# 2

# Metadata

## Knowledge Is Power

Metadata is sometimes seen as the magic bullet that will save us all and provide some order to the chaos that is hidden behind the walls of every media organization. It is not going to accomplish a solution unless we use it thoughtfully.

This chapter looks at metadata from several angles and examines how it might be used in the production process and beyond.

### Standards

Standards are developed because of a need to connect systems together. It is a search for compatibility between the systems. There are many standards available, and many more that are in development. Choosing the best ones for your system can be a challenge, because there are so many alternatives. It is sometimes difficult to select standards that are compatible with systems and technologies you already have in place. The standards continue to evolve whilst your systems might be deployed and running for years.

A standard is usually developed by a group of like-minded people who may operate commercially in competition with one another. Standards create business relationships and drive commercial activity. That may mean agreeing with one of your competitors to deliver consistent output from each of your competing products. This is driven by the hope that the overall marketplace will grow larger, and your own competitive slice of the cake will be bigger even if your market share remains the same.

Suppliers use standards to make their systems more flexible and capable of integration. Purchasers like standards because it helps them to avoid lock-in. We all need standards to ensure systems and software are interoperable.

## What Is Metadata?

Metadata is "data about data." It may come as a surprise that metadata is not a recent invention by the broadcasting industry. It has been around for thousands of years. It hasn't been formalized until relatively recently—in the last few hundred years that is.

An index that collates references to information contains metadata. It can be implemented physically with a set of handwritten record cards such as you might find in a library. It is more convenient to use an online system, but both are metadata systems. Information professionals describe the information that adds value to the underlying essence data as metadata. The essence data is created, collated, organized, described,

tracked, and maintained by the system with any auxiliary information being stored as metadata. Information objects that are wrappers or containers represent external essence data in a way that can be understood by a workflow system.

## Why is Metadata Useful?

Metadata describes the information necessary to locate a document or other media object in a consistent way. A metadata *scheme* is a minimum set of metadata that is well understood and used by everyone. It should be unambiguous. A metadata scheme provides these facilities:

- A standardized way to locate network-accessible material.
- A consistent descriptive framework to store properties of the material.
- Facilitates queries that are more precise.
- A degree of fuzziness for queries (near, like, similar to).
- Groups objects into sets.
- Provides an order by which objects can be ranked.
- Access control.
- Commercial value and business logic support.
- Conversion and reuse for other purposes.
- Industrial strength workflow automation.

## The Difference Between Data and Metadata

It is natural (but wrong) to assume that essence data and metadata are the same thing even though they may look similar. The simplest explanation is that essence data is the actual information product while metadata is the data about that essence data.

A collaborative task force assembled by European Broadcasting Union (EBU) and Society of Motion Picture and Television Engineers (SMPTE) members addressed the question and decided that some clarifying definitions were required (See Table 2-1):

**Table 2-1 Terminology definitions**

| *Terminology* | *Description* |
|---|---|
| Essence data | Describes the text, pictures, sound or moving images |
| Metadata | Describes the properties of the essence data |
| Content | Combining Essence data and Metadata together |
| Asset | An asset is some content plus its rights-management properties |

In the context of a digital video file, the information that comprises the actual pictures you see is essence data. The file name and the count of the number of frames in that sequence, as well as the copyright information, are not part of that presentation but describe the essence data in some way. It is metadata.

Metadata can be multilayered. As well as describing the essence data, it can describe the containers in which the essence data is stored. Higher levels of abstraction can describe combinations of essence data and metadata as *content*.

The data itself is called *essence data* because it is the true essence of the information being stored. The essence data is that which you have some proprietary rights over and which has commercial value, while the metadata helps you find, manage, and distribute that essence data in order to monetize your asset value. You may also have rights that pertain to the metadata, which may be separate to the rights you have to the essence.

# Metadata Management

When building a system, get the metadata management working robustly. This book is about improving the quality of metadata. It is the very foundation of the system. If we do this right, subsequent stages of the process can build on it in the knowledge that there is a secure underpinning.

If we make the process of improving metadata quality easier through effective use of automation, then it is likely that the quality of our metadata won't be compromised so easily through laziness or omission. We must never assume that automation can take the place of a human being. Content is created for consumption by human beings. It makes sense that it is authored and qualitatively checked editorially by a human.

## The Information Science Viewpoint

Information Science deals with the philosophy and semantics involved in metadata. Standard approaches to its organization are:

- Taxonomies.
- Vocabularies.
- Dictionaries.

These are all tools that describe structural relationships between different aspects of the data.

