Accessible Broadcasting in India

A report based on ITU's "Making Television Accessible Report" prepared by the Centre for Internet and Society

Srividya Vaidyanathan

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Executive Summary

Television and Radio are mediums to inform, educate and entertain. Sitting down at the end of the day and turning on the TV or radio is a rather involuntary task for many. They have become part of the fabric of almost every Indian's life. However, there are a significant number of people in India who are unable to enjoy TV or Radio.

Television and Radio technologies have advanced at a rapid pace but accessibility of TV and Radio in India has been a persistent problem. Being mediums that are consumed through sight and sound, those with impairments in these two areas have found TV viewing and radio listening difficult or impossible. Not much progress has been made in the area of Accessible Broadcasting since the introduction of the TV "Weekly News Bulletin for the hearing impaired" in 1987.

The purpose of this report is to provide information to Indian policymakers about various TV and Radio Accessibility options available, best practices followed internationally and suggest recommendations for a brighter future in the area of Accessible Broadcasting.

This report is based on ITU's "Making Television Accessible Report" (November 2011) by Peter Olaf Looms, Chairman ITU-T Focus Group on Audiovisual Media Accessibility. It has been adapted especially to cater to the needs and interests of India. We'd like to thank ITU for the use of this report and Peter Olaf Looms for his inputs to this abridged version.

The full report is available at http://www.itu.int/ITU-D/sis/PwDs/Documents/ITU-G3ict%20Making_TV_Accessible_Report_November_2011.pdf

This abridged report specifically covers:

•TV Accessibility Options
• Costs Involved & Bandwidth Requirements
• Best Practices followed internationally
• Radio Accessibility Options
• Recommendations.

Introduction

India has the highest number of people with visual and hearing impairments. One out of every three blind people in the world lives in India - an estimated **15 million blind**[1] people live in India. There are **5-15 million deaf** people in India. There are approximately 3 million deaf children in India. About 25,000 children are born deaf every year. By 2050, India will be home to one out of every six of the world's older persons, and only China will have a larger number of elderly people, according to estimates released by the United Nations Population Fund[2]. The elderly population faces problems of reduced dexterity, hand strength, cognition and vision. The needs of this significant population have to be included to achieve growth in the truest sense.

TV and Radio Accessibility benefit a very large section of the population such as people with disabilities, senior citizens, illiterate people and linguistic minorities. Given that most information is communicated over the TV and Radio and this will only increase in the future, ensuring accessible broadcasting becomes very important. Without TV and Radio accessibility, persons with disabilities are in danger of being excluded from public announcements especially during emergencies, essential services, and social information. Hence, there is a pressing need to implement accessible broadcasting.

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[1] From WHO Factsheet available at http://www.who.int/mediacentre/factsheets/fs282/en/
[2] From http://mospi.nic.in/mospi_new/upload/elderly_in_india.pdf and http://www.thehindu.com/news/national/concerns-over-an-aging-india/article3972671.ece

Accessible broadcasting calls for Universal Design. Universal Design means the design of products, environments, programs and services that is useable by all people, to the greatest extent possible, without the need for adaptation or specialized changes.

TV Accessibility Options:

There are two main options for promoting television accessibility in India:

(1) Making sure that the television picture and sound are intelligible

(2) Offering access services (subtitles, visual signing and Audio Description and spoken subtitles) with television programmes

(1) Making sure that the television picture and sound are intelligible

Much can be achieved through short awareness-building sessions and written guidelines for all involved in producing and transmitting TV programmes. A simple measure of intelligibility is to monitor picture and sound quality on a 'middle-of-the- road' television receiver and applying standard checklists from bodies such as Tiresias.org.

Significant improvements can be made if we:

- Optimize Audio
- Optimize Video
- Check screen layout for enhanced accessibility
- Check closed captioning to fit with other on-screen captions
- Ensure the availability and accessibility of program guides.
- Establish and use quality metrics and
- Involve and seek regular feedback from viewers with disabilities.

