DIGITAL INCLUSION

Making
TELEVISION
ACCESSIBLE

Report

G3ict

ITU

Making Television Accessible

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Foreword

Ensuring that all of the world's population has access to television services is one of the targets set by world leaders in the World Summit on the Information Society. Television is important for enhancing national identity, providing an outlet for domestic media content and getting news and information to the public, which is especially critical in times of emergencies. Television programmes are also a principal source of news and information for illiterate segments of the population, some of whom are persons with disabilities. In addition, broadcasting can serve important educational purposes, by transmitting courses and other instructional material.

While the availability of broadcasting in terms of coverage is nearly complete, with practically the whole planet covered by a TV signal, and with televisions in over 1.4 billion households around the world, representing 98 per cent of households in developed countries and nearly 73 per cent of households in developing countries, the question now is: How to make this widely available ICT accessible for persons with disabilities?

Indeed, many of the 1 billion or so people who live with some form of disability are unable to enjoy the audiovisual content that comes to their homes. This is because either the content, information and/or devices necessary for them to access these services are not accessible for them. Yet, solutions exist today that can make it possible for them to fully enjoy television, and which can help them participate in so many more aspects of social and cultural activity. Accessible TV should be a fundamental tool in building inclusive societies. This report is written for decision-making professionals involved in introducing or scaling up measures to make television and other kinds of audiovisual content accessible to all.

The emphasis of this report is on making digital media accessible. Television is going digital. I believe the migration from analogue to digital TV represents an ideal opportunity for ITU members to take the necessary steps to ensure TV is accessible. Moreover, more than 100 ITU Member States have now ratified the United Nations Convention on the Rights of Persons with Disabilities (CRPD). As explained in this report, television accessibility is explicitly mentioned in the Convention. It requires ratifying countries to ensure that persons with disabilities enjoy access to television programmes in accessible formats.

Spectrum is required for many of these access services, although the bandwidth required varies by service. This is especially so for terrestrial broadcasting services, which require spectrum availability, and to some extent for satellite broadcasting, where spectrum costs rather than availability is the issue. Here, too, ITU Member States have an opportunity to ensure that any spectrum needed is allocated for this purpose.

Making TV accessible is everyone's business. This report identifies accessibility solutions for media executives, regulators and policy makers, pay-TV operators, consumer electronics manufacturers, sales outlets as well as disabled persons organizations. It is my goal that this report will assist ITU members to take the necessary steps to ensure that persons with disabilities can enjoy their CRPD right to access TV. In line with the goals of universal design, making TV accessible can also improve literacy eradication (not only for persons with disabilities but for the non-educated, women and other marginalized groups), support the social inclusion of immigrant populations, and of course address the needs of increasingly aging populations who will also benefit from accessible TV.

This report identifies the kinds of access services required by a range of persons with disabilities and the respective accessibility options. These include closed captioning and signing for the deaf, audio description and audio captions for the blind or those with visual impairments, and accessible remote control devices for the elderly and those with reduced dexterity. This report explains how access services are produced and delivered so that regulators and service providers can better understand the costs involved. It also identifies the need to make the target users aware of access services and provides a checklist for those implementing accessible TV.

I am delighted that this report has been developed in collaboration with G3ict, our partner in the e-Accessibility Policy Toolkit for Persons with Disabilities – www.e-accessibilitytoolkit.org. This report will be added to the wealth of resources already available in the toolkit and shared with our membership on this site and our own BDT website. In line with the One ITU policy, this report was prepared by the Chairman of ITU-T Focus Group on Audiovisual Media Accessibility. I encourage all ITU members to make use of the online e-Accessibility Toolkit and this watershed study on Making TV Accessible. Let's ensure that persons with disabilities are included as we strive to connect the next billion.

Brahima Sanou

BDT Director

What is this report about and who is it for?

This report looks at the strategic implications of making audiovisual content accessible to persons with disabilities. The focus includes not only the content itself, but also the information and devices needed by people to enjoy audiovisual content. It is written for professionals involved in decisions to introduce or scale up measures to make television and other kinds of audiovisual content accessible.

The term "audiovisual content" is a broad term used to cover content with pictures and sound. The most widely used audiovisual content today is television. But audiovisual content also includes cinema films and videos distributed on other networks (for example the Internet and mobile telephone networks). It also includes audiovisual content distributed on physical storage media (pre-recorded videos on cassettes, CDs and DVDs, recordings on hard disc and flash-memory devices such as video recorders, computer games delivered on storage media), online or combinations of local and network storage.

While the report covers analogue and digital content, the emphasis is on digital media. Twenty years ago, digitalization began to have an impact on the distribution of audiovisual content. Currently, television is going digital. Analogue television transmission has already been shut off in many countries around the world. We can expect the switch to digital distribution to be complete sometime in the next fifteen years. Similarly, digital cinemas are on the increase. Today, consumers use their computers, tablets or smart phones to access television, video and music, and the Internet has become a means of sharing not only television but also short-form video content via portals such as YouTube.

Although the aim of this report is to address audiovisual works in general, the focus is on television, in particular Digital Terrestrial Television (DTT). The reason for this choice needs explaining. While the production or authoring of access services is much the same for any digital time-based medium, when it comes to the Internet there is a wide variety of distribution solutions on both the open Internet and on IPTV. There are currently more than 12 widespread IPTV solutions and the number is growing.

Some of them build on the work of the World Wide Web Consortium (W3C) and the Open IPTV standards and its rigorous stance on intellectual property so that the standards are truly open. Others are based on ad hoc industry consortia. One such group is the Web Hypertext Application Technology Working Group (WHATWG) that has made proposals for handling access services as part of HTML5. Others include the Digital Entertainment Content Ecosystem (DECE) working on a Digital Rights management system allowing digital audiovisual content to be accessed from multiple devices, and Apple's iCloud. Ultimately the availability and cost of providing access services on Internet-based platforms will be determined in the market place by the relative success of these contenders.

As the principles behind the creation, exchange and delivery of access services are the same, this report concentrates on examples of good practice from broadcasting. Broadcasting is a highly regulated area where more than 60 years of international standardization has been successful in achieving the exchange of programmes and the interoperability of television services. The four major digital television "families" of standards have gone from continental to global use. Fortunately, they all build on the same basic building blocks such as the MPEG2 and MPEG4 encoding and decoding standards and have well-defined mechanisms for creating, exchanging and delivering access services. Good practice from broadcast television can be adapted and then applied to the authoring and digital distribution of other kinds of audiovisual content.

Apart from going digital, the *characteristics* of audiovisual content continue to change. There has been a move towards better picture quality (High Definition), multi-channel audio, three-dimensional images and also the inclusion of interactivity. While the report cannot address all of these topics, it can provide strategic pointers to action in the short, medium and long term.

This report is written with a range of decision-makers in mind:

- Access service advocates from organizations representing persons with disabilities wishing to get a clear picture of the access options currently available and in the development pipeline.

- Media executives concerned with access service provision and complying with media regulation.

- Regulators and legislators working on measures to improve digital media accessibility to comply with international conventions and directives.

- Pay-TV operators and consumer electronics manufacturers and sales outlets examining the implications of demographic change and media regulation on their business.

The report aims to help the reader with the following kinds of strategic challenge:

- Formulate the objectives and Key Performance Indicators to make television accessible in a given territory.

- Set up from scratch and operate one or more access services on analogue television.

- Plan the transition from analogue to digital television and the access services that accompany television programmes.

- Conduct pilot tests of a new access service on digital television.

- Scale up access services after completion of a pilot phase.

Common to all of these challenges is the ability to identify the nature and extent of the access challenge. The report starts here by first looking at the needs that have to be addressed by accessible television.

The report also explains in general terms what the options are for improving the accessibility of television. In subsequent chapters there is more about the options for producing and delivering access services, and what they cost to establish and run.

It concludes with a chapter on managing change – metrics, key performance indicators and processes to get started. Mention is made of a range of legal instruments that can be used to ensure that a new access service, or an existing service that is scaled up, becomes a success.

A check list of strategic issues that need to be covered when considering actions to make television accessible has been included as an appendix to this report. This check list can be used to ensure that key issues have been considered.

Acknowledgements

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1 Which viewers have difficulties accessing television?

The aim of this chapter is to provide the reader with a basic understanding of why television is difficult or impossible for persons with disabilities to find, use and benefit from. It looks at accessibility from a number of perspectives to illuminate the nature of this challenge.

1.1 Statistics and awareness

Even in affluent countries, discussions of access service provision are marred by poor statistics and a lack of awareness of the issues facing viewers with disabilities and functional impairments. The following considerations can be used to inform decision-making:

1. Even in small, affluent and well-educated countries such as Denmark, at least one person in ten has one or more disabilities that make viewing of television difficult or impossible[1]. The proportion of persons with disabilities in other territories can be far higher. Regardless of the numbers in question, countries will seek to identify solutions for a significant minority of their citizens who have disabilities that influence their use of audiovisual content.

2. Conduct a study building on good practice such as the methodologies recommended by the UN Washington Group[2]. Ambitions will depend on the resources available and the current situation with accessibility statistics in the territory in question.

3. As the proportion of the world's population emerging from poverty increases, disabilities will still be with us, although there will be a gradual shift from functional impairments caused by accident or illness to age-related impairments. This is discussed in further detail in chapter 8.

4. In a world where there are refugees and immigrants, some of the disabilities that need to be addressed are social in nature.

5. The challenge that needs to be addressed is not whether solutions should be found that make audiovisual content accessible, but rather, how can we use the principles of universal design to decide which access services should be offered, how they should be produced and delivered, how much this is going to cost and who is going to pay for it?

From a strategic perspective, depending on which stakeholder the reader represents, this chapter can help ask the right questions about the services to be offered and the targets that need to be established.

There are a number of different approaches to scoping the nature of the challenge:

- broadcasters are often used to segmentation based on age groups (viewing and age);

- broadcasters and regulators will have to consider accessibility and which language or languages are to be used (viewing and language);

- non-governmental organizations (NGOs) working with persons with disabilities will focus on various communities with shared functional impairments (viewing and specific functional impairments);

- educational institutions will be interested in the educational role of television (viewing and literacy); and

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[1] The following paper quantifies the size of the accessibility challenge in Denmark: Looms, Peter Olaf. E-inclusiveness and digital television in Europe – a holistic model. Universal Access in Human-Computer Interaction. Addressing Diversity. Pages 550-558. Springer Berlin / Heidelberg

[2] The UN Washington Group on Disability Statistics. http://unstats.un.org/unsd/methods/citygroup/washington.htm

- governments may have concerns to do with the social dimension of accessibility.

The following sections deal with these overlapping approaches to scoping. They describe television viewing and their associated accessibility challenges from various perspectives.

1.2   Viewing and age

Consider the requirements of persons ranging in age from small children to elderly adults when studying accessibility and audiovisual content:

- Children watching a programme with a parent who is deaf. The adult will need captioning in order to follow the programme with the child.

- Children of immigrants and refugees who can read, even teenagers and young adult refugees, who have problems following a television programme if captioning is not available.

- Small children are reliant on the spoken language, as they cannot yet understand captions and captioning when viewing a programme in a foreign language. Such programmes may need some kind of dubbing or voice-over to make them accessible.

- Teenagers and young adults who may have hearing loss caused by exposure to high noise levels or from listening to devices at excessive volume levels have difficulty understanding what is said.

- Elderly viewers have difficulties keeping up with the language in the TV programme since they are unfamiliar with modern idioms or slang, or with fast or unclear diction common among younger adults.

- Those over 65 are likely to suffer from two or more impairments (e.g. wear glasses in order to see, have hearing loss and not have the dexterity to use a remote control device of the television set).

The above examples all occur. In order to plan access services on a sound footing, it is necessary to know how prevalent each of them is and in which sequence they need to be addressed.

1.3   Viewing and languages

When studying accessibility and television, consider which languages will be needed:

- The world's nations are culturally and linguistically diverse.

- Some countries are monolingual with one language and a limited number of dialects.

- Others have two, three or more official languages, or a widely-spoken national language (lingua franca) and a number of languages spoken regionally or by immigrant and refugee groups.

- Still others may have both official national and regional languages and a range of local languages or dialects. South Africa is a case in point, with 11 official languages[3].

- The challenge here is linguistic accessibility, ensuring that as many citizens as possible can understand a given programme in an official language that may or may not be their mother tongue.

- Languages are also a key means of building a society that is socially inclusive. In countries with significant numbers of immigrants or refugees, there are minorities who may not understand or read the official language. Here captioning in multiple immigrant languages can be a vehicle of social integration and promote social cohesion.

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[3]   South Africa's languages. Tongues under threat 20 Jan 2011. The Economist Print Edition.
       www.economist.com/node/17963285?story_id=17963285

- Some deaf viewers only understand signing and not captioning. If they live in a country where sign language is recognized on a par with spoken languages it will be necessary to agree on targets to meet the needs of this community of deaf viewers.

1.4   Viewing and specific functional impairments

When planning action on accessible audiovisual content, the absolute numbers of people with a given disability are often less important than having a sense of which groups of individuals and communities have requirements that need to be addressed. Statistics can be useful to support calls to action. Depending on the country in question and the criteria used for functional impairments related to senses, a significant minority of the population may not be able to benefit from viewing television. Here are examples of the kind of problems some adults have when they watch TV news:

- Good hearing, but serious visual impairments: The viewer is missing key cues about the identity of those being interviewed because the captions cannot be seen. If there are interviews with foreigners, the captioning cannot be read and what is said cannot be understood.

- Good hearing and sight, but "word blind[4]": The viewer can follow most of the news items but cannot understand the items in foreign languages because the captioning does not help.

- Poor hearing and good sight: The viewer has connected the hearing aid to pick up the television sound directly. Depending on how well the hearing aid works, the viewer may be looking at the picture, unconsciously lip-reading and also reading the captioning (if closed captioning has been selected).

- Congenital deafness but good sight: If the viewer can read, most attention will be on the subtitles and with some eye movements in the direction of the faces of the persons on the screen. If viewers cannot read, then they will be dependent on signing to understand what is going on.

- Those over 65 are likely to suffer from two or more impairments (e.g. wear glasses in order to see, have hearing loss, and not have the dexterity to use a remote control device).

When studying accessibility and audiovisual content, it can be useful to identify the proportion of persons who are deaf that have congenital deafness or were born deaf, as this may have implications for the choice of access service:

- Children born deaf or with serious hearing impairments can be treated, either by fitting a hearing aid or by undergoing a cochlear implant between the ages of one and two. Both of these measures may not yet be realistic in developing countries for economic reasons. With or without such measures, the infant with a serious hearing impairment can learn to communicate by signing from around the age of one.

- In the industrialized world, congenital deafness accounts for about 0.1 to 0.2 per cent of all births. Those who develop deafness through age, accident or illness later in life – oralists   are more numerous (about 1 to 2 per cent of the population).

- Hearing impairments include not only the loss of hearing acuity but also a reduction of the audible frequencies the viewer can hear. There is a considerable range of individual differences that have to be addressed when considering access services for such persons.

- Sight impairments include a general loss of spatial acuity, selective loss of vision in the field of sight, and difficulties coping with low contrast and/or specific combinations of colours. As with hearing impairments, there is a considerable range of individual differences. Fortunately we have

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4   "word blind" is an all embracing term free from social stigma found in everyday language. It encompasses a range of reading difficulties

clear, evidence-based guidelines when it comes to planning the size and contrast of text and the use of colour on screens (covered in more detail in chapter 3).

• With age, adults lose the ability to accommodate (i.e. refocus from far to near objects).

• Viewing television may require glasses or contact lenses.

• The perception of depth varies considerably among adults and this can lead to discomfort or unpleasant side effects when viewing 3D television, games and films in cinemas.

• Research shows that blind persons watch lots of television, or would certainly like to do so. In order to benefit fully from viewing, they need aural inputs to help them understand who the characters are and the social and physical context of the dialog.

• Mobility and dexterity are two age-related challenges for adults when it comes to the ability to set up and use a modern television receiver.

• There are also age-related issues with the switch from analogue to digital television. Many adults have difficulty with the change in the user interface. They are used to television sets with "on/off" buttons. They now have to learn to use "point-and-click" interfaces where the remote control is used to highlight a choice and then to confirm it using the OK button.

• The use of a television remote-control device from the normal viewing position may be difficult or complicated if the viewer has not learned the conventions associated with the buttons, or has difficulty seeing or identifying the correct button to press.

• With age there are significant differences in short-term memory. These differences manifest themselves when the viewer has to follow a television programme in which there are attention-demanding features such as crawlers, picture-in-picture and delays that influence the intelligibility of captions.

• Some cognitive impairments are age-related, but individual impairments make themselves felt at different ages, even among children and teenagers. While there is a gradual reduction in sensory acuity over time, competencies such as speech continue to develop in people well into their sixties.

• Other cognitive impairments are caused by illness or accidents.

• If there are no good statistics in the territory in question, an interactive calculator available online can be used to make a rough estimate of the number of persons in a particular age range that have specific kinds of disability. A good example can be found in the University of Cambridge Inclusive Design Toolkit based on data from the United Kingdom.[5] This uses a forerunner of the methodology suggested by the Washington Group.

• Communication with various stakeholders can also be improved by creating a limited number of "personas". These are short, illustrated case stories about hypothetical individuals typical of communities or persons with disabilities. Research on design processes indicates that personas can help communicate the accessibility challenge to those involved in designing solutions[6].

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[5] University of Cambridge Inclusive Design Toolkit
www.inclusivedesigntoolkit.com/betterdesign2/exclusioncalc/exclusioncalc.html

[6] Long, F. 'Real or Imaginary: The Effectiveness of using Personas in Product Design'. Proceedings of the Irish Ergonomics Society Annual Conference, May 2009, pp1-10 Dublin.

1.5   Viewing and literacy

When studying accessibility and audiovisual content, it is also important to consider the impact of literacy levels, reading ability and reading comfort on proposed access services in the territory in question.

- Viewers may choose to watch in order to improve their ability to understand. Regular television viewing with captioning has an impact on reading skills. There are several major studies that demonstrate that same-language-captioning can have a major impact on literacy and reading growth across a broad range of reading abilities[7,8].

- Literacy has an impact on accessibility. Television usually requires the viewer to be able to read titles, captions and captioning.

- Where captioning is used, viewing will be dependent not just on being able to read, but also on being a proficient reader. Even in countries with high literacy levels, as many as 10 to 20 per cent will not be able to follow on-screen texts including captioning unless there is some degree of language condensation to bring the required reading speed down to acceptable levels (often regarded to be below 180 words per minute).

- Captioning and the required reading speed is both an issue of reading ability and comfort. User studies indicate a distinction between what viewers are able to read, and the reading speed at which the viewing experience is comfortable.

- There may be viewers with receptive aphasia, (sometimes referred to as "word blindness") or age-related visual and reading problems. In such cases, viewers do not benefit from captions because they appear on the screen for too short a time.

- In developing countries, illiteracy is a problem for more marginalized populations, e.g. in countries where girls or indigenous groups do not receive a high level of education. Where such persons do not have the same access to school education as their peers, their marginalization may be compounded by also having a disability.

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[7]   Brij Kothari, Ashoka.org www.ashoka.org/fellow/3557

[8]   Biswas, Ranjita (2005). Hindi film songs can boost literacy rates in India.

2   What can currently be done to make audiovisual content more accessible? – The value proposition

The aim of this chapter is to provide the reader with a basic understanding of the current options to make television more accessible.

In addition to radio and acoustic sirens, television is occasionally an emergency channel used to make public announcements. These contain alerts about the risks of an impending disaster such as an approaching tsunami or an explosion at a chemical or power plant. Assuming the TV channel continues to operate, are there television viewers who will be unaware of the hazard?

In this example of a public announcement by the Japanese prime minister, the speech was provided with captioning by the public service broadcaster NHK. Visual signing was also included in the programme. The retransmission elsewhere had additional captioning in the national language:

Figure 1: A public service announcement on Japanese television

Television is usually a medium to inform, educate and entertain. When dealing with television from this perspective, we can ask the same question: *"Are there persons who cannot benefit from television viewing?"*

We may be able to improve accessibility by doing something about the programmes themselves or by offering access services. There may be other ways of making a difference to viewers by using assistive technologies to make television more accessible, for example well-designed remote controls with legible buttons. It could also be a wireless connection between a television and the viewer's hearing aid.

This chapter looks at television accessibility from the same user perspectives as the previous chapter to highlight the options that already exist to make television accessible.

From the perspective of a broadcaster, programmes differ in their audience appeal. Some are of general interest whereas others cater for the needs of specific audiences and interest groups, for example programmes made specifically for persons who are deaf.

In terms of access services, these can be made generally available, or they may have restricted availability (e.g. programmes with access services can be shown late at night or on a separate channel).

In general terms, analogue terrestrial television broadcasting is less flexible than its digital equivalent. In most cases, accessible analogue television means open access services, that is to say open captioning that everyone has to see, or open visual signing which everyone has to watch. This leads to four main scenarios illustrated in Figure 2:

A   assistive,

B   mainstreamed,

C   assistive with conditions, and

D   mainstreamed with conditions.

Figure 2: Scenarios for "open" access services on analogue television
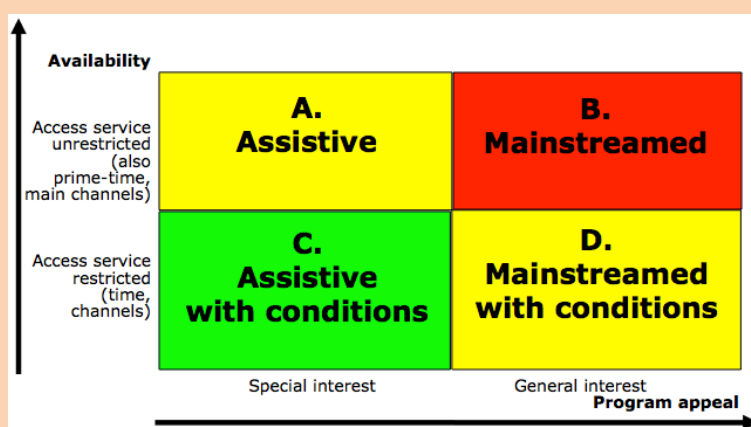
The easiest scenario to implement is C, "*assistive with conditions*". In this case, the broadcaster offers programmes for special interest groups, including, for example, the deaf community that needs visual signing. Such programmes are broadcast outside prime time.

The most challenging is scenario B, "*mainstreamed*". In this case, the broadcaster offers programmes of a wide range of genre. Nearly all programmes are broadcast with open captioning and visual signing.

While B is easy to implement from a technical perspective, feedback to broadcaster and Pay TV operator call centres indicates that mainstreaming "open" solutions, such as signing, that have to be seen by all viewers on major channels or in prime time slots, can lead to adverse reactions from persons without impairments. There have been instances of widespread complaints that constitute a threat to the television channel's market share and thus to its viability.

Open captioning and open visual signing are normally found on analogue television. When digital distribution is possible, the options for "closed" access services (ones where the viewer can turn them on or off) are more extensive. Figure 3 illustrates the three main scenarios for "closed" access services on digital television:

A   assistive,

B   mainstreamed, and

C   assistive with conditions.

