Columbia University Libraries

Preserving Historic Audio Content: Developing Infrastructures and Practices for Digital Conversion

Final Report to the Andrew W. Mellon Foundation

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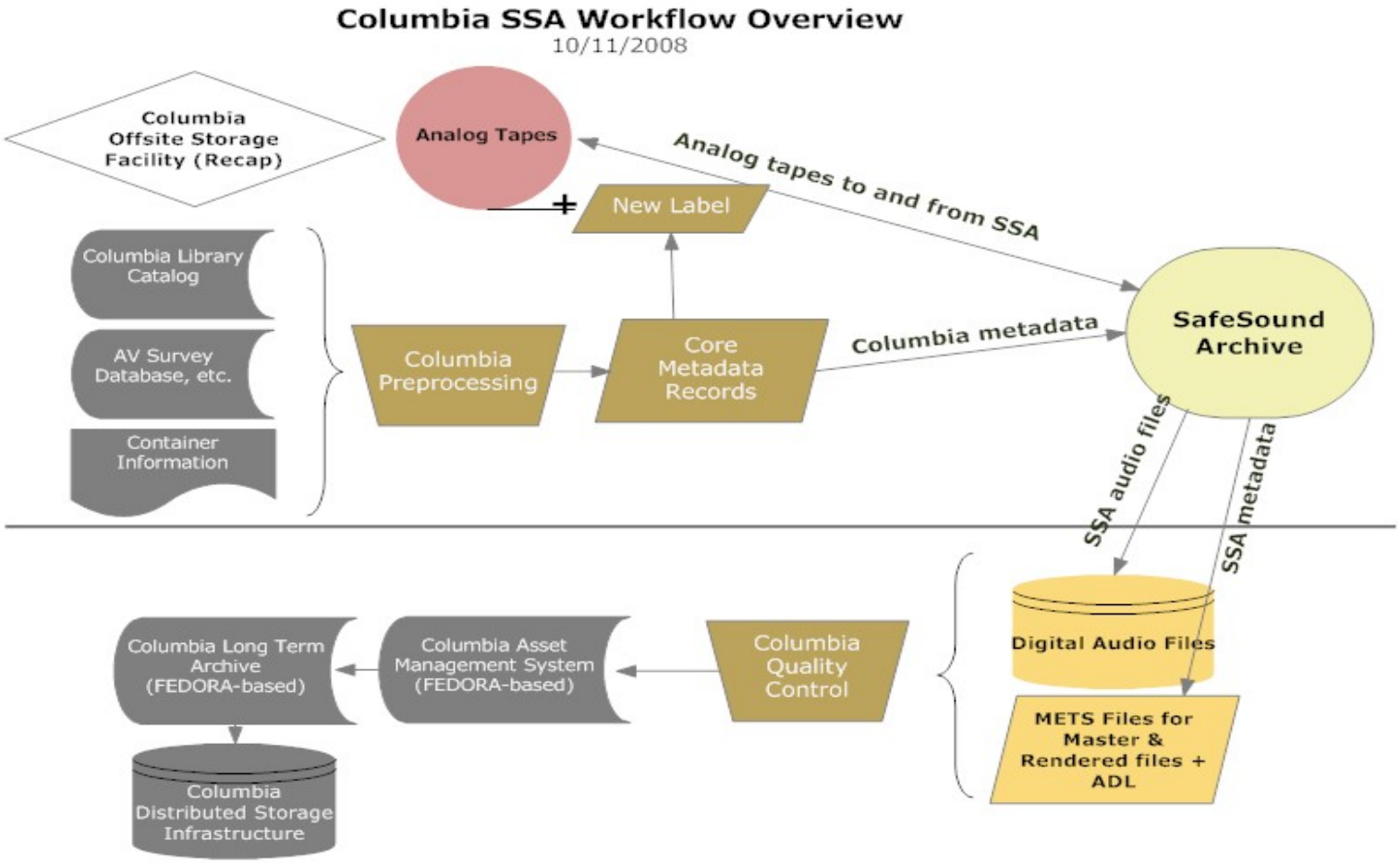
Appendix 1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10/11/2008
