channel characteristics with time and frequency. DVB-T2 has the additional flexibility provided by the choice of eight scattered pilot patterns that can be selected based upon the FFT size and Guard Interval fraction adopted to maximize the data payload.

DVB-T2 offers a choice of various robustness and protection levels for each service separately within a transport stream.
carried by a signal in a given channel. This allows each service to have a unique modulation mode depending on the required signal robustness through the use of Physical Layer Pipes (PLPs).

**DVB-T2 network configuration**

DVB-T2 allows for the possibility of maximizing the performance in single frequency network applications. Compared with the DVB-T standard, new carrier modes, including 16 and 32k modes, have been added to improve the performance of SFNs and increase the symbol period.

This increase in the symbol period, in turn, allows for a reduction in the proportional size of the guard interval while still handling multipath reflections.

Compared with DVB-T, the DVB-T2 standard allows for a reduction in the peak to average power used in the transmitter station. The peak amplifier power rating can be reduced by 25% which significantly reduces the total amount of power that must be made available for the functionality of high power transmission stations. This is achieved through the use of tone reservation and ACE (active constellation extension) techniques.

The DVB-T2 standard defines a single profile which incorporates time-slicing but not time-frequency-slicing (TFS). The features which would allow for a possible future implementation of TFS (for receivers effectively with two tuners/front-ends) can be found in annex E (ETSI EN302755). TFS might in future make it possible for a large multiplex of signals to be spread across several linked frequencies and thus benefit from a potentially significant gain in capacity as a result of statistical multiplexing and a gain in network performance as a result of increased frequency diversity.

**Optimised performance to match frequency channel propagation characteristics**

The DVB-T2 standard provides for improved signal robustness against external influences such as the impact cause by geography, weather, and buildings. This is achieved through the use of the rotated constellations technique and time and frequency interleaving.

Rotated constellations provide significantly improved robustness against loss of data cells by ensuring that loss of information from one channel component can be recovered in another channel component. This is achieved by mapping data on normal QAM (x,y axis) which is then rotated in the "I-Q" plane so that each axis on its own (u1, u2) carries sufficient information. The I and Q components are sent at different times using different cells to ensure information recovery if necessary.

Time interleaving has also been included in DVB-T2 and provides further signal robustness against disturbances such as impulsive noise over a given period of time and disturbances over a limited frequency span.

**Spectrum efficiency gain**

In countries where a DVB-T2 network will replace an existing DVB-T network, it may be necessary to re-use existing infrastructure such as transmission sites, transmitters, combiners and antenna systems. As a result, some of the potential benefits that DVB-T2 may bring in terms of optimized network coverage may not be achieved. Instead, the network’s existing coverage will remain constant while capacity will be increased to allow for the introduction of new services.

The table shows a comparison of the DVB-T and DVB-T2 standards intended for rooftop reception in a Mixed Frequency Network.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>DVB-T</th>
<th>DVB-T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>8 MHz</td>
<td>8 MHz</td>
</tr>
<tr>
<td>FFT size</td>
<td>2k</td>
<td>32k</td>
</tr>
<tr>
<td>Carrier mode</td>
<td>N/A</td>
<td>extended</td>
</tr>
<tr>
<td>Scattered Pilot Pattern</td>
<td>N/A</td>
<td>PP7</td>
</tr>
<tr>
<td>Guard interval</td>
<td>1/32 (7 (\mu)s)</td>
<td>1/128 (28 (\mu)s)</td>
</tr>
<tr>
<td>Modulation</td>
<td>64-QAM</td>
<td>256-QAM</td>
</tr>
<tr>
<td>Code rate</td>
<td>2/3</td>
<td>2/3</td>
</tr>
<tr>
<td>C/N (Rice)</td>
<td>201 dB</td>
<td>20.0 dB</td>
</tr>
<tr>
<td><strong>Resulting data rate</strong></td>
<td><strong>24.1 Mbit/s</strong></td>
<td><strong>40.2 Mbit/s</strong></td>
</tr>
</tbody>
</table>

Source: EBU Tech report 3348

For further information on the network and planning aspects of DVB-T2, please see the EBU Tech report 3348.