(2) Offering access with television programmes

There are several options here:

Captions/Subtitles

Captions/Subtitles are words displayed on a television screen that explains the audio of a program to let viewers who are deaf or hard of hearing understand the dialogue and action of a program at the same time.

There are two types of captioning: Closed and Open.

Closed captioning is enabled on a television set by a decoder that's built in the television. Closed captioning can be turned on or off by the viewer. Open captioning works differently. Open captions show the same text as closed captions, but the captions are always on the screen and cannot be turned off.

Open Caption Advantages
One advantage of open captioning is that the captions automatically appear on a television. With closed captioning, the viewer has the responsibility to figure out how to turn on the captions. For video content, some viewers prefer to have their video products contain open captioning. Also, open captioning has comprehensive design benefits for people whose first language is not the official language, or for people in noisy surroundings.

Closed Caption Advantages
In the past, open captioning was used to show dialogue for presidential addresses, news bulletins and other TV

programming developed by or for people who are deaf or hard of hearing. But since the availability of closed captioning, open captions are not used nearly as much. One disadvantage of open captioning is that it cannot be turned off (a potential issue in a country such as India with a rich linguistic heritage in which two or more official languages are typically spoken in the area covered by a given TV transmitter).

Tele-text is the generic name for inclusion of text information (news, weather, Closed Captions etc) within a broadcast television signal. The text data is encoded onto a part of the television signal not normally shown by regular television sets called the Vertical Blanking Interval or VBI. Special decoders or TV sets with integrated tele-text decoders are able to receive and display the data on the TV screen.

DVB Text is the other delivery mechanism for subtitles in the digital television system selected by India. The subtitles are pre-prepared and transmitted with the television programme. The broadcaster has full control over the font, size, contrast and positioning of DVB Text (which is not the case for Tele-text as this is determined by the consumer electronics manufacturer and their choice of character generator).

Sign language

Sign language translation/interpretation is useful for people who are deaf and sign is their primary language. Sign language comprises the use of manual gestures, facial expression and body language to convey meaning. For example, the video at http://www.youtube.com/watch?v=eskZVAg7v0o uses the Sign Language to explain Medicare basics along with closed captions.

Audio description

Audio description (AD) says what's in the visuals, so it's available to people who are blind. Audio description describes what is happening on screen. This could be changes of location, actions, and facial expressions, gestures and so on to give the context and set the scene. They are fitted between dialogues to avoid interrupting the flow of the programme. There are two methods of receiving audio description. The description can be carried on the same channel as the original programme. It can be broadcast on a second sound channel which contains the audio description. The latter system allows more flexibility as one person can listen on headphones whilst others watch the programme without audio description. Audio description can be received by subscribers to digital cable services by adjusting the settings on their set top boxes, and by viewers of digital terrestrial channels, by purchasing a suitable receiver. For example, on the movie "The Lady Vanishes" at http://www.youtube.com/watch?v=zCqN_cCLnnk the video is displayed with audio description and closed captions.

Spoken subtitles

For digital television where DVB Text or Tele-text is used to provide subtitles, India can apply Text-To-Speech technologies (developed nationally for the languages mentioned in the Constitution) to read aloud subtitles for news and documentary programmes by transmitting an optional audio channel using the same delivery mechanism as audio description. This inexpensive service has been introduced in Scandinavia and can be delivered to television sets complying with the DVB standard. It addresses not only the needs of persons who are blind or have serious visual impairments, but also of those who have cognitive impairments and individuals whose reading abilities are modest.

The following are the accessibility options available where impairments are the limiting concern.

Hearing impairments – Signing and Captioning.
Visual impairments – Audio Captioning (also known as audio subtitles or spoken subtitles). Speech synthesis built in as part of the TV set is used in developed countries such as UK.
Reduced mobility and dexterity in older adults– Simpler remotes.

The table below lists the options available and the target audience it caters to.

