A Practical Approach in Digitizing Analogue Audio Assets

Rezza Moieni., Leyla Roohi and Subariah Ibrahim

***Abstract*— Today, Broadcast companies are migrating from a Tape-based workflow to that File-Based .This not only affects growing number of channels and new ways of broadcasting, but also it changes the way we store and retrieve our precious contents. Such historical essences are transferred to digital only once and used numerous of times, so the method we use for transferring these materials is so important. Technical parameters of digitizing from Capturing and scanning to Storage media and formats are as important as non-technical concepts like metadata and Cataloguing. In this paper, a practical method of transferring Analog materials to digital formats and media is presented. Suitable formats, backup, metadata and quality control methods are introduced. A very best practice of digitizing project at IRIB huge archive will be introduced as a practical example.**

***Index Terms*— Digitization, Audio archive, metadata, Digital archives**

I. Introduction

The key to prosperity in today's world is access to digital content and skills to create new content. Audio/video archives are moving from basements to the heart of broadcast organizations whereby the majority of transactions have a relation with archives. Moving from Analog to Digital is almost a revolution in today's broadcast industry. The growing number of radio and television channels and the Internet and the need to walk fast toward efficient resources enforce Broadcast organizations to make essential changes in the workflow of storing and retrieving data from archives. Changes in format of long-term archival and the format of the files that will be used in production cycle is inevitable too. Resources available in the archives are antiquity and the need to protect their transcription is another issue that needs attention. Large amounts of archival resources and the time consuming and costly nature of such operations, makes the importance of accelerating these transformations as double.

Moreover, the original archives are also required to publish a copy of the original essence or a copy which can be in lower quality. Usually the long-term file format is a non-compressed format that needs a huge storage. This becomes more important when we talk about archives with 1000s of hours of media. The file format of the copy versions can be in other formats. This new file be kept in the same or different medium due to usage of online, near line or offline usage, There are also non-technical parameters that are important when we want to choose medium or format[8]. In the paper are discussed specifics approaches used to building and protect a digital archive with multimedia content.

II. The A/D process Algorithm

A. Review Stage

Digitization takes analog information (sound-image-text) into digital form. Therefore, file digitization and particularly audio archive digitization, presupposes the ideal capture and recording of the existing information. Here we describe an improved audio digitization algorithm. The main steps include treatment, capturing, editing, storage, backup, quality control and metadata. These steps are shown in figure 1.

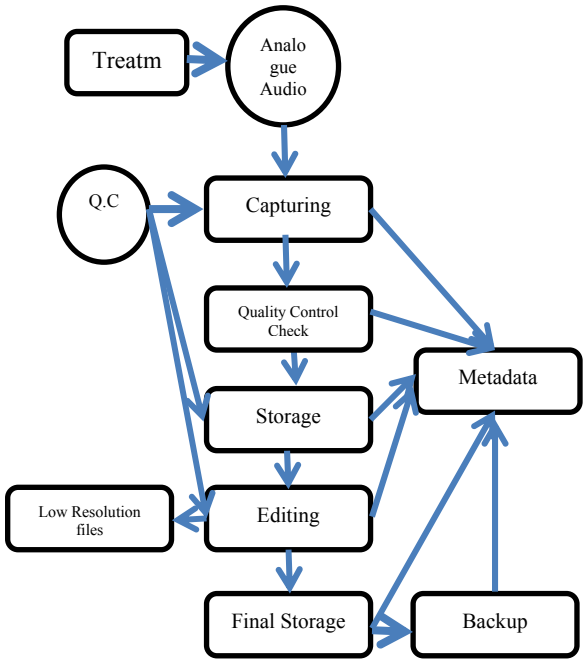

Figure 1: Framework of Proposed Model

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Yet, another point of confusion is the difference between the conversion of an audio archive in digital form (digitizing) and the re-establishment of an audio archive so as to sound better and without problems.(restoration – re-mastering). In the first case we are talking about digitization with any problems that the material for digitizing may have due to its age and in the second case we are talking about the use of tools and techniques from an experienced sound engineer who will resolve the problems and improve the sound. Another point is that each time a tape is played without the required preparatory work and care we lose part of the recorded information [7].