**IMPLEMENTATION OF SINGLE FREQUENCY NETWORKS (SFNS)**

A Single Frequency Network (SFN) is a network where several transmitters simultaneously send identical signals over the same frequency channel. In contrast, a Multiple Frequency Network (MFN) uses different frequency channels to broadcast a similar DTT signal. The DVB-T2 standard increases the performance of SFNs compared with DVB-T, however, it does not mitigate the constraints.

Single Frequency Networks offer several advantages compared with Multiple Frequency Networks. Firstly, they can potentially provide higher spectrum efficiency for large service areas of similar shape and size. Secondly, they can improve the quality of coverage due to ‘network gain’ since the received signal level at a particular reception point is higher as it is the sum of several signals sourced from more than one transmitter. Finally, SFNs offer greater flexibility in
network implementation, allowing for ‘allotment planning’ which can simplify the technical aspects of frequency coordination.

However, SFNs also have several constraints. Because SFNs offer the greatest spectrum efficiency over large coverage areas, they limit the possibility to offer regional and local services since the content distributed within the SFN must be identical. Alternatively, should SFNs be used to provide coverage in small areas, the difference in spectrum efficiency compared with MFNs will be marginal.

The operation of a SFN is more complex and costly compared to a MFN. Because all transmitters in a SFN use the same frequency channel, any work to the network requires timing synchronization. Transmitters cannot be operated independently of each other. Costs are also increased in the distribution of content to transmitters. While it is possible with a MFN to use an off-air signal from a main transmitter and re-broadcast it to relay transmitters, doing so with a SFN is more difficult to implement.

Finally, a large SFN can also increase the problem of self-interference. This can be particularly problematic when confronted with changes in atmospheric conditions that favour tropospheric propagation. The quality of the television signal degrades and viewers can lose services.

Further information on the benefits and limitations of SFNs can be found in the EBU Technical Report 016.

MOBILE TELEVISION SERVICES
The DVB Project developed the DVB-H standard for the provision of television services to a handheld device in 2008. However, this standard did not succeed in reaching mass-market appeal, due to in large part to the lack of attractive receivers available at a reasonable price. Service providers were unable to find a successful business model as viewers did not seem ready to access television content from a small screen. However, with the increased popularity of tablets and smartphones, the demand for linear television on a mobile device has emerged.

Concurrently, the DVB Project has developed the DVB-T2 Lite profile, a subset of the DVB-T2 standard, which is well suited for mobile reception conditions. DVB-T2 Lite (DVB-T2 v1.3.1) reduces the available DVB-T2 parameter settings based on the requirements of portable and mobile reception to allow for greater efficiency and reduced complexity for receiver chipsets.

DVB-T2 Lite uses OFDM modulation and LDPC code rates with two additional code rates (1/3 and 2/5) added for improved robustness under mobile conditions. It offers low bitrates (maximum of 4 Mbit/s), limits FFT size to exclude 1K and 32K, and only allows short forward error correction frames to reduce receiver power usage.

DVB-T2 Lite can be implemented using an existing DVB-T2 network. With the use of the Future Extension Frame (FEF) feature, it is possible to deploy both DVB-T2 and DVB-T2 Lite services from one multiplex. In Italy, the public service broadcaster RAI undertook a trial in which it transmitted high-definition and mobile services from a single multiplex. The trial demonstrated the feasibility of providing television services to mobile devices from an existing DVB-T2 multiplex at a marginal cost.

TECHNICAL CONSIDERATIONS FOR DIGITAL SWITCHOVER
When undertaking digital switchover, significant changes must be carried out to the DTT network equipment and reception equipment. Time and financial investment will be necessary to undertake these changes.

Network issues
Migrating an analogue network to digital technology requires significant investments in terms of new equipment and, potentially, new transmission sites.

It will be necessary to make changes to such equipment as transmitter towers, antennas, radio-frequency multiplexers, amplifiers, and power equipment. In some cases, since transmitter sites are often in remote places, it may be cost-effective in making such changes to use helicopters. These changes will also take significant time. In some countries, seasonal weather changes will impact the ability to access transmission sites.

In preparation for analogue switch-off, the broadcast network operator will need to make plans to switch-off all analogue channels in a given region simultaneously. The radio frequency transmission links to the relay transmitters in the transmission site network must also be re-organised. In some cases, new UHF links will be used or direct feeds from a satellite. When analogue switch-off takes place, all analogue and digital transmissions will be stopped and new multiplexers connected to the transmitting antenna.

