Tools for File Format Identification, Validation and Characterization

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Motivation: Digital Curation Tools

Digital Curators need automated tools for:

- **Identification of file formats**
- **Validation of file formats, with pertinent error messages**
- **Extraction of metadata**
- **Viewing/playing/reading file formats**
- **Conversion of legacy formats to current/standard formats**

Motivation Digital Curation Tools

- **Identification: DROID/PRONOM; File/Magic**
- **Validation: Harvard's JSTOR/Harvard Object Validation Environment (JHOVE), UCDL (JHOVE2)**
- **Metadata Extractor: National Library of NZ Metadata Extractor; GNU libextractor**
- **Viewers/Players: NASAView, QuickView Plus, IrfanView, XNView, KeyView, Columbus viewer**
- **Conversion: XML Electronic Normalization of Archives (Xena), OpenOffice.org's Format Converter, Alchemy**

Definitions

- **A file format is a set of rules for encoding and decoding data or computer instructions in a file.**
- **A *file type* is a class of files with the same file format.**
- **A *file format signature* is invariant data in a file format that can be used to identify the file type (or format) of a file**

External File Format Identifiers

- File Name Extensions
- Metadata stored in the operating system
  - MacOS HFS Creator Code & File Type Code
  - MacOS X Uniform Type Identifier (UTI)
- Multipurpose Internet Mail Extensions (MIME) media types
- PRONOM Persistent Universal Identifier (PUID)

Linux File Command and Magic File

- Unix (Linux) File Command and Magic File are probably the most widely used tool for file format identification.
- Magic number is the term used for the concept of an internal file format signature.
- The file command applies tests for magic numbers contained in the Magic file to files to determine their file type and relevant metadata.

Some Limitations of the file Command and Magic File

- Difficult to update the tests for magic numbers.
- Tests that may give conflicting results must be properly sequenced.
- Tests for magic numbers are not one-to-one with file types.
- Tests output metadata as well as file type.
- Tests for character set and language of text files needs refinement.
- Only a few tests for MS Windows file types.
- Tests for Magic numbers have not been rigorously tested

Extensions of File Command and Magic File to overcome Limitations

- File Format Library
- Magic for individual file formats
- Output of file command/magic file is File Format ID
- Rewriting file command code for identifying Characteristics of Text files and Document Types
- Defined approx. 900 file format signatures
- Collected examples of approx. 700 of the file format types
- Created File Signature Database
- Verified that File Format Identifier with magic file correctly identifies approx. 700 File Types

Georgia Tech Fle Format Library

GTRI File Format Listing

Home | File Format | Extensions | Import Data

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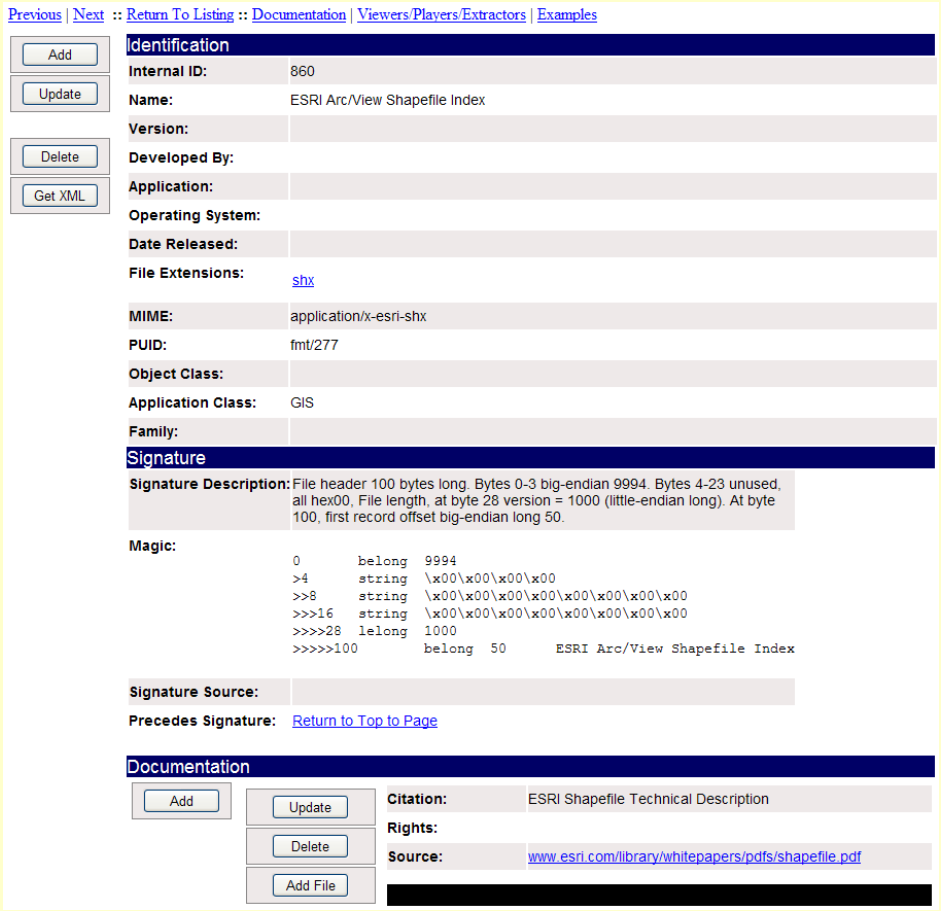
Sort by: FFL ID :: Bottom of Page