Access Options	Benefiting audience	User prerequisites
Captioning		
Same language captions	• Persons who are deaf • 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) • Children and the not-so-educated can co-relate speech with written words. Helps improve literacy.	Average reading skills or better
Foreign language captions	In addition to the audience 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 (description in same language as the program)	• Persons who are blind • Persons with serious visual impairments • Persons who wish to follow a program without watching the screen • Persons with cognitive impairments	Average hearing ability Understanding of the official language being used.
Audio subtitles (reading the [foreign] language subtitles 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.

Accessibility Options – Analog TV vs. Digital TV

In general terms, analog TV is less flexible than its digital equivalent. Accessible analog TV means open access services. That means open captioning that everyone has to see, or open visual signing which everyone has to watch. This can lead to adverse reactions from persons without impairments.

In digital TV, the options for "closed" access services (ones where the viewer can turn them on or off) are extensive. However, the key here is having the incentives, resources and expertise to offer access services with all programs.

Remote Control Devices and wireless connectivity to hearing aids

Remote control devices that do not adhere to Universal Design principles are not easy to use for people with impairments. In some countries such as the United Kingdom set-top boxes and remote controls that are designed to

be accessible are provided. Tiresias.org has produced an accessibility design checklist for television remote control devices (http://www.tiresias.org/research/guidelines/checklists/remote_checklist.htm) to make such devices as useful as possible for persons with disabilities.

For viewers with hearing impairments and who use a hearing aid, accessibility can be improved by a wireless connection between the television set and the viewer's hearing aid.

Access services delivered over non-television networks

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, and digital radio, Internet streaming to a mobile phone or a fixed line telephone service.

How are access services produced, delivered and used?

This section lists the summary of various access services from creation to delivery are listed in the table below. The relative costs involved and the bandwidth requirements for providing the access services are also included.

Creating	Exchange/Contribution	Delivery	Presentation on device
Subtitling			
Captioning[i]	Tape VBI, DVD File-based	Bit-map captioning Tele-text or VBI captioning	Digital receiver with bitmap captioning Digital receiver with Tele-text captioning
Audio/spoken captioning[ii]			
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 capable of mixing
Audio Description[iii]			
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[iv]			
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)

Program guides and other kinds of on-screen promotion

One of the main challenges with providing access services is to ensure that potential users are aware of its existence and have the necessary information to discover and use them. Program guides and other kinds of on-screen promotion are prerequisites for true television accessibility.

When reviewing television production and distribution that includes accessibility, the following areas need consideration:

1. Television programs,
2. Access services for television programs, and
3. Information about programs with access services (program guides, spots and trailers and also information on changes about the available channels, their names and channel IDs).

Costs Involved

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 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 discover and use 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 availability.