In order to reduce costs, many national administrations have required broadcast operators to share DTT transmission sites.

Reception issues
Digital switchover will require viewers to make changes to their reception equipment in order to access DTT services. In migrating from analogue to digital technology, viewers will need to purchase DTT receivers. In some cases, they may also need to make changes to their antenna installation.
• Receivers
As part of the digital switchover process, all analogue equipment will need to be converted to digital to remain functional. This will include analogue television sets as well as analogue video recording equipment. The proper disposal of unwanted analogue television sets will need to be addressed so as to prevent the dispersal of toxic materials in landfills.

As digital technology becomes more widespread, most manufacturers now sell television sets that are equipped with a digital tuner. While this simplifies the transition to digital since fewer television sets need to be converted to digital, it requires that national administrations make their DTT receiver specification available to manufacturers so that receivers include the correct technical standards for their market.

In markets where the penetration of mobile devices is high, such as in Asia, DTT platform operators may want to consider making their services available for handheld reception. However, they will need to ensure that handheld devices with a DTT tuner are available on the market. In Thailand, local manufacturers have made available tablets and smart phones integrated with a built-in DVB-T2 tuner.

• Reception antennas
Viewers may need to make changes to their antennas in order to access the DTT platform. In some cases, the reception mode will have changed allowing viewers to install portable indoor antennas rather than roof-top antennas. In Thailand, over 40% of viewers will be able to access the DTT platform using an indoor antenna.

In many countries, however, the DTT platform has been designed for roof-top reception. As these antennas have often not been changed in decades, the launch of the DTT platform provides an opportunity for updating or reinstalling them. A change of antenna design may also be necessary should the frequency band used for the DTT platform differ from the frequency band used by the analogue platform. It is for this reason that regulators have advised DTT platform operators to share transmission sites so that viewers need only one antenna that faces one direction.

Households relying on common antennas (SMATV) for the distribution of terrestrial services are also indirectly affected by analogue switch-off. In these buildings, the head-end distribution equipment can receive the terrestrial analogue signals which is then re-modulated and distributed to each household using a local analogue coaxial cable network. In preparation for analogue switch-off, the distribution equipment needs to be converted to replace the analogue tuners with new DVB-T receiver modules. These communal antennas will need to be adjusted again should changes be made to the DTT platform whether in terms of the technology used or the frequencies from which they operate.
Managing analogue switch-off

In preparing for analogue switch-off, national administrations need to determine the best strategy for doing so. The strategy selected will be dependent on such factors as the number of terrestrial television viewers, the coverage and penetration of the DTT platform as well as regional or international obligations.

It will also be important to consider the needs of the viewers and the communication tools that will be used to inform viewers about the switch-off of the analogue terrestrial platform. Financial assistance to some members of the population may also be necessary. National administrations must make sufficient resources available to ensure a successful migration. Funding will be necessary for information and communication campaigns as well as viewer help schemes.

DIGITAL SWITCHOVER STRATEGIES
In switching off analogue terrestrial television services, regulators must determine whether to use a phased approach or a national approach, the speed at which switch-off will proceed, and ensure against conflicts with other national activities.

Phased versus national approach
In a phased approach, analogue switch-off takes place in a given country region by region. DTT planners prepare a timetable detailing when analogue transmitters will be shut off throughout the country.

With this approach, DTT planners can apply the lessons learned from one region to improve the process in another region. Should something go wrong, the ‘damage’ is limited to a single region. In addition, a phased approach allows DTT planners to spread the cost and effort of digitalisation over time. Most countries in the world have used the phased approach.

Determining where to begin the analogue switch-off process varies between countries. Some countries have begun the process in large urban areas with high population densities but few transmitters. This has often been the case in Africa where analogue transmitters are primarily located in urban centres. Other countries, especially in Europe, have opted to begin the process in areas with low population densities.

In a national approach to analogue switch-off, analogue services are ended simultaneously across the whole country. All viewers benefit from the advantages of digital switchover, as viewers are treated equally and given the same access to services but equally all suffer from the need to equip for digital. This approach has been adopted in Denmark, the Netherlands and the United States.