B. Treatment

When preparing to transfer sound from an analog audio tape, the engineer's first step is to examine the original tape box, if available, and any accompanying documentation. Knowledge of the age and make of the tape will help the engineer decide what to do to mitigate any problems that may arise. All tapes should be checked before entering the transforming workflow. They must be to clear up the dust to get the highest analogue quality many problems like pops and clicks will not be totally removed in digital in a lossless way. The cleaning device is left on the bar and by

a very thin blade, which is located in the path of additional strips of tape is removed and then cleaned by a cloth that can be installed on the system.

Almost in all audio archives, Analogue Audio resources include:

- Quarter-inch reel tapes including 600ft, 1200ft and 2400ft tapes
- 1 inch and 2 inch reel tapes
- Vinyl discs (in the speed of 33rpm,45 rpm ,66rpm and 78rpm)
- Cassette tapes

Each of the above media can be mono or stereo type. There are also 8 channel reel tapes that are usually used for music recordings.

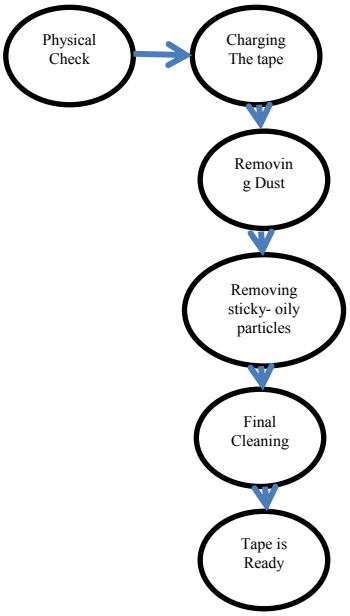

Figure 2: Treatment Process

C. Capturing

Capturing is the process of playing the analogue source and recording the signal in a computer by sampling the signal and quantizing the samples. Uniform time sampling systems are the backbone of current digital transformation. Here is the sub-steps of capturing process:

1-To Ensure the safety of the audio machine heads. Any defection must be removed by technicians.

2 - To clean up the entire tape device.

3 - Stand on the tape.

4 - Select the appropriate speed for the speed of sound recording. Note: There may be a tape speed of 1.87 or 3.75 or

7.5 or 15 inches per second is recorded.(For reel tapes) Once an original analog tape is in condition to play, the correct playback speed must be determined. The audio preservation engineer should have playback machines capable of playing at all known speeds with all known tape head configurations, plus a variable pitch control. When in doubt about a tape's speed, the engineer should start at 7-1/2 inches per second and listen. Expert listening is the first step in determining playback speed. Audio preservation engineers should be aware that recording speed can vary throughout the recording; this is particularly true of field recordings.

5 - Opening the software and select a standard file format for recording.

6 – First prepare software in record mode and then put the tracks in playback mode.

7- After Capturing there must be a splitting process as there are many tracks per tape in analogue medium that is kept in a separate file.

8 - Audio files must be monitored by ear to ensure the health of the process

9 - To transfer files stored on central storage.

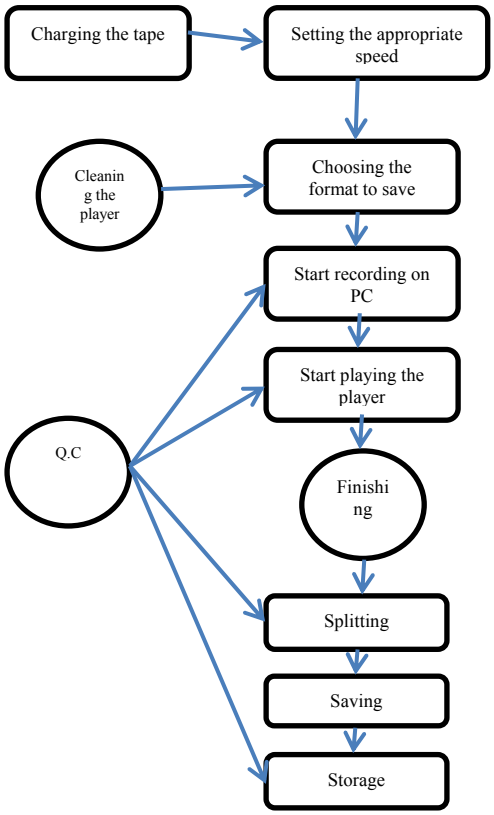

Figure 3: Capturing Process

D. *The sound card*

Card used must have a minimum signal to noise ratio better than 110 dB of SN ration. The inputs and outputs must be balanced and cover all the audio bandwidth. The EBU standards should not distort the signal to 18dBu.