Columbia Offsite Storage Facility (Recap)
Analog Tapes
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New Label
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Container Information
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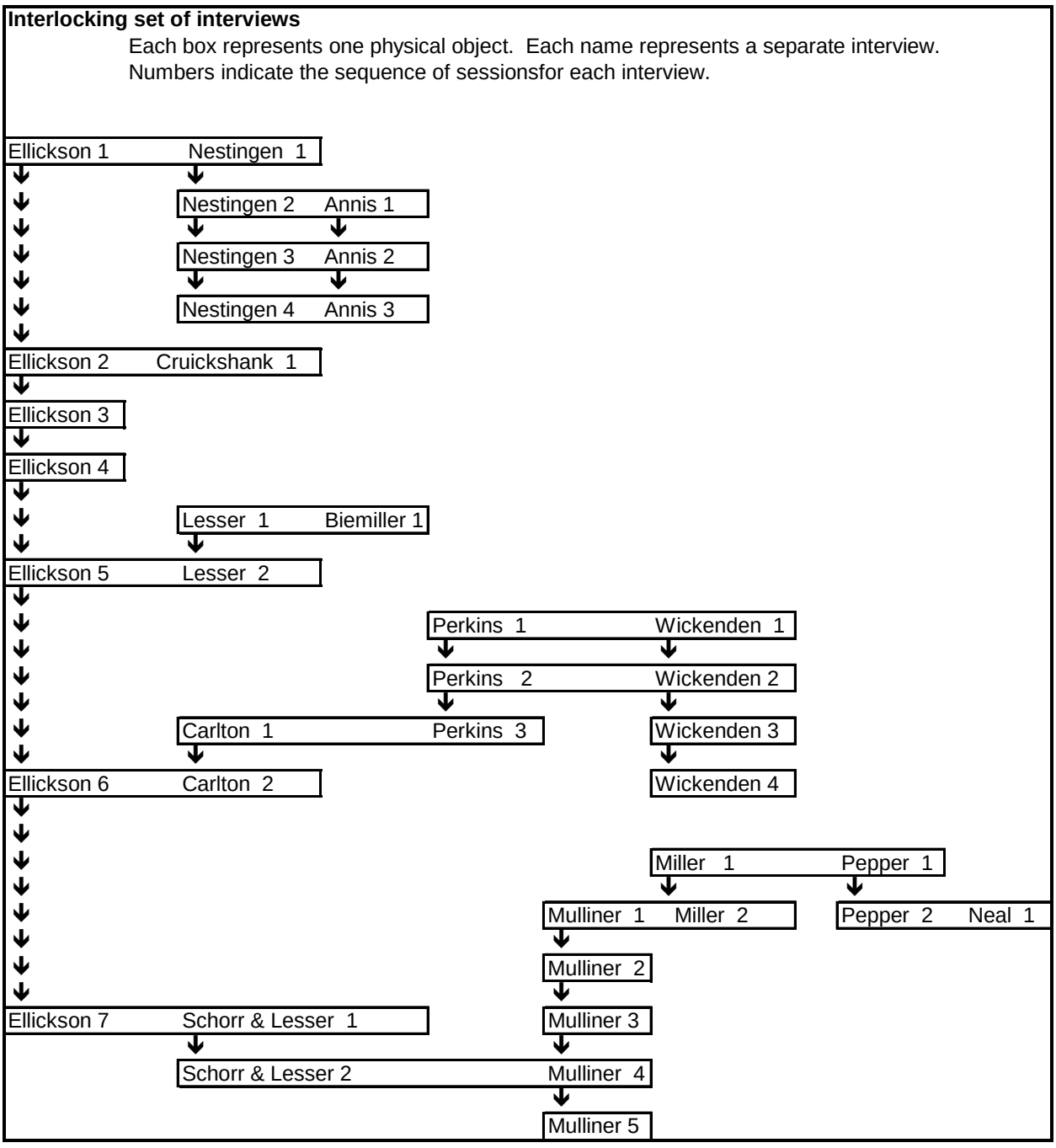
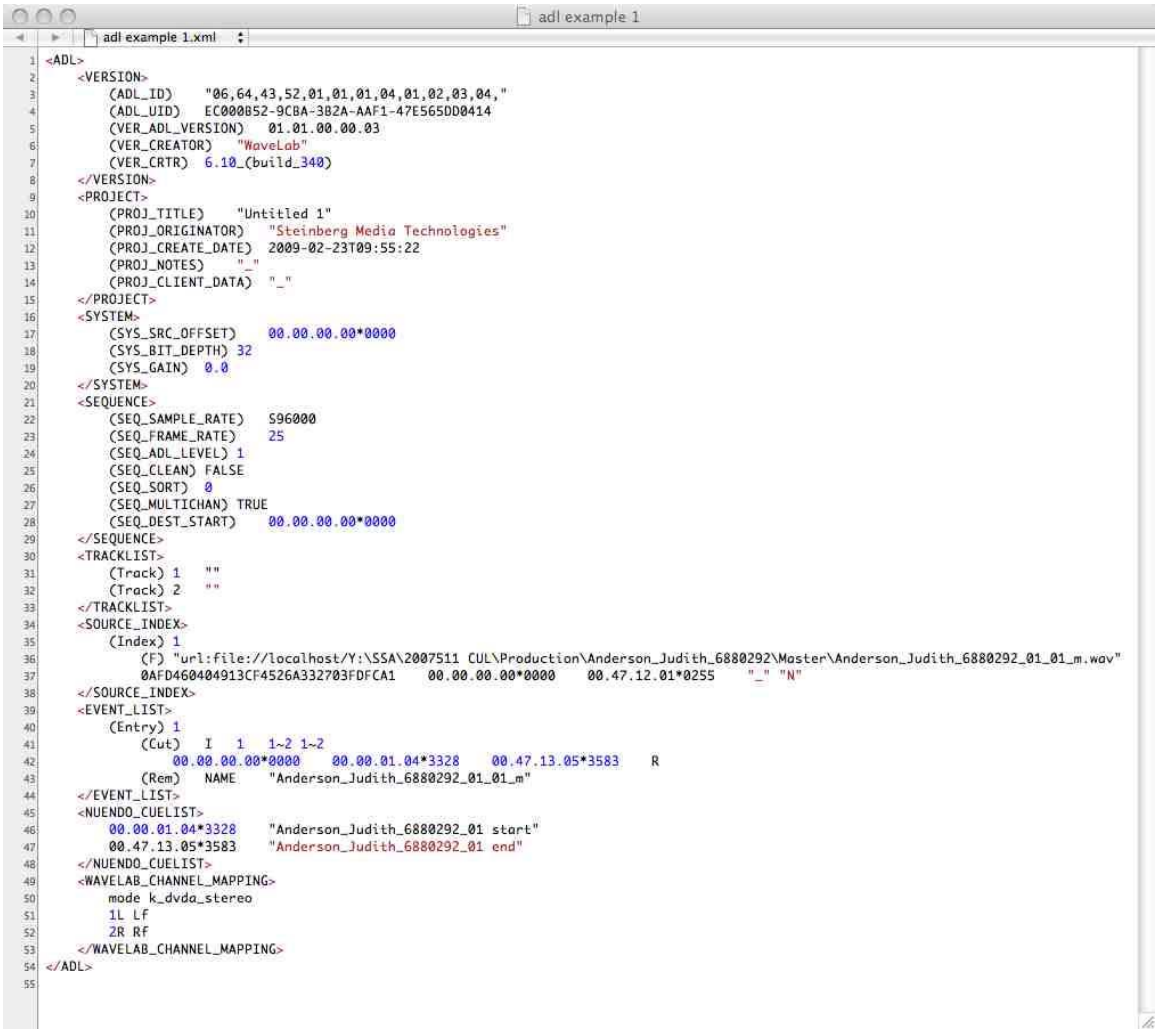
Appendix 2
Diagram of Interlocking Interviews