When a single date for analogue switch-off is selected, any subsequent delays can have negative consequences if not properly managed. It is for this reason that national administrations must strive to achieve a consensual analogue switch-off date with all industry stakeholders. The risk otherwise is to be caught in time-consuming legal disputes.

In situations when the analogue platforms is switched off and then subsequently switched back on, viewers will be confused and reluctant to purchase a DTT receiver.

• Speed of digital switchover
Planners must consider how much time it will take the broadcast community, including viewers, to prepare. In a phased approach, planners must consider the total number of phases necessary and the length of each phase. This will then determine how long it will take a given market to complete the process. For example, the analogue switch-off process in Tanzania took place across several phases from December 2012 until October 2014. In Rwanda, switch-off occurred very rapidly across 4 phases over a 6-month period between January and July 2014.

Analogue switch-off cannot advance too rapidly without the risk of disenfranchising viewers. The speed of the process will be determined by the time necessary to ensure that viewers no longer depend on the analogue terrestrial platform. It was for this reason that Namibia decided to delay the first phase of analogue switch-off in Windhoek, Okahandja and Rehoboth by 6 weeks to ensure that viewers were properly equipped. However, many viewers will wait until the last moment to purchase the necessary conversion equipment. In some countries, viewers did not purchase their receivers until after the switch-off was completed. It is estimated that 27% of television households lost their television services following switch-off in Rwanda.

DTT set-top box vendors need ensure that they have sufficient quantities of DTT receivers available for viewers to purchase. In Africa, the lack of accredited vendors and available set-top boxes has been an impediment to DTT household penetration.

• Choosing the right time of the year
The date chosen for analogue switch-off can impact the success of the process. The time of the year, the day of the
week and the events on the political and sporting agenda must be taken into consideration.

The calendar for political and sporting events will also need to be taken into consideration with major events, such as General Elections or the Olympic Games, to be avoided. In Kenya, plans for analogue switch-off were put on hold due to the Presidential election in March 2012. Switch-off should also be avoided during religious holidays.

NEEDS OF VIEWERS
A successful analogue switch-off process goes smoothly and largely unnoticed by the general public. However, an ill-planned process can have profoundly negative consequences where confused viewers can suddenly lose their television services. To help viewers prepare adequately, the broadcast community needs to address information to all television households relying on the analogue terrestrial platform using targeted communication tools that can reach out to diverse population segments.

Communications activities will generally take place at the national level with complementary efforts made at the regional level. It will also be important to target specific groups such as property managers and households that rely on communal antennas.

Communication tools
Communications is the key to providing the general public with information on the analogue switch-off process so that viewers can clearly understand what will happen and how they must prepare. Generally, communication campaigns have included both national and regional activities. Information provided to third-parties, such as the media or retailers, can be a further means for reaching viewers.

Tools used in communication campaigns have included websites, advertisements in national print and broadcast media, and call centres. In some countries, broadcasters and pay-DTT operators have participated in roadshows to promote information about the upcoming switchover.

Reaching out to targeted audiences
It is recognized that some households will require more support than others will to prepare for analogue switch-off. As a result, many communication activities have focused on helping the most vulnerable viewers. It has also been important to reach out to those responsible for communal antennas where the single antenna may provide signals for a large number of households.

In general, vulnerable viewers have been defined as those of a certain age, with physical disabilities or living alone and who may have difficulties knowing how to prepare for analogue switch-off. Often, help schemes target these viewers and provide assistance that can include checking the existing antenna and installing the necessary equipment.

Special focus has also been given to owners and managers of multiple dwellings and apartment blocks. Not only are they an important means for distributing information to the household level but they must often take responsibility for the work of upgrading antennas.

COST OF DIGITAL SWITCHOVER
The cost of digital switchover varies between countries. It can depend on the size of the country, the number of viewers that need to be informed about the switch-off as well as the policy tools that will be used to promote digital switchover.

Costs will also be borne by broadcasters who will need to launch new services on the DTT platform as well as simulcast analogue and digital television services. Broadcast network operators will need to roll-out a DTT network whose cost will vary depending on the number of transmission sites that need to be upgraded.

DTT distribution
As with the introduction of any new technology, the launch of the DTT platform will require significant investments in the transmission network. The amount of the investment will depend upon the number of transmission sites that must be upgraded. In the Philippines, the commercial broadcaster GMA Network plans to invest PHP 3 billion (EURO 60 million) in its DTT network.

