Digital Photography
Meta Data Overview

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Document Version: 1.2

Version History

1.0 Initial Release
1.1 Added Maker Notes section
1.2 Miscellaneous edits and wordsmithing

1 Introduction

Winston Churchill's immortal description of 1939 Russia as "A riddle wrapped in a mystery inside an enigma" is equally true of the current state of digital photography meta data.

Most casual digital photographers never come face to face with meta data. They take their photos, they upload them to a web photo sharing or social networking web site, they may even print a photo occasionally, and at no time are they even aware that digital photography meta data exists. In many respects, they are the lucky ones.

Serious amateur and professional photographers wrestle with meta data as part and parcel of their daily workflow. Meta data problems, flaws, corruptions and disasters are a regular part of photography forums and discussion groups. Challenges can be as simple as one tool displaying a photo's caption/description while another will not. Or, they can be as catastrophic as the loss of thousands of photos' meta data, often painstakingly entered over weeks, months or years.

Meta data, defined as "data about data," can be a very technical, daunting subject. In practice and application in digital photography, it has often been an unmitigated disaster.

Even at its young age, digital photography has experienced multiple meta data standards. Each of these standards has been ignored, corrupted or "enhanced" by digital photography software vendors. There has been no backwards compatibility or standardized mapping established to bridge from one standard to the next. The lack of standards regarding the labeling of meta data information has led to a plethora of conflicting terms used to label the very same piece of meta data, spawning mass frustration and confusion among users.

Unfortunately, there is no immediate relief in sight for serious amateur and professional photographers. If anything, the meta data anarchy and chaos created by the software vendors promises to increase.

The only hope for those tasked with unwrapping the meta data riddle lies in better understanding digital photography meta data. Only by understanding meta data can we accurately diagnose the challenges and build workarounds.

2 Meta Data Defined

In the data community, meta data is colloquially defined as "data about data." That phrase says it all to a data professional, but is yet another riddle wrapped in a mystery inside an enigma to the average digital photographer.

Phrased in a more accessible way, meta data is information about a particular set of data. The data can be any set of data, e.g. from a financial system, an aircraft control system, etc. In the case of digital photography, the set of data we are concerned with are digital photographs.

A digital photo is just a set of data. It is a series of ones and zeros arranged in a particular way, grouped together in a data structure, which is comprehensible by computer software. The ones and zeros of a digital photo, at a minimum, are capable of being decoded and displayed as an image. Everything in the digital photo data file beyond the ones and zeros that comprise the image data is, in one way or another, meta data - information about the data set that comprises the image.

For example, the following photo is nothing but a collection of ones and zeros that the workflow software is capable of interpreting and displaying.

As humans, we can see that the image contains water and birds, but there is nothing in the ones and zeros making up the image that relates anything about water or birds. All the ones and zeros that define the image do only that one, single thing: define the image itself. They do nothing to describe when the image was created, where it was created, who created it and what the image depicts. Only by adding meta data can we add intelligence to the ones and zeros that make up the image.

Meta data is the information that provides knowledge about the image beyond the ones and zeros that define the image itself. Who shot the image, where it was created, how it was created, the content of the image, etc. are all contained within the meta data of the image.

Without meta data, an image is just an image. If we ever want to be able to know where, when or how an image was created, or by whom it was created, we need meta data. If we ever want to later quickly locate the image based on its content, we need meta data.

Some of the meta data can be added automatically by the digital camera and workflow software but much of the most valuable meta data, especially the descriptive meta data, must be added manually.

The digital camera begins this work by embedding the technical characteristics of the image when it is created.

The core set of technical characteristics meta data that the camera embedded with this image is:

Make	: Canon
Camera Model Name	: Canon EOS-1D Mark III
Shutter Speed Value	: 1/160
Aperture Value	: 6.3
Exposure Program	: Shutter speed priority AE
Date/Time Original	: 2008:02:27 20:15:05.33-08:00
Exposure Compensation	: 0
Focal Length	: 300.0 mm
ISO	: 800
Flash Fired	: False

With this information we can sort, select and search based on date, camera model, ISO, shutter speed, f stop, lens length, etc.

Another element of meta data that can be automatically embedded is the GPS geolocation of the image. This information can be added to the image's meta data at the instant it is created if the camera has an integrated or attached GPS receiver. Or, it can be added later by deriving the camera's location based on the image creation date/time and a corresponding GPS waypoint or track.

The derived GPS geolocation meta data for this image is:

GPS Altitude Ref	: Above Sea Level
GPS Altitude	: 83.2163925170898 m
GPS Map Datum	: WGS 1984
GPS Date/Time	: 2008:02:27 23:15:05
GPS Latitude	: 50 deg 58' 27.92" S
GPS Latitude Ref	: South
GPS Longitude	: 72 deg 43' 50.85" W
GPS Longitude Ref	: West
GPS Position	: 50 deg 58' 27.92" S, 72 deg 43' 50.85" W

The GPS geolocation meta data allows us to know precisely where the image was created. We can now group, select, sort and search the images based on location.

