

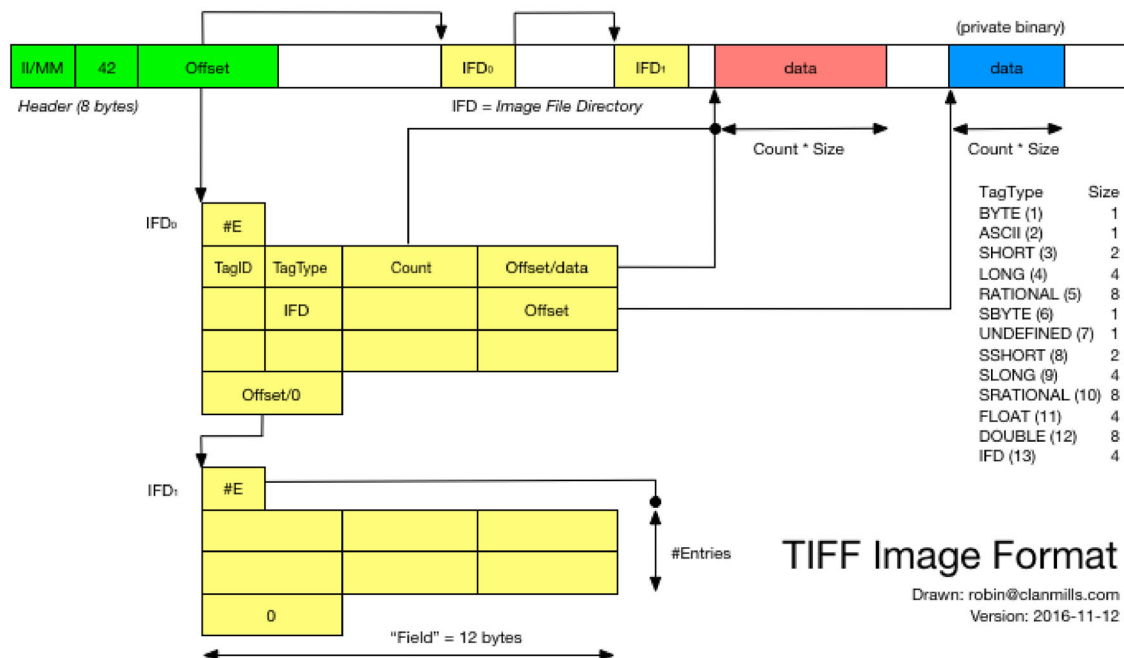
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The Metadata in TIFF files

The Tagged Image File Format is a container. It's very flexible and can deal with multiple pages, different colour spaces and frame configurations, as well as metadata. The specification is available from: <https://partners.adobe.com/public/developer/en/tiff/TIFF6.pdf>

The TIFF container is so flexible it is used as the structure for most RAW formats including Adobe's DNG. Additionally the TIFF container is used to store the metadata that lies inside the Exif blocks embedded in JPEG and PNG files.

There is a 64bit version of Tiff called **BigTiff**. This is currently not supported by exiv2.



The format consists of an 8 byte header which provides a 2 byte endian flag (II or MM), a 2 byte type "magic number" (42) and a 4 byte offset to an **Image File Directory**.

The **IFD** (Image File Directory) has a two byte header which contains the length of the directory followed by 12 byte "fields" or "tags". The trailing 4 bytes of the directory is the offset to the next directory **or** zero to terminate the directory chain.

A tag consists of a 12 byte record: TagID, TagType, Count and Offset which are 2,2,4 and 4 bytes respectively. The TagID defines the purpose of the record (Width, Height, ColorSpace etc) and the TagType defines the data format. Count and Offset are used to contain the raw data **or** provide an offset in the file at which to read the raw data for this tag.

Example:

The version of exiv2(.exe) which ships with v0.25 provides options **-ps** to reveals the structure of the TIFF and option **-pX** is used to extract the raw XMP/xml data.