Appendix 3
ADL Development

The CUL-SSA team opted to use one comprehensive ADL for the entire interview, as opposed to one ADL per Session of an interview. This ADL would be created using the audio software program WaveLab[1], as discussed in the digitization section. This was the first time SSA had used WaveLab to produce an ADL and as such, the outputted ADL was subject to intense scrutiny to ensure that it both met the AES31-3 standard and that it was interoperable with other audio editing systems. This testing was done by comparing the text output with the AES31-3 Standard Document and by attempting to import the ADL into other editing systems. The results of that testing conclusively pointed to failure on both counts. Some problems were simply bugs within the software, others were a result of proprietary information that WaveLab outputted within each ADL.

Figure 1 is an example of the text version of an ADL outputted by WaveLab 6.


adl example 1

adl example 1.xml

```
<ADL>
    <VERSION>
        (ADL_ID)    "06,64,43,52,01,01,01,04,01,02,03,04,"
        (ADL_UID)   EC000B52-9CBA-382A-AAF1-47E565DD0414
        (VER_ADL_VERSION)   01.01.00.00.03
        (VER_CREATOR)   "WaveLab"
        (VER_CRTR)  6.10_(build_340)
    </VERSION>
    <PROJECT>
        (PROJ_TITLE)    "Untitled 1"
        (PROJ_ORIGINATOR)   "Steinberg Media Technologies"
        (PROJ_CREATE_DATE)  2009-02-23T09:55:22
        (PROJ_NOTES)    "_"
        (PROJ_CLIENT_DATA)  "_"
    </PROJECT>
    <SYSTEM>
        (SYS_SRC_OFFSET)    00.00.00.00*0000
        (SYS_BIT_DEPTH) 32
        (SYS_GAIN)  0.0
    </SYSTEM>
    <SEQUENCE>
        (SEQ_SAMPLE_RATE)   S96000
        (SEQ_FRAME_RATE)    25
        (SEQ_ADL_LEVEL) 1
        (SEQ_CLEAN) FALSE
        (SEQ_SORT)  0
        (SEQ_MULTICHAN) TRUE
        (SEQ_DEST_START)    00.00.00.00*0000
    </SEQUENCE>
    <TRACKLIST>
        (Track) 1   ""
        (Track) 2   ""
    </TRACKLIST>
    <SOURCE_INDEX>
        (Index) 1
            (F) "url:file://localhost/Y:\SSA\2007511 CUL\Production\Anderson_Judith_6880292\Master\Anderson_Judith_6880292_01_01_m.wav"
            0AFD460404913CF4526A332703FDFCA1    00.00.00.00*0000    00.47.12.01*0255    "_" "N"
    </SOURCE_INDEX>
    <EVENT_LIST>
        (Entry) 1
            (Cut)   I   1   1~2 1~2
                00.00.00.00*0000    00.00.01.04*3328    00.47.13.05*3583    R
            (Rem)   NAME    "Anderson_Judith_6880292_01_01_m"
    </EVENT_LIST>
    <NUENDO_CUELIST>
        00.00.01.04*3328    "Anderson_Judith_6880292_01 start"
        00.47.13.05*3583    "Anderson_Judith_6880292_01 end"
    </NUENDO_CUELIST>
    <WAVELAB_CHANNEL_MAPPING>
        mode k_dvda_stereo
        1L Lf
        2R Rf
    </WAVELAB_CHANNEL_MAPPING>
</ADL>
```

Figure 1: WaveLab ADL Example

[1] http://www.steinberg.net/en/products/wavelab/audioediting_wavelab6_details.html

The first discrepancy with AES31-3 that SSA found can be seen in line 10 of Figure 1. In section 6.3.1.2 of AES31-3 (the <PROJECT> header section), it states that the "header section shall contain information relating to the specific project." [2] SSA was unable to discover how to change the (PROJ_TITLE) to anything but "Untitled 1" within the WaveLab Software.

The second variance from the specification can be seen within the Source Index (line 37 of Figure 1). According to section 6.3.1.6.3 (URI source type) the unique identifier (UID) is defined as "the OriginatorReference field in the BWF file." [3] If WaveLab actually derived this UID from the BWF file, you would see CLIO:6880292 (the OriginatorReference for this BWF). Instead, WaveLab generated a random UID.