Sound track: Player also be used in a way that the media with the same quality sound without adding noise to a player (level of noise added to the noise level of 70dB signal to noise ratio of analog devices is acceptable). The original copy must be complied with analog versus digital.

The software used for capturing should meet at least the following characteristics:

- Analog-modeled multiband compressor
- frequency space editing capability
- Lasso tool.
- Spectral Controls.
- Spectral Pan and Phase display
- Broadcast wave support
- Multi track support
- Ability to work with plug-Ins

E. *File Format*

To preserve the integrity of auditory information and lowering the cost of storage, we recommend uncompressed formats are the best choice as they are lossless. The main formats that are include lossless can be like PCM (*.wav (or Broadcast wave format)BWF -96KHz - 24bit – Stereo for Music files and 48KHz - 24bit – Stereo - BWF or windows pcm (*.wav) for audio files which do not contain music. Music contains higher harmonics and due to Nyquist theorem need higher sampling rate [5]. A music sample can have frequencies up to 25 KHz but human speech usually does not exceed more than 9 KHz.

F. *Editing*

During editing any unwanted signals are removed to audio and making it more pleasurable for human ear. Actually it is a process of modifying the audio file in order to be more similar to its original version. In this process human resource is a fundamental parameter as ear is still the best system that can decide about the quality.

In this step the main audio components including level, frequency and phase are manipulated to reach thebest quality of original archival file. Editing actions take the following form:

1-All resources must be normalized on-3db pp Normalize. It must be noted that RMS normalizing is not acceptable as it may change the signals.

1 - Removing any noise and Hiss within hearing range of the ear, if possible

2 - Removing pops & clicks as possible

3 - Using a variety of filters and equalizer for noise removal and rebuilding the removed frequencies.

4 - If possible transparency should be taken if harmonic sound in there.

5 - All resources must have a standard of silence, and a second in the first 2 to 3 seconds at the end and sound

Quality ha correction is possible.

6 - Refining resources in any part of the sound should not be removed. (Like the program introduction or the crowd noise)

7- If removing the noise lead to modify any part of original audio, it is recommended to keep the noise instead of producing a different audio from its original.

G. *Storage and backup*

Once the audio essence becomes available in digital format it has to be stored somehow. All captured and edited materials need to be stored in a safe and secured environment. There are at least 3 different versions of the essence that requires to the storage: the first is the captured and original file that is exactly what was on the analogue medium containing even noises and unwanted signals. This version is without any edit. The second one is the edited version that contains all editing steps. This version is the

best for using in production workflow and studios. The third version is a compressed format that is for browsing and searching purposes. It is a low quality file that is not for production. The policies of networking storage define how to manage these files. It can be on online, near line or offline storage environments.

H. Metadata

Metadata along with essence becomes the formulated content. The amount of metadata depends on standards used and provider requirements. The presence of metadata with correctly placed points of connection ensures speed and accuracy of the application, and user interaction. Currently the problem is the lack of standards in exchanging of metadata between systems.

I. Quality Control

Quality control, unique the quality of all factors involved in production It implies a complete overview and re-evaluation of the specification of a product.

III. Conclusion

Due to the need of managing the growth of content available today in archive of digital platforms, digitization is a necessity. This paper explains the workflow of digitization used within

IV. Acknowledgement

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- Audio Format in AV archives
- Video Format in AV archives
- Metadata standards
- Environmental standards for archives
- Centralizing Archives
- Digital Archives role in digital workflow of broadcasters
- Digital Archives role in new broadcast platforms(IPTV,MOBILE TV,WEBCASTING,…)
- Security in Archives
- UGC(User Generated Contents)
- BM(Business Model for IRIB Archives)
- Human resource model for IRIB Archives
- Tape Libraries (Models and specifications)
- OCR (text,Video) 2008
- Speech to text (2009)
- Audio retrieval (2009)