The option **-pv** is used to print the metadata values.

```
$ exiv2 -pv test/data/test.tiff
0x00fe Image      NewSubfileType      Long      1  0
0x0100 Image      ImageWidth        Short     1 282
0x0101 Image      ImageLength       Short     1 212
0x0102 Image      BitsPerSample     Short     3 8 8 8
0x0103 Image      Compression       Short     1 5
0x0106 Image      PhotometricInterpretation Short     1 2
0x010e Image      ImageDescription  Ascii     32
0x010f Image      Make             Ascii     5 SONY
0x0110 Image      Model            Ascii     9 DSC-S600
0x0111 Image      StripOffsets     Long      16 4372 14864 ...
0x0112 Image      Orientation      Short     1 1
0x0115 Image      SamplesPerPixel  Short     1 3
0x0116 Image      RowsPerStrip     Long      1 14
0x0117 Image      StripByteCounts  Long      16 10492 ...
0x011a Image      XResolution      Rational  1 96/1
0x011b Image      YResolution      Rational  1 96/1
0x011c Image      PlanarConfiguration Short     1 1
0x0128 Image      ResolutionUnit   Short     1 2
0x0132 Image      DateTime         Ascii     20 2009:04:26 12:38:18
0x013d Image      Predictor        Short     1 1
0x0153 Image      SampleFormat     Short     3 1 1 1
0x02bc Image      XMLPacket        Byte      2505 (Binary value suppressed)
0x8773 Image      InterColorProfile Undefined 1352 (Binary value suppressed)
```

```
$ exiv2 -pS test/data/test.tiff
STRUCTURE OF TIFF FILE (II): test/data/test.tiff
address | tag | type | count | offset | value
10 | 0x00fe | NewSubfileType | LONG | 1 | 0
22 | 0x0100 | ImageWidth | SHORT | 1 | 282
34 | 0x0101 | ImageLength | SHORT | 1 | 212
46 | 0x0102 | BitsPerSample | SHORT | 3 | 8 8 8
58 | 0x0103 | Compression | SHORT | 1 | 5
70 | 0x0106 | PhotometricInterpretation | SHORT | 1 | 2
82 | 0x010e | ImageDescription | ASCII | 32 | 296
94 | 0x010f | Make | ASCII | 5 | 328
106 | 0x0110 | Model | ASCII | 9 | 334
118 | 0x0111 | StripOffsets | LONG | 16 | 344
130 | 0x0112 | Orientation | SHORT | 1 | 1
142 | 0x0115 | SamplesPerPixel | SHORT | 1 | 3
154 | 0x0116 | RowsPerStrip | LONG | 1 | 14
166 | 0x0117 | StripByteCounts | LONG | 16 | 408
178 | 0x011a | XResolution | RATIONAL | 1 | 472
190 | 0x011b | YResolution | RATIONAL | 1 | 480
202 | 0x011c | PlanarConfiguration | SHORT | 1 | 1
214 | 0x0128 | ResolutionUnit | SHORT | 1 | 2
226 | 0x0132 | DateTime | ASCII | 20 | 488
238 | 0x013d | Predictor | SHORT | 1 | 1
250 | 0x0153 | SampleFormat | SHORT | 3 | 508
262 | 0x02bc | XMLPacket | BYTE | 2505 | 514
274 | 0x8773 | InterColorProfile | UNDEFINED | 1352 | 3020

END test/data/test.tiff
$ exiv2 -pX test/data/test.tiff | xmllint --format -
<?xml version="1.0"?>
<?xpacket begin="" id="W5M0MpCehiHzreSzNTczkc9d"?>
<x:xmpmeta xmlns:x="adobe:meta/" x:xmptk="XMP Core 4.4.0-Exiv2">
  <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    <rdf:Description xmlns:dc="http://purl.org/dc/elements/1.1/" rdf:about="">
      <dc:title>
        <rdf:Alt>
          <rdf:li xml:lang="x-default">this is a test image</rdf:li>
        </rdf:Alt>
      </dc:title>
    </rdf:Description>
  </rdf:RDF>
</x:xmpmeta>
<?xpacket end="w"?>
$
```

You can use the output from **-pS** to determine the location of the XMLPacket:

```
$ exiv2 -pS test/data/test.tiff | grep XMLPacket
262 | 0x02bc | XMLPacket | BYTE | 2505 | 514 | <?xpacket begin="" id="W5M0Mp ...
$
```