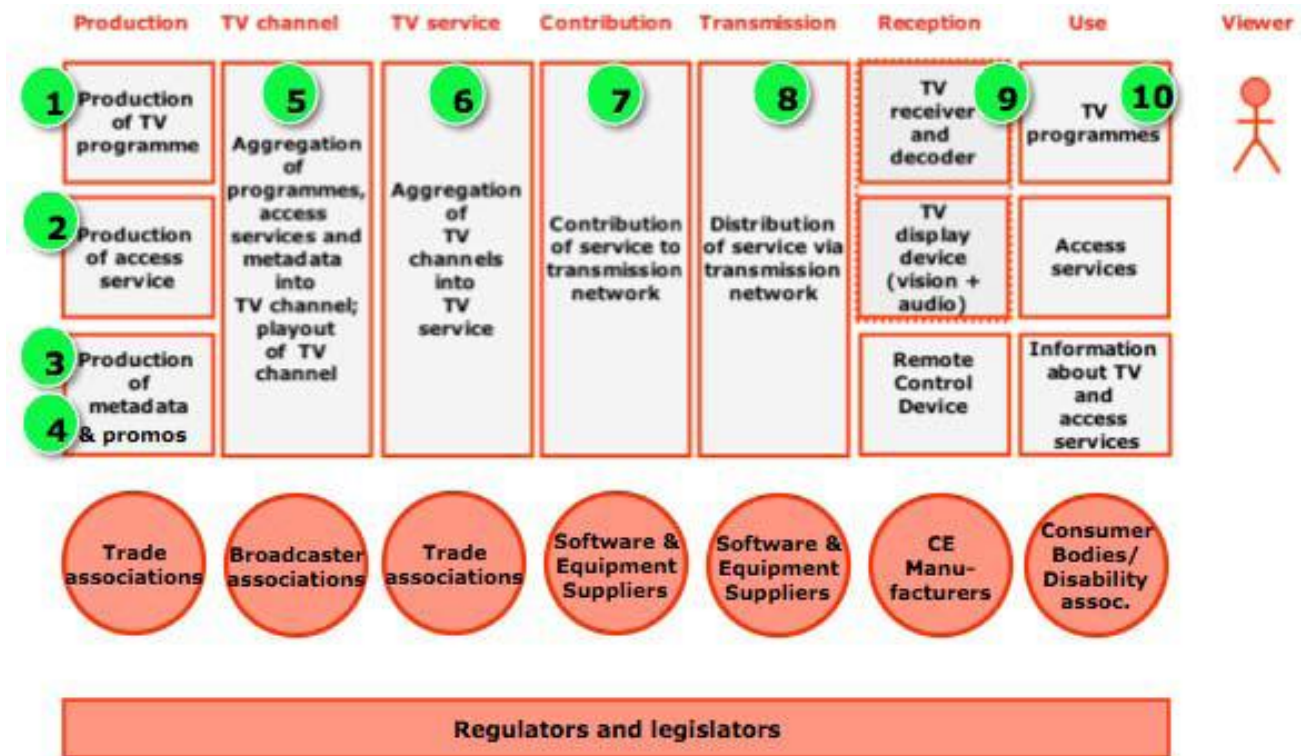The picture below shows the value chain in making TV Accessible

Figure 1 –The picture above shows the value chain in making TV Accessible.

The generalized value chain shown in the figure above 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.

The picture below shows gives an impression of the **relative production** costs. The figure shows, in relative terms, the price bands for various access services. Spoken captioning based on Text- To-Speech is relatively cheap. Audio description, lectoring(partial voice-overs) and dubbing are relatively expensive.
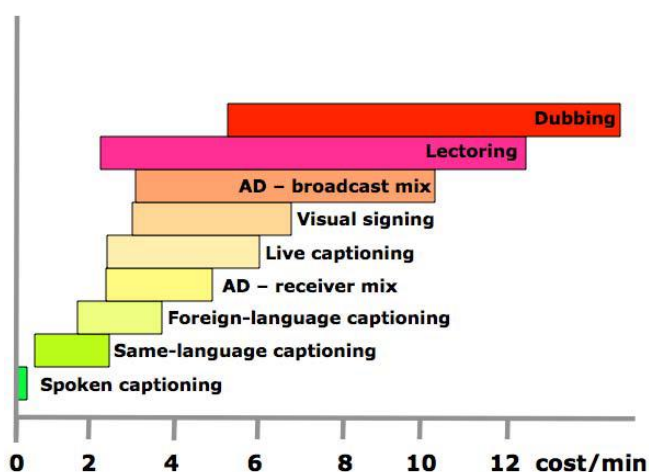

Figure 2 – The picture gives an impression of the relative production costs.. Spoken captioning based on Text- To-Speech is relatively cheap. Audio description, lectoring(partial voice-overs) and dubbing are relatively expensive.

In a recent consultation process of access services for non-domestic broadcasters operating from the UK but broadcasting television signals to teritories elsewhere in Europe, the television regulator OFCOM published figures for access service production and delivery. The use of metrics for 'market share' and 'affordability' could be considered when determining access service targets for India.

Bandwidth requirement for access services

The regulators responsible for frequency and bandwidth allocation may wish to consider the likely bandwidth requirements of access services. BBC R&D has conducted further studies of bandwidth requirements for DVB-T2 that could provide benchmarks for comparable decisions in India.