File Format Name Filter: All # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Add New File Format

Row #	FFL ID	Name	Version	MIME	PUID
1	852	AutoCAD Plotter Model Parameters File		application/x-autocad-pmp	
2	853	CATIA Material Description	5	application/x-catia-material; version=5	x-fmt/438
3	854	Computer Graphics Metafile (Clear Text)	2	image/cgm; encoding=ascii; version=2	
4	855	Computer Graphics Metafile (Clear Text)	3	image/cgm; encoding=ascii; version=3	x-fmt/142
5	856	Computer Graphics Metafile (Clear Text)	4	image/cgm; encoding=ascii; version=4	fmt/302
6	857	Computer Graphics Metafile (Binary)	2	image/cgm; encoding=binary; version=2	fmt/304
7	858	Computer Graphics Metafile (Binary)	3	image.cgm; encoding=binary; version=3	fmt/305
8	859	Computer Graphic Metafile (Binary)	4	image/cgm; encoding=binary; version=4	fmt/306
9	860	ESRI Arc/View Shapefile Index		application/x-esri-shx	fmt/277
10	861	SIARD Archive	2.0	application/siard; version=2	fmt/161
11	862	FLAC (Free Lossless Audio Codec)		audio/flac	fmt/279
12	863	PalmDOC		application/x-palm-doc	
13	864	Plucker Document		application/x-plucker	
14	865	Paint Shop Pro Image	9	image/x-paintshoppro; version=9	
15	866	CATIA Process Description	5	application/x-catia-process; version=5	
16	867	ESRI ArcGIS Projection File		application/x-esri-prj	
17	868	ESRI Grid Header File		application/x-esri-grid-header	
18	869	Electronic Arts VP6		video/x-ea-vp6	

Library Entry for ESRI Shape File Format



Previous | Next :: Return To Listing :: Documentation | Viewers/Players/Extractors | Examples

Add
Update
Delete
Get XML

Identification

Internal ID:	860
Name:	ESRI Arc/View Shapefile Index
Version:	
Developed By:	
Application:	
Operating System:	
Date Released:	
File Extensions:	shx
MIME:	application/x-esri-shx
PUID:	fmt/277
Object Class:	
Application Class:	GIS
Family:	

Signature

Signature Description: File header 100 bytes long. Bytes 0-3 big-endian 9994. Bytes 4-23 unused, all hex00, File length, at byte 28 version = 1000 (little-endian long). At byte 100, first record offset big-endian long 50.

Magic:

```
0       belong  9994
>4      string  \x00\x00\x00\x00
>>8     string  \x00\x00\x00\x00\x00\x00\x00\x00
>>>16   string  \x00\x00\x00\x00\x00\x00\x00\x00
>>>>28  lelong  1000
>>>>>100        belong  50      ESRI Arc/View Shapefile Index
```