Another problem found within the Source Index was in WaveLab's generation of the Source File Path. In section 6.3.1.6.2 of the specification, AES31-3 calls for the File_Path string to be separated by forward slashes. WaveLab's file path contained backward slashes (seen in line 36 above). [4]

Perhaps the most disturbing fault with the WaveLab ADL was found in their proprietary use of Markers. CUL and SSA had decided to use the ADL <MARK_LIST> to identify the beginning and ending of sessions within an interview. The description of Markers can be found in section 7.5 of the standard. Markers grant the ability to "communicate specific times on specific tracks" thus providing the needed structure map for recreation of the editing process.[5] The expectation was to see an output like:
<MARKER_LIST>
(MK) 1 00.00.01.04|00.47.13.05 _ "Anderson_Judith_6880292_01"
</MARKER_LIST>[6]
Instead what WaveLab outputted was a series of proprietary markers known as the <NUENDO_CUELIST> (seen in line 45 in Figure 1). [7]

In addition to the Nuendo Cuelist; WaveLab also created another proprietary section called <WAVELAB_CHANNEL_MAPPING> (line 49 in Figure 1), which WaveLab requires to route the audio channels in its montage. The latest AES31-3 contains a Pan section (section 7.3) [8] that would address this issue but WaveLab 6 does not support this feature.

These two proprietary issues and the other variances with the AES31-3 Standard limited WaveLab's ADL interoperability with other editing systems.[9] SSA's attempts to open the WaveLab created ADL with other editing systems like the SADiE program were unsuccessful.[10]

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[2] Audio Engineering Society, *AES31-3-2008*, 18.
[3] Audio Engineering Society, *AES31-3-2008*, 22.
[4] Audio Engineering Society, *AES31-3-2008*, 20.
[5] Audio Engineering Society, *AES31-3-2008*, 40.
[6] Where "1" reference the source file, "00.00.1.04" indicates the start location on the time line of the source file and "00.47.13.05" indicates the stop location on the time line of the source file.
[7] The ability to store markers was not defined in AES31-3 until 2008.
[8] Audio Engineering Society, *AES31-3-2008, 36.*
[9] Wasn't the point of the AES31-3 to be a "simple format for audio exchange"? If you can not open an ADL created on one editing system on a different editing system, that is certainly not exchangeable! Nor interoperable. And I would probably extend that thought to say that it is also not sustainable!
[10] SSA was able to open some ADLs within the SADiE system after they manipulated the text documents to better meet the AES31-3 standard.

In order to create an ADL that both met the standard and provided maximum interoperability, SSA approached the problem in two ways. The first involved creating a custom script to alter the ADL text to meet the standard. The resulting changes can be seen in Figure 2.

The script was designed to change the (PROJ_TITLE) to the interview's ID (see line 11 in Figure 2), change the forward slashes in the Source ID File to backward slashes (line 37) and to replace the WaveLab created Source UID to match the OriginatorReference in the interview's files (line 38).