You can see the XMLPacket of 2505 bytes stored at offset 514. You can extract the XMP with the following command:

```
$ dd bs=1 count=2505 skip=514 if=test/data/test.tiff | xmllint --format -
2505+0 records in
2505+0 records out
2505 bytes (2.5 kB) copied, 0.0064 s, 391 kB/s
<?xml version="1.0"?>
<?xpacket begin="" id="W5M0MpCehiHzreSzNTczkc9d"?>
<x:xmpmeta xmlns:x="adobe:meta/" x:xmptk="XMP Core 4.4.0-Exiv2">
  <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    <rdf:Description xmlns:dc="http://purl.org/dc/elements/1.1/" rdf:about="">
      <dc:title>
        <rdf:Alt>
          <rdf:li xml:lang="x-default">this is a test image</rdf:li>
        </rdf:Alt>
      </dc:title>
    </rdf:Description>
  </rdf:RDF>
</x:xmpmeta>
<?xpacket end="w"?>
```

The option **-pX** doesn't use dd to achieve the same result and is much more convenient to use.

To demonstrate that the metadata block in a JPEG is a TIFF file, extract and print the structure.

```
$ exiv2 -pS test/data/Reagan.jpg
STRUCTURE OF JPEG FILE: test/data/Reagan.jpg
address | marker | length | data
0 | 0xffd8 | SOI |
2 | 0xffe1 | APP1 | 5718 | Exif..MM.*.....
5722 | 0xffed | APP13 | 3038 | Photoshop 3.0.8BIM.....Z...
```

8762	0xffe1 APP1	5329	http://ns.adobe.com/xap/1.0/.<?x
14093	0xffe2 APP2	576	ICC_PROFILE.....0ADBE....mnrRG chunk 1/1
14671	0xffee APP14	14	Adobe.d@.....
14687	0xffdb DQT	132	
14821	0xffc0 SOF0	17	
14840	0xffdd DRI	4	
14846	0xffc4 DHT	418	
15266	0xffda SOS		

\$

We can extract the APP1/Exif data as follows:

```
$ dd bs=1 skip=$((2+2+8)) count=$((5718-8)) if=test/data/Reagan.jpg of=ReaganExif.tiff
5710+0 records in
5710+0 records out
5710 bytes (5.7 kB) copied, 0.026688 s, 214 kB/s
$ exiv2 -pS ReaganExif.tif
STRUCTURE OF TIFF FILE (MM): ReaganExif.tif
address | tag | type | count | offset | value
10 | 0x0100 ImageWidth | SHORT | 1 | 13107200 | 200
22 | 0x0101 ImageLength | SHORT | 1 | 8519680 | 130
34 | 0x0102 BitsPerSample | SHORT | 4 | 242 | 8 8 8 8
46 | 0x0103 Compression | SHORT | 1 | 65536 | 1
58 | 0x0106 PhotometricInterpretation | SHORT | 1 | 131072 | 2
70 | 0x010e ImageDescription | ASCII | 403 | 250 | 040621-N-6536T-062.USS Ronald Re ...
82 | 0x010f Make | ASCII | 18 | 653 | NIKON CORPORATION
94 | 0x0110 Model | ASCII | 10 | 671 | NIKON D1X
106 | 0x0112 Orientation | SHORT | 1 | 65536 | 1
118 | 0x0115 SamplesPerPixel | SHORT | 1 | 262144 | 4
130 | 0x011a XResolution | RATIONAL | 1 | 681 | 3000000/10000
142 | 0x011b YResolution | RATIONAL | 1 | 689 | 3000000/10000
154 | 0x011c PlanarConfiguration | SHORT | 1 | 65536 | 1
166 | 0x0128 ResolutionUnit | SHORT | 1 | 131072 | 2
178 | 0x0131 Software | ASCII | 40 | 697 | Adobe Photoshop Elements 12.0 Ma ...
190 | 0x0132 DateTime | ASCII | 20 | 737 | 2016:09:13 11:58:16
202 | 0x013b Artist | ASCII | 34 | 757 | Photographer..s Mate 3rd Class ( ...
214 | 0x8769 ExifTag | LONG | 1 | 792 | 792
226 | 0x8825 GPSTag | LONG | 1 | 1400 | 1400
1422 | 0x0103 Compression | SHORT | 1 | 393216 | 6
1434 | 0x011a XResolution | RATIONAL | 1 | 1498 | 72/1
1446 | 0x011b YResolution | RATIONAL | 1 | 1506 | 72/1
1458 | 0x0128 ResolutionUnit | SHORT | 1 | 131072 | 2
1470 | 0x0201 JPEGInterchangeFormat | LONG | 1 | 1514 | 1514
1482 | 0x0202 JPEGInterchangeFormatLeng | LONG | 1 | 4196 | 4196
END ReaganExif.tif
$
```