The table below lists 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)

Best Practices and Case Studies in TV Accessibility

The UK Communications Act of 2003 is generally regarded as a good example of a legal framework for television access services. It lays down a number of supply-side requirements for captioning, audio description, and signing on broadcast television and a roadmap for their implementation. The US 21st Century Communications and Video Accessibility Act signed into law on 8 October 2010 also warrants attention. Organizations such as Tiresias.org have produced easy-to-use checklists based on accessibility research to optimize the design process. One such checklist can be found at http://www.tiresias.org/research/guidelines/checklists/television_checklist.htm

Figure 3 - 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 are:
- 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/Consultation/Feedback* (how the achievement of objectives and goals can be traced and tracked).
- *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).
- *Risk management* (so that potential risks can be identified, addressed and mitigated).

Radio Accessibility Options

With the advent of FM and its huge success in India, radio has once again become a potent medium to connect with the Indian audience. Like its digital TV counterpart, next generation digital radio technology has inherent features that allow for providing accessibility features for people with sensory impairments.

The following aspects of digital radio technology play a key role in making radio accessible:

Captioned Radio – Captioned radio will mean access to programming, emergency alerting, life-saving disaster relief information and critical community information.

Captioning allows people with hearing impairments to have a higher degree of interaction with the broadcast by providing the ability to read captioned text such as song lyrics and talk show transcripts.

The main reason why captioned radio is gaining popularity is because technology is making it possible to include screens with digital radio. This is a boon for those with hearing impairments who can read the captions from the screen.

Accessible Design - Accessible design is the process of extending a standard design of a product to enable use or enjoyment by people with any form of sensory or motor impairment. Spoken feedback when a button is pushed, audio prompts that notify which direction the tuner is going, what channel the radio is on, telephone style keypads and remotes and voice assisted menus are some of the features that can make digital radio accessible.

Reading Services via Radio - Australia has successfully implemented radio reading services for the visually impaired and those with print disabilities by broadcasting printed content via radio since the 1970s.

Emergency Warning Notifications - Broadcasters play an important role in issuing emergency warning notifications. Digital radio provides additional capabilities which can alert a person with a sensory impairment to an emergency. NPR (National Public Radio) has been examining methods of embedding emergency messages into a HD Radio broadcast for use in the US and these include concepts such as Wake-up-on-alert (attract attention and display emergency captions to a person with a hearing-impairment), Bed shaking function (waking a sensory impaired person from sleep by shaking the bed connected to the digital radio receiver) and Strobe light alerting   (attract attention of the sensory impaired person).

Best Practices and Case Studies in Radio Accessibility

NPR (National Public Radio) in the US has an inclusive vision for future radio programs and has pioneered captioning for radio programs for twenty three million deaf and hard of hearing Americans. Their goal is to be able to distribute these services in real-time on both new digital radio receivers and web distribution. On election night November 2008, NPR broadcast the first nationwide live captioned radio on dedicated HD radio channels and npr.org. Groups of deaf and hard of hearing consumers gathered for the demos in each city and they were amazed at the ability to make radio accessible. The continued research by NPR on radio accessibility can be found at http://www.nprlabs.org/research-ar.html

Swedish Radio (public service radio) is testing an app https://itunes.apple.com/in/app/sveriges-radio-play/id300548244?alreadyRedirected=1&mt=8 for smartphones that allows listeners to adjust the voice level and the 'background' which may be music or something else. The solution involves using 3 audio channels, speech which is placed in the middle and the conventional music in stereo. Those who want to enhance the intelligibility can listen to the radio channel and lower or increase the background. The 3 channels are transmitted as a conventional stereo signal, but the encoding allows the 3 audio channels to be recreated and mixed in the listener's smart phone - and listened to in stereo.

Recommendations

Doordarshan's joint efforts with PlanetRead to provide SLS (Same Language Subtitles) on popular programs such as Rangoli, Chitrahaar and a few regional programs have been met with tremendous success. These efforts have not only improved accessibility for the hearing impaired but also increased literacy.