Designing the metadata structures should happen long before any essence data is created or ingested into your repository. This is analogous to an architect designing a house where the software engineer is equivalent to the builder. Both have their skills and have to work together to build a house correctly. The builder may have insights about the practical process that the architect needs to assimilate and vice-versa. The same applies to information design and software engineering a system according to that plan.

### The Engineering Viewpoint

From an architectural point of view, essence data is quite different from metadata (information that describes the essence data). When we start to engineer a solution, the distinction is much less obvious. We use the same kind of containers and store similarly formatted information for both.

An image pixmap is clearly essence data, while its modification date is metadata. An event in a calendar might also have a modification date, but the essence data is a date value too. For calendars, we might have two date values represented identically, but one is essence data and one is metadata.

**The engineering problems and quality issues regarding accuracy and formatting apply equally to metadata and essence data.**

This book is about considering metadata quality and how it helps you to design and build better systems. The practical advice is directly applicable to both essence data and metadata.

We want to deliver the best quality we can for both essence data and metadata.

### Separating Content and Style of Presentation

Metadata fits with the concept we have developed around web sites where the information content and presentational style are separated from each other. If the layout and appearance is maintained separately, then repurposing for a different form factor is much easier to do.

The typical HTML vs. CSS proposition can be applied to interactive TV and multimedia presentations. The HTML page is essence data and a CSS style sheet describes how that content appears. It isn't quite metadata, but the relationship is similar.

In an interactive TV scenario, we might have a collection of assets that need to be aggregated into an interactive package (MPEG-4 BIFS, wired QuickTime, SMIL or Flash). The assets are manufactured independently of each other, but the metadata describes how they can be combined into a package that can be viewed interactively. By changing the metadata, the content can be reshaped to work on a different platform without affecting its meaning.

## Where Do We Use Essence Data?

In a digital TV workflow process, the essence data is the footage that might be cut and edited on your video editing desktop computer. Perhaps you are using Apple's Final Cut application, Avid Xpress, or Adobe Premiere. These applications might store the data in different kinds of project containers, but the essence data they are manipulating is the same. They might perform the editing operations in completely different ways and use different algorithms. The result is always a playable video clip.

In multimedia and broadcast systems, those video clips may have been edited together from a variety of different sources. For public broadcast purposes, we need to know where they came from and who owns them. They are (usually) not owned by the person who edited the clip together. This provenance information is metadata, and it must be maintained at the highest quality and accuracy.

The provenance chain is shown in Figure 2-1 for a quite simple two-generation edit.

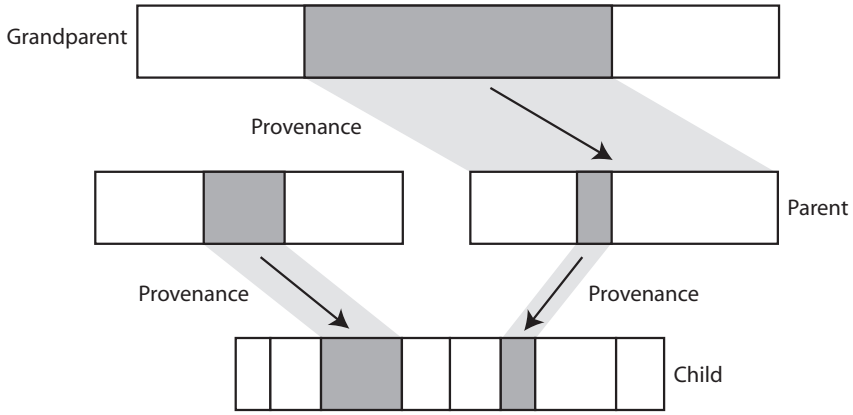


**Figure 2-1** Inheritance via provenance metadata

Tracking that provenance is of vital importance, because the rights issues surrounding the use of video clips are extremely limiting and complex. A broadcaster may have permission to broadcast a goal in a soccer match only six times. An additional usage fee is due if it is broadcast a seventh time.

A scene in a studio with a TV set showing an old episode of a TV program would be even more complex. The broadcaster must clear the rights for the picture and sound on that TV set in addition to what is being filmed in the foreground.

In the past, this was managed with massive amounts of paperwork, but now computerized databases make the job much easier. Those databases need to be carefully integrated with the workflow process, and the provenance may need to be nested with parent and child relationships between clips having to be maintained through some complex duplication, cutting, and redistribution mechanisms. Clearly, this is a nontrivial thing to get right. If the data is inaccurate or missing then you have wasted your money investing in a computerized system.