In the long-term, the conversion to digital technology will bring cost advantages. Digital networks are less expensive to operate than analogue networks and because spectrum is used more efficiently, more services can be delivered to viewers using the same frequency channels.

PHASED ASO APPROACH IN KENYA
A 3-phased approach to analogue switch-off

Phase 1 on 31 December 2014
Region of Nairobi

Phase 2 on 2 February 2015
Regions of Mombasa, Malindi, Nyeri, Meru, Webuye, Kakamega, Kisii, Nakuru, Eldoret, Nyahururu, Machakos, Narok, and Loldiani

Phase 3 on 31 March 2015
Regions of Garissa, Kitui, Lodwar, Lokichogio, Kapenguria, Kabarnet, Migori, Voi, Mbwinzau/Kibwezi, Namanga, and other remaining sites
**Reception equipment**
In most countries, viewers will be responsible for purchasing the necessary equipment to allow for the reception of the DTT platform. This can include digital TV sets, set-top boxes as well as antennas.

Many viewers may be prepared voluntarily to invest in new equipment or replace their existing TV set if the DTT platform is perceived to offer additional benefits compared with the analogue platform. The continued price decrease of DTT receivers has also aided in reducing the cost to viewers. The per-capita income in a given country can help determine whether viewers have sufficient resources to purchase a receiver.

In some countries, especially in Africa, government have helped reduce the price of DTT receivers by eliminating receiver import taxes as well as sales taxes. In Thailand, the government has given all households a voucher to be used towards the purchase of a DTT receiver.

**DSO information campaigns**
Communication activities costs will vary depending on the activities undertaken. For example, sending information brochures to all households will be much more costly than making the information available on a dedicated website. In Europe, the measured cost of communication activities has varied from €255 million budgeted in France to €3 million spent in Ireland.

The broadcasters may contribute to these activities indirectly by airing digital switchover advertisements but not charging for the cost of the air time. Network operators may agree to operate a call-centre and provide information on websites without charge. In many countries, pay television operators have provided information about analogue switch-off, which has often served to simultaneously attract new subscribers. In anticipation of analogue switch-off, some pay-DTT operators have also launched special promotional subscription offers.

In Tanzania, communication campaigns were tailored to target different audience groups based on age and social backgrounds.

**Financial support for viewers**
Support given to viewers can be made available to all households as part of a general subsidy or may be targeted to certain segments of the population.

- **Targeted assistance**
  Financial assistance can be used to help some households to purchase equipment directly; for other households, some practical assistance will be necessary to help set-up new digital equipment. Deciding who should benefit from this help has been addressed by many national governments.

  In the United Kingdom, the Digital Switchover Help Scheme provided assistance to an estimated 1.2 million eligible recipients which included households with at least one member aged 75 years or over or with significant disability. In Singapore, the government has announced that it would provide 170,000 low-income households with the necessary support to acquire and install a DTT set-top box and antenna. In Malaysia, two million DTT set-top boxes will be distributed to low-income households. Similarly, the South African government will make 5 million DTT set-top boxes available to eligible households. These set-top boxes are expected to be locally manufactured.

In other countries, target assistance programmes were not always in place. Volunteer work was available in Ireland, while the government’s social services help low-income families in Sweden acquire digital receivers.

- **General subsidies for all households**
  In some countries, financial support has been made available to households regardless of income levels, financial need or television delivery platform used. In the United States, all households could apply for up to two coupons worth USD$40 each to use towards the purchase of digital set-top boxes.

  Similarly, the NBTC is currently in the process of distributing a THB 690 coupon to all 22 million households in Thailand. While this coupon should suffice for the purchase of a DTT set-top box and receiving antenna, it can also be used towards the purchase of a digital television set. The funding for this programme has been made possible through the revenue generated from the auction of broadcast licenses on the DTT platform. As of June 2015, 5 million coupons had already been redeemed.

  Similarly, in Namibia, the government subsidised the cost of DTT receivers. As a result, all viewers could purchase a DTT set-top box for the price of NAD 199 (EURO 15).
Key factors for success

Several factors have been identified to help make analogue switch-off proceed smoothly in those markets that have begun the process. These general recommendations have been incorporated into the analogue switch-off plans of many countries.