Figure 3: Scenarios for "closed" access services on digital television
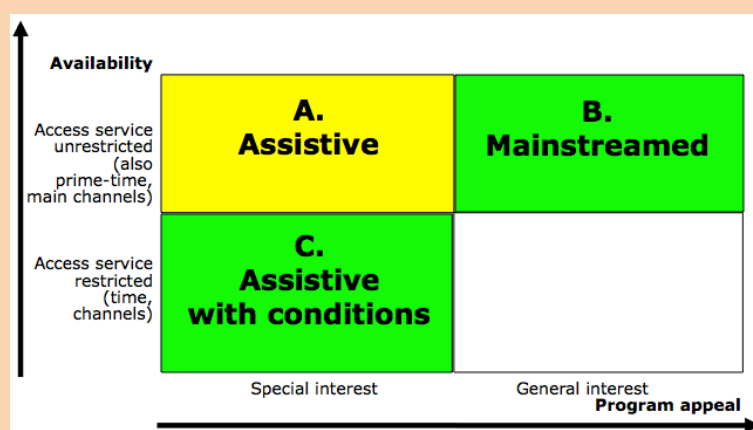
As was the case with analogue TV, the broadcaster can offer assistive programmes for special groups and communities, starting with scenario C "Assistive with conditions" and moving to scenario A "Assistive". As with captioning, visual signing or audio description can be offered to those who need it; the access services do not create adverse reactions from other viewers.

Here the broadcaster can also offer mainstreamed programming with access services, scenario B. The key limiting factor here is not audience acceptance, but having the incentives, resources and expertise to offer access services with all programmes. While same-language captioning has been mainstreamed in a few countries, audio description and visual signing are not widely available.

Scenarios are simply plausible options that help us formulate robust strategies. What this review of the options shows is that it is possible to offer both assistive programmes catering for specific communities with disabilities and to mainstream television programming of general interest by offering access services.

There is a clear incentive to move from "open" to "closed" access services in order to provide a greater degree of flexibility among viewers and to minimize adverse reactions from audiences. Public service announcements during crises are clearly an exception – they need to be "open". Ideally we should be working towards both scenario A and B ("assistive" and "mainstreamed") for both special interest and general interest television programmes.

The rest of this chapter focuses on the accessibility of television programmes themselves without access services. It responds to the question "What can we do to make programmes themselves and programme guides as accessible as possible?"

Subsequent chapters address the following related issues:

- Adding or improving the access services that accompany a given television programme (dealt with in chapter 3).

- Improving programme guides to make sure access services are listed (dealt with in chapter 3).

- Improving television receivers themselves (dealt with in chapter 4).

- Making it easier for viewers to set up and use television receivers and peripherals such as remote control devices (dealt with in chapter 4).

2.1 Improving the production of programmes and on-screen programme guides themselves

Optimize the audio

The intelligibility of *audio* depends on the care taken in handling and mixing speech, all the way from the source to the receiver. Recent studies reported by the BBC[9] indicate that attempts to clean the audio at broadcast and in the receiver are no substitute for care earlier in the production chain. As television coverage of the 2010 World Cup Championship in South Africa showed very clearly, making sure that the picture and sound do their jobs makes all the difference to the viewing experience, especially when thousands of fans in the stadium are blowing Vuvuzela trumpets. If we were always to apply the same rigorous standards to the sound quality of all television programmes, this would make a marked difference to programme intelligibility.

Figure 4: Television coverage of the World Cup in South Africa, July 2010

Optimize the video

The intelligibility of the *video* (stills and motion pictures) is both a question of usability and accessibility.

Careful design of the picture and picture elements based on what is known about human perception can make a significant difference to all viewers, and not just those with sensory impairments.

Organizations such as Tiresias.org have produced easy-to-use checklists based on accessibility research to optimize the design process.

Figure 5 is an extract from a checklist for the use of text and colour in television programmes. For each possible action, the potential benefits for different groups of persons with disabilities is assessed, ranging from no significant benefits to major benefits[10]:

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[9]   Nick Tanton, BBC at ITU-EBU Joint Workshop on Accessibility to Broadcasting and IPTV ACCESS for ALL. Geneva, Switzerland, 23–24 November 2010 www.itu.int/ITU-T/worksem/accessibility/20101123/programme.html

[10] Tiresias.org Research resources – television checklist.
www.tiresias.org/research/guidelines/checklists/television_checklist.htm

Figure 5: Extract from an accessibility checklist for television pictures

	Visual	Hearing	Physical	Cognitive	Ageing
User Groups					
— No significant benefits					
O Minor benefits					
✚ Major benefits					
Text on TV screens					
The typeface is optimised to reduce confusion between letter shapes.	✚	—	—	✚	O
The font is clear and legible	✚	—	—	✚	O
Mixed case is used	✚	—	—	✚	O
Italic, underlined, oblique, condensed or fancy fonts should not be used	✚	—	—	✚	O
Flashing and scrolling text should not be used	✚	—	—	✚	O
Text size should be a minimum of 24 lines high on a capital 'V'	✚	—	—	✚	O
There is extra spacing between letters, words and lines	✚	—	—	✚	O
There is generous inter-line spacing to minimise problems of visual tracking	✚	—	—	✚	O
Colours					
Ensure that text on the screen is displayed using good colour contrast	✚	—	—	—	O
Ensure that the selected menu option is indicated on screen in different colour highlight, offering good contrast, but never rely solely on colour to convey information about e.g. selected options	✚	—	—	—	O
Avoid combinations of red and green	✚	—	—	—	O
Avoid pure red or white colours	✚	—	—	—	O

The screenshot in Figure 6 is from the late television news on RTBF (the French language service of Belgian public service television) and shows the ten news items in a menu on the right. As the news programme progresses, the indicator moves down the list. For some viewers with visual impairments, however, the text contrast of the menu bar on the right is too low.

Figure 6: Television news screen layout designed to promote accessibility

The screenshot in Figure 7 from the Flemish service of Belgian public service television shows that the same-language captioning for those with hearing impairments is positioned to be visible without covering the caption containing the name of the interviewee. Here the interviewee has captioning in light blue. The interviewer has captioning in white.

- **Ensure the availability and accessibility of programme guides** (both those offered by the receiver itself – Electronic Programming Guides (EPGs) – and conventional paper-based guides). These play a role in ensuring that programmes with access services are identified as such. Without metadata (information about programmes and their access services), access services are to all intents and purposes hidden from their potential users.

Figure 7: Closed captioning designed to fit with other on-screen captions

The EPG in Figure 8 is for a pay TV system in India and is provided by Microsoft. In this example, some of the programmes are displayed using the "present" and "following" convention. The thumbnail image at the bottom left is the programme the viewer is currently tuned to. The challenge of EPGs is to strike the right balance between overview and detail. In this case (and in fact most broadcaster EPGs), the viewer has to go down one more level in order to find information about access services.

Figure 8: An example of an Electronic Programming Guide (EPG) from India

- **Establish and use quality metrics**. Some distribution means are more prone to *quality issues that affect accessibility* than others. If the signal in analogue cable or terrestrial transmission is weak, this can lead to artifacts such as "snow" and shadows in the picture as well as a noisy audio channel with low intelligibility.

Figure 9 shows a programme with "snow" due to poor reception (ABC Television, Australia).

Figure 9: "Snow" on an analogue television picture

- **Digital broadcasting can be affected by adverse weather conditions and/or a weak signal leading to the picture blocking or freezing**. Audiovisual content delivered over Internet networks (both IPTV and webcasts on the open Internet) can suffer from jitter, leading to the picture and sound freezing or suffering delays. If the quality of service is below acceptable thresholds, this will lead to a variety of issues affecting accessibility.

The screen shot in Figure 10 is from a digital TV programme with picture artifacts. On the left is the normal picture. On the right is the TV picture with blocking artifacts when the signal strength dropped due to bad weather.

Figure 10: Digital television artifacts

3 Which access services can currently be offered with television programmes?

The aim of this chapter is to provide the reader with a more detailed understanding of the current options to offer access services themselves to improve the accessibility of general television programming. It looks at accessibility from the same user perspectives as chapter 1 to illuminate current accessibility options. While the aim of chapter 2 was to answer the question "How do we improve programme production?", this chapter addresses the question "Which access services are currently available to address the needs of persons with disabilities?" Issues related to the production and distribution of these access services are discussed in chapter 4.

3.1 Age-related accessibility options

When planning for accessible audiovisual content in a given territory, the age-related needs of viewers in a given territory will be of importance.

- **For children, consider the use of dubbing or lectoring**. Children watching a programme in a language other than their own and who cannot yet read can be helped by dubbing (voice-overs) or lectoring (partial voice-overs).

  - *Dubbing (voice-overs)* involves the replacement of the original soundtrack with an audio track in the official language of the territory where the programme is to be shown. The speech is synchronous with the original and the lip-movements correspond approximately to those of the original language.

  - *Lectoring (partial voice-overs)* has been used for decades in Scandinavia, parts of Eastern Europe and Latin America. The sound level of the original voices is lowered, and a narration in the official language is added that both explains what is said but also provides other cues that are not immediately self-evident from the picture. Good examples include the Swedish television versions of *Pippi Longstocking* and *Emil from Lönnenberg* for children. Both were first shown on TV in Scandinavia with lectoring but are now available on DVD with dubbing. In some quarters in Scandinavia and Eastern Europe there is a wish to promote lectoring as the service promotes the learning of a language in a neighboring country or region. This may be applicable in other parts of the world.

- **For adults watching a programme in a language other than their own and who can read, consider the use of dubbing, lectoring (partial voice-overs) or captioning.**

  - Captioning (intra-lingual/same language subtitles for the deaf and heard-of-hearing or inter-lingual subtitling/foreign language subtitling) exists in a variety of forms. Depending on the territory and the captioning traditions, the captions in the official language may be a verbatim transcription of what is said or a linguistically condensed version. The captions may use colour-coding to indicate that two or more people are speaking. The captions may contain what is said, or may also include mention of features central to the understanding of the programme, e.g. names, reactions of the speakers and noises heard on the sound track.

  - Captions may be open, or in-vision (i.e. "burnt" into the television picture itself so that everyone has to see them) or they may be closed (i.e. optional captions that are delivered separately through Teletext, information stored in the vertical blanking interval or another means requiring action on the part of the viewer to see them).

- **For (elderly) adults watching a programme in a language that they speak and read, consider the use of same-language captioning with some language condensation to keep reading speed down.** The issue here is typically that those speaking in the programme have a fast or indistinct diction, speak a dialect, or make use of vocabulary items with which some viewers are unfamiliar (modernisms, slang, technical terms). Same language captioning may be pre-prepared and

delivered with a recorded programme or it may be live captioning, delivered with a live programme with a delay of some seconds.

3.2   Viewing and languages – accessibility options

When planning for accessible audiovisual content in a given territory, information about the languages and dialects spoken and read by people in the territory will be a critical prerequisite.

There are six main scenarios when it comes to language diversity and audiovisual content:

1. **Monolingual** (territories with one official language and few dialects; very limited immigration).

2. **Bilingual** – spoken-signing (territories with one official spoken language and where sign language is also recognized as an official language).

3. **Bilingual** – spoken only (territories with two official spoken languages).

4. **Tri- and quadri-lingual** (territories with three or four official spoken languages and/or sign language(s)).

5. **Multi-lingual** (territories with one or more official languages and numerous regional or local languages).

6. **Territories with sizeable immigrant and refugee minorities** who may not speak, understand, read nor write the official language.

The challenge in each of these scenarios is to ensure that as many citizens as possible can understand a given programme directly, or indirectly through an access service.

In territories where the population is predominantly literate, captioning should be considered.

Figure 11 shows the options for the each of the six scenarios.

Figure 11: Language scenarios for hearing impairments			
Scenario	**Deaf and hard-of-hearing**	**Age-related hearing challenges**	**Immigrants and refugees**
In monolingual territories One official spoken language and few dialects; very limited immigration	*Open* or *closed captioning* in one official language. The programme can be in the official language or captions translating into the official language and is accessible to all those who speak and can read captions in that language. The programme is not accessible to deaf people who understand sign language only, to the elderly who also have visual impairments, and to immigrants and refugees who are illiterate, do not understand the official language or who are deaf or have age-related impairments.		
Bilingual territories One official spoken language and sign language	*Open* or *closed captioning* in the official spoken language (+ signing in the official sign language). The programme is not accessible to those who have multiple impairments including visual impairment.	*Open* or *closed captioning* in the official spoken language. The programme is not accessible to those who have multiple impairments including visual impairment.	*Open* or *closed captioning* in the official spoken language. The programme is not accessible to those who do not understand the official language or who are deaf or have age-related impairments.
Bilingual territories Two official spoken languages	*Closed captioning* in the two official spoken languages. The programme is not accessible to those who are blind or have sign language as their only language or have multiple impairments including visual impairment.	*Closed captioning* in the two official spoken languages. The programme is not accessible to those who have multiple impairments including visual impairment.	*Closed captioning* in the two official spoken languages. The programme is not accessible to those who do not understand the official language or who are deaf or have age-related impairments.

Scenario	Deaf and hard-of-hearing	Age-related hearing challenges	Immigrants and refugees
Tri- and quadri-lingual territories Three or four official languages	*Closed captioning* in the three or four official (spoken) languages. Each language usually has its own channel (+ signing in the official sign language(s)). The programme is not accessible to those who are blind or have sign language as their only language or have multiple impairments including visual impairment.	*Closed captioning* in the three or four official (spoken) languages. The programme is not accessible to those who have multiple impairments including visual impairment.	*Closed captioning* in the three or four official (spoken) languages. The programme is not accessible to those who do not understand the official language or who are deaf or have age-related impairments.
Multilingual territories More than four languages	*Closed captioning* in as many as nine languages per channel that may require careful training of the audience to select the appropriate captioning. The programme is not accessible to those who are illiterate, are blind or have sign language as their only language, or have multiple impairments including visual impairment, or who wish to watch with others viewing captions in a different language.	*Closed captioning* in as many as nine languages per channel that may require careful training of the audience to select the appropriate captioning. The programme is not accessible to those who are illiterate or have multiple impairments including visual impairment or who wish to watch with others viewing captions in a different language.	*Closed captioning* in as many as nine languages per channel that may require careful training of the audience to select the appropriate captioning. The programme is not accessible to those who are illiterate or have multiple impairments including visual impairment or who wish to watch with others viewing captions in a different language.
Territories with sizeable immigrant and refugee minorities Multiple languages are spoken by immigrants and/or refugees	*Closed captioning* in as many as nine languages (official or spoken) per channel that may require careful training of the audience to select the appropriate captioning. The programme is not accessible to those who are illiterate, are blind or have sign language as their only language, or have multiple impairments including visual impairment, or who wish to watch with others viewing captions in a different language.	*Closed captioning* in as many as nine languages (official or spoken) per channel that may require careful training of the audience to select the appropriate captioning. The programme is not accessible to those who are illiterate, or have multiple impairments including visual impairment, or who wish to watch with others viewing captions in a different language.	*Closed captioning* in as many as nine languages (official or spoken) per channel that may require careful training of the audience to select the appropriate captioning. The programme is not accessible to those who are illiterate, or have multiple impairments including visual impairment, or who wish to watch with others viewing captions in a different language.

Where literacy levels are low, see section "3.4 Viewing and literacy – options" for a discussion.

3.3   Viewing and accessibility options for specific disabilities

This section introduces the viewing and accessibility options for hearing, sight, speech, mobility and dexterity, and cognitive impairments.

3.3.1   Options for hearing impairments

For viewers who were born deaf, most will benefit from *signing* and some may be able to follow *captioning*.

For viewers who have become deaf (oralists), most will benefit from *captioning*, unless they also have visual impairments.

For viewers with hearing impairments who use hearing aids, being able to hear the programme can be helped by the use of *wireless connections* between the television receiver and the hearing aid itself.

Closed captioning of the programme will also help many to follow fast colloquial speech, unless they have vision or reading impairments.

Work is being done on "clean" or "clear audio", either to ensure that an audio channel is available without music or other additions, or to improve the intelligibility of the audio in the receiver through the use of users' profiles and filtering. This still has the character of being "work in progress".

3.3.2   Options for sight impairments

For viewers who are blind or have serious visual impairments, the main access option for television programmes in an official language of the country is *audio description*. This requires that the viewer has average hearing. The UK pay-TV operator, B Sky B, has a good introduction to AD on its website[11]. The UK Channel 4 also has an imaginative spot for audio description on YouTube[12].

For viewers who are blind or have serious visual impairments, the main access option for television programmes in a foreign language is *audio captioning* (also known as audio subtitles or spoken subtitles). Currently services of this kind use speech synthesis at the broadcaster playout center to generate an additional audio track in mono. This can be delivered using the same mechanisms as audio description.

Solutions exist in a few countries to produce audio captioning in the television set itself using speech synthesis (e.g. the Royal National Institute for the Blind (RNIB) solution available in the UK). Consumer electronics manufacturers are also working on a speech interface in which the viewer can operate a television receiver using a remote control and through spoken feedback created using speech synthesis. This still has the character of being "work in progress".

3.3.3   Options for persons with speech impairments

There are persons who have suffered accidents that have affected the speech centre that may find it difficult to understand the spoken language, even with the help of captioning. One of the current challenges is the "one size fits all" strategy for captioning. Ideally, captioning could be a verbatim transcription that is "parsed" or compressed linguistically according to the needs and capabilities of each viewer. Those working on captioning software solutions suggest that it should be possible to mark-up captioning so that it could be processed in the television receiver. However, we are some years away from solutions that are technically viable and that have a sustainable business model. Solutions for persons with speech impairments still have the character of being "work in progress".

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[11]   The B Sky B website link to audio description is here:
http://accessibility.sky.com/get-the-most-from-sky/sky-tv/if-you-have-visual-impairment/audio-description

[12]   The Channel 4 spot can be found here: www.youtube.com/watch?v=qu0GYkuCrRg

3.3.4 Options for persons with reduced mobility and dexterity

Persons with impaired mobility find it difficult to get around, also within the home. In such cases, getting into the right position in order to tune or retune a set-top box or television receiver may constitute a major obstacle. The solutions range from formal help schemes for the elderly and those with registered disabilities (e.g. the UK switch-over scheme to help over 75s and those with disabilities switch from analogue to digital television[13]) to informal help from family and friends.

Persons with reduced dexterity may find it difficult to handle the buttons on a remote control device because the buttons are so small, difficult to see, or numerous. The dexterity problems may be compounded by visual impairments (being long-sighted, finding it difficult to look at objects close at hand).

Dexterity may also be an issue in the digital world for two other reasons: there are typically more channels to choose from and the user interface is often somewhat different from the analogue TV one. The user may have been accustomed to turning on the analogue set and watching one channel. Having more choice and the introduction of remote control devices has meant a change from a user scenario in which interaction was primarily a question of using the on/off functions to a scenario where choices are made by selecting from a number of options using the arrow keys and the OK button, or the numerical keys with some kind of point-and-click interface.

3.3.5 Options for persons with cognitive impairments

Cognitive impairments are a category in which the needs of a wide range of persons with disabilities are lumped together.

The University of Cambridge exclusion calculator[14] does a good job of identifying many of these.

Depending on the individual, the focus may shift from optimizing the programme itself to checking that existing access services such as captioning actually deliver what they are required to do.

3.3.6 A summary of mature access services and the target audiences they address

The main access service options currently available are the following:

Figure 12: Summary of mature access services, target audiences and user prerequisites		
Access service	**Target audience**	**User prerequisites**
Captioning		
Same language (intra-lingual)	• Persons who are deaf (oralists) • Persons with hearing impairments • Persons who find it difficult to understand colloquial language • Persons in contexts where watching TV with the audio is an issue (on public transport, in bars, or in homes with family members who are asleep)	Average reading skills or better

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[13] The [digital television] Switchover Help Scheme. www.helpscheme.co.uk/

[14] University of Cambridge Inclusive Design Toolkit
www.inclusivedesigntoolkit.com/betterdesign/downloads/exclusioncalc.html

Access service	Target audience	User prerequisites
Foreign language (inter-lingual)	In addition to the audiences for same language captioning: • Persons who do not understand the language in question	Average reading skills or better
Signing	• Persons who were born deaf • Persons with a variety of cognitive impairments	Able to understand signing in the sign language offered
Audio description – also known as video description in North America (description in same language as the programme)	• Persons who are blind • Persons with serious visual impairments • Persons who wish to follow a programme without watching the screen	Average hearing ability Understanding of the official language being used
Audio captioning (reading the foreign language captioning aloud using speech synthesis)	In addition to the audiences for audio description those who do not understand the foreign language in question	Average hearing ability Understanding of the official language being used

3.4   Viewing and literacy – accessibility options

Television is a global phenomenon and is a good window on the world. When programmes or news items in foreign languages are aired, they are either dubbed, provided with captioning or lectoring. This may constitute a problem for those who are illiterate, "word-blind" or have receptive aphasia. The information in Figure 13 shows the impact of literacy levels on the six language scenarios:

Figure 13: Access service options for language scenarios

Scenario	Viewers who are illiterate	Viewers who are word-blind	Viewers who have receptive aphasias
In monolingual territories (one official spoken language and few dialects; very limited immigration)	*Dubbing the sound track*	*Closed captioning* in the official spoken language + audio captioning (spoken subtitling) in the official language. This may only help some of the target audience	*Closed captioning* in the official spoken language + audio captioning (spoken subtitling) in the official language. This may only help some of the target audience
Bilingual territories (one official spoken language and sign language)	*Dubbing the sound track and offering open signing (analogue) or closed signing (digital)*	*Closed captioning* in the official spoken language + audio captioning (spoken subtitling) in the official language. This may only help some users	*Closed captioning* in the official spoken language + audio captioning (spoken subtitling) in the official language
Bilingual territories (two official spoken languages)	*Alternative audio tracks (analogue)* or *Virtual television channels with the same picture but different stereo audio tracks (digital)*	*Closed captioning* in the two official spoken languages + audio captioning (spoken subtitling) in the official languages. This may only help some of the target audience	*Closed captioning* in the two official spoken languages + audio captioning (spoken subtitling) in the official languages. This may only help some of the target audience

Scenario	Viewers who are illiterate	Viewers who are word-blind	Viewers who have receptive aphasias
Territories with three or four official languages	No solution currently available apart from multiple TV-channels (analogue) or multiple virtual TV-channels (digital)	*Closed captioning* in the three or four official (spoken) languages. Each language usually has its own channel. It may also have audio captioning	*Closed captioning* in the three or four official (spoken) languages. Each language usually has its own channel. It may also have audio captioning
Multilingual territories	No solution currently available apart from multiple TV-channels (analogue) or multiple virtual TV-channels (digital)	Closed captioning in as many as nine spoken languages. This may only help some of the target audience	Closed captioning in as many as nine spoken languages. This may only help a small proportion of the target audience
Territories with sizeable immigrant and refugee minorities	No solution currently available apart from multiple TV-channels (analogue) or multiple virtual TV-channels (digital)	Closed captioning in as many as nine spoken languages. This may only help some of the target audience	Closed captioning in as many as nine spoken languages. This may only help a small proportion of the target audience

4 Getting started – who needs to do what so that the viewer can see television programmes with access services?

Having looked at television programmes themselves, this chapter looks at the television receiver[15]. Before the viewer can watch a programme with the accompanying access service, there are several things that need to be dealt with.

There needs to be:

- a television signal,
- a television receiver tuned to receive the television signal, and
- information about the television programmes and access services.

The viewer has to be able to:

- discover and select something to watch,
- watch the programme with the accompanying access service, and
- benefit from the access service.

The aim is to help the reader identify what is necessary in their own territory for viewers to be able to do this on their own or with help from somebody.

A particular challenge is the transition from analogue to digital television. In a report on a technical trial to introduce digital television in the United Kingdom[16], the agency in question noted that "a minority needed support – most issues were resolved over the telephone by the Trial Helpline. A small minority needed a lot of support – mostly the very elderly and the disabled."

The elderly needed help for a number of reasons: difficulties in installing their own equipment, difficulty in re-scanning, lack of confidence (extra advice and re-assurance were needed in using the equipment), remote control issues, the use of captions because of hearing difficulties, and difficulty in bending down to adjust their television.