## Standardization

Content systems work best when the essence data and metadata is standardized and many people agree to use the same structure, format, and meanings for the values being exchanged. Anything you can do to eliminate conversions between one format and another will help to maintain the quality of your metadata. The conversion processes are often where some of the most subtle data corruption takes place.

The meshing and intersection of standards is complicated because they don't all support the same entities and properties. Some are strictly hierarchically organized, while others are not much more than a vocabulary. This makes the harmonization more difficult. You should choose the smallest set of standards that do what you need and design your own object model as a superset of them so that you don't truncate fields, records, properties, or objects.

Be careful how you implement extensions. Often the comment fields can be used as additional storage locations with some careful formatting of what you embed there. You shouldn't rely on them being stable after any export/import operations. Comments are routinely stripped off and discarded. It is because they are (disposable) comments. Genuine structures containing real data should remain intact.

Profiles can be used to reduce the complexity of a standard and impose some range limits on the values being stored. This is helpful, but make sure that you remain compatible with the profile and not just with the standard in its nonprofiled form.

Table 2-2 lists some relevant standards for metadata and essence data formats. This list is not exhaustive and a more complete description of metadata standards is provided in Appendix B.

**Table 2-2 Metadata and essence data standards**

| *Standard* | *Description* |
|---|---|
| ATSC | Advanced Television Standards Committee is the U.S. equivalent to DVB for standardization of digital TV services. |
| DTV | Digital TeleVision services describe packaging of data into a broadcast stream. Your metadata will end up here *en route* to the viewer. |
| DCMI | The Dublin Core Metadata Initiative delivers a range of standard descriptors to assist in searching for material across systems. |
| DVB | Digital Video Broadcasting consortium. Primarily European standards-oriented. Some DVB standards work is applicable in the U.S. |
| DVB-SI | The DVB equivalent to PSIP for carrying EPG metadata and service information. |
| EBU P/META | The P/META standard defines a set of Names and Identifiers that are organized as a vocabulary. |

**Table 2-2 Metadata and essence data standards (continued)**

| | |
|---|---|
| EPG | Electronic Program Guides are available as embedded data streams that you can extract from the broadcast signal or as online services that can be downloaded. There are standards for the format and structure, but some data is available in nonstandard ways. |
| ISAN | ISO Audio-Visual Number. |
| MPEG-7 | The MPEG-7 standard describes a "Multimedia Content Description Interface." |
| PDC | Program Delivery Control as specified by ETSI also describes a genre-tagging scheme. |
| PSIP | The Program and System Information Protocol standard describes how metadata is carried in an ATSC transmission. |
| SMEF | Standard Media Exchange Framework, an "Enterprise Semantic Data Model," designed to cope with large data sets. |
| SMPTE 335M | The SMPTE Metadata Dictionary Registry. |
| TV-Anytime | The TV-Anytime standard describes a mechanism for discovering programs using metadata-searching techniques. |
| V-ISAN | Version controlled ISO Audio-Visual Number. |

## Exchange File Formats

We are all familiar with file formats such as Windows Media, Real Video, Flash and QuickTime. They are ubiquitous and well supported within certain platform constraints that are driven by commercial imperatives.

**Choose your formats wisely to avoid being locked in to a format that prevents you doing things in the future. Always go for openness and avoid proprietary choices when you can.**

For industrial-strength workflow design, we cannot afford to be painted into a corner by one format or another. The emerging nonplatform-specific formats are more attractive.

That is not to say we wouldn't use QuickTime or Windows Media, but their limitations need to be weighed carefully. QuickTime has an advantage in that it is generally as well-supported on Mac OS X and Windows, and it is, after all, a platform that plays open standard and proprietary formats without prejudice one way or the other and it is not only a video/audio player but a multimedia platform. By comparison, Windows Media is a less attractive option because it is well-supported on Windows but barely supported on Mac OS X—and then only by virtue of a third-party plug-in (Telestream's Flip-4-Mac). Where it uses open standard media, it doesn't always support it correctly (e.g., open standard MPEG-4 video with proprietary audio). Neither Windows Media nor QuickTime are supported properly on Linux although some third-party solutions and hacks help deal with playback.

Table 2-3 lists some useful exchange formats for file-based content.