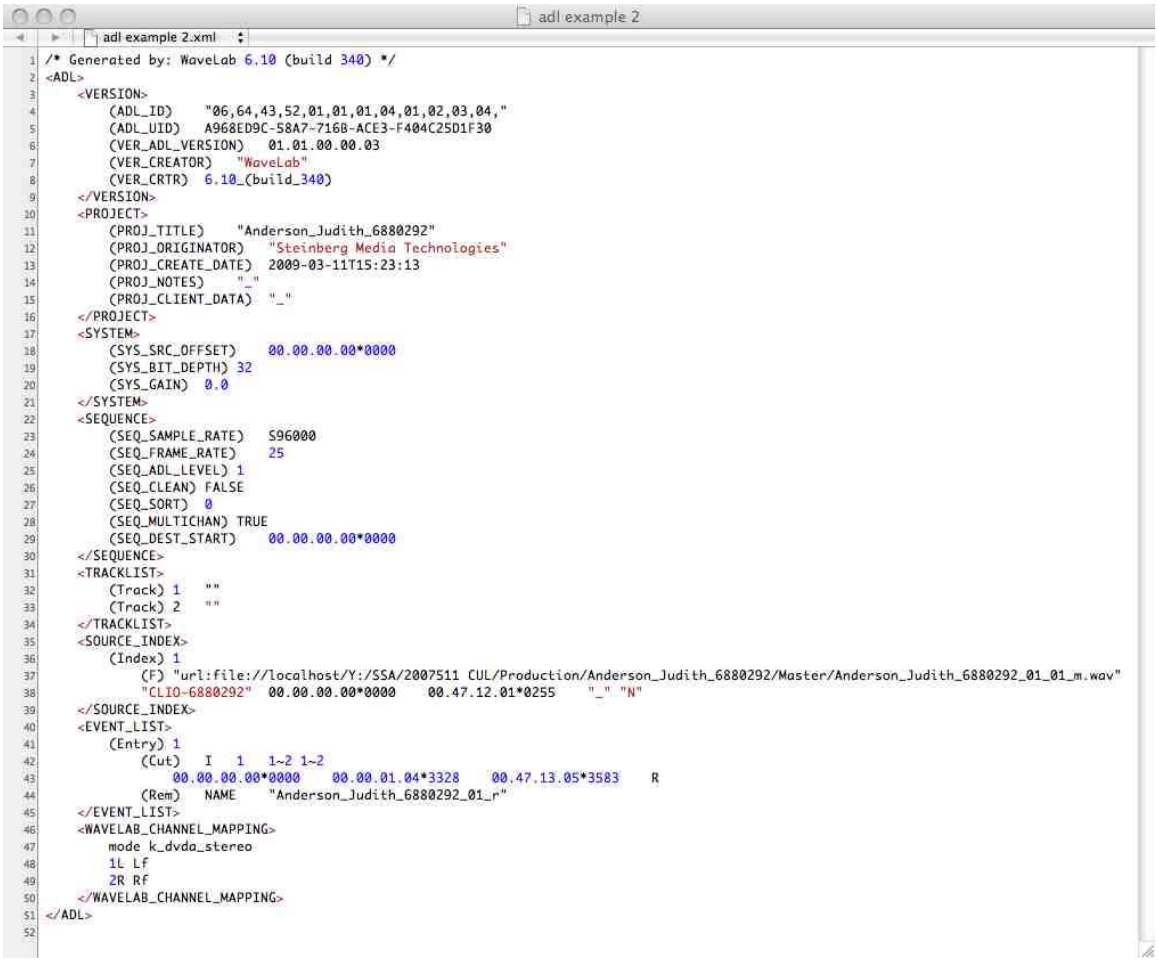


Figure 2: SSA Edited ADL example

The second decision made was to forego the use of markers altogether and to designate session information using only the EVENT_LIST section of the ADL. The clips in the WaveLab montage were split at session start/stop times and named as a reference to the corresponding sessions (see lines 40-45 in Figure 2). This removed the proprietary NUENDO_CUELIST from the ADL. A resulting issue from that decision was that an event could only take place on one face.[11] Therefore if a session spanned one or more faces, it would need to be expressed in an

[11] A "face" equals one side of a reel or cassette.

equal number of events. The solution for that issue was to adopt a naming schema within the ADL of following the session number with consecutive alphanumeric representation.[12] It was decided to leave in the WaveLab Channel mapping as CUL was using WaveLab to open the ADLs at their facility (and thus actually needed that proprietary bit).

Despite these issues, the ADL did prove itself to be a useful document for this project, at least internally. It provided a mapping of the complicated construction of the Rendered and service files. However, given the fact that many editing software vendors still do not support the ADL and those that do are lax in consistency, the long term sustainability of the ADL as a means of preservation documentation remains an open issue.[13]

[12] i.e. if the example in Figure 1 and 2 had consisted of two faces for the one session, the first event would be "Anderson_Judith_6880292_01a_r" and the second event would be "Anderson_Judith_6880292_01b_r"

[13] No common desktop tools (iTunes, Windows Media Player, RealPlayer, Quicktime, etc) recognize or support any level of AES31-3. Indiana University was also concerned with the lack of tech support the ADL currently receives and as such, duplicated their data in the METS <structMap> (*Sound Directions*, 107).

Appendix 4
Examples of CLIO Bibliographic Records

Record for Analog Original – Public View

Oral history interview with Walter Eberstadt

Author: Eberstadt, Walter A., interviewee.
Title: Oral history interview with Walter Eberstadt, 1991.
Other Title: Reminiscences of Walter Eberstadt, oral history, 1991
In : Northside Center for Child Development project.
Physical Description: Transcript: 34 leaves.

Restrictions: Copyright by The Trustees of Northside Center for Child Development, 1991. Permission required to cite, quote, and reproduce. Contact repository for information.
LC Subjects: Eberstadt, Walter A. --Interviews.
Northside Center for Child Development.
Bankers --Interviews.
Community mental health services --New York (State) --Harlem (New York)
Community education --New York (State) --Harlem (New York)
Psychiatric clinics --New York (State) --Harlem (New York) --Financial crises.
Mental health personnel --Labor unions.
Other Subject Terms: Oral histories.
Interviews.
Added Entries: Lee, Jonathan S., interviewer.
Biographical/ Historical Note: Investment banker.
Indexes: Name index available.
Notes: Interviewed by Jonathan S. Lee.
Forms part of Northside Center for Child Development project.

Summary: Childhood and educational background; association with Northside Center for Child Development [Northside], 1960s- ; personal interest in minority problems; Northside: personalities, interests of board members, problems with attracting interest, relations with Harlem community, educational, counseling services, unionization of staff, 1971, financial problems, tensions between Mamie Clark and psychiatric staff; search for Mamie Clark's successor.
Provenance: Gift of Walter Eberstadt.
Material Type: Archival/Manuscript Material

Record for Digitized Version – Public View

Oral history interview with Walter Eberstadt

Author: Eberstadt, Walter A., interviewee.
Title: Oral history interview with Walter Eberstadt [electronic resource], 1991.
Other Title: Reminiscences of Walter Eberstadt, oral history, 1991
In : Northside Center for Child Development project.
Physical Description: 2 sound files : digital preservation master, WAV files (96 kHz, 24 bit)

Restrictions: Copyright by The Trustees of Northside Center for Child Development, 1991. Permission required to cite, quote, and reproduce. Contact repository for information.
LC Subjects: Eberstadt, Walter A. --Interviews.
Northside Center for Child Development.
Bankers --Interviews.
Community mental health services --New York (State) --Harlem (New York)
Community education --New York (State) --Harlem (New York)
Psychiatric clinics --New York (State) --Harlem (New York) --Financial crises.
Mental health personnel --Labor unions.
Other Subject Terms: Oral histories.
Interviews.
Added Entries: Lee, Jonathan S., interviewer.
Biographical/ Historical Note: Investment banker.
Indexes: Name index available.
Notes: Interviewed by Jonathan S. Lee.
Digitized by Safe Sound Archive, Philadelphia, 2010.
Digitized from analog tape reels: Oral history interview with Walter Eberstadt. Originals available in the Oral History Office, Columbia University Libraries.
Forms part of Northside Center for Child Development project.