4.1 Receiving and viewing a television signal

4.1.1 Analogue television receivers

In order to see a television programme on a television set, three things are required:

1. a source of television channels, typically an antenna, a satellite dish, a cable TV or an Internet connection,
2. a tuner or decoder to convert the source into a television signal, and
3. a display (a television set or a computer flat panel display) on which to see the programme.

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[15] A good, short reference work on the subject is "Summary of research on the ease of use of domestic digital television equipment" dated 8 March 2006, OFOM, UK.
http://stakeholders.ofcom.org.uk/market-data-research/tv-research/usability/

[16] DCMS Report of a Digital Switchover Technical Trial at Ferryside And Llansteffan, July 2005. Department for Culture, Media and Sport, UK.

Figure 14: Analogue television reception

If analogue distribution is still in use for television signals in the country in question, the existing options for access services are listed in Figure 15:

Figure 15: Analogue television – access service options

Access service	Options for analogue TV	Comments
Same language (intra-lingual) captioning	• Open same language captioning (the captions are "burnt" into the video signal and can be seen by everyone • Closed same-language captioning (the captions are delivered as an optional overlay using teletext or its equivalent)	• Where possible, choose a closed, or optional solution rather than an open, or compulsory option • If an open solution is chosen, this may require significant marketing to gain audience acceptance
Foreign language (inter-lingual) captioning	• Open foreign language captioning (the captions are "burnt" into the video signal and can be seen by everyone (one or possibly two languages) • Closed foreign language captioning (the captions in one or more languages are delivered as an optional overlay using teletext or its equivalent)	• Open captioning restricts the number of languages that can be offered to one or two • Open captioning is best in countries where a majority of the television programming has a soundtrack in a language other than the official language
Signing	• Open signing with the signer to the right or the left of the picture • A separate channel with the signer to the right or the left of the picture	• Signing works best when the viewer can see not only the hands but also the facial expressions of the signer • To avoid the signer obscuring important picture elements, the television picture is often reduced somewhat to make room for the signer • Signing is different from one country or region to another, in the same way that oral languages and dialects differ. In bi- or multilingual countries, open signing represents a challenge

Access service	Options for analogue TV	Comments
Audio description, (same language content)	• Closed audio description using the Alternative Audio track and requiring the user to select alternative audio with their remote control	• Introducing an Alternative Audio service requires tests on the installed base of television receivers to check whether they handle this feature correctly. • If a significant proportion of receivers do not handle Alternative Audio, consider using a separate device that is widespread in audience homes such as a simultaneous broadcast of the audio description on medium wave, FM, digital radio, Internet streaming to a mobile phone or a fixed line telephone service.
Audio captioning (reading the foreign language captioning aloud using speech synthesis)	• As for audio description	• As for audio description

4.1.2   Digital television receivers

If the transition to digital transmission has started (or perhaps is complete) in a country, the requirements are very similar. Viewers will need a digital receiver to extract the digital programmes and "assets" such as additional audio channels and programme information from the signal.

The digital receiver is called a set-top box and is connected to an existing TV set which then acts as a TV monitor:

Figure 16: Digital television reception – Set-top box with an existing TV set

After switching to digital television, most people have a digital television that includes a built-in digital receiver. This is usually called an integrated digital television receiver:

Figure 17: Digital television reception – Integrated digital television receiver
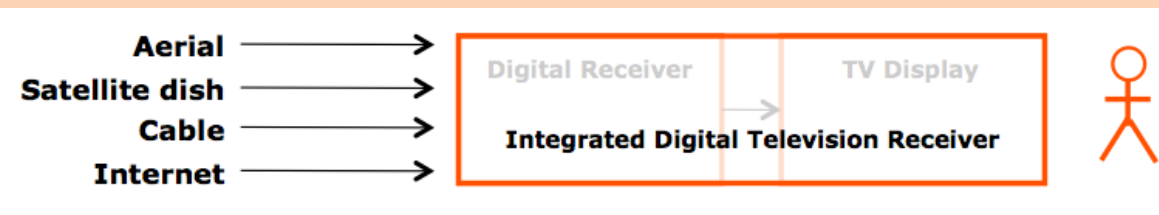
The switch to digital means a greater range of possible access services and increased flexibility. As was noted in chapter 2, digital transmission allows the broadcaster to offer "closed" access services, i.e. ones where the viewer can decide what to do. Figure 18 lists the main access service options available on digital television:

Figure 18: Digital television – access service options		
Access service	**Options for digital TV**	**Comments**
Same language (intra-lingual) captioning	• Open same language captioning (the captions are "burnt" into the video signal and can be seen by everyone) • Closed same-language captioning (the captions are delivered as an optional overlay using teletext, DVB subtitles, captions "encoded" in line 21 of the vertical blanking interval, or for Advanced Television Systems Committee (ATSC) (digital television) programming, one of the three streams that are encoded in the video in the EIA-708 format, or its equivalent in other TV systems)	• Where possible, choose a closed, or optional solution rather than an open, or compulsory option • In territories where there are both teletext and DVB subtitling (or their equivalents in the in the ATSC, Integrated Services Digital Broadcasting (ISDB), Digital Terrestrial Multimedia Broadcasting (DTMB) and Digital Multimedia Broadcasting (DMB) standards the bit-map option similar to DVD-subtitles allows for greater control over the look and feel of the interface than does teletext
Foreign language (inter-lingual) captioning	• Open foreign language captioning (the captions are "burnt" into the video signal and can be seen by everyone (one or possibly two languages) • Closed foreign language captioning (the captions in one or more languages are delivered as an optional overlay using teletext or its equivalent)	• Open captioning restricts the number of languages that can be offered to one or two. Digital closed captioning can offer as many as nine languages, if bandwidth is available • Open captioning is best in countries where a majority of the television programming has a soundtrack in a language other than the official language and there is no consumer electronics compliance mechanism to check for standards compliance
Signing	• Open signing with the signer to the right or the left of the picture • Closed signing with a separate, virtual channel with the signer to the right or the left of the picture. • Closed signing with a quarter-screen overlay that is added to the conventional digital channel • (Closed signing with simultaneous streaming of the programme with signer via broadband Internet which is displayed on a digital television receiver that also has a broadband connection)	• In many countries, there is resistance to displaying open signing in prime time. Examine the implications of such a service for all the stakeholders involved • The virtual channel solution works well where the channels in the multiplex are all standard definition and the channel can be added at will using statistical multiplexing. In the medium to long term, this solution is likely to face difficulties when channels move from Standard Definition to High Definition programming (as there will no longer be bandwidth that can be "borrowed" from the other channels in the multiplex)

Access service	Options for digital TV	Comments
	• (Closed signing with simultaneous streaming of the quarter-screen overlay with the signer via broadband Internet that is added to the conventional programme in the receiver)	• Simultaneous streaming of the programme with signing to a digital television set with Internet connection is a cost-effective solution, but assumes that good-quality broadband is cheap and readily available in the whole territory
Audio description (same language content)		
Audio description Broadcast mix	• Closed audio description using an alternative mono or stereo track with the audio description already mixed with the audio (*broadcast mix*)	• The broadcast mix audio description service can be offered as a virtual channel with its own ID in the EPG. Viewers needing audio description can choose this channel as the default
Audio description Receiver mix	• Closed audio description using a separate mono track with the audio description which is mixed with the audio in the digital television receiver (*receiver mix*) according to volume control data provided alongside the audio	• Alternatively, the broadcast mix and receiver mix audio can both be selected through the *audio description* or *alternative audio* button on the television remote control. The challenge here is that it requires the viewer to be able to identify the correct button or buttons
Separate device to deliver audio description	• Deliver the audio description through a separate delivery network to a device other than the TV receiver. There could be a designated button such as the "5" key with a raised pip to give direct access to audio description, but to date this has not been implemented	• If a significant proportion of digital receivers do not handle Audio Description, consider using a separate device that is widespread in audience homes such as a simultaneous broadcast of the audio description on medium wave, FM, digital radio, Internet streaming to a mobile phone or a fixed line telephone service
Audio captioning (reading the foreign language captioning aloud using speech synthesis)	As for audio description – receiver mix	As for audio description – receiver mix

As can be seen, digital transmission can be used for both open and closed services. There is a clear incentive to move to closed services where this is realistic.

4.2 Recording and viewing a television programme after it has been broadcast

Increasingly, viewers place a premium on convenience. Over the last three decades, television has moved to the "Anything, Anytime, Anywhere and on Any Device" paradigm. Viewers want to be able to watch television programmes on their own terms, and this means that programmes need to be accessible when and where the viewer wants, and on the device of the viewer's choice. Recording programmes is one of the challenges for access services.

4.2.1 Recording analogue television

Viewers wishing to see a specific programme when they want often record the programme using some kind of recording device. This can be a video cassette recorder with built-in tuner, a recorder using optical discs such as recordable CDs or DVDs, or a hard-disc recorder, also known as a personal video recorder (PVR).

If the access service is open (e.g. open captioning), it will be recorded and it should be possible to use the service when watching the recording.

If the access service is closed (e.g. closed captioning), it is by no means certain that the service can be recorded. The viewer will have to check the documentation of the device to check which services are supported.

4.2.2   Recording digital television (personal video recorders, PVRs)

Viewers who own a video or DVD recorder for analogue television will also be able to record and play back videos or DVDs when they switch to digital. However, analogue recorders will not allow a viewer to watch one channel and record another at the same time. To do this, the viewer requires a recorder that has its own digital tuner or tuners.

Free-to-air digital PVRs in territories such as the United Kingdom, Ireland and the Nordic region are designed to record and reproduce access services as this is a requirement of the UK Digital Television Group (DTG) and NORDIG[17] television standards. Some pay TV services also offer well-designed PVRs that can record and play back programmes with access services.

4.3   Remote control devices

Remote control devices are not equally easy to use. Help schemes in some countries such as the United Kingdom provide set-top boxes and remote controls that are designed to be accessible. Tiresias.org has produced an accessibility design checklist for television remote control devices[18] to make such devices as useful as possible for persons with disabilities.

Figure 19: Extract from an accessibility checklist for television remote controls

	Visual	Hearing	Physical	Cognitive	Ageing
Keys					
Basic keys for power on/off, volume control, mute and channel up/down are included	+	+	+	+	+
Accessibility keys are included	+	+	O	—	O
Keys are well spaced	O	—	+	—	O
Keys are large and differentiable by shape, size or texture	+	—	O	—	O
Distinct shapes correspond to the icons on the screen	+	—	—	—	O
A raised tactile dot should be placed on the number 5 key	+	—	—	—	O
There is tactile and audible feedback when a key is activated	+	+	O	—	O
Keys are prioritised for inclusion on the remote control	+	—	—	+	O
Keys are logically grouped	+	—	—	+	O
There are pre-programmable keys for frequent functions	+	—	+	+	O
The keys are placed in an intuitive position for single handed operation	—	—	+	—	O
There is a clear unambiguous key that permits the user to go back a step	+	+	+	+	+
Keys are positioned in a way that is consistent with their function	+	—	O	+	O
Keys are operated independently there is no double key pressing required	+	—	+	O	O

Legend: — No significant benefits; O Minor benefits; + Major benefits

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[17]   NorDig is a standardization body that specifies a common platform for Digital Television to be used within the Nordic region (Denmark, Finland, Iceland, Norway, Sweden) and Éire.

[18]   Tiresias.org. Checklist for remote controls. www.tiresias.org/research/guidelines/checklists/remote_checklist.htm

4.4   Wireless connections to hearing aids

For viewers with hearing impairments and who use a hearing aid, intelligibility can be improved by a wireless connection between the television set and the viewer's hearing aid. Systems using induction loops are giving way to digital solutions that work over short distances within the home[19].

4.5   Access services delivered over non-television networks

As mentioned above, in some cases access services such as audio description are delivered by means of simultaneous broadcast or distribution to additional consumer electronics devices: medium wave radio, FM radio, digital radio, Internet streaming to a mobile phone or a fixed line telephone service.

An example of audio description delivered on a radio network rather than on TV was the public service broadcaster, RTP, in Portugal[20]. They delivered audio description on the radio channel Antena 1 on medium wave to accompany Portuguese films shown on the main TV channel.

4.6   Setting up for television reception

In order to be able to watch television, there are a number of practical prerequisites: a receiver, a TV signal and in some cases a subscription and a conditional access card.

To show what is required, there are several viewing scenarios:

1.   watching television at home on a new television set;

2.   setting up a set-top box or integrated digital television receiver in connection with the switch from analogue to digital television; and

3.   retuning the television receiver when new channels or services become available.

The first scenario covers a number of different steps:

* Making sure there is a television signal (either a terrestrial aerial, a signal from a satellite or cable operator, or from an operator delivering television over an Internet connection).

* Being able to use a printed or audiovisual guide to setting up the television receiver.

* Setting up the television receiver. This includes connecting the appropriate cables and connecting a conditional access system if needed.

* Tuning the receiver to find the channels that are available and setting up the electronic programming guide (EPG), if available.

The second scenario is similar to the first, as it requires checks to be made of the source of the television signal (in some cases changing the aerial or antenna), connecting additional units such as a set-top box, tuning the receiver and setting up the EPG.

The third scenario is more limited and involves retuning the receiver or television set.

For persons with disabilities, there are three main options for setting up for television reception:

1.   doing the work themselves,

2.   asking family and/or friends for help, or

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19   Galster, Jason A. A new method for wireless connectivity in hearing aids. Hearing Journal: October 2010 – Volume 63 – Issue 10 – pp 36,38-39.
http://journals.lww.com/thehearingjournal/Fulltext/2010/10000/A_new_method_for_wireless_connectivity_in_hearing.6.aspx

20   The URL for the RTP page on AD services is: www.rtp.pt/wportal/acessibilidades/index.php

3. getting help from someone who is paid for their services or does so on a voluntary basis.

With the exception of changing or putting up outdoor aerials and satellite dishes, many adults prefer to do things themselves. Others will not be in a position to do the work themselves. If they have a network of family members or friends, asking for help is often a good solution. In the Danish digital switch-over campaign, research indicated that about 1 per cent of the population (predominantly elderly persons living on their own without close family or friends) were vulnerable and in need of help[21]. Volunteers from several NGOs were used to contact these individuals. The day after analogue switch-off, about 0.2 per cent of households had not made the transition successfully.

Research in the United Kingdom in connection with digital switchover revealed, however, that some viewers have neither family nor friends who can help. In such cases, paid help or help from volunteers may be necessary. The United Kingdom and Portugal are two cases where there is either a national help scheme for persons with disabilities[22], or this is under active consideration. As of May 2011, the UK scheme had already helped 700, 000 persons and expects to aid more than 1.5 million all told. Some pay-TV operators offer an all-inclusive set-up service that is either free or is done for a fixed charge for new subscribers.

4.7   Discovering programmes and access services

Viewers have different behavior patterns when it comes to watching television. Typical patterns include:

- Turning on the television set and watching programmes on familiar channels.

- Turning on the television and changing channel – pressing the arrow keys to "zap" or channel-hop until something of interest turns up.

- Using the electronic programme guide, or a printed listing of programmes to find something to watch.

These viewer preferences for discovering and viewing programmes have implications for finding and using access services. There is no significant marketing challenge for open services, because their availability should be self-evident. There are, however, significant differences for the three cases mentioned above when it comes to closed, or opt-in services.

In the first of the three cases, using an optional access service such as closed captioning will depend on the viewer knowing in advance that the service is available with the chosen programme. In the second case, it will depend on some kind of icon or information to help the viewer who zaps, to indicate what access service is available. In the UK, many receivers have the option of offering a "beep" that indicates to visually impaired viewers the existence of an audio description option for that channel. This is explained in more detail at the BBC accessibility website Ouch[23]. In the third case, selecting the access service will depend on whether the availability of the access service is mentioned in the EPG or the programme listing.

The challenge facing the potential user of the access service also depends on its "availability". In some countries, the availability of captioning is close to 100 per cent. It is easy to promote something that is nearly always available. Audio description, however, is not yet widely available. In countries such as the UK it is offered with 20 per cent of television programmes on the main channels with public service obligations. In other countries, audio description is available infrequently: once a week, or in some cases with a film once a month. Making sure that potential users know which film or programme is available

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[21]   Henrik Vejlgaard (2010). Danskerne og det digitale tv-signal [the Danes and Digital Television] ISBN 978-87-993785-0-0

[22]   The British [digital] help scheme: www.helpscheme.co.uk/

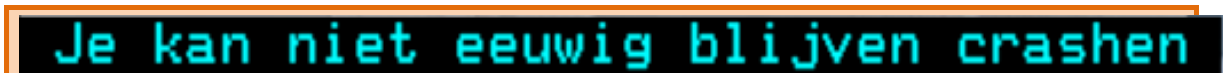[23]   www.bbc.co.uk/ouch/fact/ouch_guide_to_audio_description.shtml

with audio description is a major marketing challenge. A prerequisite for user awareness and user take-up is correct labelling of access services in all programme guides.

The conclusion here is that producing and distributing access services for television programmes is – in itself – not sufficient. For such services to make a difference to television accessibility, potential viewers need also to be given information about their existence in ways that fit their viewing habits and lifestyles.

4.8 Viewing a programme with an access service

If we assume that the potential viewer of a programme with an access service knows of its existence, the next step is to view the programme with the accompanying access service. For open services, i.e. those that are provided for all viewers, this is not a problem. For closed, or opt-in services, viewing the programme with its access service requires the viewer to be familiar with the user interface and the steps required for activating the service. If we take closed captioning first, the ideal solution would be one press of a remote control button to access captioning and another button press to remove it.

An alternative solution is to define user preferences in advance so that, regardless of channel, closed captioning is shown with all programmes. The difficulty is that the main television set in a home is often viewed by different members of the household. They sometimes view alone, sometimes together. Defining user preferences will be acceptable in some, but not all situations. The sequence of actions required to define user preferences may also require considerable efforts on the part of the viewer. Unfortunately, viewing may be more complex than this. When teletext is used to provide subtitles, the viewer is first required to press the "teletext" button, then input the three-digit code for teletext captioning page and await the start of captioning. The viewer needs to remember the code, or be given a prompt by the teletext service. The choice of font will be dependent on the television receiver manufacturer.

Captions generated using teletext.

To view closed captioning on another channel, the viewer has to deselect "teletext", choose another channel, reselect "teletext" and input the three-digit code for teletext captioning page again.

Bit-map captions – DVB captioning

Using the bit-map DVB captioning, by comparison, may require the user to define his or her user preferences or press the "captioning" button on the remote control. The broadcaster, in this case, will determine the choice of font.

Keeping the user interface simple and with as few remote button presses as possible requires careful planning on the part of the broadcaster, the television platform operator, and the consumer electronics manufacturer. This is why digital platform operators with a limited channel offering often prefer to use virtual channels to offer audio description (broadcast mix). It reduces the interface complexity and thus reduces calls to the call centre. Simplicity often makes economic sense.

4.9   Benefiting from the access service

A recent study of television viewing and persons with visual impairments in Denmark[24] revealed relatively high levels of awareness among viewers with serious visual impairments and those who were blind. Although three-quarters of the sample were able to explain what audio description was, only half of them had used it, and even fewer did so on a regular basis.

Being aware of the existence of a service did not mean that the persons in question knew how to access audio description on their television sets. Even those who knew in general terms what was required to use audio description had a number of legitimate reasons for not doing so. These included cost-benefit ("Why should I invest in a new TV set?" or "why learn to use something that is available so infrequently?").

Those interviewed who used audio description on a regular basis found it useful, and in no cases did their partners with normal sight object to watching television drama with audio description. There are clearly several thresholds that need to be overcome before the vast majority of the target audience chooses to watch television with audio description. Related exploratory studies on same language captioning, in particular *live* same language captioning[25], have shown that there may be problems associated with the viewer's reading speed (the captions strain their reading skills). In the case of live captioning, there are issues related to semantic errors and also to the delay between on-screen speech and the captions being displayed (this can be anywhere from 5 to 14 seconds, depending on the broadcaster and the captioner).

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[24]   Jakobsen and Studsgaard (2011). An exploratory study of the use of Audio Description and digital television in Denmark. Master's thesis. IT University of Copenhagen (in press).

[25]   Rander, Anni and Peter Olaf Looms. The accessibility of television news with live subtitling on digital television. Pages 155–160. Proceedings of the 8th international interactive conference on Interactive TV & Video, Tampere, Finland 09–11 June 2010. Association for Computing Machinery, Inc. NY, USA.

5   How are access services produced, delivered and used?

This chapter aims to help the reader short-list potential access services that are to be produced, delivered and used in their territory. It caters primarily to decision-makers at broadcasters and their production and distribution partners. It also has relevance for other stakeholders who will require a basic understanding of the technologies involved, but does not necessarily require an engineering background.

While the creation of access services is often quite straightforward, in some cases there are critical issues that need to be addressed. When it comes to formatting, exchanging, delivering and using access services, there are often several options. The challenge is to choose a solution that is cost-effective, reliable and easy to use, and at the same time scales well, as the service moves from its initial to final level of provision.

Furthermore, technologies do not remain static. We have seen the move from analogue to digital distribution, from standard to high definition, and there are likely to be further innovations that may be considered "disruptive" in the future.

All these metrics have to be considered before short-listing a solution. Implementation decisions will also have to consider what the various options cost (both investment in equipment and training and operating costs). These issues are addressed in chapter 6.

Figure 20: A Summary of Access Services from Creation to Use			
Creating	**Exchange/Contribution**	**Delivery**	**Presentation on device**
Subtitling			
Pre-prepared captioning Live captioning	Tape VBI, DVD File-based	Bit-map captioning Teletext or VBI captioning	Digital receiver with bit-map captioning Digital receiver with teletext captioning
Audio/spoken captioning			
Captions turned into synthesized speech	Synthesized speech with fade information	Pre-mixed audio (broadcast-mix) audio with fade info (receiver-mix)	Any digital receiver Any digital receiver of mixing
Audio Description			
Script and fade information turned into additional audio	Description signal & control track synchronized with video (tape, file-based)	Pre-mixed audio (broadcast-mix) Audio with fade info (receiver-mix) Separate delivery channel	Any digital receiver Any digital receiver capable of mixing
Visual Signing			
Signer interprets speech and action in vision	Signer on tape, file-based or live	Signer superimposed Additional vision component Simulcast IP delivery of signer superimposed on signal	Any digital receiver Any digital receiver capable of mixing Any IP-capable receiver (ISBN, HbbTV or IP device – broadband)

Source: Adaptation of summary in EBU Project Group P/AS report I44-2004.

Frans de Jong and the European Broadcasting Union (EBU) Project Group on access services provided excellent reviews of the situation for television in 2004.[26][27] Their work covered both analogue and digital access services. Digital switchover from analogue to digital television and analogue shut-off has either taken place or will do so for the next 10–15 years.

This chapter covers both *analogue* and *digital* television. The aim is to highlight well-documented challenges facing analogue television that still need to be addressed, and new challenges to do with digital television that have emerged since the 2004 report.

5.1   Access services from planning to use – work flows

This introduction covers the planning, creation, playing out[28] and the delivery of each access service. The aim of describing briefly the workflows is to highlight issues of strategic importance when introducing or scaling up a given service.

There are several inputs that can be used when planning an access service:

- international or national legislation, guidelines and checklists,
- examples of good practice, and
- research into the production and use of that access service by its intended audience.

National legislation, guidelines and checklists are often based on inputs from practitioners. Similarly, an awareness of the current status of standards for access service technologies (in particular for the production, exchange, and distribution of access services) will be necessary to assure interoperability.

A comparison of legislation and guidelines usually confirms that there is a broad consensus about what should be done. In some cases, however, there are significant differences in practices from one country to another. These differences either reflect culturally-related issues (for example significant differences in narrative traditions) or the fact that guidelines and norms are based on perceptions of good practice rather than on an evidence-based approach that builds on empirical research.