The Ministry of Information and Broadcasting (MIB) can play a crucial role in making broadcasting services accessible to persons with disabilities by-

- Formulating law/regulation/policy/code which will ensure accessibility of broadcasting services for persons with disabilities through a consultative process involving various stakeholders.
- Funding Research and Development of technologies that aid accessible broadcasting.
- Promoting public private partnerships to develop and deploy accessible broadcasting on a pilot basis.

- Identifying a basic set of TV and Radio programs that shall be made accessible for persons with disabilities over the coming year by Doordarshan and All India Radio (AIR).
- Identifying private TV broadcasters that offer accessible TV & Radio programs and encourage them through incentives such as awards, tax-breaks, concessions etc.
- Formulating India specific guidelines for Accessible Broadcasting.

To further improve upon the TV and Radio accessibility efforts in India, we recommend:

1) **Subtitling/Captioning and signing** (signer included as picture-in-picture) as a mandatory feature in the Doordarshan prime-time news every day.

2) Use of **public-private-partnership (PPP) model to include subtitles/captions** as part of as many programs as possible. Private Organizations that are desirous of improving literacy in India can be roped in to provide the subtitling/translation services.

3) Feasibility study of spoken subtitles in India using a broadcast mix and **Text-to-speech (TTS) developed** in India and **Pilot launch of Audio Description** in a half-hour dedicated segment every week (both swervives can be delivered using the same mechanism on digital television).

4**) Set cut off dates for complete switchover to digital** and switching off analog transmission. Digital Television is the way of future, providing interference free reception and remarkable picture & sound quality along with lesser spectrum requirements. Digital Television also has inherent capabilities that allow for providing accessibility features for the visually impaired.

5) Make provisions that mandate cable and DTH/satellite TV companies to **provide remote controls and set-top boxes that are accessible**. The remote controls should have standardisation and should be inter operable with any TV sets. The Set-top boxes too should be standardised and should be interoperable. This means that accessibility is a feature that is built in to the main product and not an add-on feature that has to be bought or modified. Set-top boxes that are currently available are not accessible by persons with visual impairments. On-screen text menus and program guides will need to announce themselves and have simple user interfaces for activation of closed captioning and audio description.

6) **Formulate and establish Standards and Guidelines for TV Accessibility in India (both in production and in television service delivery).** There are several international standards for Television which specifically address accessibility issues. OfCom an independent regulator/watchdog and competition authority for the UK Communications Industries has published its guidelines and standards at
http://stakeholders.ofcom.org.uk/broadcasting/guidance/other-guidance/tv_access_serv/guidelines/

7) **Formulate and establish Standards and Guidelines for Radio Accessibility in India – Suggestion:** With low-cost tablets such as *Akash* being received with success, AIR could consider streaming podcasts of talk shows directly to the android tablet via a mobile app. This could be the perfect testing ground for captioned radio where those with hearing impairments can read the captions from the screen and enjoy the radio programme. NPR (National Public Radio) has published its guidelines and standards at http://www.nprlabs.org/research-ar.html

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[i] **Captioning** - The starting point for captioning is a recording of the video on cassette, DVD or a digital file that also includes the time-codes 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 person preparing the captions usually has software for creating the captions. In some cases the software will analyze the video recording, identify the dialog dond 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, advanced captioning software will automatically produce a preliminary transcription of the dialog using speech to text analysis. In others, the person preparing the captions 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. The resulting captions will be formatted into self-contained sense blocks. 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.

ii **Audio (spoken) captions**- The starting point for audio (spoken) captions is a recording of the video on cassette, DVD or a digital file that also includes the time-codes of the production and the captions in text form. The software will analyze the video recording, and the captions are synthesized and spoken out. At the receiver end, the spoken captions are mixed with the existing audio track. 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 hearing ability.

iii **Audio Description** - 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.

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

iv **Signing** - The workflow for signing is relatively straightforward. In the case of mainstream programs 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.