The version of the exiv2 utility that ships with v0.26 later has an option `-pR` which *Recursively* prints the structure of an image file. **Recursively** means the utility prints structures embedded within other structures. For example, the Exif metadata in a JPEG is encoded as a TIFF embedded in the APP1/Exif segment of the JPEG.

```
$ exiv2 -pR test/data/Reagan.jpg
STRUCTURE OF JPEG FILE: test/data/Reagan.jpg
address | marker | length | data
0 | 0xffd8 SOI | | 
2 | 0xffe1 APP1 | 5718 | Exif..MM.*.....
STRUCTURE OF TIFF FILE (MM): MemIo
address | tag | type | count | offset | value
10 | 0x0100 ImageWidth | SHORT | 1 | 13107200 | 200
22 | 0x0101 ImageLength | SHORT | 1 | 8519680 | 130
34 | 0x0102 BitsPerSample | SHORT | 4 | 242 | 8 8 8 8
46 | 0x0103 Compression | SHORT | 1 | 65536 | 1
58 | 0x0106 PhotometricInterpretation | SHORT | 1 | 131072 | 2
70 | 0x010e ImageDescription | ASCII | 403 | 250 | 040621-N-6536T-062.USS Ronald Re ...
82 | 0x010f Make | ASCII | 18 | 653 | NIKON CORPORATION
94 | 0x0110 Model | ASCII | 10 | 671 | NIKON D1X
106 | 0x0112 Orientation | SHORT | 1 | 65536 | 1
118 | 0x0115 SamplesPerPixel | SHORT | 1 | 262144 | 4
130 | 0x011a XResolution | RATIONAL | 1 | 681 | 681/0
142 | 0x011b YResolution | RATIONAL | 1 | 689 | 689/0
154 | 0x011c PlanarConfiguration | SHORT | 1 | 65536 | 1
166 | 0x0128 ResolutionUnit | SHORT | 1 | 131072 | 2
178 | 0x0131 Software | ASCII | 40 | 697 | Adobe Photoshop Elements 12.0 Ma ...
190 | 0x0132 DateTime | ASCII | 20 | 737 | 2016:09:13 11:58:16
202 | 0x013b Artist | ASCII | 34 | 757 | Photographer..s Mate 3rd Class ( ...
214 | 0x8769 ExifTag | LONG | 1 | 792 | 792
STRUCTURE OF TIFF FILE (MM): MemIo
address | tag | type | count | offset | value
794 | 0x829a ExposureTime | RATIONAL | 1 | 1254 | 1254/0
806 | 0x829d FNumber | RATIONAL | 1 | 1262 | 1262/0
818 | 0x8822 ExposureProgram | SHORT | 1 | 65536 | 1
830 | 0x9000 ExifVersion | UNDEFINED | 4 | 808596016 | 0220
```