However, all the technical and geolocation information does not help us find the specific image of pink flamingos a year or two later. For that, we need to manually add descriptive information by embedding keywords, categories and other information in the image's meta data.

The set of primary keywords manually added to the image are:

02 February, 2008, Action, Chile, Doug-Shot, Exterior, Flamingo, Lake, National Park, Nature, Patagonia, Rural, South America, Summer, Travel, Water, Wildlife

Workflow software can add synonyms that are associated with primary keywords. Synonyms greatly aid the searching and discovery process by providing alternative search terms and criteria.

The full set of searchable keywords and associated keyword synonyms for the image are:

02 February, 2008, Action, Animal, Bird, Chile, Civil, Content, Doug, Doug-Shot, Exterior, Flamingo, H2O, Lake, Location, National, National Park, Nature, Park, Patagone, Patagonia, Rural, South America, Summer, Travel, Water, Waterfowl, Wildlife, agrarian, agricultural, animals, beach, bucolic, country, creature, duck, ducks, farming, fauna, fowl, fresh water, geese, goose, journey, lake, lake shore, landscape, ocean, ocean shore, outdoors, outside, park ranger, parque nacional, pastoral, pink flamingo, pond, public property, recreation area, river, rustic, salt water, scenery, sea, sea shore, shore, southern Argentina, southern Chile, southern South America, sports, traveling, trip, undomesticated, wading bird, wake, water birds, waterfowl, waves, web footed, wild animals, wildlife, winged, zoology

The image caption/description is:

Image Description	: Flamingos taking flight. Laguna Amarga. Near Torres del Paine National Park, Chile.

With descriptive information we can easily categorize our images by content, e.g., all images from South America or with the color pink. We can also easily search the images to locate all images that contain certain content, e.g. birds, water, etc.

Another key type of meta data is historical meta data. It is incrementally added by workflow software as we edit and modify the original image. Historical meta data allows us to step back through the history of the edits on an image, version by version, to understand the edits or to restore the original or an earlier version of the image.

A subset of the historical meta data for this image is:

Crop Top	: 0.2
Crop Left	: 0
Crop Bottom	: 1
Crop Right	: 0.92399
Crop Angle	: 0
Crop Width	: 1200
Crop Height	: 222
Crop Unit	: 0
Has Crop	: True
Already Applied	: True

All of this meta data is important and valuable, but none of it more so than security meta data. Without adding meta data required for intellectual property protection anyone can use the image without asking permission or paying proper compensation. Security meta data establishes ownership, usage rights and can enable usage detection and tracking in electronic media.

The security meta data for this image is:

Creator	: Douglas Hackney
Copyright Notice	: Copyright © 2008, Douglas Hackney
Marked	: True
Usage Terms	: Copyright © 2008, Douglas Hackney, all rights reserved. This image may not be reproduced in any form, analog or digital, without the expressed written consent of Douglas Hackney.

With this set of meta data our image is now a useful and viable image. Due to its meta data, it is much more than a photo of pink flamingos. It is an image with a full set of technical meta data that contains every aspect of its creation. It is an image whose creation location is precisely known. It is an image asset that can be quickly searched, selected, categorized and retrieved. It is an image with a full incremental history that allows us to restore it to any previous version or its original form. It is an image that is fully protected and secured.

Without meta data, an image is only useful for viewing, at the time of viewing. Any additional value or capability is due solely to its meta data.

3 Meta Data Location

Digital photography meta data is usually contained within the image file itself. If your image is a JPG, JP2, TIFF, PNG, PS, PDF, PSD, DNG, PNG, SVG, MIFF or HDP type the meta data will typically be integrated within the image file.

For RAW files, XMP meta data is written to a separate file, usually called a “sidecar” file. The sidecar file is a text format file and usually shares the RAW photo file name with an .xmp file type extension, e.g., IMG_1234.xmp.

4 Viewing Meta Data

All major photo editing, organizing and viewing tools include the capability to display a subset of a photo's meta data. Some require a specific menu command, such as "View:Image Information." Most include the capability to enable a window or panel that displays photo(s) meta data.

Some photo workflow tools also allow the user to edit selected meta data fields.

There are also a variety of meta data utilities that display and edit meta data.

Examples of workflow tools that display and/or edit meta data include:

- ExifToolGUI
- ExifTool by Phil Harvey
- Opanda IEXIF
- Exifer
- Adobe Lightroom
- Adobe Photoshop
- Adobe Bridge CS2
- Paint Shop Pro

All of these tools share common characteristics:

- Labels used for meta data fields are chosen arbitrarily and may not match the actual contents
- There is no consistency of field labeling across the various tools
- Different tools display meta data from different sources (EXIF, XMP) without clearly identifying the actual source, e.g. Date and Description.