In the absence of national requirements, a review of legislation and guidelines from elsewhere is a good place to start, in addition to the World Blind Union's user requirements document[29]. This goes into considerable detail on access services for persons with visual impairments.

The work flow for different access services is described below.

5.2   Captioning

5.2.1   Planning and handling viewer expectations

Broadcasters about to introduce captioning for the deaf and hard of hearing need to be aware of the prior knowledge and expectations viewers have about captioning. Both of these can have a big impact on the success of the proposed captioning service.

Firstly, in countries where viewers are already familiar with captioning to translate foreign language programming, there is little social stigma associated with same-language captioning. In dubbing countries,

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[26]   de Jong, Frans (EBU Project Group P/AS). Access Services for Digital Television. EBU TECHNICAL REVIEW – October 2004.

[27]   EBU Technical – Information I44-2004. EBU report on Access Services [includes recommendations] 2004.

[28]   A play-out center is the location from which a broadcaster dispatches a television channel either directly to a transmitter network or indirectly through a contribution system to one or more transmission networks.

[29]   WBU User Requirements for Television Receiving Equipment [Volume 1]
www.worldblindunion.org/en/our-work/campaigns/Pages/AccessToTechnology.aspx

however, where captioning is uncommon, captions are associated with hearing impairments. Until attitudes towards captioning become more relaxed, potential users and their families may have to overcome prejudice and resistance in order to benefit from same-language captions.

Secondly, there is the challenge of captioning that can help as many people as possible. Universal design depends on a number of factors and trade-offs, including the fidelity of the captioning and the viewer's reading speed.

Viewers cannot be expected to know how captioning is produced. For this reason, many assume that captioning is a verbatim transcription of the soundtrack. They may be suspicious of linguistic condensation that "changes" the intended meaning, rather than accepting that editing the text can help bring the required reading speed down to an acceptable level.

In user studies from Belgium, Denmark, Spain and the UK, viewers have asked for such verbatim transcriptions. Very few of the viewers in question would be able to read fast enough to benefit from them. Many of them would discover that reading verbatim transcriptions leaves little time to watch the programme.

When introducing a captioning service, it will be necessary to

- listen carefully to the audience,

- set up some kind of consultation mechanism with the organizations that represent the deaf and hard of hearing,

- assess the impact of a given solution on the various groups of users concerned, and

- be as transparent as possible about the trade-offs made in the production and distribution of captions.

A useful introduction to the viewing of programmes with captioning can be found in a study by Ofcom in the UK[30].

The report recommends that "[the] subtitling speed should not normally exceed a threshold of 180 words per minute, or three lines of text on screen".

In February 2011, the BBC released a short TV programme on YouTube that explains how pre-prepared and live captions are produced, and what viewers expect of captioning[31].

Earlier chapters have mentioned different kinds of captioning: open and closed captioning, same language and foreign language captioning. Mention has also been made of captions that are pre-prepared or produced on the fly for live programmes. The creation of open and closed captioning is essentially the same. The differences concern play-out, distribution and in the television receiver.

Live captioning that involves translation is extremely rare, leaving us with three main production workflows:

- pre-prepared same language captioning,

- pre-prepared foreign language captioning, and

- live same language captioning.

The following descriptions are based on agreed good-practice within the professional captioning community[32].

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[30] OFCOM. Subtitling – An Issue of Speed? 6 January, 2005.
http://stakeholders.ofcom.org.uk/binaries/research/tv-research/subt.pdf

[31] How Subtitles Are Made – See Hear – BBC Two www.youtube.com/watch?v=u2K9-JPIPjg

Figure 21: Pre-prepared same language captioning (intra-lingual subtitling)
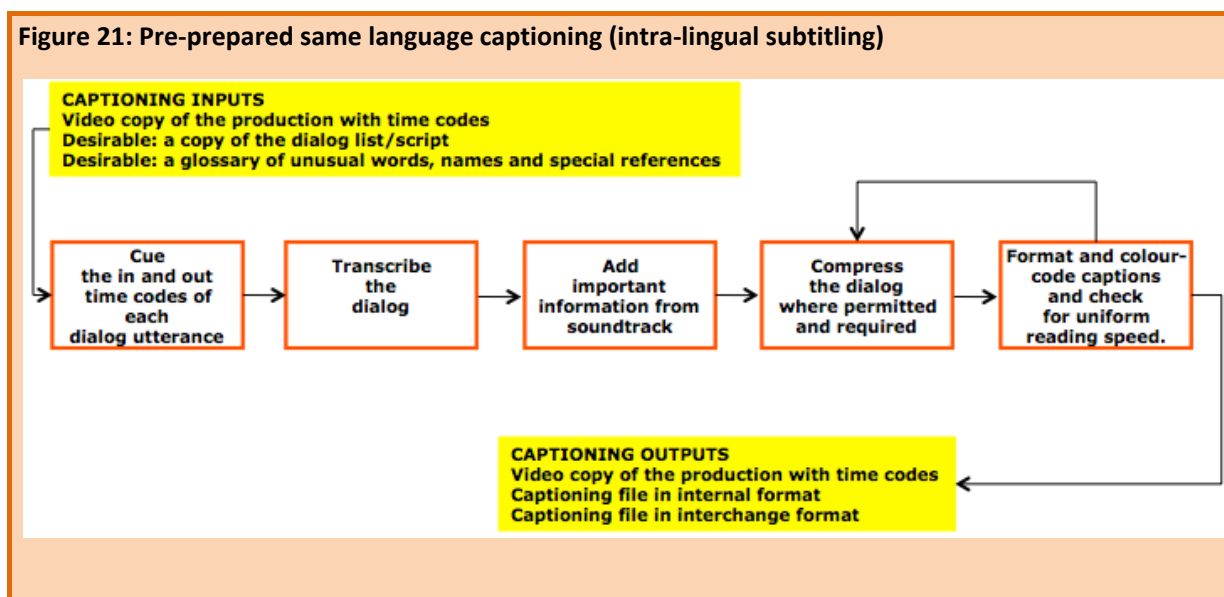
The starting point for pre-prepared same language captioning is a recording on videocassette, DVD or digital file that also includes the time-code of the production. It can be an advantage to have the original draft script or dialog list for the production, as well as a glossary of any unusual words, names or special references for inclusion in the captioning.

The captioner usually has a workstation with software for creating the captions. In some cases the software will analyze the video recording, identify the dialog and prepare preliminary cueing or timing data (i.e. the in and out points for each utterance in relation to the time-code of the programme). The process of cueing or timing utterances is sometimes called spotting.

In some cases, the captioning software will automatically produce a preliminary transcription of the dialog using speech to text analysis. In others, the captioner will create the transcription manually. Important information in the soundtrack such as off-screen voices, public address announcements and information about noises will be added.

Depending on the country and the legislation and norms in force, rapid speech will often be compressed in captioning to reduce the required reading speed. Experienced captioners may combine transcription and compression into one step.

Again, depending on national or regional circumstances, the captioning will be colour-coded to indicate that there are two or more speakers and there will be some quality control of the transcription.

The resulting captions will be formatted into self-contained sense blocks. Usually the formatting will lead to left-centered captions that are presented two or three lines at a time. Many of the formatting functions are done automatically by the captioning software.

Finally there will be some check of the overall feel and rhythm of the captioning to check that the result is in keeping with the production and does not make excessive demands of the viewer's reading ability.

When the captioner has completed the final version, it is saved as a file in an internal or exchange format. There is a move to use XML-based exchange formats for subtitling[33].

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[32] Mary Carroll and Jan Ivarsson. Code of Good Subtitling Practice. Approved at the meeting of the European Association for Studies in Screen Translation in Berlin 17.10.1998 www.transedit.se/code.htm

[33] The basis for this work is W3C Timed Text (W3C-TT). This has given rise to regional standards based on W3C-TT profiles such as SMPTE-TT in the USA and EBU-DFXP in Europe.

Figure 22: Pre-prepared foreign language captioning (inter-lingual subtitling)
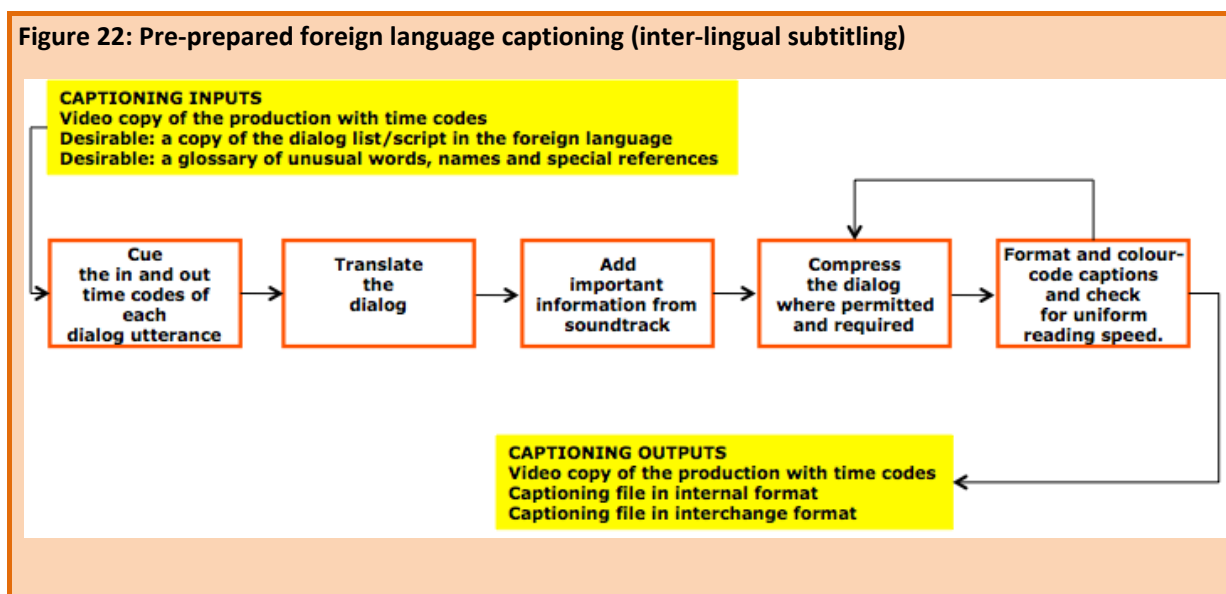
The workflow of pre-prepared *foreign language captioning* is very similar to same-language captioning. Both are done "off-line". The main difference is the second step, *translation* rather than *transcription*.

There are some additional challenges related to the viewers' likely familiarity with the culture of the production. In political satires, for example, the original names will be retained if the audience is likely to be familiar with them or replaced with the names of local equivalents if this is not the case.

In the case of films that are to be aired on television, captioning may already exist on DVD copies of the film. Why not re-use the captions?

There may be legal obstacles:

- Captions and subtitles are derivative works and enjoy copyright protection. If the film company originally commissioned captions for use in movie theaters and on DVDs, they may be available for re-use by broadcasters. These captions are a good place to start, assuming there is an explicit agreement to this effect.

- The film may be subject to editing before being aired on television to remove scenes involving sex or violence. Any content edits will also required corresponding edits to the captions.

- The language of the captions may not always be acceptable in the target country. French is spoken in a number of countries, and captioning for Canada, for example, would not necessarily be acceptable in Belgium, France or countries in West Africa.

The availability of Web tools for captioning, such as a product from Universal Subtitles and other crowd-sourcing tools used at universities,[34] and tools to deal with captioning errors, such as "Synote," have allowed for collaborative working to provide captioning for television programmes on the Internet.

"Go" and PBS "NewsHour"[35] Translation Parties in the USA are examples where volunteers work together to produce multi-lingual captioning so that immigrants and viewers who do not understand English can follow the programmes.

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[34] Wald, M. (2011) Crowdsourcing Correction of Speech Recognition Captioning Errors. In: W4A 2011: 8th International Cross-Disciplinary Conference on Web Accessibility, March 2011, Hyderabad India. http://eprints.ecs.soton.ac.uk/22430/

[35] An example of this can be seen on the PBS NewsHour site: http://to.pbs.org/g7Crvq

For broadcasters there are legal implications of letting volunteers do captioning. Media are subject to national legislation and the broadcaster would be liable for any slanderous statements produced by volunteers producing captions. Quality control would therefore be required. The economic benefits for broadcasters may not be quite so great when all such costs are included.

The workflow of live captioning is very different from off-line captioning. As the name suggests, captioning has to be provided from a production on the fly. The quality has to be high, yet the delay in delivering the captions should be as short as possible.

Traditionally, live captioning had its origins in courts of law where a transcript of the proceedings was required. Verbatim transcripts were produced by stenographers using specialized input devices. Stenographic systems for live captioning have become less common for three main reasons, the training costs (that are claimed to be higher than for re-speaking), the paucity of stenography input devices and the operational costs.

Increasingly, speech recognition is replacing stenography in so-called "respeaking" systems.

Figure 23: Live same language captioning (intra-lingual subtitling)
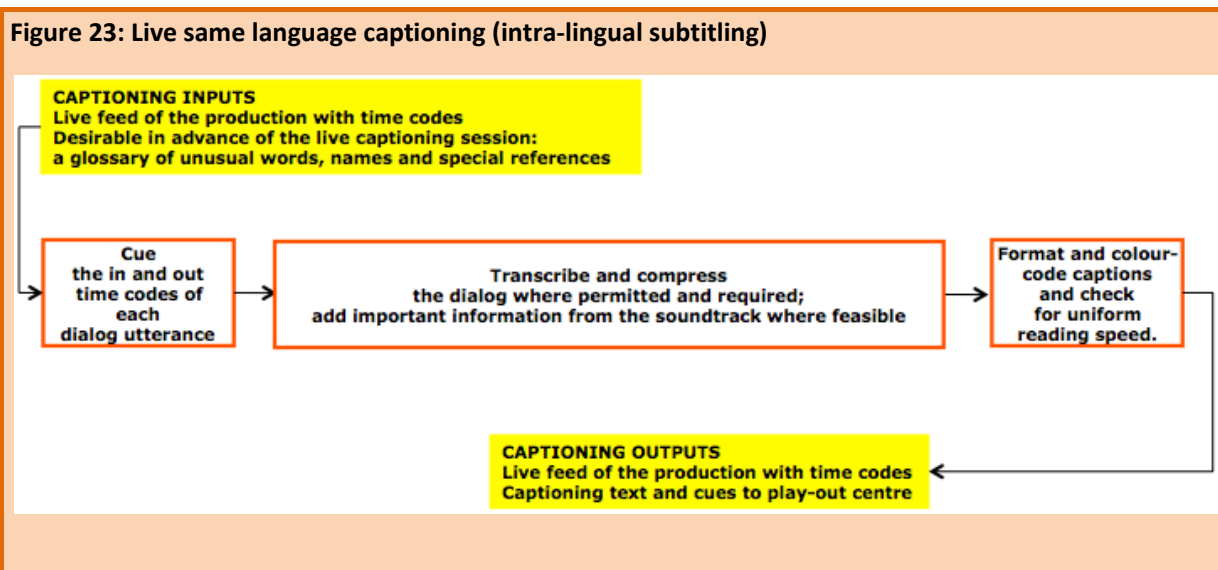
Re-speaking involves a human captioner who watches and listens to the programme and then dictates the subtitles with the necessary linguistic compression of the dialog. The text is reduced, segmented, corrected and punctuation is also added. The work entailed in re-speaking is shown in a BBC programme on YouTube.[36] Long programmes may require two captioners alternating. Voice recognition is used to turn the re-spoken input into subtitles that can be displayed in the usual way. The public service broadcaster NHK (Japan) has done much pioneering work in this field.[37]

Unlike speech synthesis, where the quality has gone up and the cost of solutions has dropped, speech *recognition* is still a difficult and expensive field. In recent years there has been considerable vendor concentration in the field of re-speaking systems. While there are open-source re-speaking solutions in use, there is little or no choice when it comes to the less-widely spoken languages. Whereas there is a healthy market for re-speaking systems for professional use (e.g. to reduce administrative staffing levels in hospitals by getting doctors to dictate their findings into patient journals), general-purpose re-speaking

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[36] How Subtitles Are Made – See Hear – BBC 2 www.youtube.com/watch?v=u2K9-JPIPjg

[37] Toru Imai, Shinichi Homma, Akio Kobayashi, Takahiro Oku, and Shoei Sato NHK (Japan Broadcasting Corporation) Science & Technology Research Laboratories, Tokyo, Japan. Speech Recognition with a Seamlessly Updated Language Model for Real-Time Closed-Captioning. INTERSPEECH 2010, Makuhari, Japan, 26–30 September 2010.

systems are both more difficult to develop and have fewer clients who need to pay for the initial capital costs of setting up the language database and the dictionary of items used for speech-to-text generation.

It is unrealistic to expect a vendor to develop a suite of re-speaking systems for a new language in the absence of a reasonable return on investment. Yet broadcasters and others cannot be held to account in terms of production targets moving towards 100 per cent subtitling without re-speaking tools that allow them to do the job at a reasonable price. Concerted political effort both nationally and internationally will be required to break this logjam.

Where captioning is being introduced for the first time, consider doing so in two phases, the first of which involves pre-prepared captioning prepared offline. When there is a body of experience from offline production, the more difficult second phase of introducing live subtitling can start with a feasibility study in which the options for using stenography or re-speaking can be addressed.

5.3   Signing

As mentioned in chapter 2, signing can be used in programmes produced specifically for the deaf community (e.g. "En Lengua de Signos" shown below) and also to make emergency alerts more accessible to such audiences (e.g. the Japanese prime minister speech shown in Figure 1). Programmes for the deaf are often broadcast outside prime time and there are lively debates on the priorities accorded to such programmes[38].

Figure 24: A television programme for the deaf community

"En Lengua de Signos". Television programme for the deaf community on RTVE, Spain.

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[38]   At The Rim: Will deaf say no to signed TV in the UK?. 20 June 2010.
http://attherimmm.blogspot.com/2010/06/will-deaf-say-no-to-signed-tv-in-uk.html

The workflow for both kinds of programme is relatively straightforward. In the case of mainstream programmes to which signing is added, the picture is sometimes shrunk somewhat to make room for the signer or the signer is added as a picture-in-picture.

In some cultures, the signers are on the right, whereas in others (e.g. Japan) the signer is often on the left (an example of which is shown in Figure 1).

When signing is provided for live programmes for extended periods, keep in mind the need to have two signers working in turns for health and safety reasons.

The main issues are open signing and the size of the signer on the screen. In countries where signing has a limited presence in prime time, introducing an open signing service may unfortunately give rise to protests from viewers who have no disabilities.

The options for closed signing on digital TV include:

- producing an additional signing channel which appears in the digital television multiplex when required (DR1, DR2 and TV2 have used this solution for several years in Denmark),

- offering the signer as a picture-in-picture overlay which the viewer can select, or

- offering a signed version of the whole programme on broadband so that it can be viewed on computers, or on a hybrid broadcast/broadband flat panel display as an alternative to the conventional television broadcast.

5.4   Audio description

Figure 25: Audio description – basic work flow

AUDIO DESCRIPTION INPUTS
Video copy of the production with time codes
Desirable: a copy of the dialog list/script in the foreign language
Desirable: a glossary of unusual words, names and special references

Cue the in and out time codes of each dialog utterance → Analyze the picture for significant cues and write AD script → Record AD → Mix the AD recording with the existing audio track(s) → Check the mix for levels and rhythm

AUDIO DESCRIPTION OUTPUTS
Video copy of the production with time codes
Mono audio file with cue for fades OR
Stereo / multitrack audio file with final mix

There are three main options for delivering the service to the viewer:

1. Broadcast *mix* where the viewer hears an alternative mix created by the broadcaster.

2. Receiver *mix* where the viewer's receiver mixes the original sound and a mono audio description track in the television receiver itself.

3. *Non-television delivery of audio description*, where the viewer listens to the audio description channel distributed by some other means (AM medium-wave radio, telephone, streaming over the Internet to a computer, netbook or tablet such as the Apple iPad, or via a mobile phone).

In the case of the broadcast mix, there are two alternative workflows for the broadcaster or production company:

1. Creating a mono audio description track with production metadata to handle the mixing of this track with the existing stereo /multichannel audio when the programme is played out at transmission time.

2. Creating a final stereo or multichannel audio mix in which the audio description is included and transmitted as an alternative to the original mix at transmission time.

Making a final audio mix is a good way to start, as there are fewer complications that can arise when the programme is transmitted.

On the other hand, for broadcasters such as the BBC with a high volume of audio description, creating audio description at transmission time is cheaper, more flexible and allows for multiple delivery formats when the same programme is simulcast on as many as 30 different distribution networks.

A decision to migrate from broadcast mix to receiver mix will therefore require careful analysis. The installed based of TV receivers (either set-top boxes or integrated digital receivers) must be capable of handling the mix as specificied by the TV standard. The feature may require activation. Viewers must also be given support and training so that they can discover and use receiver mix to enjoy TV programmes with audio description (and also spoken captions).

Figure 26 identifies the components that are delivered in the digital signal.

Figure 26: Delivering Audio Description (broadcast mix) on digital television by the Danish public service broadcaster DR

The signal contains the video (1), a normal stereo mix (2), a stereo mix containing the audio description (3) and captions (4).

Audience research in Denmark indicates that the simplest way for a visually impaired viewer to receive audio description (broadcast mix) is to create a virtual channel with its own channel ID.

Blind viewers can access a channel by selecting the channel code (in this case 098) on the remote control. This will then select a virtual channel comprising the video, the stereo mix including audio description and captioning (i.e. 1 + 3 + 4).

As currently there are only a few hours of audio description per week, a viewer tuning in to the channel in this way will always have the audio description service.

Those not wishing to hear the audio description service can tune to channel 001 which contains the video, the normal stereo mix and captioning (1 + 2 + 4).

This solution may not be practicable where the television platform operator has several hundred channels, as the use of virtual channels increases the total number of channels in the EPG. For usability reasons, there is an upper limit of approximately 400–500 channels in such EPGs.

In the case of audio description receiver mix, the television receiver is designed to mix the existing audio and the audio description mono channel in the receiver itself.

Figure 27: Delivering Audio Description (receiver mix) on digital television
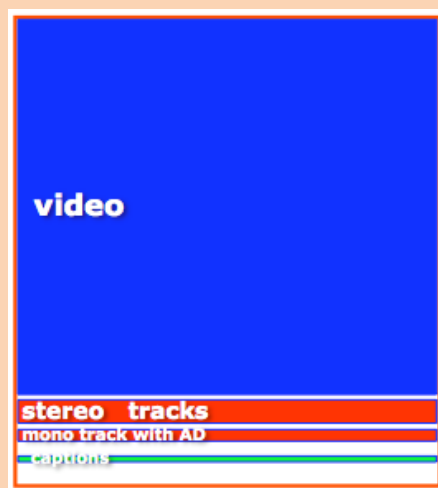
Some television receiver models that have multi-channel audio can also deliver the audio wherever the viewer wants, in the sense that the voice can be positioned left-right and in front of or behind the viewer. Blind viewers watching with their family members can choose to hear the audio description in the loudspeakers, positioned as if a friend was whispering in his left or right ear. Alternatively, viewers with impairments can listen with headphones so that family members do not have to hear the audio description track. Most families with blind family members have no issue with watching a programme with audio description.

In the case of audio description receiver mix, the mono track is broadcast together with the conventional stereo or multi-channel audio tracks. There is also fade metadata that tells the receiver when to raise or lower the volume of the conventional audio tracks in order to mix the audio description mono track.

The receiver mix solution has two main advantages:

1. It requires less bandwidth than audio description broadcast mix (important where this is scarce or expensive).

2. It is flexible (viewers can choose to mix the audio or listen to the audio description track on headphones).

The main disadvantage is availability. Whereas sets for receiving free-to-air television in the UK. Ireland and the Nordic region are required to have this feature, it is not yet widespread elsewhere in Europe. Even in these markets, there is little user feedback about receiver mix use and enjoyment. In markets in some developing countries, the overriding concern is to keep the cost of digital set-top boxes as low as possible, preferably below USD 20, so in the short-term, this audio description solution has not yet been adopted.