Summary: Childhood and educational background; association with Northside Center for Child Development [Northside], 1960s- ; personal interest in minority problems; Northside: personalities, interests of board members, problems with attracting interest, relations with Harlem community, educational, counseling services, unionization of staff, 1971, financial problems, tensions between Mamie Clark and psychiatric staff; search for Mamie Clark's successor.
Funding Information: Digital reproduction funded by the Andrew W. Mellon Foundation.
Provenance: Gift of Walter Eberstadt.
Material Type: Nonmusical Sound Recording

Record for Digitized Version – MARC View

Oral history interview with Walter Eberstadt

000 02864cim a2200541 i 450
001 7091829
005 20100721123820.0
006 m h
007 cr nna---muuuu
007 sz zunnnnnzn||
008 090313s1991 nyunnn s t eng d
035 __ |**a** (OCoLC)611925330
035 __ |**a** (OCoLC)ocn611925330
035 __ |**a** (NNC)7091829
040 __ |**a** NNC |**c** NNC |**e** dacs
043 __ |**a** n-us-ny
050 _4 |**a** HV3185.N7
100 1_ |**a** Eberstadt, Walter A., |**e** interviewee.
245 10 |**a** Oral history interview with Walter Eberstadt |**h** [electronic resource], |**f** 1991.
246 13 |**a** Reminiscences of Walter Eberstadt, oral history, 1991
300 __ |**a** 2 sound files : |**b** digital preservation master, WAV files (96 kHz, 24 bit)
580 __ |**a** Forms part of Northside Center for Child Development project.
545 __ |**a** Investment banker.
520 __ |**a** Childhood and educational background; association with Northside Center for Child Development [Northside], 1960s- ; personal interest in minority problems; Northside: personalities, interests of board members, problems with attracting interest, relations with Harlem community, educational, counseling services, unionization of staff, 1971, financial problems, tensions between Mamie Clark and psychiatric staff; search for Mamie Clark's successor.
500 __ |**a** Interviewed by Jonathan S. Lee.
500 __ |**a** Digitized by Safe Sound Archive, Philadelphia, 2010.
534 __ |**p** Digitized from analog tape reels: |**t** Oral history interview with Walter Eberstadt. |**n** Originals available in the Oral History Office, Columbia University Libraries.
536 __ |**a** Digital reproduction funded by the Andrew W. Mellon Foundation.
561 __ |**a** Gift of Walter Eberstadt.
540 __ |**a** Copyright by The Trustees of Northside Center for Child Development, 1991. Permission required to cite, quote, and reproduce. Contact repository for information.
555 __ |**a** Name index available.
541 __ |**3** Oral history
583 __ |**3** Oral history |**a** Submitted |**c** 07/--/91
600 10 |**a** Eberstadt, Walter A. |**v** Interviews.
610 20 |**a** Northside Center for Child Development.
650 _0 |**a** Bankers |**v** Interviews.
650 _0 |**a** Community mental health services |**z** New York (State) |**z** Harlem (New York)
650 _0 |**a** Community education |**z** New York (State) |**z** Harlem (New York)

650 _0 |**a** Psychiatric clinics |**z** New York (State) |**z** Harlem (New York) |**x** Financial crises.

650 _0 |**a** Mental health personnel |**x** Labor unions.

655 _7 |**a** Oral histories. |**2** ftamc

655 _7 |**a** Interviews. |**2** ftamc

700 1_ |**a** Lee, Jonathan S., |**e** interviewer.

773 0_ |**7** unbc |**a** Northside Center for Child Development project. |**w** (CStRLIN)NXCP94-A63.

852 __ |**a** Columbia University. |**b** Oral History Research Office, |**e** Box 20, Room 801 Butler Library, New York, NY 10027.

965 __ |**a** 965mellonaudioc

948 1_ |**a** 20100407 |**b** o |**c** mw2064 |**d** OSMC

900 __ |**a** AUTH

Appendix 5
Filenaming System

A. File Naming

Consists of name of interviewee, catalog record ID number, and sequence numbers. When a tape contains parts of more than one interview, the name and catalog ID of the first interviewee are used.