**ALL ACTORS ON BOARD**
Analogue switch-off will require the active participation of all stakeholders in the television industry. National administrations, broadcasters, network operators and manufacturers will need to support the initiative and take positive steps to allow for the completion of the analogue switch-off process. Court challenges will only cause delays, create animosity and politicise the process.

National administrations need to take political decisions, such as issuing a national DTT receiver specification and setting a firm analogue switch-off timetable, and ensure a sufficient supply of compliant DTT receivers. Broadcasters need to ensure that viewers are informed and continue receiving their television services. Network operators need to make necessary upgrades to their equipment to allow for digital broadcasting.

By working together, the broadcast industry can ensure a minimum amount of disruption for viewers.

**STRONG LEADERSHIP**
The decision to cease broadcasting analogue television services needs strong leadership to affirm when and how analogue switch-off will take place and define a clear roadmap. This can provide the necessary credibility to the process and help avoid unnecessary delays. Generally, such leadership must come from the government, usually the upper echelons, to ensure that stakeholders will not cause unnecessary delays to the process.

Most countries have set up an organisation to steer the analogue switch-off process. Such an organisation brings together members of the broadcast industry, as well as government representatives, and consumer groups. To succeed, the organization must be given a clear mandate and sufficient funding to carry out its work.

**EFFECTIVE COMMUNICATIONS STRATEGY**
In order to prepare for analogue switch-off, viewers will need to have access to adequate information in a timely fashion. They will need to be informed on the launch of DTT services, the availability of alternative television platforms available and the date when analogue terrestrial television will end.

It may also be useful to provide viewers with information about DTT receiver and antenna installation as well as the use of remote control functionalities.

**SUFFICIENT FINANCIAL RESOURCES**
While the cost of digital switchover will vary among countries, sufficient resources must be available to roll-out DTT networks, provide content on the platform, support communication and marketing activities, and assist viewers with the acquisition of DTT receivers. Resources may also be necessary to provide DTT receivers to low-income households.

Countries without sufficient resources to roll-out their DTT networks have relied upon foreign bank loans or the proceeds from the future sale of frequency licenses.
Future issues for consideration

As countries complete digital switchover, questions have begun to emerge on the use of frequencies in the UHF band. The propagation characteristics of these frequencies are particularly appealing to telecom operators for the provision of mobile broadband services.

In Africa, the mobile telephony market is the fastest growing in the world and is currently expanding at twice the rate of the global market. It is for this reason that many national administrations have been considering allocation of frequencies for mobile telecom services.

However there is a major contrast and physical incompatibility between the network topologies of broadcasting (often high tower/high power networks) and mobile telecoms (dense lower power cellular networks), which may tend to make it difficult for broadcasters and mobile telecom operators to share spectrum access in the future. Technology innovations have also opened the possibility to make use of the so-called white spaces between the frequency channels in use in a particular area by broadcasters.

DIGITAL DIVIDEND
The move from analogue to digital technology on the terrestrial television platform has allowed for the more efficient use of spectrum capacity. As a result, it is possible for some frequencies to be allocated to new uses.

• 800 MHz band
The ITU Radio Regulations give mobile telecom operators co-primary allocation status in the 800 MHz band alongside broadcast services in all regions of the world as of 2015.

Since 2007, mobile telecom services share co-primary allocation status with broadcast services in the Americas, parts of Asia and the Asia Pacific (ITU Regions 2 and 3). In Africa, parts of Asia and Europe (ITU Region 1), this allocation does not take effect until 2015 unless otherwise permitted by national administrations.

• 700 MHz band
The Radio Regulations give mobile telecom services co-primary service allocation with broadcast service in the 700 MHz in the Americas, parts of Asia and the Asia Pacific (ITU Regions 2 and 3) since 2007. In Africa, Europe and parts of Asia (ITU Region 1), a similar allocation was discussed at the World Radiocommunications Conference (WRC) in 2012 and national administrations agreed to put this allocation into effect until at the next WRC in 2015.