5.5   Audio (spoken) captions

In many countries, a proportion of the television programming is in a language that is not the official language of the territory (e.g. popular sit-coms from the US which are broadcast around the world). Depending on the traditions of the territory in question, such programmes are either dubbed or provided with captions in the official language(s).

In territories where captioning of foreign language programming is available, *spoken* captions can also be provided. Viewers of programmes in foreign languages can follow the programme by listening to the captions read aloud in their own language. Speech *synthesis* programmes using SAPI (Speech Application Programming Interface) or other W3C standards are available in many languages to provide spoken captions.

Audio captions are already being created and broadcast in Finland and Sweden. In the case of the RNIB project in the UK, speech synthesis is done decentrally in the receiver. The public service contract[39] for television for 2011–2014 in Denmark requires the public service broadcaster DR to evaluate spoken captions for non-Danish programmes in 2011–2013. A decision will then be taken about the future of this service.

The advantage of handling the speech synthesis in the receiver (the green boxes in Figure 29) is that the same feature can cover all channels that are offered with captioning.

The disadvantage is cost. Currently the viewer has to buy a plug-in box or a new receiver to read captions aloud. (Incidentally, this also applies to solutions that offer a spoken interface for persons with visual impairments).

The advantage of spoken captions delivered centrally is that they can re-use existing mechanisms for handling audio description (receiver mix) with no additional hardware requirements. From the broadcaster perspective the capital and operating costs per TV channel are relatively low. The operating costs of audio captioning are discussed in chapter 6.

Figure 28: Audio (spoken) captions – audio produced by the broadcaster
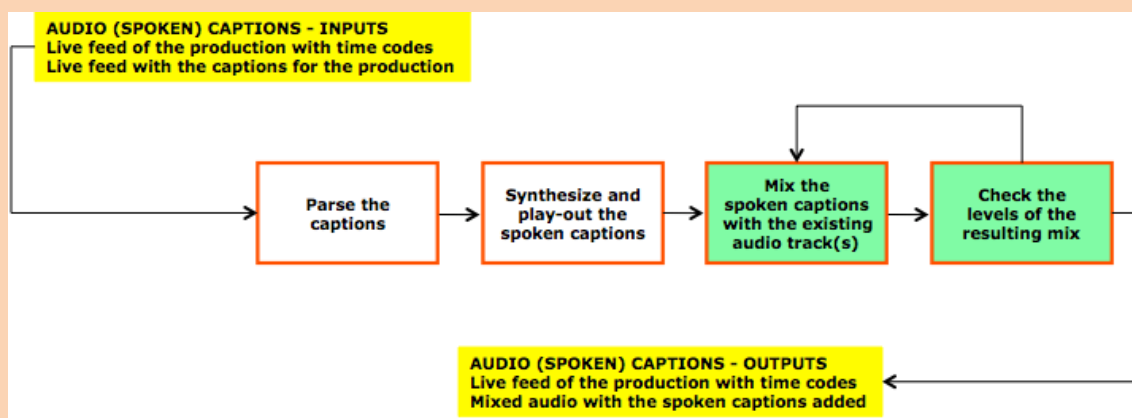
Captions generated by the broadcaster (centralized solutions) are already in use in several countries. The white boxes show which functions are done centrally by the broadcaster, and green boxes show which are done in the receiver.

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[39]   Public Service fra DR til alle [Public Service from DR to Everyone] 28 January 2011
http://kum.dk/nyheder-og-presse/pressemeddelelser/2011/januar/public-service-fra-dr-til-alle/

Figure 29: Audio (spoken) captions – decentral solution using text-to-speech in the receiver

AUDIO (SPOKEN) CAPTIONS - INPUTS
Live feed of the production with time codes
Live feed with the captions for the production

Parse the captions → Synthesize and play-out the spoken captions → Mix the spoken captions with the existing audio track(s) → Check the levels of the resulting mix

AUDIO (SPOKEN) CAPTIONS - OUTPUTS
Live feed of the production with time codes
Mixed audio with the spoken captions added

5.6   Programme guides and other kinds of on-screen promotion

One of the central challenges facing a given access service is whether potential users are aware of its existence and have the necessary information to discover, use and enjoy programmes with access services.

Programme guides and other kinds of on-screen promotion are prerequisites for true television accessibility. By implication, if an access service is present but is not advertised, for all intents and purposes it does not exist from the viewer's perspective. Equally problematic for would-be viewers is a situation where closed captioning is mentioned in a programme guide but for some reason is not available.

When reviewing television production and distribution, there are three key areas:

1. television programmes themselves,

2. access services for television programmes, and

3. information about programmes with access services (programme guides, spots and trailers and also information on changes about the available channels, their names and channel IDs).

In some countries, national disability agencies offer an information service for persons with severe visual impairments in which they deliver information about television programmes with audio description. Here it is critical to identify the "food chain" for programme listings to ensure that programmes with audio description and other access services are identified as such in programme listings from the broadcaster all the way to the intended user of this information – the viewer. The chain is only as strong as its weakest link. If this information is omitted by the broadcaster or by the "metadata wholesaler", audio description programmes in particular (both the first airings and repeats) will not benefit the intended users.

5.6.1   Programme guides on analogue television

In the case of analogue television, the options for promoting accessible television include:

- Icons (for captioning and signing) and announcements (audio description) at the beginning of programmes to indicate the presence of the access service.

- Icons and text in channel guides and EPGs to indicate the presence of the access service for a given programme.

- Icons, text, a short spoken message or audio signal in trailers and spots for upcoming programmes with access services.

- Comparable information both in teletext and Web programme guides and printed television programme guides in newspapers and weekly magazines.

5.6.2 Programme guides on digital television

In addition to the options mentioned for analogue television we can add further options (shown in italics):

- Icons (for captioning and signing), a short spoken message *or audio signals including beeps* (*audio description and audio captioning*) at the beginning of programmes to indicate the presence of the access service.

- Icons, text or audio signals in channel guides and EPGs (*delivered with the digital signal or separately via the Internet)* to indicate the presence of the access service for a given programme.

- Icons, text, a *commentary* or audio signal in trailers and spots for upcoming programmes with access services (*in some cases with the "trailer record" option where the viewer can click a button while the trailer is being shown in order to book the programme and ensure that it is recorded*).

- *Service messages* about the dates of forthcoming channel changes that may require the user to retune the digital receiver.

- Comparable programme listing information both in teletext and Web programme guides and printed television programme guides in newspapers and weekly magazines.

6 What does it cost to set up and run a given access service for audiovisual content?

This chapter aims to help the reader estimate in general terms what it will cost to set up and run a specific access service in a given territory. It caters primarily for decision-makers at broadcasters and their production and distribution partners but is also relevant for broadcast regulators. It requires a basic understanding of the costs involved, but does not necessarily require a background in economics.

There are both capital and operational costs associated with creation, delivery and use of access services. When it comes to formatting, exchanging, delivering and using access services there are often several options.

There are also costs associated with the introduction and scaling-up of a given access service (for example advertising and marketing so that the intended users are aware of its existence and make use of it). The challenge is to choose a solution that is cost-effective, reliable and easy to use, and at the same time is also one that scales well, as the service moves from its initial to final level of provision.

As with technologies, costs do not stand still. Some things – especially hardware – are likely to get cheaper, whereas others (bandwidth and labour costs) are moving in the other direction. There is a strategic dimension to capital and operating costs: whether to do some or all of the work in-house or to outsource access service production. All these costs have to be considered before short-listing a solution.

A final point: costs have to be seen in relation to the *quality* of the access service that is the result. There need to be agreed metrics for what constitutes an acceptable quality that all stakeholders can use when assessing access service provision.

6.1 Costs and the television value chain

Figure 30: A value chain – making television accessible
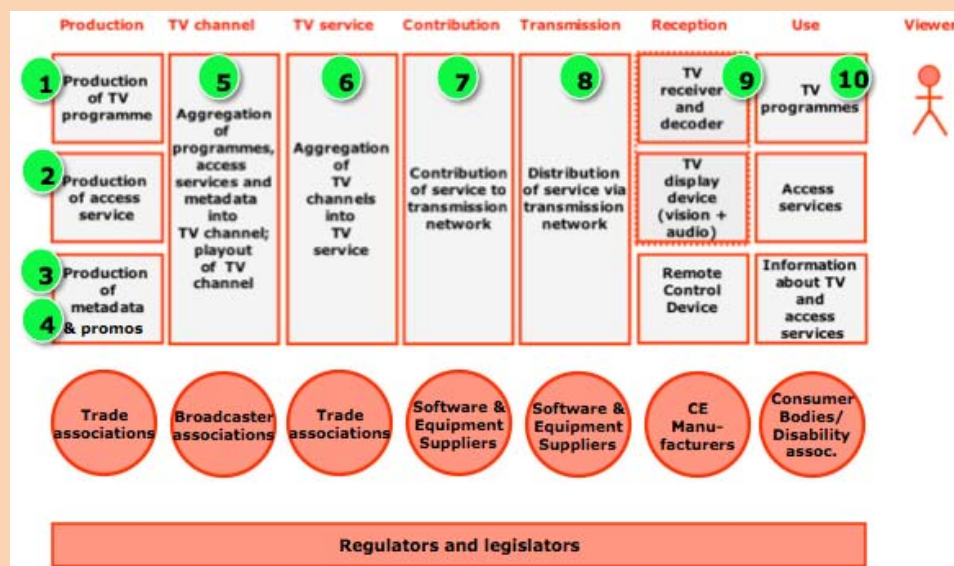
The generalized value chain shown in Figure 30 identifies costs associated with:

1. The **production of the television programme** itself.

2. The **production of the access service** both labour costs to make the service and the costs of the production equipment needed to make subtitles or produce audio recordings for audio description.

3. The **production of metadata** both programme listings mentioning the access service and production metadata such as data flags indicating the time codes for fading the original soundtrack in and out.

4. The **production of promos and other kinds of marketing materials** to make sure that the programme and access services reach their intended audiences.

5. The **aggregation of the programmes, promos, trailers and metadata into a television channel** and playing this out.

6. The **aggregation of two or more television channels into a TV service** on a given TV platform (e.g. a free-to-air or Pay TV operator) encoding and multiplexing.

7. The delivery of the signal to the distribution system (usually termed contribution).

8. The onward delivery of the signal via the distribution system (transmitter, satellite, cable, Internet) to the viewer's home. This includes not only the cost of owning, operating or paying for the transmission distribution infrastructure, but also the cost of the required bandwidth (especially in terrestrial transmission networks where bandwidth is limited).

9. The **decoding and display of the signal** (both the decoding of the signal, its display on a TV screen with loudspeakers and the remote control device for discovering and viewing the television programme).

10. The viewing of the programme itself by one or more viewers.

As can be seen, the cost of the *production* of an access service is just one of a number of costs all the way down the value chain. The cost (normally expressed as a *cost per minute* or *cost per programme*) varies considerably. It depends on the number of people involved in the process, the number of person-hours required, the TV genre and also on the required quality and features of the service. In addition, the costs will depend on whether the people producing the access service are in-house or whether production has been outsourced to an external contractor. Finally, manpower costs vary considerably from one country to the next.

Figure 31 gives an impression of the **relative production** costs. Note that there may not be a close relationship between direct costs and market rates from commercial suppliers of access services. A recent example is same-language captioning and foreign language captioning for television. Here market rates are converging, even though the inherent costs of foreign language captioning are higher. The range of unit costs can be considerable.

The figure shows, in relative terms, the price bands for various services. Spoken captioning based on Text-To-Speech is relatively cheap. Audio description, lectoring and dubbing are relatively expensive.

Once the infrastructure for spoken captioning is in place, there are next to no production costs, assuming that foreign language captioning has already been produced and paid for.

Same language captioning tends to be a little cheaper per minute than foreign language captioning. Captioning of television programmes in less-commonly spoken foreign languages is also more expensive than from English. Captioners from English to a target language are usually more numerous than from, for example, Mongolian to the same target language. In some cases, where captioners are not available between two languages, foreign language captioning is prepared using English as an intermediary language. This has implications for the quality of the resulting captioning.

At the costly end of the price scale, high quality dubbing involving several actors is an intensive and expensive process, followed in price by lectoring and audio description where a new stereo or multichannel mix needs to be made.

Figure 31: Relative production costs for specific television access services
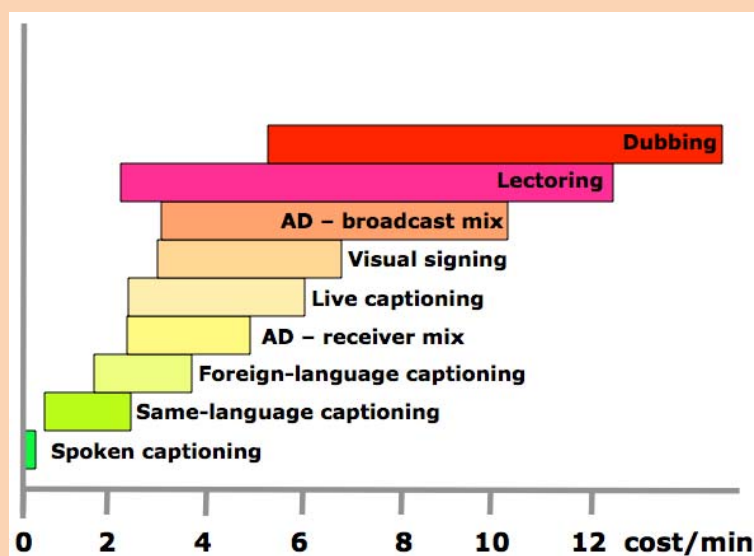
Access service production costs are examined below with reference to two examples:

a. The main television channel of an affluent country of at least 50 million inhabitants that produces many of its own television programmes covering a wide range of programme genres and which is phasing in access services.

b. A small channel in a small country or one with a modest Gross National Product (GNP) that is reliant on low-budget productions combined with buying television programmes and which is phasing in access services.

In the case of *example a*, the channel will include some programme genres such as big budget TV dramas that have a long shelf life. In such cases, the additional cost of producing same-language subtitles, audio description, or both, would be an additional 1 per cent of the drama budget. Offering access services for other programme genres would lead to increases of between 1 to 10 per cent of their production budget.

In some cases such as drama, the costs can be shared with the publishing wing of the broadcaster who can recoup some of the costs through DVD or pay-per-view sales that also need these access services.

In others, the costs may be covered by a government grant earmarked for the production of access services (e.g. Belgium) or the costs are covered by sponsorship (predominantly USA, but with some examples in countries such as the UK).

In the case of *example b,* offering access services is more of a challenge for those who are getting started with access services. In relation to their television production budgets, the additional costs are, relatively speaking, more noticeable. They can be in the range of 10 to 30 per cent of the production budget. Just to get started, the threshold to be overcome may require a mixture of regulatory and organizational incentives and sanctions – carrots and sticks.

6.2   Captioning

Captioning, especially for news and current affairs, is one of the access services that is often done in-house.

The activities in the workflow until captions are ready have been explained in chapter 5. These can be used to estimate the costs of providing different kinds of captioning by working out the number of person-hours required for each activity.

Same language captioning in the official or national language(s) of the country tends to be cheaper than inter-lingual captioning, especially for minority languages. Genre, the length of the programme, the required quality and the annual volume of work all influence unit costs. One US company offers some insights into production costs for captioning in the US as part of the marketing of its services[40].

Live captioning is more expensive and demanding in terms of investment in re-speaking equipment than pre-prepared captioning. All solutions currently in use require the system to be given training with the voice of each re-speaker. Re-speaking is not available for all languages, so care needs to be exercised when checking the feasibility and cost structure of live subtitling. While there are good solutions in some European languages, Mandarin and Arabic, some of the best solutions are only available for non-commercial, academic use as they were developed for the US Department of Defense. When considering re-speaking for live captioning, consider central government funding to develop the necessary language model for speech recognition if no solution is commercially available. The costs can be recouped through non-exclusive licenses to those needing to do live captioning.

The production costs of captioning are a sizeable proportion of the total costs. Closed captions require a modest amount of bandwidth, so the distribution costs of captioning for one language are quite small.

6.3   Visual signing

The production costs of visual signing are comparable with live captioning. Open signing involves overlaying the programme with a signer, or producing programmes with and for the signing community.

The main challenge with visual signing are cost-effective, *closed (opt-in) solutions*. These currently require an additional broadcast channel or an overlay that can be combined with the broadcast signal. A whole broadcast channel (standard definition) is typically 4 to 5 megabits/second and the bandwidth on a terrestrial broadcast transmission network is a significant cost if it has to be reserved for daily broadcasts with signing. In the future, a cost-effective way of delivering closed signing may well be to deliver the overlay or the programme mixed with the signer overlay as a broadband signal to television sets using a hybrid solution such as HbbTV, or some kind of IPTV.

6.4   Audio description

The authoring phase of audio description is surprisingly culture-specific. Two deliverables of the DTV4ALL project contain analyses of existing services in Europe and make mention of the Pear Tree Project in which issues associated with audio description across cultures are discussed[41].

When setting up audio description for the first time, the safest approach is to look for a solution using alternative audio (analogue – mono), or the broadcaster mix (digital – stereo) in which an alternative stereo mix including audio description is available. Approximate costs for audio description are available in the link provided in the footnote[42].

The challenge to the scaling up of audio description broadcast mix is bandwidth. If four television channels in the same multiplex all require an alternative stereo mix at the same time, there may be an issue since each stereo mix requires about 256 kilobits/second. This is one of the reasons for looking into audio description using the receiver mix approach. This requires less bandwidth, and the mono audio file

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[40]   Actual Costs For Pop-Up Captioning. http://customcaptions.com/

[41]   See under *Deliverables*: D2.5: Final Report on Pilot Services (1 of 2) and D2.5: Final Report on Pilot Services (2 of 2) www.psp-dtv4all.org/

[42]   Heidrun Gerzymisch-Arbogast [2007]. Workshop [on] Audio Description. At www.translationconcepts.org/pdf/audiodescription_forli.pdf

with mixing metadata can be assembled at playout, building on the experience of this approach gained by the BBC.

6.5   Audio (spoken) captions

The two options – speech synthesis at the broadcaster head end or speech synthesis in the digital TV receiver – build on the existence of captioning and add value by making foreign language television programmes accessible to persons with visual impairments.

The advantage of offering spoken captioning centrally is that it builds on the same infrastructure as audio description delivered as a broadcast or receiver mix. It requires capital investments at the head end of each channel, but the running costs are very modest.

The advantage of having a decentralized solution for spoken captioning is the ability to share resources with a spoken interface in order to offer, in principle, spoken captioning for all television channels with closed captioning. It does, however, require two changes:

1. Further development of existing digital television standards to handle the conversion of subtitles (bitmaps) into alphanumeric data that can feed speech synthesis using some kind of built-in optical character recognition or reusing alphanumerical texting data transmitted in the transport stream, currently being discussed for the HbbTV system and IPTV.

2. The incorporation of speech synthesis chips for all the languages required in the set-top box, the digital TV receiver or a stand-alone unit that can be connected to the digital receiver.

These changes will lead to an initial overall increase in the retail price of digital television receivers. For this reason, the stand-alone option is more realistic in the short-to-medium term.

6.6   Programme guides and other kinds of on-screen promotion

There is a lively market in many parts of the world in which aggregators offer programme listings for television channels in electronic form. In countries with "narrowcast" television channels that operate on a shoestring, a solution may be to offer a web interface to the managers of these small channels so that they can manually input programme-listing details for their channels. From that point, the programme metadata can be re-used elsewhere in the value network.

7 The market for accessibility – what business models exist so that access services can be offered on a sustainable basis?

This chapter aims to help the reader select a business model or combination of business models to ensure that access service provision is both feasible and sustainable. It also looks at a number of demographic, socioeconomic and technological trends that can lead to new market opportunities for e-accessibility.

What needs to be put in place are *two sets of inter-related business models:*

- for the access service provision, and
- for the television device (receivers) needed by the viewer to use that access service.

7.1 Business models for television access service provision

The predominant business models that underpin the provision of access services for television are:

- funding out of existing production budgets to meet regulatory targets for access services;
- co-funding – where legal – from sales of audiovisual merchandise re-using access services;
- sponsorship of access services by private companies and bodies;
- public funding of access services (both direct and tax relief).

7.2 Business models for television receivers

The business models that exist for television devices needed for a given access service include:

- universal design – including access service capabilities in mainstream consumer electronics;
- *separate but equal* – selling separate products with access service capabilities for persons with disabilities (no subsidy);
- public subsidies of products for persons with disabilities to reduce the cost to the consumer.

What is necessary is a combination of both. Care is needed to avoid a "chicken and egg" situation. Consumer electronics manufacturers will not, of their own volition, begin to make television receivers that can handle access services unless there is a market for such devices or legal requirements to make hardware and software changes. Broadcasters will be reluctant to invest in equipment and human resources to deliver access services unless there are television receivers in viewers' homes that can make television accessible. Figure 32 summarizes the main options.

The history of access services such as closed captioning started in the central column with services specifically for persons with disabilities, either with *public funding*, *sponsorship*, or *existing production budgets*. Closed captioning in Europe was originally delivered using teletext. Although the analogue teletext decoder originally cost a few dollars, television receivers with the feature were originally sold at a premium, as the decoder chip also allowed for the delivery of a simple but easy-to-use online text-based information service.

When the use of teletext spread, television receivers with the decoder became ubiquitous and moved to scenario 12, i.e. a mainstream situation in which teletext services were paid out of existing production budgets and the decoder chip became ubiquitous, allowing for the shift to universal design.

As far as television receivers are concerned, at the beginning of the product life cycle, products tend to follow the same route as teletext, i.e. being launched as products for persons with disabilities that could be purchased with or without public subsidies. When the case for both the product and the access service is in place, there is often a shift to the universal design model in which all products on the market have the necessary capabilities to handle access services.

Figure 32: A matrix combining business models for television receivers and access services – twelve scenarios

	Television receivers		
Television access services	**Public funding**	**Free market "Separate but equal"**	**Universal design**
Public funding	1	2	3
Co-funding	4	5	6
Sponsor-ship	7	8	9
Existing production budget	10	11	12

The business case for commercial broadcasters funding access services is strongest for captioning and somewhat less compelling for audio description and signing. Even so, the commercial case is not usually perceived as being strong where there are no regulatory requirements. The existence of closed captioning for lifestyle products in advertising on New Zealand digital television is anecdotal evidence that there is a business case for access services:

Figure 33: Advertising incorporating closed captioning

It's designed to fit your thumb,
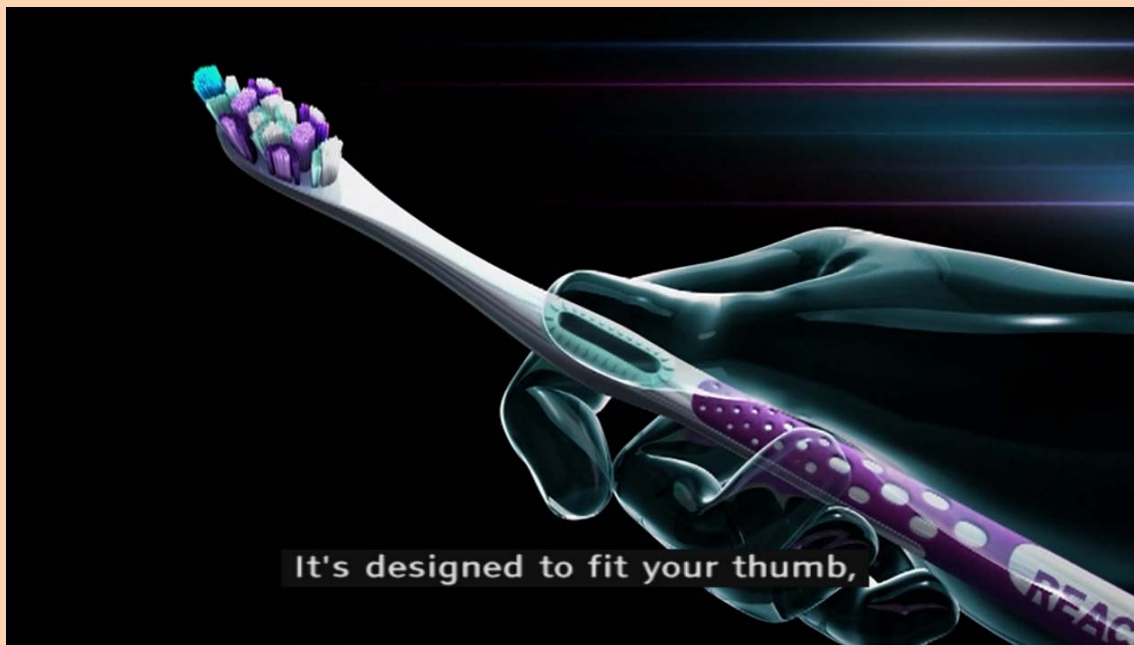
The captioning in this example is opt-in (closed captioning) and can be selected by viewers wishing to view both programmes and advertising with captions.