Often the only way to view the complete, accurate set of meta data for a photo is to use a low level, technical utility, such as ExifTool, to extract and display the unprocessed, and therefore undistorted, meta data.

A list of the available meta data fields (tags) and the meta data for the sample image used in this document are here: http://www.hackneys.com/travel/docs/sample-metadatalist.txt

5 Meta Data Types and Purposes

Digital photography meta data has four main types and five primary purposes:

Types:

1. Technical characteristics
   Technical characteristics are added to the image's data set by hardware and software. Common examples include shutter speed, f stop, iso, color balance, etc. A subset of technical characteristics meta data is added to the image's data set when the image is created. Technical characteristics meta data can also be added to or edited by workflow software such as pixel dimensions when an image is cropped and resaved.
2. Event/transactional
   Event or transactional meta data is created by software when an image is processed during or subsequent to the workflow. Event or transactional meta data is created every time software interacts with the image and writes additional meta data to the image file(s). Common examples include digital watermarking and non-destructive editing data such as that created by Adobe Lightroom or Cannon Digital Photo Professional.
3. Derived
   Derived meta data is created by interpreting existing meta data or calculating new meta data based on existing meta data values. A common example is deriving GPS geolocation data based on an image's date/time stamp.
4. Descriptive/Classification
   Descriptive/classification meta data is usually manually added to the image's meta data. It is typically used to add descriptive or classification information to the image. Common examples include captions, keywords, location, image categories, etc.

Purposes

A. Automation
   Meta data enables the automation of tasks and processes via software. Software reads and interprets the image's meta data. The information provided in the meta data allows the software to understand the image's data set and process it correctly.
B. Segmentation
   Meta data enables the segmentation of images into various types, categories and characteristics. Meta data enables the quick and easy sorting, grouping and structuring of images by any meta data value. Common examples include client, location, date, camera, lens, image type, subject, etc.
C. Security
   Meta data enables establishment, maintenance, monitoring and enforcement of intellectual property rights and image authenticity. Meta data contains creator, copyright and usage rights information. Meta data can also contain digital watermarking which enables the monitoring of image utilization in electronic media. In addition, meta data can contain information that establishes and authenticates the veracity and unedited, unaltered status of an image.
D. Discovery
   Meta data enables the discovery of specific images within a collection of images. By searching meta data images containing specific keywords, categories, words, descriptions, characteristics, subjects, etc. can be identified and selected. Common examples include subject matter, location, image type, etc.
E. History
   Meta data enables the history of an image to be established and maintained. Meta data creates an audit trail that can be used to establish an image's original form and subsequent modified forms. Common examples include non-destructive editing information and milestone versions.

6 The Meta Data Challenge

Today's world of digital photography meta data is filled with questions and confusion.

"Why can't I see the photo captions on my web site?"

"What happened to the edited keywords?"

"Why did my IPTC data disappear?"

"Why are my create date/time values different when I use different tools?"

"Why does one tool display different values for EXIF meta data than another tool?"

"What happened to my copyright notice?"

"Why don't my image comments appear anymore?"

"Why does the same image have three different captions in three different tools?"

"What happened to all of the detailed camera information?"

All of these questions and the resulting confusion are due to different aspects of the chaos surrounding meta data engendered by the software vendors and their development teams.

The challenge lies in sorting through the industry disinformation and vendor finger pointing to discover the underlying causes of the confusion.

7 The Six Causes of Confusion

In an effort to shield users from the gory mess they've made of meta data, software developers often use nicely formatted displays and comforting, familiar names, such as "Description" or "Date," when displaying meta data.

Unfortunately, the rule of unintended consequences comes into play and this well meaning effort to protect the users from the underlying complexity has often led to misunderstandings, lost and corrupted meta data, and widespread user community confusion. This is especially true when one tool displays a description for a photo and another doesn't. Or, when one tool displays one date/time value for a photo and a different tool shows a completely different date/time for the same image.

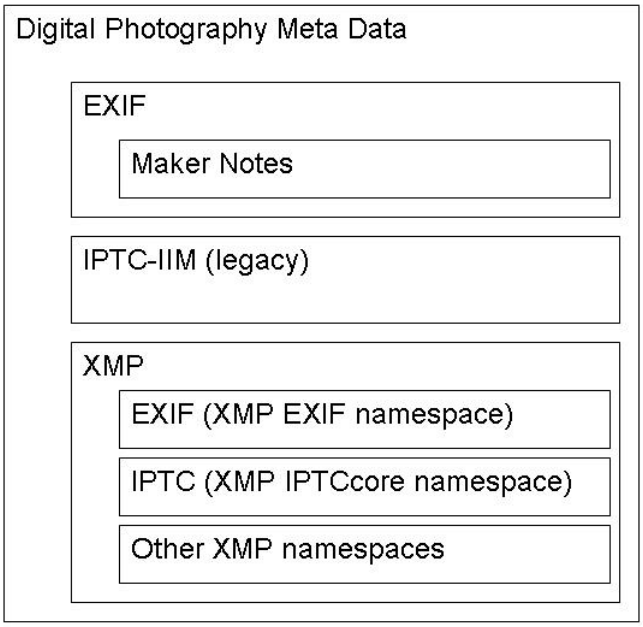
In these circumstances, the frustration and confusion of the user community is palpable.