In order to increase worldwide, harmonised use of this band for mobile services, countries in Europe, the Middle East, Africa and Latin America are planning to implement the APT700 band plan developed by Asian Pacific countries

• Further frequency allocations?
Proposals have been made to allow co-primary allocation to broadcast and mobile broadband services in the UHF band at the upcoming WRC in 2015. This would allow mobile broadband services to operate in the frequencies from 470 – 862 MHz in the ITU Region 1 countries.

However, many regional organisations have indicated their opposition to such an allocation and instead prefer to retain broadcasting services on a primary basis in the frequencies from 470 – 694 MHz. The CEPT (Europe) and the ATU (Africa) support a “no change” policy for these frequencies which denotes a continued provision of broadcast services. ASEAN (Asia Pacific) has not yet issued its position regarding the allocation for these frequencies.

In the United States, the government has agreed to release further frequencies in the UHF band for mobile telecom operators through a process known as spectrum incentive auctions. Broadcasters are invited to voluntarily give up their UHF band frequencies in return for financial compensation. These frequencies will then be sold via auction to mobile broadband providers. The auction is expected to take place in 2016.

• Revenue generated from spectrum auctions
In countries where the auction of spectrum licenses in the UHF bands has taken place, national administrations have been able to generate significant funds.

The table over the page details the amounts raised by various national administrations.

The telecommunications industry’s lobby group, GSMA has estimated that the African continent could generate $13 billion in the auction of frequency licenses in the 700 MHz and 800 MHz bands. Currently, the licensing of these frequencies has not yet taken place.

The National Communications Authority in Ghana opened a consultation on the licensing of frequencies in 800 MHz band which closed in June 2015. In Nigeria, some media outlets have reported that the previous President may have allocated frequency licenses in a process that contravened national legislation.
The consequences of allocating frequencies in the UHF band will vary between regions of the world with the process easier in some parts of the world compared with others.

In Europe, the decision to allocate the 800 MHz band for the provision of mobile telecom services (4th generation LTE services) using harmonized technical conditions has had significant repercussions for the DTT platform in terms of frequency migration, interference, and future planning considerations. The existing DTT services needed to migrate to new frequency locations which entailed changes at transmission sites and, in some cases, upgrades to reception antennas. In addition, DTT reception has been affected by interference caused by mobile broadband services. Using the 700 MHz band for mobile broadband services will not only result in a loss of 30% of the DTT platform’s allocated capacity but results in similar problems associated with the migration, namely migration costs and interference to the DTT platform.

In Africa, the situation is different given that the upper part of the UHF band is not used for the provision of DTT services. Instead, Band III has been used for analogue broadcasting and the DTT platform has not needed to use frequencies in the 700 MHz and 800 MHz bands. Already 47 nations in the sub-Sarahan have begun frequency coordination. Allocating these frequencies to mobile broadband services will not present the difficulties for the DTT platform which have been present in Europe.

**SHARING THE UHF BAND WITH NON-BROADCAST SERVICES**

Ideas are beginning to emerge on ways which broadcasters can share frequency capacity with other service providers through the introduction of such concepts as shared spectrum usage, dynamic broadcasting, and white space usage.

These options can be useful in countries where the need for frequency capacity is high and many users own smart phones.

**Country** | **Date auction completed** | **Revenue generated** | **Licensed frequency bands**
--- | --- | --- | ---
Denmark | June 2012 | DKK 739 million (€99 million) | 800 MHz
France | Dec 2011 | €2.6 billion | 800 MHz, 2.6 GHz
Romania | Sept 2012 | €682 million | 800 MHz, 900 MHz, 1.8 GHz, 2.6 GHz
Spain | July 2011 | €1.6 billion | 800 MHz, 900 MHz, 2.6 GHz
Sweden | March 2011 | SEK 2 billion (€230 million) | 800 MHz
United States | March 2008 | $19 billion | 700 MHz band

**Consequences to the broadcast industry**

The concept of shared spectrum use has gathered momentum. This concept calls for broadcasters and mobile telecom operators to share frequencies based on predefined harmonized technical conditions.

In an initial phase, it would likely result in a strict geographical separation where, for example, broadcasters would use a given frequency channel in urban areas while the same frequency channel would be used by mobile telecom operators in rural areas. However, one mobile telecom operator has proposed that a network structure could be set up in using the traditional high-power broadcast network with a low power mobile broadband network operating under licensed conditions using adjacent channels within the frequency band. The mobile network operating in the same frequency band as the broadcast network would only provide downlink services while uplink services would use other frequency bands.