Sponsorship is occasionally seen as a supplementary revenue stream for the production of access services and not just for the television programme itself. Given the discussions on corporate social responsibility there is untapped potential here. For platform operators, providing access services for elderly viewers may be motivated by a wish to reduce subscriber churn and thus reduce costs in mature television markets (attracting "replacement" customers).

Public funding of access services does exist, either directly in the form of production grants to broadcasters (e.g. in Belgium) or indirectly in the form of tax rebates to small businesses (e.g. in the USA[43]).

7.3   Business models and the regulatory climate

National regulators responsible for frequency and bandwidth allocation may wish to consider the likely bandwidth requirements of access services[44.] These bandwidth requirements vary as illustrated in Figure 34.

Figure 34: Examples of current bandwidth requirements (approximate figures for terrestrial television broadcasting using DVB)

Access service (the examples are for services in one language)	Mean bit rate per channel	Effective peak bit rate per channel	Effective peak bit rate per multiplex (4 TV channels simultaneously offering the access service in question)
Closed captioning (bit maps)	<10 kbit/s	25 kbit/s	100 kbit/s
Closed captioning (teletext)	40 kbit/s	40 kbit/s	160 kbit/s
Audio description (receiver mix) and spoken captions	64 kbit/s	64 kbit/s	256 kbit/s
Audio description (broadcast mix) and and spoken captions	128 – 256 kbit/s	128 – 256 kbit/s	500 – 1,100 kbit/s
Visual signing (quarter-screen video overlay)	2.5 Mbit/s	2.5 Mbit/s	10 Mbit/s (not feasible)
Visual signing (extra video sharing same audio)	2.5 – 4.5 Mbit/s	4.5 Mbit/s	18 Mbit/s (not feasible)

For closed captioning they are minimal. For audio description, however, they may be significant when several channels offer audio description at the same time in the same multiplex. Visual signing may be bandwidth-hungry, if signing requires an additional channel rather than being offered as an open service to all viewers. The spectrum regulator may need to keep broadcast bandwidth requirements for access services in mind when looking at spectrum management. It should be noted that the introduction of more efficient compression formats has a lead-in time of years before it affects the installed base of television receivers. This is due to the effective lifetime of such receivers. Computer and smartphone solutions have shorter lead-in times.

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[43]   US Internal Revenue Service. Tax Benefits for Businesses Who Have Employees with Disabilities. www.irs.gov/businesses/small/article/0,,id=185704,00.html

[44]   Depending on the jurisdiction, this could be a converged broadcasting and telecommunications regulator, the telecommunications regulator or an independent spectrum agency.

The UK Communications Act of 2003 is generally regarded as a good example of a legal framework for television access services. It laid down a number of supply-side requirements for captioning, audio description, and signing on broadcast television and a roadmap for their implementation. The regulator, currently Ofcom, was instrumental in setting up guidelines and targets for access services and checking whether these were met. Ofcom targets have been met or, in the case of audio description, exceeded.

The US 21st Century Communications and Video Accessibility Act signed into law on 8 October 2010 also merits closer attention. It removes the distinction between broadcast and Internet delivery of programmes.

"Within 6 months, the FCC will set a schedule for requiring closed captions on video displayed online, for video that was delivered with captions on broadcast television. (Section 202)".

It also addresses issues to do with the interfaces for watching programs on both broadcast television and IPTV: "The FCC will define regulations within 18–36 months which require access to the controls that accompany video programming (e.g. play, pause, closed captioning, volume controls) to enable access for people who are blind or visually impaired. (Section 204)".

"The FCC will define regulations within 18–36 months which require on-screen menus and program guides to be accessible to people who are blind or low-vision. (Section 205)[45]".

Clear legislation, regulation with staged targets and time for the various stakeholders to make the necessary adjustments all have a major influence on viable business models.

7.4 Market opportunities for e-accessibility

In the coming decades, television is likely to maintain its appeal as a medium to inform, educate and entertain. At the beginning of the second decade of the 21st century, television viewing is surprisingly robust. This section looks at selected economic, demographic and technological trends.

Those concerned with a roadmap for access services for the short to medium term will need to know what changes are imminent and what impact they are likely to have.

The trends addressed include:

- Changes in economic activity and urbanization.
- Demographic change, health and well-being.
- Population mobility.
- The move to digital distribution – from digital switchover to analogue shut-off.
- The move from broadcast to Internet-based distribution.

7.4.1 Changes in economic activity and urbanization

The world's economy has changed markedly over the last four decades. The global economy has grown. Agriculture has declined in relative importance whereas services have become the dominant economic activity, as shown in Figure 35.

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[45] www.webteacher.ws/2010/10/11/21st-century-communications-and-video-accessibility-act-now-law/

Figure 35: Global economic activity in 1970 and 2001[46]

World (1970)

■ Economic Activity - Agriculture

■ Economic Activity - Industry

■ Economic Activity - Services

World (2001)
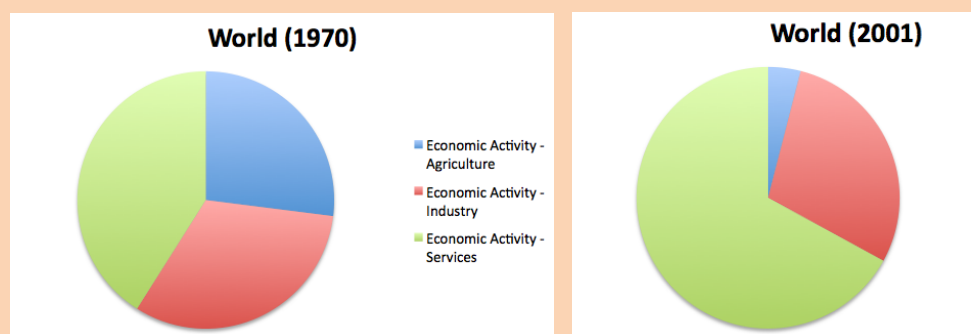
In the same period, the proportion of the labour force engaged in agriculture has declined. In the developing world, agriculture still plays an important role. One-third (29 per cent) of the labour force worked in agriculture in 2010 compared with two-thirds in 1980; the proportion of the labour force working in agriculture in developed countries dropped from 10 per cent to 3 per cent in the same period[47].

The shift in economic activity has gone hand-in-hand with the move from rural areas to towns and cities. More people now live in urban areas than in rural areas:

Figure 36: Proportion of the world population living in urban and rural areas (1950–2050)[48]

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46 http://unctadstat.unctad.org/TableViewer/tableView.aspx?ReportId=95

47 http://unctadstat.unctad.org/TableViewer/tableView.aspx?ReportId=94
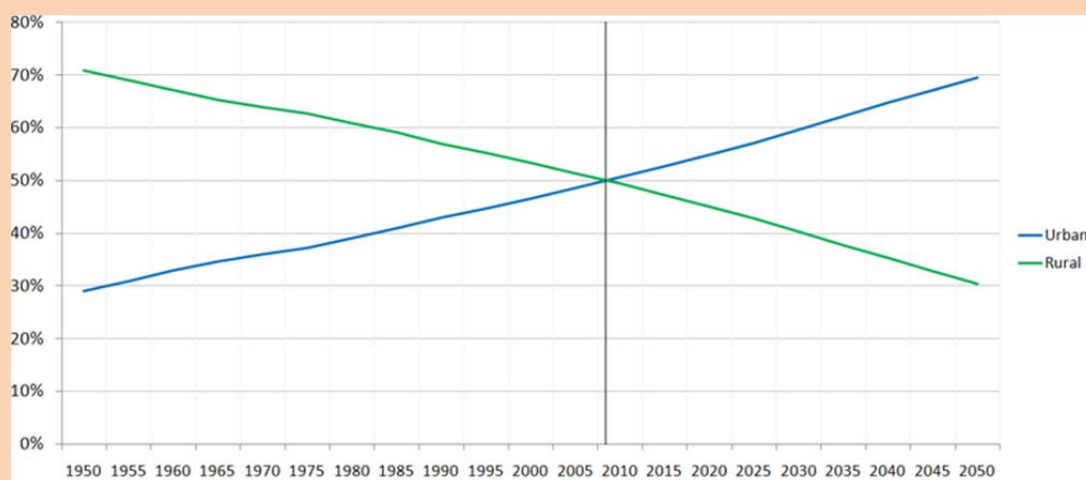
48 World Urbanization Prospects: The 2005 Revision, Pop. Division, Department of Economic and Social Affairs, UN. Quoted in Wikipedia: http://en.wikipedia.org/wiki/Urbanization

7.4.2   Demographic change, health and well-being

While world population continues to grow, population growth rates have slowed, including in developing countries. In most developed countries, the growth rate has reached or fallen below the replacement rate. The proportion of the world population from developing countries, including least developed countries, increased from 68 per cent in 1950 to 82 per cent in 2010[49].

Infant mortality and sickness rates also follow a downward trend.

The world's population is aging at an accelerated rate, according to a report from Rand[50]: "People aged 65 and over now comprise a greater share of the world's population than ever before, and this proportion will increase during the 21st century.

This trend has significant implications for many countries around the globe in connection with policies and provisions for the elderly. While the challenge of population aging is significant, the Rand report concludes there is no crisis. "Aging is gradual and its consequences tend to appear gradually and predictably. Thus policymakers have time to deal with these issues before they become acute problems. Furthermore, because aging is at different stages around the world, there are opportunities for nations to learn from each other's experiences. Taking advantage of these opportunities will require cross-national planning and coordination of research and data collection.

Population aging refers to an increase in the percentage of elderly people (65 and older). The number of elderly increased more than threefold since 1950, from approximately 130 million (about 4 percent of global population) to 419 million (6.9 percent) in 2000. The number of elderly is now increasing by 8 million per year; by 2030, this increase will reach 24 million per year. The most rapid acceleration in aging will occur after 2010, when the large post World War II baby boom cohorts begin to reach age 65."

The elderly population itself is also growing older. "The "oldest old" (80 and older) population is the fastest-growing group among the elderly. Levels of illness and disability among this group far exceed those for other age groups, and thus the needs of this group are likely to increase substantially in the 21st century. After Japan, Europe has the highest proportion of population aged 65. However, other regions of the world will begin to age much more rapidly in coming decades: The percentage of those aged 65 and older in Asia, Latin America and the Caribbean, and the Near East/North Africa will more than triple by 2050."

On the one hand, an increasing proportion of the world population survives the first year of life and suffers less from illness. This increase in health and well-being is to some degree offset by increasing longevity and the increase in age-related disabilities among the "oldest old".

One perspective on the prevalence of disabilities is to look at the UN's Millennium Development Goals (MDGs) and the assessment of progress conducted in June 2010[51]. Progress towards the MDGs is monitored through a set of 21 measurable and time-bound targets and 60 indicators. Most of the targets are to be achieved by 2015 and start from a 1990 baseline.

While there is considerable local, national and regional variation, the report is cautiously optimistic. In general terms, there is a general, long-term trend towards a world in which illness is less prevalent as the cause of disabilities.

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[49]   Hackman, Gene, Xun Wang and Ya-Lin Liu. 2002. Brief review of world demographic trends. Available at http://gsociology.icaap.org/report/demsum.html

[50]   RAND Report: Preparing for an Aging World: The Case for Cross-National Research www.rand.org/pubs/research_briefs/RB5058/index1.html

[51]   Millennium Development Goals: 2010 Progress Chart Compiled by Statistics Division, Department of Economic and Social Affairs, United Nations. http://unstats.un.org/unsd/mdg/Default.aspx

7.4.3   Population mobility

Changes in economic activity coupled with the move from rural to urban areas have led to population mobility. This can take the form of migration within a country such as the People's Republic of China where as many as 10 per cent of the population move within the country in search of work[52]. While the Chinese share the same written language, Chinese Mandarin is the official language, one of the 56 languages and dialects in use in the country. Television can be a powerful mechanism to inform, educate and entertain those who have recently moved to urban areas on a temporary or permanent basis.

Natural disasters (earthquakes, tsunamis, drought and flooding) can also lead to involuntary population mobility where mass media such as television can contribute to keeping the refugee population informed about the current status of relief work.

Urbanization can also lead to cross-border migration where adults emigrate in search of employment. Bangladesh and the Philippines have significant numbers of citizens working in South-East Asia and the Arab States region.

Changes in the political climate in a country or region can trigger sudden and substantial changes in population movements, leading to a build-up of considerable numbers of refugees in neighbouring countries.

Mainstream television that is accessible to minorities (whether they be immigrants or refugees) has the potential to promote social cohesion. Catalonia and Finland both use multi-lingual captioning for prime-time television programmes to encourage immigrant groups to watch locally-produced television rather than rely exclusively on satellite television from their country of birth for information, education and entertainment. The ultimate aim is to encourage these groups to learn the host language. Being able to use closed captioning as a social integration outreach strategy builds on work done in India to improve literacy through captioning (see page 10 of this report).

7.4.4   New opportunities – from digital switchover to analogue shut-off

The transition from analogue to digital television began in 1997. The motivation for the change is the freeing-up of radio frequencies for new uses, also known as the digital dividend[53]. One element of the digital dividend is the availability of spectrum for television access services.

A useful resource from the ITU is entitled "Guidelines for the transition from analogue to digital broadcasting".[54] The guidelines are intended to provide information and recommendations on policy, regulation, technologies, network planning, customer awareness and business planning for the smooth transition to Digital Terrestrial Television Broadcasting (DTTB) and introduction of Mobile Television Broadcasting (MTV).

At the time of writing this report (2011), analogue shut-off had been completed in the United States and parts of Europe. By the end of 2014, Europe and Japan will have completed the transition to digital television. Roadmaps for the transition to digital transmission exist for a number of countries across the globe. It is not unrealistic to assume that by 2025, the overwhelming majority of television households will be receiving a digital signal – whether broadcast or IPTV.

There are three stages in the move from analogue to digital television:

1. Planning the transition.

2. A period with both analogue and digital transmission.

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[52]   www.sinomania.com/facts_about_china/china_is_people.html

[53]   The digital dividend – opportunities and challenges. ITU News Jan Feb 2010.
www.itu.int/net/itunews/issues/2010/01/27.aspx

[54]   Guidelines for the transition from analogue to digital broadcasting: www.itu.int/pub/D-HDB-GUIDELINES.01-2010/en

3. Analogue shut-off (and digital-only transmission).

The move to digital transmission and analogue shut-off has taken place at a time where receivers using cathode ray tubes have been replaced by flat-panel displays using plasma, liquid crystal display (LCD) and light emitting diode (LED) technologies. Average retail prices continue to fall by 10 to 15 per cent year-on-year with high definition and 3D displays offering a means to stimulate retail sales.

Digital switchover represents a window of opportunity to harness the inherent flexibility of digital television solutions to make television more accessible. The experience gained in Europe and the United States by industry bodies such as DIGITALEUROPE - formerly the European Information Technology and Consumer Electronics Trade Association (EICTA) - and the US Consumer Electronic Association (CEA) demonstrates that useful work can be done in the period leading up to analogue shut-off and also after digital switchover.

The DIGITALEUROPE experience emphasizes the need for a clear vision and a roadmap that covers both the business case for digital receivers and for the access services themselves. More than five years have been devoted to reaching consensus on international standards for digital receivers. This has been accompanied by awareness-building among European broadcasters to ensure that access services were forthcoming. This is a clear "chicken and egg" situation where it is important to have both access services and accessibility-ready receivers.

Some of the standards for handling access services have emerged "bottom-up" in bodies like DTG in the UK and the NORDIG group and have subsequently had an impact on pan-European standards within DVB. Having examples of good practice – where possible solutions have been identified and tested – paves the way for "top-down" standardization in a broad forum of constituents such as DVB.

There have been some unforeseen issues, one of which is the lack of basic data. The European Broadcasting Union (EBU), which represents public service broadcasters, contributes with regular surveys of access service provision across Europe, given the patchy international statistics on the current state of access services across the continent.

The US experience indicates that momentum needs to be maintained after analogue shut-off. In August 2010 the CEA set up a working group,"R4 WG19", to develop standards and guidelines for accessibility of video devices. The group expects participation from consumer electronics manufacturers, including designers, engineers, manufacturers, users with disabilities and accessibility design specialists.

The initial focus of the working group is to work on remote controls to assist in locating and distinguishing buttons and features on TV, recorder, audio and other remote-controlled devices and on other video accessibility topics for consumers with visual and auditory impairments.

7.4.5   New opportunities – from broadcast to Internet delivery.

In many industrialized countries, Internet-based television (both the so-called IPTV and over-the-top television via the Internet) has gained a small but important foothold in the market in the last decade both to deliver conventional channels and so-called on-demand or "catch-up TV" services.

Television consumption falls into four main categories:

1. Watching major events with family and friends.

2. *Appointment viewing* – watching programmes and series that the viewer views as *golden moments* central to his or her interests.

3. *Snacking* – watching short-form programmes and snippets from programmes, and

4. *Killing time* – watching television as a way of relaxing.

The television screen is still the device of choice for the first kind of viewing, but competes with the personal video recorder (PVR) and catch-up TV[55] via the Internet for the other three categories. Interactive television has made modest headway, primarily in terms of user control and convenience and to some degree as a means to facilitate viewer participation. Simplicity and ease of use are still key features of a good television experience.

For the last ten years, mobile television (either streaming over 3G mobile phone networks or datacast solutions such as DMB-T and DVB-H) has been promoted as a platform to allow the viewer to watch television anywhere. The problem was not so much the technology but the difficulty in finding a sustainable business model. Television distribution continues to diversify and fragment. In the last four decades, it has moved from terrestrial transmission to a wide range of satellite, cable and wireless distribution networks. Some of these (e.g. free-to-air analogue and digital terrestrial transmission broadcasting) are regulated in a way that *over-the-top* Internet[56] and IPTV services are not, leading to *sloping playing fields*. In an ideal world, for all television services viewed on a screen, a level playing field could be achieved by regulatory neutrality.

In terms of making television viewing accessible, the US 21st Century Communications and Video Accessibility Act is an important step in the direction of regulatory neutrality. By the same token, the Act represents a market opportunity for the hardware and content providers alike to ensure that access services delivered on broadcast networks can also be re-used on Internet and mobile networks. A pragmatic conclusion on market opportunities for e-accessibility is that there are several underlying demographic, socioeconomic and technological trends that justify further action on access services and hardware to use them.

The business case is strongest in countries where there is clear legislation on television accessibility coupled with a regulator that can ensure a realistic roadmap and targets for access service provision. It is far from compelling in the eyes of commercial stakeholders, although there are examples of good practice such as Sky in the UK where the main driver is not recruiting new subscribers but reducing churn among those it already has. Viable approaches will need to identify a good combination of business models for access service production and consumer hardware. Digital switchover and the move to IP-based delivery are two windows of opportunity in this regard.

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[55] Catch-up TV is an informal term for any mechanism that allows the viewer to see a program within minutes, hours or days of its being aired

[56] "Over-the-top" delivery of television requires the viewer to have a receiver connected to both a broadcast signal and a broadband connection. The broadband connection allows for the delivery of television programs via an ordinary Internet connection. Programmes are viewed on the television screen.

8 Managing change – introducing and scaling up an access service

This chapter looks at the issues facing the introduction of a new television access service and the scaling up of an existing access provision, and the issues they both raise.

Chapter 9 then goes on to discuss the legal instruments available to promote change in the area of accessibility, including the United Nations Convention on the Rights of Persons with Disabilities, CRPD

8.1 Introducing a new access service

Figure 37: Trade-offs when introducing a new access service

A number of prerequisites need to be in place if the introduction of the service is to be a success. These include:

- The *business case* for introducing the access service (the rationale for action now rather than at a later date).

- *Objectives and goals* (what the introduction of the access service should achieve and when).

- *Metrics* (how the achievement of objectives and goals can be assessed).

- *Resources* (what funding is needed to set up and run the access service on a sustainable basis; whether the access service is to be produced and distributed in house or using outsourcing; whether the necessary human resources are available in the country).

- *Authority* (the stakeholders who need to be involved in the process to get the service going on a sustainable basis).

Ideally, there should also be a mechanism for *risk management* (so that potential risks can be identified, addressed and mitigated).

The business case is a compelling set of arguments for action. These may be quantitative (the increased number of persons that can be catered for, the increase in the percentage of programmes that can be accessed by a given target group), or they may be qualitative (new legislation or a public service agreement require action by a given date).

The business case is required by the project "sponsor" to get the necessary resources and buy-in from key stakeholders. The various stakeholders in such a project may have differing views on what constitutes a legitimate call to action so care should be taken to understand the interests and concerns of each stakeholder.

When it comes to objectives and goals, the approach differs from one territory to the next. Countries such as the United Kingdom have very explicit objectives and goals that have been turned into supply-side targets (the percentage of first-time broadcasts and repeats for which there is closed captioning and audio description). In other countries, the objectives are somewhat less explicit. In its public service contract for the period 2011–2014[57], the Danish public service broadcaster DR is required to "give priority to the captioning of programs on DR1 and DR2, so that the overwhelming majority of programs are provided with captioning in the course of 2012. The implication is that all news programs on DR1 and DR2 are captioned". While "all" is unambiguous, "overwhelming majority" is not, and can lead to differences of interpretation.

Metrics are any type of measurement used to gauge some quantifiable component of an organization's performance. When it comes to the provision of access services, they are measured as hours per channel per week, or as a percentage of all the television airtime. In such cases, it is important to stipulate whether this applies to the initial airing or also to all subsequent repeats of that programme.

In some cases, regulators monitor supply-side metrics and also look at demand-side indicators such as citizen awareness of a given access service. Figure 38 shows awareness levels of audio description in the United Kingdom before and after a campaign to promote it:

Figure 38: Awareness of audio description before and after the awareness raising campaign in 2008[58]		
	Awareness before (%)	**Awareness after (%)**
General public	37	60
Visually impaired	43	72
Severe + profound sight loss	61	82
Moderate sight loss	40	66
Mild sight loss	26	66

While measures of what are offered and public awareness of access services are a useful beginning, they need to be complemented with metrics that cover access service use and satisfaction with a given access service. As was mentioned earlier in this report, the lack of "use" and "satisfaction" metrics meant that several years passed before decision-makers realized that there were issues with live captioning. These were caused by the delay between the dialog in a programme and the subtitles appearing on the screen. Planners originally thought the delay was a minor issue but research with people using live subtitles showed it to be otherwise.