Most of the frustration, anxiety and bewilderment regarding digital photography meta data is due to six primary factors, the six causes of confusion:

1. Multiple Meta Data Classes.

There are multiple types or classes of meta data. The relevant classes include EXIF, IPTC-IIM, and XMP.

The conceptual model of digital photography meta data may be considered as:



EXIF (Exchangeable Image File Format) meta data is initially populated by the digital camera. EXIF information is formatted according to the TIFF specification, and may be found in JPG, TIFF, PNG, MIFF and HDP images, as well as many TIFF-based RAW images, and even some AVI and MOV videos. EXIF Maker Notes meta data contains proprietary camera manufacturer information and varies from camera to camera, even from the same manufacturer and within the same product family.

IPTC-IIM (legacy) (International Press Telecommunications Council) meta data is an older standard that is generally being phased out in favor of the XMP-IPTCcore namespace and associated XMP fields. IPTC-IIM information may be embedded in JPG, TIFF, PNG, MIFF, PS, PDF, PSD and DNG images.

XMP (Extensible Metadata Platform) is a standard created by Adobe. XMP is an XML/RDF-based metadata format. It can be embedded in many different image file types including JPG, JP2, TIFF, PS, PDF, PSD, DNG, PNG, SVG and MIFF, as well as audio file formats supporting ID3v2 information. XMP is an extensible meta data structure, meaning different tools can create and utilize meta data within the XMP data structure. XMP is segmented into multiple sub-classes called namespaces. XMP field (tag) names can be duplicated between namespaces. A full XMP field (tag) name includes the namespace, e.g., XMP-exif:Contrast or XMP-crs:Contrast. There are namespaces within XMP that are named and/or contain EXIF and IPTC data.

Each of the three main classes of digital photography meta data: EXIF, IPTC-IIM and XMP exist as independent entities. None of them inherently knows about the existence of or the contents of the other classes. It is up to each tool that reads, displays, edits and writes meta data to correctly display the meta data, keep it in synch with each other, and correctly, in a non-destructive way, write the meta data.

It is all too common for tools to corrupt or destroy existing meta data when they write to the photo file. For example, when editing a photo and saving it. Or, when creating, adding to, editing, and subsequently writing to the photo's meta data.

There are no international standards related to how tools must, or even should, display or label meta data. It is up to each tool's development team to decide how they will label and display the meta data. For instance, a tool can display or label the field that contains the date/time the image was created as "Date" or "Creation Date" or "Image Date." The same is true for every single element of meta data, which is why "description" or "caption" can appear under so many different names or labels in so many different tools.

In addition, there is widespread duplication of photo meta data across the three classes, especially between EXIF and XMP. Meta data such as date/time and description/caption exist in both classes, and can be independently edited by various tools.

2. No Synchronization

The EXIF meta data class was the initial digital photography meta data class. Cameras embed EXIF metadata such as shutter speed, f stop, etc. into photo files as they are created.

XMP was not and is not part of the EXIF standard. If a tool was developed prior to XMP, such as Exifer or Paint Shop Pro (PSP) 9, then that tool has no way to view or edit XMP metadata.

Adobe, Breeze Systems, and a growing number of other developers and products support XMP metadata.

If a tool only displays, edits and maintains XMP, then the two data sets, EXIF and XMP, can become de-coupled for common data points that exist in both classes, such as date/time.

If a tool, such as RoboGEO, relies on the EXIF version of a common data point but that common data point, such as date/time, was edited by a tool that only maintains XMP data, such as Adobe Lightroom (LR), then the EXIF dependent tool will be working with out-of-synch data.

There is no mandate or requirement for tools to maintain synchronization between common data points in the various meta data classes. Tools are free to edit values in one class of meta data, such as XMP, and not update the corresponding common data point in the EXIF class.

3. The EXIF of XMP

The XMP specification has a namespace area labeled EXIF. Adding to the confusion even more, the XMP-EXIF namespace has field names that exactly duplicate those of EXIF field names.

This means that a tool can display an XMP-EXIF namespace class meta data field using the label “EXIF Date.” Unfortunately, that XMP-EXIF class field may contain data that is different from the EXIF class date/time field.