842	0x9003	DateTimeOriginal	ASCII	20	1270	2004:06:21 23:37:53
854	0x9004	DateTimeDigitized	ASCII	20	1290	2004:06:21 23:37:53
866	0x9101	ComponentsConfiguration	UNDEFINED	4	16909056	...
878	0x9102	CompressedBitsPerPixel	RATIONAL	1	1310	1310/0
890	0x9201	ShutterSpeedValue	SRATIONAL	1	1318	1318/0
902	0x9202	ApertureValue	RATIONAL	1	1326	1326/0
914	0x9204	ExposureBiasValue	SRATIONAL	1	1334	1334/0
926	0x9205	MaxApertureValue	RATIONAL	1	1342	1342/0
938	0x9207	MeteringMode	SHORT	1	131072	2
950	0x9208	LightSource	SHORT	1	655360	10
962	0x9209	Flash	SHORT	1	0	0
974	0x920a	FocalLength	RATIONAL	1	1350	1350/0
986	0x9290	SubSecTime	ASCII	3	808845312	06
998	0x9291	SubSecTimeOriginal	ASCII	3	808845312	06
1010	0x9292	SubSecTimeDigitized	ASCII	3	808845312	06
1022	0xa000	FlashpixVersion	UNDEFINED	4	808529968	0100
1034	0xa001	ColorSpace	SHORT	1	4294901760	65535
1046	0xa002	PixelXDimension	LONG	1	200	200
1058	0xa003	PixelYDimension	LONG	1	130	130
1070	0xa217	SensingMethod	SHORT	1	131072	2
1082	0xa300	FileSource	UNDEFINED	1	50331648	.
1094	0xa301	SceneType	UNDEFINED	1	16777216	.
1106	0xa401	CustomRendered	SHORT	1	0	0
1118	0xa402	ExposureMode	SHORT	1	65536	1
1130	0xa403	WhiteBalance	SHORT	1	65536	1
1142	0xa404	DigitalZoomRatio	RATIONAL	1	1358	1358/0
1154	0xa405	FocalLengthIn35mmFilm	SHORT	1	4128768	63
1166	0xa406	SceneCaptureType	SHORT	1	0	0
1178	0xa407	GainControl	SHORT	1	0	0
1190	0xa408	Contrast	SHORT	1	0	0
1202	0xa409	Saturation	SHORT	1	0	0
1214	0xa40a	Sharpness	SHORT	1	0	0
1226	0xa40c	SubjectDistanceRange	SHORT	1	0	0
1238	0xa420	ImageUniqueID	ASCII	33	1366	127c1377b054a3f65bf2754ebb24e7f2 ...
END MemIo						
226	0x8825	GPSTag	LONG	1	1400	1400
1422	0x0103	Compression	SHORT	1	393216	6
1434	0x011a	XResolution	RATIONAL	1	1498	1498/0
1446	0x011b	YResolution	RATIONAL	1	1506	1506/0
1458	0x0128	ResolutionUnit	SHORT	1	131072	2
1470	0x0201	JPEGInterchangeFormat	LONG	1	1514	1514
1482	0x0202	JPEGInterchangeFormatLeng	LONG	1	4196	4196
END MemIo						
5722	0xffed	APP13	3038	Photoshop 3.0.8BIM.....Z...		
Record	DataSet	Name	Length	Data		
1	90	CharacterSet	3	.%G		
1	90	CharacterSet	3	.%G		
2	0	RecordVersion	2	..		
2	120	Caption	402	040621-N-6536T-062.USS Ronald Reagan (CV...		
2	122	Writer	9	Dir. NVNS		
2	40	SpecialInstructions	49	Credit as U.S. Navy photo by Elizabeth T...		
2	80	Byline	32	Photographer..s Mate 3rd Class (
2	85	BylineTitle	21	U.S Navy Photographer		
2	110	Credit	8	U.S Navy		
2	115	Source	24	Navy Visual News Service		
2	5	ObjectName	18	040621-N-6536T-062		
2	55	DateCreated	8	20040621		
2	60	TimeCreated	11	000000+0000		
2	62	DigitizationDate	8	20040621		
2	63	DigitizationTime	11	233753-0400		
2	90	City	19	Straits of Magellan		
2	101	CountryName	13	South America		
2	15	Category	1	N		
2	20	SuppCategory	12	703-614-9154		
2	20	SuppCategory	23	navyvisualnews@navy.mil		
2	20	SuppCategory	11	UNCLASSIFIED		
2	10	Urgency	1	5		
2	25	Keywords	13	ronald reagan		
2	25	Keywords	6	reagan		
2	25	Keywords	6	cvn 76		
2	25	Keywords	6	cvn-76		
2	25	Keywords	18	straights magellan		
2	25	Keywords	8	magellan		
2	25	Keywords	7	carrier		
2	25	Keywords	12	nimitz-class		
2	25	Keywords	4	ship		
2	25	Keywords	8	underway		
8762	0xffe1	APP1	5329	http://ns.adobe.com/xap/1.0/.<?x		
14093	0xffe2	APP2	576	ICC_PROFILE.....0ADB.....mnrRG chunk 1/1		
14671	0xffee	APP14	14	Adobe.d@.....		
14687	0xffdb	DQT	132			
14821	0xffc0	SOF0	17			
14840	0xffdd	DRI	4			
14846	0xffc4	DHT	418			

15266		0xffda SOS
\$		

Updated by [Robin Mills](#) about 5 years ago · 20 revisions