Setting up realistic implementation targets that the television industry can handle is also crucial.

In the same RNIB Audio Description Briefing containing Figure 38, there is a discussion of three scenarios for changing targets for audio description. Common to all three scenarios is the rate of change, requiring annual increases of 2 per cent until the new target is reached. Realistic implementation deadlines are just as important as the targets themselves.

Resources is a category that covers funding, technology and staffing:

- Funding is required to set up, produce and deliver metadata and access services in a sustainable fashion. There will capital and operating costs to consider, regardless of whether the service is

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[57] http://kum.dk/nyheder-og-presse/pressemeddelelser/2011/januar/public-service-fra-dr-til-alle/

[58] OFCOM study reported in RNIB Audio Description MP briefing.
www.rnib.org.uk/getinvolved/campaign/.../Ofcom_MP_briefing__10_09.doc

produced by the broadcaster/operator or outsourced to an external supplier. Capital costs for re-speaking solutions used to create live captioning are the most expensive. Operating costs are normally a function of the number of hours of the access service that need to be produced.

- Technologies and solutions for producing and distributing metadata and access services are often available as off-the-shelf solutions. In the case of live captioning, the problem is that solutions do not exist for all the languages required. Investing in the development of the necessary language models is expensive as was mentioned in chapter 6.

- When it comes to audio description and visual signing in particular, the critical factor may be the availability of bandwidth on digital television to deliver the access service. As far as digital distribution options are concerned, there should be some freedom to identify the effective lifetime of an access service on a given distribution platform. As new options such as audio description receiver mix emerge and become widespread in the installed base of television receivers, the focus should be on getting the service to as many users as possible, rather than detailed regulation of the delivery mechanism.

- Staffing will depend on whether the access service is produced in-house or outsourced to an external contractor. In some cases, the choice of production method will be constrained by the availability and cost of trained staff. In the case of live captioning, the availability of stenographers for a given language needs to be considered when choosing between stenography and re-speaking. Ultimately, the provision of access services will be dependent on there being educational provisions to educate and train staff to do captioning, audio description and visual signing.

- Authority is the power to take and enforce decisions. As discussed in chapter 6 on costs, there are many stakeholders in the television value chain, all of whom have their own legitimate interests when a new access service is introduced. In many countries where there are already television access services, the legislative body, the regulator or the broadcaster has consultation mechanisms with stakeholders. These include persons with disabilities and the organizations that represent them and their motto: "*Nothing about us without us*". Building a consensus among all the key stakeholders of an access service is no guarantee of success, but is a good way of preventing inadvertent failure.

- It is highly desirable to have some *risk management mechanism* in place so that risks of various kinds can be identified as the project develops and action is taken to mitigate the problem before it becomes a showstopper. As television distribution systems go digital and new modulation, encoding and decoding standards are adopted, the effective lifetime of an access *distribution* system may only be years rather than decades.

8.2   Scaling up the level of access service provision to its final target

Scaling up a service from its original introduction to some higher target involves the same list of prerequisites. If a service has been in place for several years, a risk management mechanism can be useful to establish if any of the working assumptions or prerequisites of the original service have changed.

In the case of the Danish approach to visual signing – offering a virtual channel that appears when required so that three different channels can coordinate and deliver visual signing on the same channel – the frequency in question will change from MPEG2 to MPEG4 encoding in 2012.

Users of visual signing currently can select Channel 21 on their programme guides and see news and current affairs programmes from three competing channels that have arranged to coordinate their schedules so that programmes with signing run from 5 – 7:30 p.m. in the same slot called "Tegnsprogskanalen" (the Signing Channel).

It will be necessary to review the implications of this encoding change for the mechanism currently used to dynamically "borrow" bandwidth from other television channels in the same multiplex using a technique called statistical multiplexing. Certainly the possible move from standard definition to high

definition and, possibly, DVB-T2 in this multiplex in the course of the decade will require a major rethink of the way in which visual signing is delivered to its users.

Figure 39: Channel 21 on Digital Terrestrial TV in Denmark – virtual signing channel

9   Incentives and sanctions – what mechanisms exist to promote access service provision?

This chapter discusses some of the mechanisms available to promote change in the area of accessibility, including the United Nations Convention on the Rights of Persons with Disabilities, CRPD.

In principle, ensuring that television is accessible to persons with disabilities could be done without any legal instruments if there were consensus about providing access services.

The reality of access provision is that there are two main types of legal instruments at the international, regional, national and local level that can be used to ensure that television is universally accessible.

The first includes conventions, directives, laws, government decrees, ministerial orders and public service contracts that determine *what* needs to be done. Conventions, treaties and directives govern relations between states while the others apply to companies and individuals.

The second includes international and national standards and norms, not only general human factors standards that are finding their way into public sector ICT procurement[59] but also those governing television receivers and television transmission that provide the basis for implementing access services – *how* things need to be done.

Determining both the *whats* and the *hows* is extremely important for free-to-air television where the interoperability of services depends on standards.

The *whats* are just as important for Pay TV operators. However, operators as gatekeepers have more freedom in deciding on the *hows* within their own distribution systems, since it is the Pay TV operator who specifies which television receivers can be used by its customers. Even so, inter-operability is also a key concern for Pay TV operators. They need to be able to receive television signals from a number of broadcasters and deliver them to their customers. For this reason, the contribution and distribution of Pay TV channels comply with television transmission standards. A recent example of this from the US is the Enhanced TV Binary Interchange Format (EBIF), developed for US cable TV operators. One of the key features of EBIF is "the ability to segment application data into common and platform-specific sections, so as to support reuse of common constructs, while still allowing platform-specific specialization. A decoder needs only to load the common constructs and the platform-specific constructs that apply to the decoder platform in order to decode and render an application"[60]. Receivers themselves may still have bespoke features to ensure subscriber loyalty by making it difficult or expensive to change operator[61].

When putting in place legal instruments for television and accessibility, legislators and regulators need to have an understanding of the family of television standards that has been adopted in their region or country (DVB in Europe, ATSC in North America, ISDB in Japan and much of South America and comparable digital television standards from Korea and the People's Republic of China). By keeping this in mind, proposed access solutions can be designed to fully exploit existing and forthcoming standards for television receivers – the current and future "hows".

Such digital television standards usually have provisions for captioning and audio description. For this reason, it makes economic sense to start with the features that are already there (and are often present

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[59]   ETSI TR 102 612 V1.1.1 (2009-03) Technical Report. Human Factors (HF); European accessibility requirements for public procurement of products and services in the ICT domain (European Commission Mandate M 376, Phase 1)

[60]   OpenCable™ Specifications. ETV Enhanced TV Binary Interchange Format 1.0 OC-SP-ETV-BIF1.0-I06-110128 page 19. 28 January, 2011.

[61]   The differences in gatekeeper behaviour on free-to-air and Pay-TV platforms are explained further in this article: Looms, Peter Olaf. Who chooses the news? Gatekeeping and digital media. September, 2010. Media Digest, RTHK, Hong Kong SAR www.rthk.org.hk/mediadigest/20100914_76_122659.html

in digital television receivers) rather than risking national and regional market fragmentation leading to higher production and receiver costs.

9.1 The Convention on the Rights of Persons with Disabilities[62]

The United Nations Convention (generally referred to as CRPD) marks a departure from previous instruments of its kind as regards its position on disabilities. It does not talk of *handicapped* or the *physically or mentally challenged*, nor of people in a general sense, but of *persons with disabilities*.

Article 1 states that "Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others". Thus the Convention argues that *"a disability results from an **interaction** between a non-inclusive society and individuals:* A person with extreme near-sightedness who does not have access to corrective lenses may not be able to perform daily tasks. This same person with prescription eyeglasses would be able to perform all tasks without problems."* Disability for a television viewer with hearing loss would similarly be the result of a lack of captioning or sign language interpretation. The responsibility to address barriers belongs to society at large and more specifically to the many providers of services to the public.

Article 4 sets out a long list of obligations on States Parties. Further, each provision in the CRPD sets out the various actions that States Parties must take to promote and protect each specific right. These use a specific typology of human rights obligations to respect, protect and fulfill:

- *Respect* – the State must refrain from taking certain acts that would violate human rights.

- *Protect* – the State must ensure that third parties respect human rights (e.g. the private sector).

- *Fulfill* – the State must take a range of legislative, financial, political, social, budgetary, educational and other measures to improve enjoyment of human rights.

Under the Convention, the obligations in article 4 can be grouped according to these three categories:

- *Respect* – States Parties must: refrain from engaging in any act or practice that is inconsistent with the Convention; modify or abolish existing discriminatory laws, customs and practices; closely consult with and actively involve persons with disabilities in the development and implementation of legislation and policies to implement the Convention.

- *Protect* – States Parties must take all appropriate measures to eliminate discrimination on the basis of disability by any person, organization or private enterprise.

- *Fulfill* – Many of the specific obligations on States fall within this category. For example, States must adopt legislative, administrative, policy, programmatic and other measures to implement the rights of persons with disabilities; undertake or promote research and development into relevant goods and services; provide accessible information to persons with disabilities on relevant technology and other assistance, services and facilities; promote training of professionals and staff working with persons with disabilities.

Audiovisual works such as television are covered by article 9: "To enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, *to information and communications, including information and communications technologies and systems*..."

Section 1.b mentions "Information, communications and other services, including electronic services and emergency services".

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[62] The full text of the Convention can be found here: www2.ohchr.org/english/law/disabilities-convention.htm

Section 2.h requires member states to "Promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost".

Television is mentioned explicitly in article 30.1.b:

"Article 30 Participation in cultural life, recreation, leisure and sport

1. States Parties recognize the right of persons with disabilities to take part on an equal basis with others in cultural life, and shall take all appropriate measures to ensure that persons with disabilities:

    a) Enjoy access to cultural materials in accessible formats;

    b) *Enjoy access to television programmes*, films, theatre and other cultural activities, in accessible formats."

The implication of article 30 is that metrics for television accessibility need to cover not only *awareness* of access service provision, but also *use* and *benefit*.

Finally, article 9.2.b. stipulates that State Parties to the Convention must "Ensure that private entities that offer facilities and services which are open or provided to the public take into account all aspects of accessibility for persons with disabilities", a disposition which covers private sector broadcasters and producers of audio-visual content.

9.2 Private sector led initiatives

As was mentioned in this chapter and previously in chapter 7, industry bodies such as the Consumer Electronics Association and OpenCable (USA), and DIGITALEUROPE with constituents including the hardware manufacturers have been working on the accessibility of television receivers. The challenge has been to link work on receiver capabilities with the provision of access services themselves, as the business models of the two are interrelated.

Experience to date highlights the need for the judicious use of carrots and sticks to maintain momentum on both the provision of access services and on the television receivers needed to use them.

Work in the UK Digital Television Group on usability and accessibility issues for more than ten years demonstrates that voluntary stakeholder collaboration combined with clear legislation (the Communications Act of 2003) and targets set by the regulator Ofcom can achieve significant results. All the major UK channels on both free-to-air and Pay-TV platforms have reached almost 100 per cent% availability of same-language captioning. Audio description levels exceed the original target of 10 per cent of output.

9.3 National negotiated roadmap among stakeholders

As was mentioned in the previous section, progress on the road to accessible television requires careful consideration of targets on the one hand, and the stakeholders' ability to deliver metadata, access services and the necessary television receivers on the other. The UK is a good example of what can be done when the right balance is struck in the form of a negotiated roadmap covering milestones for access service rollout.

9.4 Regulatory approach, national and regional

When it comes to planning and implementing a new television access service, there is no single approach to be followed, as "there are many roads that lead to Rome".

Big national markets such as India, China and the United States are large enough to sustain a viable market for free-to-air and Pay TV receivers that can handle access services delivered with the television transmission standards in force in that territory.

Small national markets, each of which adopts its own standards and norms, would lead to increased receiver costs. There is much to be said in favour of regional or continent-wide collaboration to set hardware and transmission standards and to agree a road map for action in terms of access service roll-out. The regional approach towards "e-inclusion" being followed by the European Union in the form of the Direction on Audiovisual Media Services Directive can be combined with legislation, regulation and public service contracts at national and local levels across Europe.

The regional approach may involve collaboration based not on geographical proximity but on the television standards in use for receivers and television transmission. This is of particular importance in areas such as satellite Pay-TV operators who may cover several states, or upload their signals from a country different from those who watch the service.

Ultimately, the provision of successful and sustainable access services will depend on the stipulations of Article 9.2.h of the CRPD to "promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost".

Appendix (Checklist)
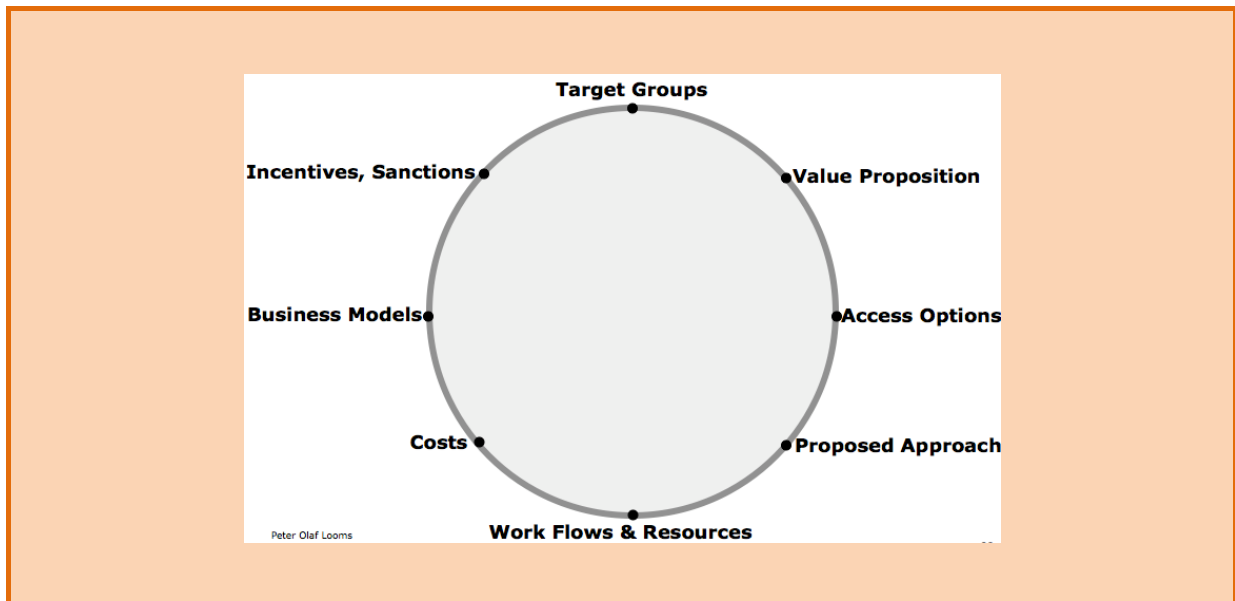
1. Target groups

Which viewers have difficulties accessing television? (chapter 1)

   a)   Which groups of viewers have been identified for the accessibility action?

   b)   Why have these viewers been prioritized?

   c)   What is known about the viewers and their needs? (chapter 1.2 – 1.5)

   d)   Is there a mechanism in place to engage persons with disabilities and the organizations that represent them in the accessibility action?

2. Value proposition

What is needed by the viewers? (chapter 2)

   a)   Changes to improve the usability of the content itself – mainstream scenario

   b)   Changes in the information about the content – mainstream scenario

   c)   The provision of an access service for the content – mainstream or assistive add-on

   d)   A combination of (a) – (c)

   e)   What is the value proposition from the viewer perspective of the planned accessibility action?

   f)   What is the case for implementing the planned action now rather than at later date?

3. Current and emerging access service options

Which access services are to be offered in the time-frame contemplated for the accessibility action? (chapter 3)

   a)   What are the service options taking into consideration the characteristics of the target groups and the current production and distribution infrastructure?

b) Are there any major infrastructure changes planned for the period in question? (e.g. potential synergies or obstacles in connection with digital switchover, transition to HD or IPTV)

4. The approach and its prerequisites

Who needs to do what so that the viewer can see television programmes with access services? (chapter 4)

a) What does the viewer have to do in order to set up the equipment, discover, view and enjoy programmes and the accompanying access services?

b) What needs to be added or changed to the production and distribution infrastructure in order to handle the proposed accessibility action?

c) What additions or changes are required by key stakeholders in the value network?

5. Work flows and resources

How are the access services to be produced, delivered and used? (chapter 5)

a) Are all the various technologies available for the workflows foreseen for the accessibility action?

b) Are all the necessary human resources available in the territory, including trained personnel required for access service production?

6. Costs

What does it cost to set up and run a given access service for audiovisual content? (chapter 6)

a) What capital investments will be needed throughout the value network to get the accessibility action going?

b) What are the annual operational costs for the accessibility action for each of the stakeholders in the value network?

7. Business models

Is there a business model so that access services can be offered on a sustainable basis? (chapter 7)

a) Is there a business model for the access service provision itself and is it sustainable?

b) Is there a business model for the consumer hardware needed for the service and is it sustainable?

Introducing and/or scaling up an access service (chapter 8)

a) What metrics and key performance indicators are proposed to ascertain whether the planned accessibility measure meets its objectives?

b) How is the planned access service measure going to be planned and implemented?

c) What plans exist to ensure an alignment of stakeholder interests?

8. Incentives and sanctions

What mechanisms exist to promote access service provision? (chapter 9)

a) What conventions and directives as well as national legislation and guidelines govern media accessibility in the territory in question?

b) What international and industry standards apply to media production and distribution?

c) Is there a commercial case for for the accessibility action? How is it perceived by the stakeholders involved in the implementation of the action?

d) Are there any changes in regulation or legislation that could have an impact on the case for the accessibility action during its lifetime?

Terminology and definitions

Key terms are shown in bold. Related terms that are also key terms are listed in italics. The entry for each key term mentions the page number where the first instance of the term is used in the report.

Access Service [UK] = Accessibility service [US] (page 5). A service such as captioning, audio description or visual signing that improves the accessibility of a television programme for which it was made.

Accessibility (page 5) The degree to which a product, device, service, or environment is available to as many people as possible. Accessibility can be viewed as the "ability to access" and possible benefit of some system or entity. Accessibility is often used to focus on persons with disabilities or special needs and their right of access to entities, often through use of *Assistive technology* or *Access Services*.

Accessibility is strongly related to *Universal Design* when the approach involves "direct access". This is about making things accessible to all people (whether they have a disability or not). An alternative is to provide "indirect access" by having the entity support the use of a person's assistive technology to achieve access[63]. There is less agreement about the case for including technological features that support a wide range of access services for television than for, say, mobile phones. Michael E. Porter recently suggested that: "The solution lies in the principle of shared value, which involves creating economic value in a way that *also* creates value for society by addressing its needs and challenges[64]."

Accessibility, Linguistic (page 8) The degree to which the language of an audiovisual work can be understood by as many persons as possible in the target audience.

AD – see Audio Description (page 13).

Aphasia, Receptive (page 22) People with receptive aphasia can speak with normal grammar, syntax, rate, intonation and stress, but their language content is incorrect. They may use the wrong words, insert nonexistent words into speech (neologisms), or string normal words together randomly (word salad).[65]

Assistive Technology, AT (page 11) AT is an umbrella term that includes assistive, adaptive, and rehabilitative devices for persons with disabilities. It also includes the process used in selecting, locating, and using them. AT promotes greater independence by enabling people to perform tasks that they were formerly unable to accomplish, or had great difficulty accomplishing, by providing enhancements to or changed methods of interacting with the technology needed to accomplish such tasks. It provides "indirect access", whereas *Universal Design* provides "direct access".

ATSC – see The Advanced Television Systems Committee (page 61).

Audio Description (page 13). Also known as "Video Description". Audio description is the verbal depiction of key visual elements in media and live productions. The description of media involves the interspersion of these depictions with the programme's original audio[66].

Audio Description, broadcast mix (page 30) In this case, the audio description consists of pre-mixed audio created by the broadcaster or production company.

Audio Description, receiver mix (page 26) In this case, the audio description consists of the original audio with fade information. Mixing takes place in the viewer's device.

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[63] http://en.wikipedia.org/wiki/Accessibility

[64] Michael E. Porter and Mark R. Kramer. The Big Idea: Creating Shared Value. Harvard Business Review. The Magazine. January – February, 2011. http://hbr.org/2011/01/the-big-idea-creating-shared-value/ar/1

[65] http://en.wikipedia.org/wiki/Receptive_aphasia

[66] Based on definition in the Description Key, the Described and Captioned Media Program. www.dcmp.org/descriptionkey/

Audiovisual Content (page 5) All kinds of time-based content consisting of images and sounds.

Audiovisual Media (page 5) Audiovisual Media has several connotations, including *Audiovisual Content* and the Distribution Networks and Storage Media used to get the content from those who make it to those who want to use it.

Bit map (page 32) Captions can be displayed on a screen either using vector graphics (the top letterA) or bitmap graphics (bottom letter A). Bit map graphics break down the letters into pixels or rectangles[67]:

Blocking (page 17) Artifacts in television pictures where the viewer sees rectangular distortions in the image.

Business model (page 49) A business model describes the rationale of how an organization creates, delivers, and captures value. This may be viewed in a narrow sense (economic value, what are the costs, and where are there revenue streams to pay for them). Increasingly, a business model includes social or other forms of value[68].

Captioning (North America) is also known as "same language subtitling" or "intra-lingual subtitling" in Europe. Subtitling in North America is restricted to foreign language programmes. This is the equivalent of "foreign language subtitling" or "inter-lingual subtitling" in Europe. Captioning is the process of converting the audio content of a television broadcast, webcast, film, video, CD-ROM, DVD, live event, or other productions into text and displaying the text on a screen or monitor. Captions not only display words as the textual equivalent of spoken dialogue or narration, but they may include speaker identification, sound effects, and music description. Captioning aims to include as much of the original language as possible. However, altering the original transcription may be necessary to provide time for the caption to be read and for it to be in synchronization with the audio[69].

Captioning may be presented as text or, in the case of foreign-language dialog, read aloud in the form of *Audio Captioning* (North America) also known as *"Spoken"* or *"Audio Subtitles"* in Europe. The service may be something the viewer has to select (*Closed Captioning*) or may be an integral part of the image (*Open Captioning*). Where possible *Intra-lingual Captioning* is *pre-prepared* or produced live using *Stenography* or *Re-speaking*.

Captioning, Audio (page 21) is also known as Audio Subtitles or Spoken Subtitles. Audio content of an audiovisual work or sequence in a foreign language is converted into captions or subtitles in the target

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[67]   Illustration from Christie Pennisi's blog
http://sthcpennisicreativemedia.blogspot.com/2011/05/vector-vs-bitmap-images.html

[68]   Based on definition in http://en.wikipedia.org/wiki/Business_model

[69]   Based on definition in the Caption Key, the Described and Captioned Media Program. www.dcmp.org/captioningkey/

language. These *inter-lingual captions* are then read aloud. This may be done at the source or in the user's device using *speech synthesis*.

Captioning, Closed (page 9) is also known as Closed, or User-selected Subtitles. The user has to select the service, c.f. *Open Captioning* which is seen by all and cannot be turned on and off.

Captioning, In-vision (page 18) is a synonym for *Open Captioning*.

Captioning, Inter-lingual (page 18) is also known as foreign-language captions or subtitles (North America).

Captioning, Intra-lingual (page 18) is also known as same-language captions or subtitles, or SDH, subtitles for the deaf and hard-of-hearing.

Captioning, Open (page 12) Captioning where the user does not have to do anything in order to see the captions or subtitles, as they are an integral part of the picture.

Captioning, Pre-prepared (page 31) Captions or subtitles prepared before the programme is broadcast or distributed.