[editorial comment] The developers of the tool probably consider themselves correct in labeling the field “EXIF Date” since the data comes from the XMP-EXIF namespace date/time meta data field. They might even consider themselves bold, forward thinking standard setters for completely ignoring the old, and in their eyes, completely outdated, EXIF meta data date/time field. But, however stylish and trendy they might be in the developer community, their actions create a user community that is betrayed, and in the end, confused and frustrated.

No matter what the developers would like the world to be like, the real world is still populated by a wide variety of tools, many of which rely on, primarily or exclusively, EXIF meta data. It is up to the developers and their tools to maintain consistency across all common meta data in all meta data classes.

For instance, if a tool writes to the XMP-dc:Description field, it needs to also write to the EXIF ImageDescription field and the JPEG Comment field. [end editorial comment]

4. EXIF is not always EXIF

Just because a tool labels a piece of meta data as EXIF, it doesn’t mean it actually is EXIF class meta data.

For instance, Breeze Systems Breeze Browser Pro (BBP), LR, Photoshop Elements (PSE), Adobe Bridge, etc. use, either exclusively or primarily, XMP metadata, even though they may label/display it as EXIF.

LR, for example, only displays the XMP date/time values, even though they are labeled EXIF date/time.

BBP displays different sources for the image caption/description depending on the type of file and the file’s internal data structure. The displayed image caption/description can be EXIF on one image and XMP on another, all with no designation or clear labeling to tell the user the source of the data.

These examples are merely the tip of the iceberg for this issue. The EXIF label is used prolifically in all digital photography workflow tools and it is a rare occurrence when the user can know with certainty the true source of the data.

The label EXIF does not guarantee that the data is actually EXIF class meta data.

5. Brittle Maker Notes

Maker notes are a subset of the EXIF meta data class. They are embedded into the image data file at the time of creation by the digital camera's software.

Maker notes contain an extensive amount of very useful information such as:

Macro Mode: Normal	AF Points In Focus: 22
Self Timer: Off	AF Points Selected:
Quality: Fine	0,1,2,3,4,5,6,7,16,17,27,28,37,38,39,40,41,42,43
Canon Flash Mode: External flash	Original Decision Data Offset: 0
Continuous Drive: Single	Bracket Mode: Off
Focus Mode: One-shot AF	Bracket Value: 0
Record Mode: CR2+JPEG	Bracket Shot Number: 0
Canon Image Size: Small	Raw Jpg Size: Large
Easy Mode: Manual	Noise Reduction: On (mode 4)
Digital Zoom: None	WB Bracket Mode: Off
Contrast: Normal	WB Bracket Value AB: 0
Saturation: Normal	WB Bracket Value GM: 0
Metering Mode: Evaluative	Lens Type: EF24-70mm f/2.8L USM
Focus Range: Not Known	Internal Serial Number: G02XXXX
Canon Exposure Mode: Manual	Exposure Level Increments: 1/3-stop set, 1/3-stop comp.
Long Focal: 70 mm	ISO Speed Increments: 1/3-stop
Short Focal: 24 mm	ISO Speed Range: Enable; Max 0; Min 100
Focal Units: 1	Focus Distance Upper: 0.61
Max Aperture: 2.8	Focus Distance Lower: 0.54
Min Aperture: 23	

A sample of the full set of maker notes for the Canon 1D MkIII is here:
http://www.hackneys.com/travel/docs/canon-1dmk3-makernotes.txt

Maker notes is a set of proprietary information provided by the camera's manufacturer. They are undocumented and use inconsistent and non-standard formats for the data set, even within the same camera model family from the same manufacturer.

Maker notes are implemented within the EXIF data. The EXIF data specification is based on the TIFF format. The EXIF/TIFF data format specification is crippled by a fundamental design flaw involving the layout of information segments.

In technical terms, the format uses pointers with an absolute offset from the beginning of the file. In layman's terms, the EXIF/TIFF format is brittle.

Again in technical terms, if any data segment is altered within the EXIF data, all pointer references must be recalculated and rewritten. In layman's terms, if any EXIF data is altered in any way, such as cropping the image so the X and Y pixel lengths change, the entire EXIF data structure must be recalculated and rewritten.

This recalculation and rewriting process would merely be tedious and inefficient if all the data structures were documented. But, because the maker notes are proprietary and undocumented, whenever the EXIF data is touched by a workflow tool in any way, the maker notes disappear.

The complete and irretrievable loss of the maker notes information can be a significant challenge. This is especially true if your standard workflow alters the EXIF data during the download process. If your download tool destroys the maker notes data, you will never have access to it within the remainder of your workflow.

Photo editing software such as Photoshop (PS) and PSP destroy the maker notes data the first time a jpg file is saved. If you do not create an untouched, unedited backup copy of your original file you lose the maker notes the first time you edit and save the image, even if all you do is crop.

