[UNDER CONSTRUCTION: last update 20200614]

1 Introduction

During writing software to change dates in MP4/MOV files I had a lot of moments that I thought: how is this data stored? There are a lot of special cases that have probably grown during the development and merging with other standards. This document (for now) focuses on the atoms/boxes where metadata is stored. The idea behind this document to make things more clear and explain some of the knotty terminology with things often meaning the same (or not).

About this ***webpage design***: there is none. I am currently updating this information in an HTML file that I edit MS Word, with the main aim to also make it printable on A4/letter format. There are Excel tables linked in this document that I want to 'keep on the page'. I realise that it looks sub-optimal in a browser… Please resize the browser to a small width, or: [pdf version here]

MP4 or Quicktime? What name to use: The MP4 format is based on the Quicktime format[1] but from here I will call it MP4 format since this has become more general.

2 Dates and data in MP4 files

This whole exercise started with the annoyance of having MP4 files wrongly dated because of wrong time-setting on the recording device and also by noticing strange sorting behavior during sorting in Google Photos and other applications. Simply, the first distinction is between the operating system file attributes (time created, modified, last opened) and the data stored within the MP4 file.

3 Atoms that contain metadata

3.1 Meta atom

Table 1: Example of metadata atom that has no ‘keys’ section. (file had no metadata before, metadata inserted by Windows property editor). Note that metadata atom is a **full-atom here**. File:[2]

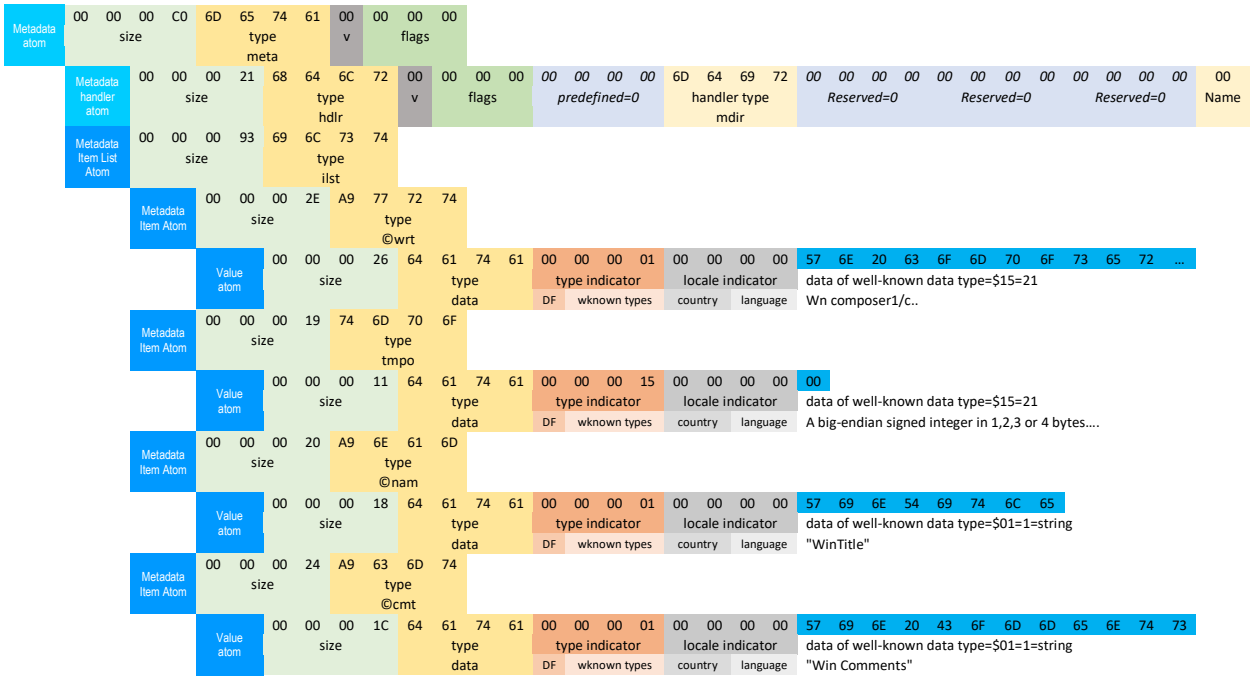

Table 2: Example of metadata atom that has a ‘keys’ section. Note that metadata atom is a **non-full**-atom here. File: [3]