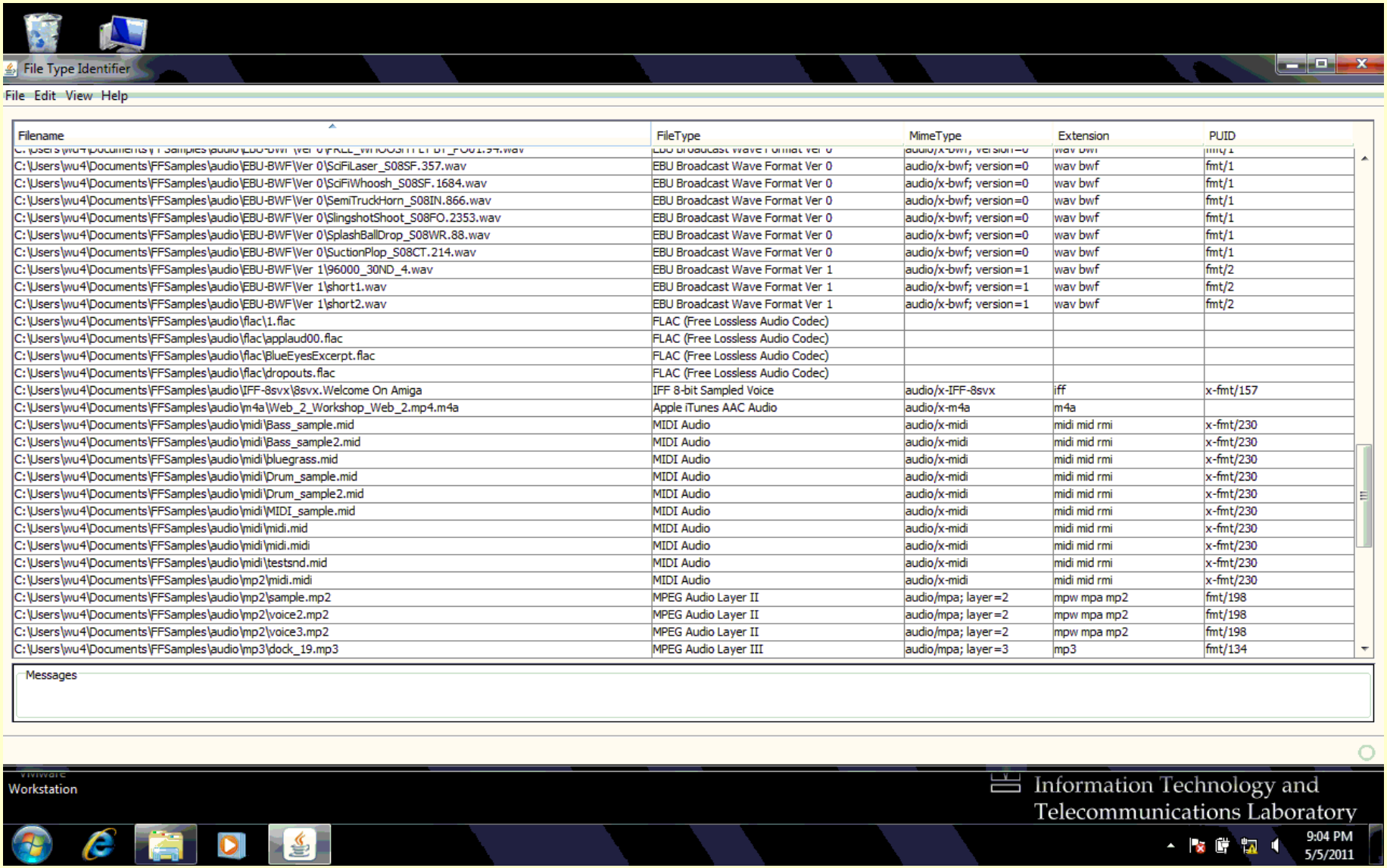
Signature Source:

Precedes Signature: Return to Top to Page

Documentation

Add
Update
Delete
Add File

Citation:	ESRI Shapefile Technical Description
Rights:	
Source:	www.esri.com/library/whitepapers/pdfs/shapefile.pdf


