

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]

Metadata atom	00 00 00 00 size	6D 65 74 type meta	61 00 v	00 00 flags																												
	Metadata handler atom	00 00 00 21 size	68 64 type hdlr	6C 72 v	00 00 flags	predefined=0				6D 64 69 72 handler type mdir				Reserved=0								Reserved=0				Reserved=0				00 Name		
	Metadata Item List Atom	00 00 00 93 size	6C 69 type ilst	73 74																												
	Metadata Item Atom	00 00 00 2E size	A9 type @wrt	77 72 74																												
		Value atom	00 00 00 size	00 26 type data	64 61	00 00 00 01 type indicator				00 00 00 00 locale indicator				57 6E 20 63 6F 6D 70 6F 73 65 72 ... data of well-known data type=\$15=21 Wn composer1/c..																		
	Metadata Item Atom	00 00 00 19 size	74 type tmpo	6D 70 6F																												
		Value atom	00 00 00 size	00 11 type data	64 61 74 61	00 00 00 15 type indicator				00 00 00 00 locale indicator				00 data of well-known data type=\$15=21 A big-endian signed integer in 1,2,3 or 4 bytes....																		
	Metadata Item Atom	00 00 00 20 size	A9 type @nam	6E 61 6D																												
		Value atom	00 00 00 size	00 18 type data	64 61 74 61	00 00 00 01 type indicator				00 00 00 00 locale indicator				57 69 6E 54 69 74 6C 65 data of well-known data type=\$01=1=string "WinTitle"																		
	Metadata Item Atom	00 00 00 24 size	A9 type @cmt	63 6D 74																												
		Value atom	00 00 00 size	00 1C type data	64 61 74 61	00 00 00 01 type indicator				00 00 00 00 locale indicator				57 69 6E 20 43 6F 6D 6D 65 74 73 data of well-known data type=\$01=1=string "Win Comments"																		

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 size	6D 74 type meta	61
Metadata handler atom	00 00 00 size	68 6C 72 type hdlr	00 v flags predefined=0
Metadata Item Keys Atom	00 00 00 size	93 6B 65 79 type keys	00 v flags Reserved=0 Name
	00 00 00 entry_count	03	key_name (Apple calls it key_value)
	Key value 1	00 00 00 key_size	28 6D 64 74 61 key_namespace mdtm key_name (Apple calls it key_value) com.apple.quicktime.creationdate
	Key value 2	00 00 00 key_size	21 64 61 74 61 key_namespace mdtm com.apple.quicktime.model
	Key value 3	00 00 00 key_size	24 A9 6E 61 6D key_namespace mdtm key_name (Apple calls it key_value) com.apple.quicktime.location.ISO6709
Metadata Item List Atom	00 00 00 size	xx 69 6C 73 type ilst	74
Metadata Item Atom	00 00 00 size	30 00 00 type =key 1	01
	Value atom	00 00 00 size	28 64 61 74 61 type data DF wknown types locale indicator language 2014-07-05T13:02:04+0200
Metadata Item Atom	00 00 00 size	21 00 00 type =key 2	02
	Value atom	00 00 00 size	19 64 61 74 61 type data DF wknown types locale indicator language iPhone 5s
Metadata Item Atom	00 00 00 size	32 00 00 type =key 3	03
	Value atom	00 00 00 size	2A 64 61 74 61 type data DF wknown types locale indicator language +43.6521+003.3638+148.202/
Free Atom	00 00 04 size	00 66 72 65 65 type free	00 00 00 00 00 00 00

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.

Property	Value	Origin	Content
Description		Directors	MyDirect
Title	MyTitle	Producers	MyProd
Subtitle	MySubt	Writers	MyWriter
Rating	★ ★ ☆ ☆ ☆	Publisher	MyPubl
Tags	MyTag1; MyTag2	Content provider	MyContProv
Comments	MyComments	Media created	2012-07-11 07:16
Media		Encoded by	MyEncBy
Contributing artists	MyContrArtists	Author URL	MyAuthURL
Year	2020	Promotion URL	MyPromoURL
Genre	MyGenre	Copyright	
			Parental rating
			Parental rating reason
			Composers
			Conductors
			Period
			Mood
			Part of set
			Initial key
			Beats-per-minute
			Protected

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).

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

[illegible]

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>.