In another model for spectrum sharing, broadcast and mobile telecom operators could converge onto a single platform utilizing the whole UHF band to offer both wireless broadband services as well as broadcast media services.

**Dynamic broadcasting**

Researchers in Germany have developed an architecture that allows for a dynamic time-varying approach to the delivery of content to viewers. This concept makes use of existing technologies but within a framework that can change depending on the anticipated instantaneous demands of viewers.

Combining the benefits of the terrestrial television platform, broadband connections and the local hard-disc storage capacity in the viewer’s receiver, Dynamic Broadcasting delivers content using the most suitable delivery technology. Content that is watched by many viewers and/or must be watched “live” is delivered via the terrestrial television broadcasting platform. However, other content can be delivered to the local hard-disc for later viewing in non-real time, or delivered via the viewer’s broadband connection.
Within this framework, mobile telecom services can operate within the UHF frequencies allocated to broadcast services. This could be possible through the leasing of unused frequency capacity by the broadcast network operator to mobile telecom operators or allowing broadcast network operators to operate wireless broadband services within their network.

**White Spaces**

National regulators are considering whether the gaps in a given frequency channel which separate broadcast services from each other, the so-called white spaces or interleaved spectrum, could be utilized for the provision of new services such as mobile broadband, local television, and WiMAX networks. Traditionally, these white spaces have been used by services ancillary to broadcasting, known as programme-making and special events (PMSE), and include such technology as wireless microphones.

Software-defined radio and cognitive radio systems (CRS) can make use of these white spaces. However, the availability of white spaces will depend on the given location and the moment in time. Therefore, a transmitting device that seeks to make use of white spaces must first determine the availability of the frequency through the use of a geolocation database which tracks the available frequencies in a given area or the use of spectrum sensing capabilities. However, any reduction in DTT frequency capacity overall will proportionately reduce the amount of white spaces available.

At the World Radiocommunications Conference in 2012, national administrations agreed that the introduction of such services did not require any particular regulatory measure at the international level.

White space trials have been undertaken in Singapore, the Philippines, Namibia, South Africa, Botswana, and Kenya, among others. In Namibia, 28 schools were connected to a broadband network over an area of 9424 km². In the Philippines, broadband services were made available to fishing villages in remote areas.
Conclusions

The migration from analogue to digital technology on the terrestrial television platform brings new opportunities for the broadcast industry and for viewers. Broadcasters can offer new services and generate additional revenue with the adoption of new business models. Viewers have increased choice, not only in terms of the number of television channels offered, but also with the type of services offered. For national administrations, the greater efficiency of digital broadcasting has provided some reduction in the use of UHF frequencies and made frequencies available potentially for new uses. The auction of these frequencies to mobile telecom operators has allowed governments to generate revenue.

Most notably, the digital migration has ensured the continuing economic viability of the terrestrial television platform which in turn has promoted competition among the various television delivery platforms. It is the only platform that continues to make its services available on an open market, with receivers available in a horizontal market. In most countries, it is also the only platform that guarantees access to public service content and is available free of charge.

For countries in Asia and Africa, it can be expected that digital switchover will be completed in the next 3-5 years. While many DTT platforms in Africa will be dominated by pay television services, countries in Asia will expand their free-to-air television offering. In Africa, few countries have succeeded in completing digital switchover by the deadline of 17 June 2015 when analogue broadcasting in the UHF band would no longer be protected. However, this date has served as an impetus to begin the digital switchover process. Countries in both regions have benefited from their comparatively late launch of their DTT platforms to benefit from the most recent technologies. As a result, most countries use the DVB-T2 and MPEG-4 AVC standards which has increased spectrum efficiency while not compromising viewer choice.

The widespread use of mobile telephones can also bring new opportunities for terrestrial broadcasting. Rather than relying on television sets, viewers may instead choose to watch television from portable and handheld receivers. This can help increase the penetration of broadcast television, especially in Africa where few households own television sets.

In combination with a rising middle class across Asia and Africa, terrestrial broadcasting will benefit from the switch from analogue to digital technology. New opportunities are available with the launch of DTT platforms that can offer viewers increased choice as well as portable and handheld reception.
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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