File Type Identifier
File Edit View Help
Filename
FileType
MimeType
Extension
PUID
C:\Users\wu4\Documents\FFSamples\audio\EBU-BWF\Ver 0\SciFiLaser_S08SF.357.wav
EBU Broadcast Wave Format Ver 0
audio/x-bwf; version=0
wav bwf
fmt/1
C:\Users\wu4\Documents\FFSamples\audio\EBU-BWF\Ver 0\SciFiWhoosh_S08SF.1684.wav
EBU Broadcast Wave Format Ver 0
audio/x-bwf; version=0
wav bwf
fmt/1
C:\Users\wu4\Documents\FFSamples\audio\EBU-BWF\Ver 0\SemiTruckHorn_S08IN.866.wav
EBU Broadcast Wave Format Ver 0
audio/x-bwf; version=0
wav bwf
fmt/1
C:\Users\wu4\Documents\FFSamples\audio\EBU-BWF\Ver 0\SlingshotShoot_S08FO.2353.wav
EBU Broadcast Wave Format Ver 0
audio/x-bwf; version=0
wav bwf
fmt/1
C:\Users\wu4\Documents\FFSamples\audio\EBU-BWF\Ver 0\SplashBallDrop_S08WR.88.wav
EBU Broadcast Wave Format Ver 0
audio/x-bwf; version=0
wav bwf
fmt/1
C:\Users\wu4\Documents\FFSamples\audio\EBU-BWF\Ver 0\SuctionPlop_S08CT.214.wav
EBU Broadcast Wave Format Ver 0
audio/x-bwf; version=0
wav bwf
fmt/1
C:\Users\wu4\Documents\FFSamples\audio\EBU-BWF\Ver 1\96000_30ND_4.wav
EBU Broadcast Wave Format Ver 1
audio/x-bwf; version=1
wav bwf
fmt/2
C:\Users\wu4\Documents\FFSamples\audio\EBU-BWF\Ver 1\short1.wav
EBU Broadcast Wave Format Ver 1
audio/x-bwf; version=1
wav bwf
fmt/2
C:\Users\wu4\Documents\FFSamples\audio\EBU-BWF\Ver 1\short2.wav
EBU Broadcast Wave Format Ver 1
audio/x-bwf; version=1
wav bwf
fmt/2
C:\Users\wu4\Documents\FFSamples\audio\flac\1.flac
FLAC (Free Lossless Audio Codec)
C:\Users\wu4\Documents\FFSamples\audio\flac\applaud00.flac
FLAC (Free Lossless Audio Codec)
C:\Users\wu4\Documents\FFSamples\audio\flac\BlueEyesExcerpt.flac
FLAC (Free Lossless Audio Codec)
C:\Users\wu4\Documents\FFSamples\audio\flac\dropouts.flac
FLAC (Free Lossless Audio Codec)
C:\Users\wu4\Documents\FFSamples\audio\IFF-8svx\8svx.Welcome On Amiga
IFF 8-bit Sampled Voice
audio/x-IFF-8svx
iff
x-fmt/157
C:\Users\wu4\Documents\FFSamples\audio\m4a\Web_2_Workshop_Web_2.mp4.m4a
Apple iTunes AAC Audio
audio/x-m4a
m4a
C:\Users\wu4\Documents\FFSamples\audio\midi\Bass_sample.mid
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\midi\Bass_sample2.mid
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\midi\bluegrass.mid
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\midi\Drum_sample.mid
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\midi\Drum_sample2.mid
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\midi\MIDI_sample.mid
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\midi\midi.mid
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\midi\midi.midi
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\midi\testsnd.mid
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\mp2\midi.midi
MIDI Audio
audio/x-midi
midi mid rmi
x-fmt/230
C:\Users\wu4\Documents\FFSamples\audio\mp2\sample.mp2
MPEG Audio Layer II
audio/mpa; layer=2
mpw mpa mp2
fmt/198
C:\Users\wu4\Documents\FFSamples\audio\mp2\voice2.mp2
MPEG Audio Layer II
audio/mpa; layer=2
mpw mpa mp2
fmt/198
C:\Users\wu4\Documents\FFSamples\audio\mp2\voice3.mp2
MPEG Audio Layer II
audio/mpa; layer=2
mpw mpa mp2
fmt/198
C:\Users\wu4\Documents\FFSamples\audio\mp3\dock_19.mp3
MPEG Audio Layer III
audio/mpa; layer=3
mp3
fmt/134
Messages
Workstation
Information Technology and Telecommunications Laboratory
9:04 PM
5/5/2011

Additional Information

GTRI url: http://perpos.gtri.gatech.edu

W. Underwood. Grammar-based Recognition of Documentary Forms and Extraction of Metadata. *The International Journal of Digital Curation*, Vol 5, Issue 1, 2010. www.ijdc.net/index.php/ijdc/article/view/152

W. Underwood. Grammar-based Specification and Parsing of Binary File formats. *International Digital Curation Conference*, Bristol, UK Dec 2011.

Magic Test for Broadcast Wave Format Ver 1

Signature

Signature Description: BWAVE PCM 1: RIFF header, WAVE id, bext chunk, version 1, fmt chunk, data chunk. BWAVE MPEG 1: RIFF header, WAVE id, bext chunk, version 1, fmt chunk, fact chunk

Magic:

```
# BWAVE PCM 1
0       string  RIFF
>8      string  WAVE
>>12    string  bext
>>>&350 leshort 1
>>>>&254        search/32000    fmt\ \x10\x00\x00\x00\x01\x00
>>>>>&14        search/32000    data    EBU Broadcast Wave Format Ver 1
# BWAVE MPEG 1
0       string  RIFF
>8      string  WAVE
>>12    string  bext
>>>&350 leshort 1
>>>>&254        search/3200     fmt\ \x28\x00\x00\x00\x50\x00
>>>>>&0 search/1000     fact\x04\x00\x00\x00    EBU Broadcast Wave Format Ver 1
```

Signature Source:

Precedes Signature:

Research Motivation

- **Digital Curators need the capability to automatically identify file formats for**
  - **Identifying appropriate format validation tool**
  - **Determining appropriate viewer, player, reader, extractor**
  - **Identifying Password recovery and decryption tools**
  - **Identifying repair tool for damaged files**