Meta data after editing with PS and PSP are here:
PS – http://www.hackneys.com/travel/docs/mn-sample-metadatalist-crop-ps.txt
PSP - http://www.hackneys.com/travel/docs/mn-sample-metadatalist-crop-psp.txt

The image is the same Canon 1D MkIII file used in the prior full set example. Each photo was cropped in the respective editing tool. You will note that in these two files there is no remaining maker notes data.

The brittle nature of maker notes data requires every digital photographer that desires access to the maker notes data to retain, backup, inventory and manage in perpetuity an untouched, unedited copy of every single image they create.

6. Name Confusion and Duplication

Digital photography meta data has numerous examples of field label/name duplication between meta data classes. In addition, meta data fields are commonly named/labeled differently in tools than the meta data specification itself.

One tool may label a meta data field “Date/Time,” another “Photo Date,” another “Date,” and another “Creation Date,” and this is true even in different products from the same software vendor. The challenge lies in the fact that each of those displayed values may come from a different source. For instance, in LR, the date/time information displayed in the Metadata panel is not the EXIF date/time field metadata, it is the current contents of the XMP-EXIF namespace date/time field metadata contained in the LR database.

Each software development team picks the label it assigns to every piece of meta data it displays or edits. There is no industry standard for what labels should be used, and there is no industry standard for mapping labels from one meta data class to another, such as from EXIF to XMP. Tools are free to display whatever piece of meta data the developers decide is relevant, using whatever label they desire to use to describe that data.

As a consequence, when using multiple tools in their workflow the user has no way to know with certainty which displayed field contains which piece of meta data.

For example, the image caption/description for our sample image is:

User Comment	: Flamingos taking flight. Laguna Amarga. Near Torres del Paine National Park, Chile.
Image Description	: Flamingos taking flight. Laguna Amarga. Near Torres del Paine National Park, Chile.
Description	: Flamingos taking flight. Laguna Amarga. Near Torres del Paine National Park, Chile.
Caption-Abstract	: Flamingos taking flight. Laguna Amarga. Near Torres del Paine National Park, Chile.

When this information is displayed in different tools, it is labeled many different ways and the data is extracted from different places. For instance, in tool A, the image caption/description can be labeled “Description” but the data can be extracted from the “User Comment” field. In tool B, the image caption/description can be labeled “Caption” but the data can be extracted from the “Image Description” field.

When all the data is identical, as it is for our sample image, it doesn’t matter what the tool labels the field or where it actually extracts the data from. But, as is often the case, the tool that is used to create the image caption/description does not write or update all the available fields that can contain that data, which in this instance are User Comment, Image Description, Description, and Caption-Abstract.

It is usually the case that the tool will only edit or update the meta data field it maps to its image caption/description field. This means that if the image is viewed in another tool or uploaded to a web photo hosting site the image caption/description may not appear.

Following is an example of creating/editing image caption/description in a tool that only populates/updates a single meta data field:

User Comment	:
Image Description	: Flamingos taking flight. Laguna Amarga. Near Torres del Paine National Park, Chile.
Description	:
Caption-Abstract	:

In this example, if the web hosting site uses the “Caption-Abstract” field for the image caption/description it will be incapable of displaying the caption contained in the “Image Description” field.

A common and very challenging scenario is when the image caption/description is created or edited in multiple tools. As a result, the image contains multiple image captions/descriptions, each of which is only visible in the tool it was created/edited in.

Following is an example of creating/editing image caption/description in multiple tools:

User Comment	: Pink flamingos
Image Description	: Flamingos. Chile.
Description	: Pink flamingos taking flight. Near Torres del Paine National Park, Chile.
Caption-Abstract	: Laguna Amarga. Near Torres del Paine National Park, Chile.

In this example, the user sees a different image caption/description in every tool along the workflow.

Another example of meta data duplication with more significant implications is copyright.

The copyright information for the sample image is:

Creator	: Douglas Hackney
Artist	: Douglas Hackney
Credit	: Douglas Hackney
Rights	: Copyright © 2008, Douglas Hackney
Copyright	: Copyright (C) 2008, Douglas Hackney
Copyright Notice	: Copyright © 2008, Douglas Hackney
Marked	: True
Usage Terms	: Copyright © 2008, Douglas Hackney, all rights reserved. This image may not be reproduced in any form, analog or digital, without the expressed written consent of Douglas Hackney.

Note the multiple instances of creator/artist/credit and rights/copyright/copyright notice. Unless all of these fields are correctly populated, copyright information may not display or be accessible.

Each photo viewing, editing, searching, organizing and hosting tool/system uses a specific field for copyright information. If a stock photography agency expects the copyright information in the “Rights” field but the workflow tool that is used for the copyright information only populates the “Copyright” field then the stock agency will be unable to access, display or utilize any copyright information for the image.