- **Master File Names (96 kHz / 24 bit):**
  Last_First_CLIO_ID_TapeSequence#_FaceSequence#_[part#]_m.wav
  (where "part #" appears only if relevant)

- **Rendered File Names (96 kHz / 24 bit):**
  Last_First_CLIO_ID_Session#_[part#]_r.wav
  (where "part #" appears only if relevant)

- **Service Files From Rendered (44 kHz / 16 bit)**
  Last_First_CLIO_ID_Session#_[part#]_s.wav

B. Folder / File Hierarchy

1st level folder name: [Last Name]_[First Name]_[CLIO ID]
Overall METS file, checksum; Complete ADL file, checksum
2nd level folder name: "Master"
Master files, METS files checksums,
2nd level folder name: "Rendered"
Rendered files, METS file, checksums
2nd level folder name: "Service"
Service files, METS file, checksums

Example

Andrews_UJ_6880560

Andrews_UJ_6880560_mets.xml
Andrews_UJ_6880560_mets.xml.md5
Andrews_UJ_6880560.adl
Andrews_UJ_6880560.adl.md5

Master

Andrews_UJ_6880560_01_01_m.wav
Andrews_UJ_6880560_01_01_m.wav.md5
Andrews_UJ_6880560_01_02_m.wav
Andrews_UJ_6880560_01_02_m.wav.md5
Andrews_UJ_6880560_01_mets.xml
Andrews_UJ_6880560_01_mets.xml.md5
Andrews_UJ_6880560_02_01_pt1_m.wav
Andrews_UJ_6880560_02_01_pt1_m.wav.md5
Andrews_UJ_6880560_02_01_pt2_m.wav
Andrews_UJ_6880560_02_01_pt2_m.wav.md5
Andrews_UJ_6880560_02_02_m.wav
Andrews_UJ_6880560_02_02_m.wav.md5
Andrews_UJ_6880560_02_mets.xml
Andrews_UJ_6880560_02_mets.xml.md5

Rendered

Andrews_UJ_6880560_01_r.wav
Andrews_UJ_6880560_01_r.wav.md5
Andrews_UJ_6880560_02_pt1_r.wav
Andrews_UJ_6880560_02_pt1_r.wav.md5
Andrews_UJ_6880560_02_pt2_r.wav
Andrews_UJ_6880560_02_pt2_r.wav.md5
Andrews_UJ_6880560_r_mets.xml
Andrews_UJ_6880560_r_mets.xml.md5

Service

Andrews_UJ_6880560_01_s.wav
Andrews_UJ_6880560_01_s.wav.md5
Andrews_UJ_6880560_02_pt1_s.wav
Andrews_UJ_6880560_02_pt1_s.wav.md5
Andrews_UJ_6880560_02_pt2_s.wav
Andrews_UJ_6880560_02_pt2_s.wav.md5

Appendix 6
METS Details

Further details and sample records can be found at http://www.columbia.edu/cu/libraries/inside/projects/digital_pres/mellon_audio/metadata/mets/index.html

METS Metadata Requirements: Description

1. **For every Interview, there is one high level METS file containing:**

   a. A dmdSec containing Dublin Core descriptive metadata for the interview
   b. A sourceMD section with a pointer to an external "audio decision list" (ADL) file which reports which sections of the source audio were used to construct the rendered audio
   c. A structMap broken into 2 divs: one for the source audio, one for the rendered audio
      i. source audio contains one div for each tape which has any content related to the interview at hand, with an mptr to a METS file for each digitized tape
      ii. rendered audio contains an mptr to a single METS file for the audio content drawn from the source audio which has been edited into continuous uninterrupted audio

2. **For each digitized source audio object, there is a single METS file containing:**

   a. A dmdSec containing Dublin Core descriptive metadata for the source audio object
   b. A techMD section containing the JHOVE XML output from a JHOVE process run by the vendor for each wav file produced
   c. A techMD section containing AES Core Audio metadata for each wav file produced
   d. A sourceMD containing AES technical metadata for the original analog object
   e. A fileSec with file elements for each wav file produced by the vendor
   f. a structMap containing divs for each "face" (usually tape side) of the source audio.

3. **For each rendered audio object there is a METS file containing:**

   a. A dmdSec containing Dublin Core descriptive metadata for the entire interview and each interview session
   b. A techMD section containing the JHOVE XML output from a JHOVE process run by the vendor for each wav file produced
   c. A techMD section containing AES Core Audio metadata for each wav file produced (i.e., each session or session part)
   d. A sourceMD section containing a pointer to the ADL file mapping the portions of the source audio which were used to create each portion of the rendered audio
   e. fileSec's for the hi-res ("rendered") audio and low-res ("service") wav files (one each for each session or session part)
   f. A logical structMap breaking down the interview into sessions

Appendix 7
BEXT Specification

Broadcast Wave File Audio Extension chunk (BEXT)

1. **Description field (256 char.):**
    - **Master File** will have the following elements, formatted as shown:

Element	Source CUL Spreadsheet Element	Example
Last Name	Last_Name	"Baldwin"
First Name	First_Name	"James"
First Session on Tape #	Session(s) & [from audio]	"Session 2 of 4"
First Session on Tape Date	Recording_Date(s)	"10/14/1963"
Notes	Misc_Notes	"MOLDY'"

    - E.g.,
      "Baldwin; James; session 2 of 4; 10/14/1963; MOLDY"
      "Andrews; U.J.; session 1 of 1; 8/17/71; with George McElroy, '#41'"
      "Benjamin; Herbert; sessions 11 and 12 of 12; 1/5/77-3/15/77; sessions 1-10 on cassette in box 150A, backside label has false info"

    - **Rendered File** will have the following elements, formatted as shown:

Element	Source CUL Spreadsheet Element	Example
Last Name	Last_Name	"Baldwin"
First Name	First_Name	"James"
Individual Session #	Session(s) & from audio review	"Session 2 of 4
Individual Session Date	Recording_Date(s) & from audio review	"10/14/1963"
Part #	n/a	"pt2"