Metadata atom	00	00	xx	xx	6D	65	74	61																							
	size				type meta																										
Metadata handler atom	00	00	00	22	68	64	6C	72	00	00	00	00	*00*	*00*	*00*	*00*	6D	64	74	61	*00*	*00*	*00*	*00*	*00*	*00*	*00*	*00*	*00*	*00*	00	00
	size				type hdlr				v	flags			*predefined=0*				handler type mdta				*Reserved=0*				*Reserved=0*				*Reserved=0*		Name	
Metadata Item Keys Atom	00	00	00	93	6B	65	79	73	00	00	00	00																			
	size				type keys				v	flags																					
	00	00	00	03																											
	entry_count																														
Key value 1	00	00	00	28	6D	64	74	61	63	6F	6D	2E	61	70	70	6C	65	2E	71	75	69	63	6B	74	69	6D	...				
	key_size				key_namespace mdta				com.apple.quicktime.creationdate																						
Key value 2	00	00	00	21	64	61	74	61	63	6F	6D	2E	61	70	70	6C	65	2E	71	75	69	63	6B	74	69	6D	...				
	key_size				key_namespace mdta				com.apple.quicktime.model																						
Key value 3	00	00	00	24	A9	6E	61	6D	63	6F	6D	2E	61	70	70	6C	65	2E	71	75	69	63	6B	74	69	6D	...				
	key_size				key_namespace mdta				com.apple.quicktime.location.ISO6709																						
Metadata Item List Atom	00	00	00	xx	69	6C	73	74																							
	size				type ilst																										
Metadata Item Atom	00	00	00	30	00	00	00	01																							
	size				type =key 1																										
Value atom	00	00	00	28	64	61	74	61	00	00	00	01	46	52	1A	41	32	30	31	34	2D	30	37	2D	30	35	54	...			
	size				type data				type indicator				locale indicator				2014-07-05T13:02:04+0200														
									DF	wknown types			country		language																
Metadata Item Atom	00	00	00	21	00	00	00	02																							
	size				type =key 2																										
Value atom	00	00	00	19	64	61	74	61	00	00	00	01	46	52	1A	41	69	50	68	6F	6E	65	20	35	73						
	size				type data				type indicator				locale indicator				iPhone 5s														
									DF	wknown types			country		language																
Metadata Item Atom	00	00	00	32	00	00	00	03																							
	size				type =key 3																										
Value atom	00	00	00	2A	64	61	74	61	00	00	00	01	46	52	1A	41	2B	34	33	2E	36	35	32	31	2B	30	30	...			
	size				type data				type indicator				locale indicator				+43.6521+003.3638+148.202/														
									DF	wknown types			country		language																
Free Atom	00	00	04	00	66	72	65	65	00	00	00	00	00	00	00	00															
	size				type free																										

3.2 Microsoft Xtra atom

When an MP4 or MOV file is edited by Windows Properties in the ‘Details’ tab of (right mouse), an ‘Xtra’ atom is added in the \moov\udta atom.

Figure 1: Properties edited by Windows. ‘Media created’ is read-only.

Information is not easy to find. The data can be stored in various types that are indicated by a type enumeration (like well-know types in the meta atom).

I cannot find this information as you would expect it on the Microsoft website. Although many ‘keys’ that are used in the Xtra atom (e.g. WM/Composer) are described in the WMF Attribute list (1) including a type enumeration (WMT_ATTR_DATATYPE enumeration); part of this enumeration is as follows: WMT_TYPE_DWORD = 0, WMT_TYPE_STRING = 1, WMT_TYPE_BINARY = 2 etc. However, this is not the enumeration used in the Xtra atom.

The actual enumeration used I found in Exiftool source code (2) and in an Xtrabox Java script (3), and is shown in Table 3. As noted in (2), an implementation has existed in a branch of mp4v2 but has been removed. This is discussed in (4).

Table 3: Type enumeration of Xtra values

Const Name	Decimal	Hexadecimal
MP4_XTRA_BT_UNICODE	8	$8
MP4_XTRA_BT_INT64	19	$13
MP4_XTRA_BT_FILETIME	21	$15
MP4_XTRA_BT_GUID	72	$48

1 https://en.wikipedia.org/wiki/MPEG-4_Part_14#
2 MOV_0234-windowscomments.mp4
3 Apple-Iphone5s.mov

1. **Microsoft.** Windows Media Format 11 Attribute List. [Online] [Cited: 6 14, 2020.] https://docs.microsoft.com/en-us/windows/win32/wmformat/attribute-list.

2. **Harvey, Phil.** Perlscript "Microsoft.pm". [Online] [Cited: 6 14, 2020.] https://github.com/exiftool/exiftool/blob/master/lib/Image/ExifTool/Microsoft.pm.

3. **"XtraBox.java" script. [Online] [Cited: 6 14, 2020.] http://www.java2s.com/example/java-src/pkg/com/googlecode/mp4parser/boxes/microsoft/xtrabox-3706e.html.**

4. mp4v2 - issue #113. [Online] 8 5, 2011. [Cited: 6 14, 2020.] https://code.google.com/archive/p/mp4v2/issues/113.