Another useful example of the widespread name confusion and duplication can be found in Date/Time meta data.

Relevant Time Metadata Fields

EXIF Metadata

Tag ID	Tag-Name	Comments
0x0132	ModifyDate	Labeled DateTime by the EXIF spec
0x882a	TimeZoneOffset	1 of 2 values: 1. The time zone offset of DateTimeOriginal from GMT in hours 2. If present, the time zone offset of ModifyDate
0x9003	DateTimeOriginal	Note duplication of XMP-EXIF field name
0x9004	CreateDate	Labeled DateTimeDigitized by the EXIF spec

XMP-EXIF Namespace Metadata
(XMP metadata is segmented by namespaces. The main section is called Dublin Core, commonly referred to as dc. XMP also has a namespace called EXIF.)

Namespace	Tag-Name	Comments
dc	Date	
EXIF	DateTimeDigitized	Note duplication of original EXIF specification field name
EXIF	DateTimeOriginal	Note duplication of EXIF field name

> As illustrated with these examples, there is widespread name duplication and confusion within the meta data specifications themselves. Add a layer of tools from different development teams, each using its own labels, and you have a perfect recipe for the current state of user community meta data confusion and frustration.

Taken individually, any one of these six causes of confusion would be enough to create significant challenges. Taken as a group, they have been more than enough to create an ongoing state of meta data chaos in the digital photography world.

The chaos manifests itself when workflow tools:

- Utilize different, non-standard or misleading labels for meta data fields
- Use the label of one meta data field while displaying, editing and updating a different meta data field
- Fail to populate, edit or update all relevant meta data fields
- Fail to properly map meta data from one class to another
- Fail to synchronize meta data across classes
- Corrupt legacy meta data fields

Until the software developers resolve them, the user community will be left to wrestle with the six causes of confusion.

8 The Customer's Perspective.

A customer expects the technology to work. A customer expects that if the software industry designs and develops a new standard that it will integrate with, and carry forward, previous standards. A customer expects that new standards will be backward compatible with the customer's existing collection of thousands of images and suite of workflow tools.

In these regards, the customer is usually disappointed.

There are three factors and entities at work here:

1. Standards forming teams/companies/organizations
2. Standards certification organizations
3. Software companies and their development teams

Anybody, even me, can proclaim a new standard. I can tout my new standard within the industry, champion its cause from the podium at trade shows and pump money into PR to gain its endorsement from the trade press.

To reach critical mass of market acceptance via this approach requires a lot of time and a lot of money. I don't know if Me-Myself & I, Inc. would have those resources. A company like Adobe, however, has plenty of money to spend, so they can afford to push any standard they like.

If I felt my new standard had achieved a critical mass level of market acceptance, I could submit my new standard to an international standards body and seek to achieve status as a recognized and accepted international standard. For example, Adobe is currently seeking international standard status for DNG.

But, even if I dominate an industry and my new standard achieves international standard status, it is still up to the individual software companies and their development teams as to how that standard will be implemented and supported.

9 The Software Developer's Perspective

Software product development managers and product marketing managers are not compensated, rewarded or promoted based on standards compliance or backwards compatibility. Their rewards are based on market share and product revenue streams.

The market does not reward product managers who spend their precious budgets on mundane capabilities such as meta data. The market rewards managers with revenue who invest their budgets in sizzling marketing campaigns, flashy user interfaces and blockbuster new features.

Software development teams, by their very nature, are forward oriented. It is not a rewarding or promising career path for a developer to be assigned to a rearward view, such as documenting the code or building backward compatibility with previous standards.

Developers want to be working on the latest, greatest, most advanced things. It gives them status within their community and keeps their resume fresh and marketable.

It is for these reasons that tools like Lightroom always have the latest, greatest, RAW processing capability contrasted by simple bugs that destroy legacy meta data.

Does that make sense from a customer/user perspective? No, it doesn't.

As users, we expect things to work. We expect industries to maintain backwards compatibility with their previous standards. But, in this case, our expectations run against the grain of software marketplace realities.

10 Recommendations

The digital photography meta data situation will not improve until standards are implemented, recognized, endorsed, supported and complied with by the software vendors and development teams.

1. Establish detailed standards for meta data field name labeling
2. Establish detailed standards for meta data mapping across classes
3. Establish detailed standards for meta data synchronization across classes
4. Comply with industry standards
5. Limit or eliminate vendor unilateral standards "enhancement"

11 Summary

Digital photography meta data remains an area lacking adequate international standards and compliance with existing standards.

Digital photography meta data remains an area lacking adequate resource allocation and priority among software development teams.

For the digital photography software user, meta data will continue to be a confusing and frustrating subject overpopulated with technical jargon and vendor finger-pointing.

It is up to the user community to educate themselves on the intricacies of meta data to the extent required to ensure the accuracy of the meta data in their images.

