

Audio Digitization at the University of Michigan

The digital product

While we are not doing any onsite audio digitization (with some exception), we have adopted some basic specifications that we are asking vendors to follow when digitizing our materials. These include:

Capture: We require that recordings are digitized at a 96 kHz sample rate, with a 24-bit sampling size. The only exception is for digital originals, such as DAT or CD, which should be captured at the same rate in which they were originally recorded (e.g. 44.1 kHz/16-bit for CDs). For more on capture, see IASA-TC04 *Guidelines on the Production and Preservation of Digital Audio Objects* (not available freely online, but can be ordered at <http://www.iasa-web.org>)

File Format: The target file format for digital audio files is Broadcast Wave Format (BWF). This file format is a European Broadcasting Union (EBU) specification and is widely used for digital audio preservation.

File Types: We are asking for two audio files: a preservation master, which is a raw capture of unaltered playback of the sound recording with no tweaking or processing, and a production master, which is derived from the preservation master and includes normalization and minimal sound cleanup.

- *Preservation Master Files*
 - BWF
 - 96 kHz sampling rate
 - 24-bit sampling size
 - Pulse Code Modulated (PCM)
 - No dynamic range adjustment
 - No normalizing
 - No signal processing/noise removal
 - No file compression
 - Include silences that occur within the audio content, unless otherwise indicated
 - Remove all silence that occurs before and after the audio content, except for 2-3 seconds lead-in silence for each track.
- *Production Master Files*
 - BWF
 - 96 kHz sampling rate
 - 24-bit sampling size
 - Pulse Code Modulated (PCM)
 - Normalized
 - No dynamic range adjustment
 - No file compression
 - Include silences that occur within the audio content, unless otherwise indicated
 - Preserve the 2-3 seconds lead-in silence for each track.

Post-Processing: We are asking for no post-processing on preservation master files. The post-processing we are currently asking vendors for is to normalize the signal of all production master files to 0dbFS, without adjusting the signal to noise ratio (or dynamic range). In addition to this, in cases where there is noise (such as pops, clicks and hiss) that obscures the audio content, we are asking vendors to filter or process the signal so as to reasonably reduce or eliminate this noise.

Quality Control: We are asking vendors to diligently perform quality control on the digital product, but we will also perform our own quality control upon receipt of the digital audio files. There are two parts to our quality control: one is qualitative and involves listening to the actual files (or a sampling thereof), while the second is quantitative and involves the automated (hopefully) validation of data (running through JHOVE, checking metadata fields for required elements). We are hoping to develop a validation tool that can perform this quantitative quality control and validate each package before ingest.

Metadata

BWF Files: Because we are using BWF files, we have the ability to embed basic metadata into the BWF extension (bext) header. We are using the following document to guide what metadata is getting put in this header and how that metadata is formatted: http://www.digitizationguidelines.gov/audio-visual/documents/Embed_Guideline_090915r.pdf.

Technical Metadata: Technical metadata is being collected according to unpublished metadata standards that are still in development. However, the Sound Directions website is a good resource (with sample METS documents) for seeing the types of metadata that are generally being collected. We have used the Sound Directions document quite a bit in coming up with our specifications. To look at the publication, as well as the accompanying information, go here: <http://www.dlib.indiana.edu/projects/sounddirections/papersPresent/index.shtml>

The Repository

Submission Information Packages: The digital audio packages (which include the digitized audio files, a metadata document in xml, a checksum file, and a txt file of production notes) are set up for potential ingest into the HathiTrust repository. We modeled the ingest process for audio on what has been done with books (such as file naming conventions) in order to simplify the process and not start from scratch.

At present, two pilot projects have been ingested into HT. All other digital audio packages are being stored in UM's IT Value Storage, a centralized mass storage option provided by ITS which offers data mirroring and replication. The ingest script developed for HT is being used to validate audio added to Value Storage as well.

Access and Delivery: Currently, all audio is being put into "dark" storage. No delivery mechanism is in place yet for streaming audio files and copyright must be assessed. Audio CDs are available for in-library-use only at the Special Collections Archives.

Quality Control by vendors:

The University requires that the vendor perform quality control evaluations during and after the digitization process. The University will leave the specific methods of quality control up to the vendor, but does expect the methods used to yield digital audio files that are in line with the requirements and specifications of this document. These quality control methods can include, but are not limited to, those listed below:

- Visually inspect the waveform representation of the audio, looking for anything unusual, such as very large peaks or no signal
- Listen to the beginning and end of each digital audio file in order to verify content
- Check random places in the middle in order to verify the completeness of the content, including a 3 minute continuous stretch.
- Listen to each file (or a significant number of files), marking areas of interest (possibly tracks) and problems.
- Note problems such as extremely low levels, distortion, or other unusual events and checks documentation (audio digitization notes text file) to ensure that these were noted
- Verify that all necessary and desired files do exist, and that collection documentation exists to be given to the University (or is at least in a file to be sent to the University)
- Verify that all files will open
- Verify the checksum at various points during the process
- Check metadata in BWF <bext> chunk
- Double checks the filename matches the required filename as described elsewhere in this document
- Match data to what is heard, if possible
- Check that all technical metadata has been entered for the source audio object, digital files and processing history
- Match number of "faces" of audio object to number of files produced
- Identify elements common to all files, as well as where there will be variations (signal chain, preamp gain, etc)
- Check signal chain focusing on the data elements that are likely to vary (as reported above), looking for patterns that indicate obvious mistakes.¹

Quality Control by the University:

- Open audio files to ensure that they open and play in the appropriate format
- Spot check beginning, middle and end of file, to ensure that the complete content has been captured (this spot check can also serve to ensure that files have no additional noise or distortion) using WaveLab6
- Volume for production masters will be set to a comfortable listening levels
- Analyze files (*or a percentage of files*) using error tab on WaveLab's global analysis tool.
- Visually inspect waveform of CDs (*or a percentage of files*) to ensure proper post-processing using WaveLab6

¹ The preceding list has been paraphrased from *Sound Directions*, pp. 117-120.