    - E.g.,
      "Baldwin; James; Session 2a of 4; 10/14/1963"
      "Andrews; U.J; Session 1 of 1; 8/17/71; pt2"
      "Jones, Jenny; Session 3 of 3; 4/25/78, 4/27/78"

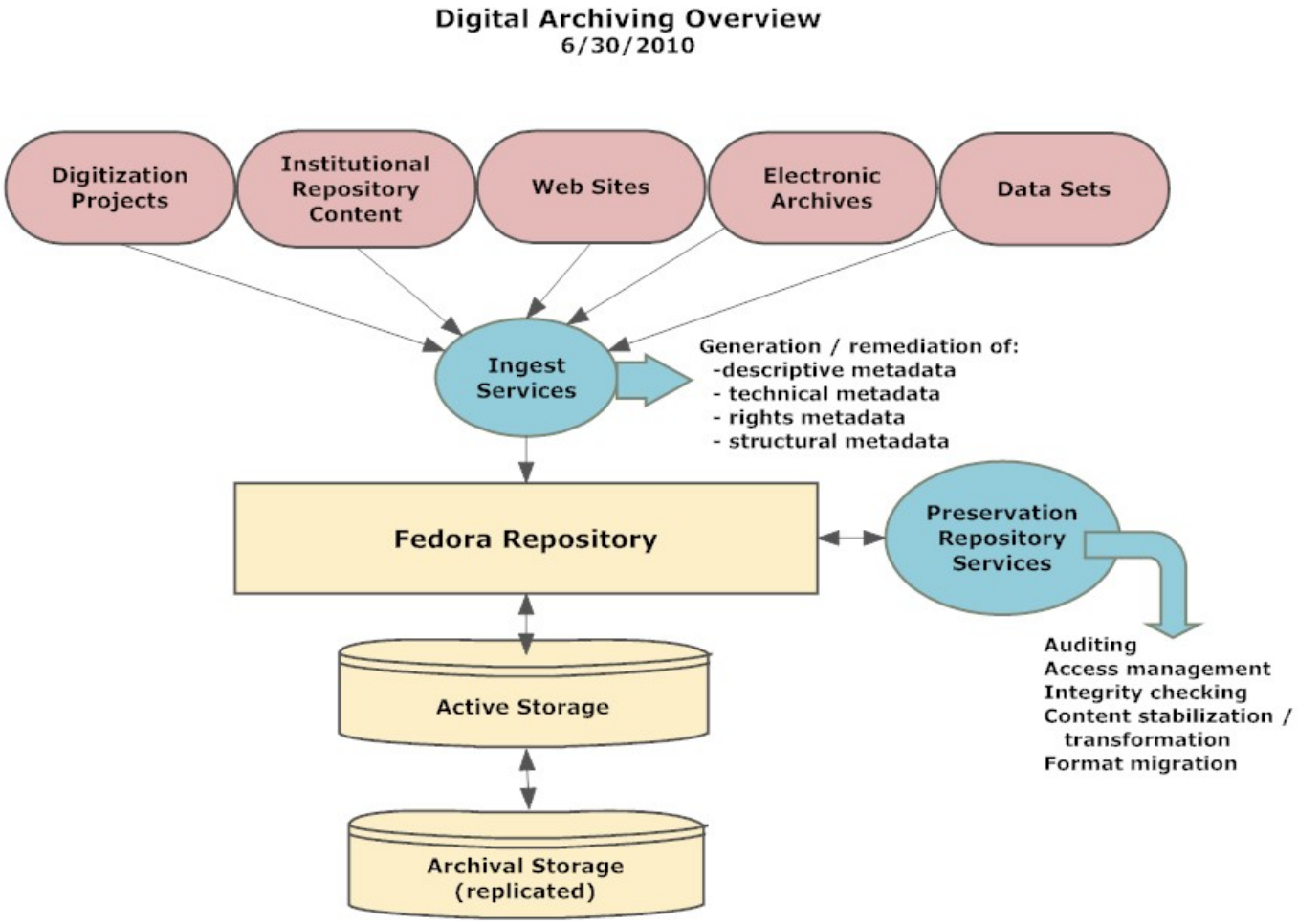
2. **Originator field (32 char.):** "Columbia University Libraries"

3. **Originator Reference (32 char.):** [LMS ID] in format "CLIO:6880560"

4. **Origination Date**
   Date file generated. "Ten ASCII characters containing the date of creation of the audio sequence. The format is “yyyy-mm-dd” (year-month-day)."

5. **Coding History fields:**
   "Non-restricted ASCII characters, containing a collection of strings terminated by CR/LF. Each string contains a description of a coding process applied to the audio data. Each new coding application is required to add a new string with the appropriate information." (See R98-1999 format for the <CodingHistory> field in BWF files.)

Appendix 8
Fedora and Columbia's Long-term Digital Archive



CUL's archival storage provides four copies of our preservation content. We have combined Sun's Storage Archive Manager (SAM) management software with Sun servers and storage and tape technologies to enable a coherent and comprehensive technology infrastructure that will ensure the survival and continued accessibility of the digital and digitized collection.

CUL's integration of the SAM technology, a combination of StorEdge 6140, 4500 and L500 tape storage media technologies, along with Fedora, allows it to remotely locate and manage digital artifacts on three tiers of storage for long-term content preservation including two off-site copies held in geographically disparate locations. The system was designed with the ability to grow

incrementally to half a petabyte of information.