Catch-up TV (page 56) A service that allows a viewer to see a TV programme independent of when it was broadcast. This is usually a kind of on-demand service on the Internet, but may also be achieved via a Personal Video Recorder (PVR) on which the viewer has chosen to record the programme, or through a "push Video On Demand" subscription where the viewer receives the programme via the Internet or his PVR.

CEA – see Consumer Electronic Association (page 55)

Clean Audio (page 20) is also known as Clear Audio. It is a service that enhances the intelligibility of the audio of a TV programme to help persons with hearing impairments.

Control, Remote (page 21) is also known as a remote, controller or sometimes channel changer. It is an electronic device used for the remote operation of a machine (television set, set-top box or PVR) often over very short distances within the home. The design of such devices needs to consider their usability and accessibility. Blind and partially sighted persons and those with other disabilities often encounter difficulties with remote controls that render them inaccessible.

Corporate Social Responsibility (page 50) is a form of corporate self-regulation integrated into a *business model*. CSR policy functions as a built-in, self-regulating mechanism whereby business monitors and ensures its active compliance with the spirit of the law, ethical standards, and international norms.

Crawler (page 9) is also known as a news-ticker. It is a small screen space on news television programmes dedicated to presenting headlines or minor pieces of news[70].

CRPD – see *United Nations Convention on the Rights of Persons with Disabilities* (page 57).

CSR – see *Corporate Social Responsibility* (page 50).

DECE – see *Digital Entertainment Content Ecosystem* (page 5).

Digital Dividend See Dividend, Digital.

Digital Entertainment Content Ecosystem (DECE) (page 5) A consortium aiming to simplify the enjoyment of audiovisual content on multiple devices in the home. The solution goes under the name of UltraViolet™.

Digital Europe Association (page 55). Formerly known as EICTA, the association represents the interests of both national associations and corporate organizations operating in the information technology and consumer electronics sector in Europe vis-a-vis the European Parliament and the European Commission.

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[70] Based on the definition at: http://en.wikipedia.org/wiki/News_ticker

Digital Switchover (page 28) The transition from analogue to digital broadcasting. There are two phases, the first with simultaneous analogue and digital transmissions, the second with digital transmissions only. In some countries, digital transmission has been introduced region by region. Phase one may vary in duration: it may be quite short (a few months in Germany) or take many years (15 in the case of the UK).

Digital Television Group (page 55). The Digital TV Group (DTG) is the industry association for digital television in the UK. The Group publishes and maintains the technical specification for the UK's Freeview and Freeview HD platforms (the D-Book) and runs the digital television industry's test centre: DTG Testing. It plays an influential role in access service development and standardization not only in the UK.

Dividend, Digital (page 51, page 54) The ITU quotes a definition of the digital dividend as "the amount of spectrum in the VHF and UHF bands that is above that nominally required to accommodate existing analogue programmes, and that might be thus potentially freed up in the switchover from analogue to digital television[71]." This leads to a debate on the societal and economic benefits of the transition from analogue to digital terrestrial transmission between 200 MHz and 1GHz. Digital transmission is 4–8 times more efficient in terms of frequency use. The frequencies that become available can be used to increase the number of technical quality of television channels, or to make spectrum available for other wireless services (mobile telephony or wireless Internet).

Disability (page 5) In this context we are concerned with the term as it is used in the in the CRPD. "The Convention marks a 'paradigm shift' in attitudes and approaches to persons with disabilities. It takes to a new height the movement from viewing persons with disabilities as 'objects' of charity, medical treatment and social protection towards viewing persons with disabilities as 'subjects' with rights, who are capable of claiming those rights and making decisions for their lives based on their free and informed consent as well as being active members of society.

The Convention is intended as a human rights instrument with an explicit, social development dimension. It adopts a broad categorization of persons with disabilities and reaffirms that all persons with all types of disabilities must enjoy all human rights and fundamental freedoms. It clarifies and qualifies how all categories of rights apply to persons with disabilities and identifies areas where adaptations have to be made for persons with disabilities to effectively exercise their rights and areas where their rights have been violated, and where protection of rights must be reinforced[72]".

"'Discrimination on the basis of disability' in the *Convention on the Rights of Persons with Disabilities* means any distinction, exclusion or restriction on the basis of disability which has the purpose or effect of impairing or nullifying the recognition, enjoyment or exercise, on an equal basis with others, of all human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field. It includes all forms of discrimination, including denial of reasonable accommodation.[73]"

DTG, see *Digital Television Group*, UK.

Dubbing (page 8) is the post-production process of recording and replacing voices on a motion picture or television soundtrack subsequent to the original shooting[74].

DVB – see Digital Video Broadcasting (page 25) works to develop, set and promote technical guidelines, standards and specifications to benefit and advance digital media markets world-wide. It was originally European in origin but today is an alliance of 250–300 companies.

DVB subtitles – bit-map or teletext captions on digital television using DVB.

EBU – see *European Broadcasting Union* (page 31) or European Blind Union

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[71] www.itu.int/net/itunews/issues/2010/01/27.aspx

[72] CRPD introduction on the UN website: www.un.org/disabilities/default.asp?navid=13&pid=150

[73] CRPD Article 2: www.un.org/disabilities/default.asp?id=262

[74] http://en.wikipedia.org/wiki/Dubbing_%28filmmaking%29

ETSI – see The *European Telecommunications Standards Institute*

Electronic Programme Guide, see *Programme Guide, Electronic, EPG.*

European Blind Union, EBU, is a non-governmental, non profit-making European organization founded in 1984. One of the six regional bodies of the *World Blind Union,* it is the only continent-wide organization representing the interests of blind and partially-sighted people in Europe. The EBU aims to protect and promote the interests of all blind and partially-sighted people in Europe.

European Broadcasting Union, EBU (page 31) is the largest association of national broadcasters in the world. It has 74 Active Members, from 56 countries in and around Europe, and 36 Associate Members around the world. The association promotes cooperation between broadcasters and facilitate the exchange of audiovisual content. The EBU works to ensure that the crucial role of public service broadcasters is recognized and taken into consideration by decision-makers.

European Telecommunications Standards Institute, ETSI, produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies. ETSI is officially recognized by the European Union as a European Standards Organization. ETSI is a not-for-profit organization with more than 700 ETSI member organizations drawn from 62 countries across 5 continents world-wide.

FCC – see *Federal Communications Commission*

Federal Communications Commission, FCC is an independent United States government agency. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC's jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions.

Functional impairment (page 7) refers to "a person's loss of functional capacity. Functional capacity is the ability or capability of an organ or system to perform its specified function. The existence of a medical condition /…/does not necessarily restrict functional capacity[75]". The UN definition is "Any loss or abnormality of psychological, or anatomical structure or function". There is a good introduction to four different historical and social models of disability by Deborah Kaplan, Director of the World Institute on Disability[76].

HbbTV – see *Hybrid Broadcast Broadband TV* (page 28)

HTML5 (page 5) HTML5 is a language for structuring and presenting content for the World Wide Web, a core technology of the Internet. It is the fifth revision of the HTML standard and most recently standardized as HTML4 in 1997 and as of August 2011 is still under development. Its core aims have been to improve the language with support for the latest multimedia while keeping it easily readable by humans and consistently understood by computers and devices (web browsers, parsers etc.). It is also an attempt to define a single markup language that can be written in either HTML or XHTML syntax. HTML5 adds many new syntactical features. These include the <video>, <audio>, <header> and <canvas> elements that make proprietary add-ons for handling video and audio unnecessary[77]. #

Hybrid Broadcast Broadband TV (page 28) is a major pan-European initiative building on work in the Open IPTV Forum aimed at harmonizing the broadcast and broadband delivery of entertainment to the end consumer through connected TVs and set-top boxes.

I-Cloud. The name given to Apple's proposed solution for sharing content using the Cloud.

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[75] Guide to Social Security Law. Australian Government.
www.fahcsia.gov.au/guides_acts/ssg/ssguide-1.1/ssguide-1.1.f/ssguide-1.1.f.270.html

[76] www.accessiblesociety.org/topics/demographics-identity/dkaplanpaper.htm

[77] Based on http://en.wikipedia.org/wiki/HTML5

Impairment, age-related (page 7) is a collection of sensory and cognitive impairments. In the general sense, it covers matters such as the deterioration of sight and hearing, memory impairment or memory loss. This report looks not only at persons who are elderly but also at the challenges facing children whose intellectual maturity has an impact on their ability to read subtitles. In principle, there can be other impairments that are related to stages in the person's life.

Impairment, cognitive (page 9) affects the individual's ability to think, concentrate, formulate ideas, reason and remember[78].

Impairment, dexterity (page 8) is reduced function of arms and hands that makes activities related to moving, turning or pressing objects difficult or impossible. This does not influence speech communication itself but makes it hard to make a phone call or use a wide range of other equipment[79].

Impairment, hearing (page 9) is a generic term including both deaf and hard of hearing which refers to persons with any type or degree of hearing loss that causes difficulty working in a traditional way. It can affect the whole range or only part of the auditory spectrum which, for speech perception, the important region is between 250 and 4,000 Hz. The term deaf is used to describe people with profound hearing loss such that they cannot benefit from amplification, while hard of hearing is used for those with mild to severe hearing loss but who can benefit from amplification[80].

Impairment, visual (page 8). Visual impairment (or vision impairment) is vision loss (of a person) to such a degree as to qualify as an additional support need through a significant limitation of visual capability resulting from either disease, trauma, or congenital or degenerative conditions that cannot be corrected by conventional means, such as refractive correction, medication, or surgery. The loss may cover visual acuity, significant central or peripheral field defects or reduced contrast sensitivity[81].

Inclusive design (page 10) The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible ... without the need for special adaptation or specialized design[82]. It is usually a synonym of *Universal Design*.

Integrated Digital Television Receiver (page 25) or set is a device with a built in digital tuner, be it for DVB-T, DVB-S, DVB-C, DMB-T/H, ATSC or ISDB.

Integrated Services Digital Broadcasting, ISDB (page 31) Originally a Japanese standard for digital television and digital radio used by the country's radio and television stations. The standard has also been adopted for digital terrestrial broadcasting by most countries in Latin America.

Internet Protocol Television, IPTV (page 5) is a system through which Internet television services are delivered using the architecture and networking methods of the Internet Protocol Suite over a packet-switched network infrastructure, e.g., the Internet and broadband Internet access networks… IPTV is distinguished from general Internet-based or web-based multimedia services by its on-going standardization process[83].

IPTV – see *Internet Protocol Television* (page 5)

ISDB – see *Integrated Services Digital Broadcasting* (page 31)

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[78] Industry Canada. Assistive technology links: www.apt.gc.ca/wat/wb14200e.asp?dId=4

[79] Industry Canada. Assistive technology links: www.apt.gc.ca/wat/wb14200e.asp?dId=123

[80] Industry Canada. Assistive technology links: www.apt.gc.ca/wat/wb14200e.asp?did=5

[81] Based on http://en.wikipedia.org/wiki/Visual_impairment

[82] Based on www.edc.eng.cam.ac.uk/betterdesign/whatis/whatis3.html

[83] Based on http://en.wikipedia.org/wiki/Internet_Protocol_Television

Jitter (page 17) is the deviation in or displacement of some aspect of the pulses in a high-frequency digital signal. As the name suggests, jitter can be thought of as shaky pulses[84].

Key Performance Indicator, KPI (page 6) is a Measure of Performance. KPIs are commonly used by an organization to evaluate its success or the success of a particular activity in which it is engaged[85].

Language condensation (page 10) Captioning is rarely a verbatim transcription of what is said in the soundtrack, but an edited version to convey the original sense of what was said while making sure that the viewer is comfortable reading the final result. As a result, the difference between the verbatim transcription and the final result involves language condensation.

Lectoring (page 18) is a kind of inter-lingual service that uses a selective or partial *voice-over* to help the viewer understand the dialogue. It is used in parts of the world where languages in neighboring countries are regarded as being less then dialects of the mother tongue but not a fully "foreign" language. The viewer can still hear the original sound track. When successful, it can promote an understanding of the language of the original programme.

MDGs – see *Millennium Development Goals* (page 53).

Metadata (page 44) is data about data, in this case information about television programs. This can be in the form of programme listings or guides, or technical data delivered with the programme to accomplish an access service (e.g. fading data for *audio description receiver mix*).

Metric (page 5) is a criterion or measure of success in reaching a particular objective or goal.

Metric, Quality (page 17) is a measure of the perceived quality of a television picture or sound.

Multiplex or mux (page 37) is also called a virtual sub-channel in the United States and Canada, and Bouquet in France. It is a group of TV channels that are mixed together (multiplexed) for broadcast over a digital TV channel and separated out again (demultiplexed) by the receiver[86].

NorDig (page 55) NorDig is a cooperative organization consisting of Nordic and Irish television companies and telecom companies working with the transmission and reception of digital TV in member countries. The collaboration is based on a vision of an open, standardized market with horizontal competition. Competition should be on content and services; not on the technical platform[87].

OFCOM – see *Office of Communications*

Office of Communications, (page 33) is the independent regulator and competition authority for the UK communications industries. It was formerly different regulators for public and commercial broadcasting that were merged.

Open IPTV Forum, OIPF (page 5). The Open IPTV Forum e.V. is a pan-industry initiative with the purpose of producing end-to-end specifications for IPTV that will take the next generation of IPTV to the mass market. The forum is fully open to participation across the communications and entertainment industries.

Oralist (page 20) is a person who advocates or uses the oral method of teaching the deaf.

Over-the-top TV (page 56) Over the top Television allows a viewer to view content that is available over the Internet. It is delivered via broadband connection to flat panel displays or computer screens and so bypasses the traditional broadcast or IPTV providers of TV services – hence the term "over-the-top"[88].

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[84]   Based on http://en.wikipedia.org/wiki/Jitter

[85]   Based on http://en.wikipedia.org/wiki/Performance_indicator

[86]   http://en.wikipedia.org/wiki/Multiplex_%28TV%29

[87]   Based on www.nordig.org/

[88]   Based on www.bci.eu.com/over-the-top-tv/over-the-top-television-ott-tv/

Personal video recorder, PVR (page 26) is a consumer electronics device or application software that records video in a digital format to a disk drive, USB flash drive, Secure Disk memory card or other local or networked mass storage device[89].

Picture-in-Picture (page 9, 38) A feature of some television receivers and similar devices. One program (channel) is displayed on the full TV screen at the same time as one or more other programs are displayed in inset windows. Sound is usually from the main programme only[90].

Playout center (page 21) A play-out center is the location from which a broadcaster dispatches a television channel either directly to a transmitter network or indirectly through a contribution system to one or more transmission networks.

Programme Guide, Electronic, EPG (page 13) and interactive programme guides provide users of television, radio, and other media applications with continuously updated menus displaying scheduling information for current and upcoming programming[91].

Programme Guide, On-screeen (page 13) as distinct from programme listings and guides on other platforms such as the Web, mobile phones and in print media.

Remote Control, see *Control, Remote*

Re-scanning (page 23) Many consumers already know about the need to run the "scan" function on their digital converter boxes or digital TV sets periodically. Scanning searches for and "remembers" the available digital broadcast channels. But in some cases, simple scanning may not be enough. There is a procedure – sometimes called "double rescanning" – that can clear your box's memory of saved channels. These earlier scans may have saved channel information that is now incorrect[92].

Respeaking (page 36) is a means to provide real-time captioning for live events including television programs. It involves a captioner "re-speaking" or dictating the captions that are transcribed using speech recognition and formatted for display on some kind of screen. There is an International Association on Respeaking (OnAir).

Sense Block (page 34)

When a long sentence is displayed in a caption,

it is split into groups or blocks of words – sense blocks – that make the caption easier to read.

The above sentence has been split into sense blocks.

Set-top box (page 25) is a device that enables an analogue television set to receive and decode digital television broadcasts.

Short-form video (page 5) is video in bite-sized chunks, unlike long-form video such as television programs and motion pictures.

Sign language (page 8). A sign language (also signed language) is a language which, instead of acoustically conveyed sound patterns, uses visually transmitted sign patterns (manual communication, body language) to convey meaning—simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to fluidly express a speaker's thoughts[93].

Signing (page 8) is communication using sign language.

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[89] Based on http://en.wikipedia.org/wiki/Digital_video_recorder

[90] Based on http://en.wikipedia.org/wiki/Picture-in-picture

[91] Based on http://en.wikipedia.org/wiki/Electronic_program_guide

[92] What you need to know about digital TV transmission www.dtv.gov/rescan.html

[93] http://en.wikipedia.org/wiki/Sign_language

Signing, Closed (page 37) is an access service which the viewer can turn on or off.

Signing, Open (page 37) is an access service which all viewers have to see.

Signing, Visual (page 11) is a synonym for signing in parts of Europe.

Simulcast (page 31) *Simul*taneous broad*cast* of a programme on two or more distribution networks

Smart phone (page 5) is a mobile phone that offers more advanced computing ability and connectivity than a contemporary feature phone.

SMPTE – see The *Society of Motion Picture and Television Engineers*

Snow (page 17) is noise in analogue video and television perceived as a random dot pattern superimposed on the picture[94].

Society of Motion Picture and Television Engineers, SMPTE (page 34) is a technical society for the motion imaging industry. SMPTE members are spread throughout 64 countries worldwide. As well, over 200 Sustaining (Corporate) Members belong to SMPTE, allowing networking and contacts to occur on a larger scale. SMPTE was founded in 1916 to advance theory and development in the motion-imaging field. Amongst other things, SMPTE publishes ANSI-approved Standards, Recommended Practices, and Engineering Guidelines[95].

Stakeholder (page 7) is a person, group, organization, or system who affects or can be affected by an organization's actions. In the case of television accessibility, the stakeholders are all those who have an impact on, or are influenced by the planning, production, exchange, delivery, use and enjoyment of television.

Stenography (page 36) is a form of short hand, allowing the writer (stenographer) to produce a transcription of dialogue in real time. In the case of television accessibility, stenography is one of the ways of producing *live captioning*. An alternative is *re-speaking.*

Subtitles, Audio : see *Captioning, Audio*

Subtitles, Spoken: see *Captioning, Audio*

Subtitling (page 18): see *Captioning*

Synthesis, Speech (page 21) is a means by which human speech can be created synthetically, rather than have to use recordings. It is used for car navigation systems, point-of-information kiosks and is being introduced as a means of offering *Audio Captioning*.

Tablet (page 5) or Tablet PC is a device equipped with a touchscreen as the primary input device and designed for personal use.

Teletext (page 31) or broadcast teletext is a television information retrieval service developed in the United Kingdom in the early 1970s. It offers a range of text-based information including subtitles or *closed captioning.* This service is typically available on page 888, but the actual page number depends on the broadcaster and country.

Terrestrial Television (page 5) is a mode of television broadcasting which does not involve satellite transmission or cables — typically using radio waves through transmitting and receiving antennas or aerials. The term is more common in Europe, while in the United States it is referred to as broadcast television or sometimes over-the-air television[96].

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[94] http://en.wikipedia.org/wiki/Noise_%28video%29

[95] Based on www.smpte.org/about/

[96] http://en.wikipedia.org/wiki/Terrestrial_television

Terrestrial Television, analogue (page 12) is a mode of television broadcasting in which one television frequency contains one television channel.

Terrestrial Television, digital (page 5) is a mode of television broadcasting in which one television frequency, two HD TV channels or as many as six standard definition television channels are multiplexed in the same frequency.

Transcription (page 33) is the representation of the sound track of a TV programme in written form.

Transcription, Verbatim (page 33) is a word-for-word representation of the sound track of a TV programme in written form.

UN Washington Group on Disability Statistics (page 7). The main purpose of the Washington Group on Disability Statistics is the promotion and coordination of international cooperation in the area of health statistics by focusing on disability measures suitable for censuses and national surveys which will provide basic necessary information on disability throughout the world[97].

Universal design (page 49) Universal design refers to broad-spectrum ideas meant to produce buildings, products and environments that are inherently accessible to both people without disabilities and people with disabilities[98].

The term "Universal Design" was coined by the architect Ronald L. Mace to describe the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life. The UN definition of Universal Design covers the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. "Universal design" shall not exclude assistive devices for particular groups of persons with disabilities where this is needed.

VBI, see *Vertical Blanking Interval*

Vertical Blanking Interval, VBI (page 31) also known as the vertical interval or VBLANK, is the time difference between the last line of one frame or field of a raster (i.e. line-by-line) display, and the beginning of the first line of the next frame. It is present in analog television, VGA, DVI and other signals. In analog television systems the vertical blanking interval can be used for datacasting (to carry digital data), since nothing sent during the VBI is displayed on the screen; various test signals, time codes, closed captioning, teletext, CGMS-A copy-protection indicators, and other digital data can be sent during this time period[99].

Virtual Channels (page 30) Digital television broadcasts consist of building blocks. Just as Lego blocks can be used to make different objects, digital television broadcasts can contain building blocks with several video, audio and other components that can be assembled to make one or more virtual TV channels.

Voice-over (page 8) is a production technique where a voice which is not part of the narrative is used in a radio, television, film, theatre, or other presentation. The voice-over may be spoken by someone who appears elsewhere in the production or by a specialist voice actor or commentator[100].

Voice-over, Partial – see *lectoring* (page 18)

W3C – see *World Wide Web Consortium* (page 5)

WBU – see *World Blind Union* (page 32) or *World Broadcasting Unions*

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[97] http://unstats.un.org/unsd/methods/citygroup/washington.htm

[98] Based on http://en.wikipedia.org/wiki/Universal_design

[99] Based on http://en.wikipedia.org/wiki/Vertical_blanking_interval

[100] http://en.wikipedia.org/wiki/Diegetic#Film_sound_and_music

Web Hypertext Application Technology Working Group, WHATWG (page 5) is a community of people interested in evolving HTML and related technologies. The WHATWG was founded by individuals from Apple, the Mozilla Foundation and Opera Software in 2004[101].

Wireless connection – TV to hearing aid (page 27) is a mechanism for linking the audio output of a television or other device to the hearing aid of someone with impaired hearing. It allows the user to hear the sound track directly rather than using the built-in microphone of the hearing aid. The original induction loop approach is giving way to digital solutions including near-field communication that are not so battery-intensive.

Work, Derivative (page 35) according to US Copyright law, derivative work is a work based upon one or more pre-existing works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which a work may be recast, transformed, or adapted[102]. In the case of captions and audio description, both of these services can be regarded as derivative works. The question about their use or re-use by third parties or in new contexts is whether the original agreement contemplates such exchange and use of access services.

World Blind Union (page 32). The World Blind Union (WBU) is an internationally recognized umbrella organization, representing about 285 million blind and partially sighted persons in 190 member countries. Speaking with a universal voice on a global level, WBU brings together major national and international organizations of blind persons and those providing services to them[103].

World Broadcasting Unions is the coordinating body for broadcasting unions who represent broadcaster networks across the globe. It was established in 1992 as a coordinating body at the international broadcasting level. Since then, the WBU has provided global solutions on key issues for its member unions. The broadcasting unions who belong to the WBU are the Asia-Pacific Broadcasting Union (ABU), the Arab States Broadcasting Union (ASBU), the African Union of Broadcasting (AUB), the Caribbean Broadcasting Union (CBU), the European Broadcasting Union (EBU), the International Association of Broadcasting (IAB/AIR), the North American Broadcasters Association (NABA) and the Organización de Telecomunicaciones Iberoamericanas (OTI)[104].

World Wide Web Consortium, W3C (page 5) is an international community that develops standards to ensure the long-term growth of the Web.

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[101] http://en.wikipedia.org/wiki/WHATWG

[102] Based on http://en.wikipedia.org/wiki/Derivative_work

[103] www.worldblindunion.org/en/about-wbu/Pages/default.aspx

[104] www.nabanet.com/wbuarea/about/about.asp