At this time, there is no cavalry riding over the hill to rescue anyone seeking consistent, accurate and reliable meta data.

For the foreseeable future, digital photography meta data will remain chaotic and frustrating.

Unless and until they establish adequate standards and comply with them, the software vendors' meta data implementations will remain a riddle wrapped in a mystery inside an enigma.

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Sources:

- ExifTool by Phil Harvey documentation

Terminology note: I used the database term "field" to denote meta data "tags." My goal was to avoid confusion between meta data tags and the term "tags" used in tools such as PSP and PSE for keywords and categories.

12 Resources

Digital Photography Meta Data Tags (Fields)

These documents list the meta data tags used to store a photo's meta data. They are very useful when attempting to track down the source of a meta data problem.

Classes

EXIF	http://www.hackneys.com/travel/docs/EXIF.html
IPTC-IIM	http://www.hackneys.com/travel/docs/IPTC.html
XMP	http://www.hackneys.com/travel/docs/XMP.html

Selected Camera Manufacturers

Canon	http://www.hackneys.com/travel/docs/Canon.html
Canon Custom	http://www.hackneys.com/travel/docs/CanonCustom.html
Canon RAW	http://www.hackneys.com/travel/docs/CanonRaw.html
Canon VRD	http://www.hackneys.com/travel/docs/CanonVRD.html
Nikon	http://www.hackneys.com/travel/docs/Nikon.html
Nikon Capture	http://www.hackneys.com/travel/docs/NikonCapture.html

Other

DNG	http://www.hackneys.com/travel/docs/DNG.html
GPS	http://www.hackneys.com/travel/docs/GPS.html
JPEG	http://www.hackneys.com/travel/docs/JPEG.html
Jpeg2000	http://www.hackneys.com/travel/docs/Jpeg2000.html
PhotoMechanic	http://www.hackneys.com/travel/docs/PhotoMechanic.html
Photoshop	http://www.hackneys.com/travel/docs/Photoshop.html

Source: ExifTool by Phil Harvey resource files

Utility Batch Files

Following are links to batch files used for examining a photo's meta data. Each batch file displays the available meta data fields of a jpg file named sample.jpg.

There are three batch files used to create three different text files of meta data information: EXIF, XMP and All.

All of these batch files use an image file named sample.jpg. I provided a copy of the image used in this document as sample.jpg file here: http://www.hackneys.com/travel/photos/metadata/sample.jpg.

To use with your own image(s), simply rename your image to sample.jpg.

All batch files create corresponding txt files of their output that can be opened in any text editor.

Requirements:

An unzipped copy of the Windows command line exiftools utility by Phil Harvey available here: http://www.sno.phy.queensu.ca/~phil/exiftool/

Note: Download the windows executable and the Perl library version. You will eventually want the HTML documentation files in the Perl version.

Configuration:

1. Unzip the exiftool utility.
2. Rename the utility exiftool.exe
3. Copy the exiftool.exe file to your windows folder or to a folder on your system path
4. Copy the batch file(s) to the folder containing the photos you wish to process

Batch Files:

1. list-exif-tags-sample.bat

Batch to display all available EXIF meta data fields (tags) for a jpg file.
Available here: http://www.hackneys.com/photos/bbp-test/list-exif-tags-sample.bat

To use:
a. Create a copy of a jpg you are interested in, i.e. for a specific camera
b. Rename the copy sample.jpg
c. Put the list-exif-tags-sample.bat in the same folder as the jpg
d. Open windows explorer
e. Double click on list-exif-tags-sample.bat

A sample of the output of this batch file is here:
http://www.hackneys.com/photos/bbp-test/sample-exiflist.txt

2. list-XMP-tags-sample.bat

Batch to display all available XMP meta data fields (tags) for a jpg file.
Available here: http://www.hackneys.com/photos/bbp-test/list-xmp-tags-sample.bat

To use:
a. Create a copy of a jpg you are interested in, i.e. for a specific camera
b. Rename the copy sample.jpg
c. Put the list-xmp-tags-sample.bat in the same folder as the jpg
d. Open windows explorer
e. Double click on list-xmp-tags-sample.bat

A sample of the output of this batch file is here:
http://www.hackneys.com/photos/bbp-test/sample-xmplist.txt

3. list-metadata-tags-sample.bat

Batch to display all available meta data fields (tags) for a jpg file.
Available here: http://www.hackneys.com/photos/bbp-test/list-metadata-tags-sample.bat

To use:
a. Create a copy of a jpg you are interested in, i.e. for a specific camera
b. Rename the copy sample.jpg
c. Put the list-metadata-tags-sample.bat in the same folder as the jpg
d. Open windows explorer
e. Double click on list-metadata-tags-sample.bat

A sample of the output of this batch file is here:
http://www.hackneys.com/photos/bbp-test/sample-metadatalist.txt