**Table 2-3 Exchange file formats**

| *Format* | *Description* |
|---|---|
| AAF | Advanced Authoring Format. |
| AFXP | Authoring Format eXchange Profile. An enhanced version of DFXP for authoring subtitle content once and mapping it to many other outlets. Still in development, and expected to support graphics as well as text. |
| ASF | Advanced Systems Format. |
| DFXP | Distribution Format eXchange Profile. |
| DPX | Digital Picture eXchange Format. Designed to transport moving image representations in a file per frame structure. |
| EXIF | EXIF stands for EXchangeable Image File Format, and is a standard for storing interchange information in image files, especially those using JPEG compression. Favored by digital camera manufacturers. |
| GXF | The General eXchange Format was originally conceived by Grass Valley Group for the interchange of simple camera shots over data networks, and for archival storage on data tape. Now standardized as part of SMPTE 360M. |
| MXF | Pro-MPEG Material eXchange Format. Also favored by the P/META group. |
| TT AF | The W3C Timed Text Authoring Format represents text media for interchange between authoring systems. Timed text is textual information that is associated with timing information such as subtitles. |

## Where Do We Use Metadata?

The metadata will facilitate many of the commercial processes involved in production, editing, and broadcast. We discussed editing earlier, but here are some more opportunities for metadata to provide assistance:

- Researching, developing and planning the program ideas.
- Commercial planning, budgeting, and control.
- Managing resources.
- Technical systems management.
- Paying the correct cameraman to go out on a shoot.
- Paying a stock footage company only for the footage being used.
- Capture, ingest, and logging.
- Postproduction.
- Publishing/marketing.
- Promotion planning for advertising and media sales.
- Ensuring that programs are broadcast to the correct territories.
- Ensuring programs are broadcast at the right time.

- Controlling whether, when, and for how long a program may be stored on a PVR.
- Driving interactive services with embedded and synchronized content.
- Linking programs to enhanced and interactive functionality and supporting web sites.
- Compliance recording (FCC and other international bodies).
- Feeding location data through so that programs can be found via end-user searches.
- Audience research and feedback after broadcast.

## Editing Metadata—Accidentally

Manufacturers of nonlinear editors (NLE) advertise that their systems will maintain embedded metadata when cutting video content together. Avid MetaSync shows how metadata editing is infiltrating the whole NLE editing workflow. Final Cut supports exchanges via an XML interface.

If your video editing is wired into a workflow system, as might be commonplace in a news environment, the metadata might be maintained outside of your NLE tools but within the content management system. The BBC News organization has a project to implement this sort of capability on a massive scale.

The NLE will edit sound and video clips and place them in any order taking them from a variety of sources that might all have a different provenance. If the NLE also copies metadata from those sources and embeds it in the edited output you should check that the metadata is correct as well as the audio and video cutting. This can be classified as an accidental and potentially erroneous edit because the metadata is usually invisible. The operator may be completely unaware that they have edited it along with the sound and picture.

Depending on your system, the maintenance of the metadata might be done manually or automatically. It is likely that if a significant manual process is involved, many errors and omissions will occur.

Automation significantly reduces the likelihood of problems happening but it needs to be capable of responding in a benign way to unexpected situations. Problems that could be attributed to human error might be caused by:

- Tiredness.
- Laziness.
- Negligence.
- Carelessness.
- Lack of training.
- Lack of supervision.
- Lack of postproduction quality auditing.

Your automation and business process logic needs to guard against all of these possibilities, as well as cope with purposeful acts of malice.

## Metadata Dictionaries

Metadata dictionaries are quite big. When you combine several metadata schemes for different aspects of your system (technical, commercial, content genre-specific), you can have a large dictionary to manage (see Table 2-4 for examples).

**Table 2-4 Dictionary sizes**

| *Standard* | *Scale (approximate)* |
|---|---|
| SMPTE Metadata Dictionary | 1000 terms |
| Automation and control systems | 150 commands |
| Traffic management | 100 terms |
| Genre thesaurus/vocabulary | 2500-5000 terms per genre |

While you wouldn't expect to use all of these dictionaries, you need to ensure your name spaces are free of any clashes, and you need to know about them all.

In 2001, the SMPTE Metadata for Broadcast and New Media conference highlighted more than 70 ongoing metadata standards-related activities. That number must be significantly higher by now. Many initiatives are aware of each other. Some standards have merged. Some standards have edited out the duplication and refer to other standards documents instead.

For example, country codes are usually represented using an ISO standard whenever they are referred to in other standardized schemes. Provided each individual standard is maintained separately and does not encroach on areas covered by other standards—we can develop a healthy ecology using whichever standards are necessary for our systems design.

## Metadata Tagging

Tagging is the process of attaching keywords to programs so that they can be located by genre or content. The tagging might be hierarchical or a simple list of keywords. If a hierarchical method is used, you need to be careful how you define the precedence of each keyword.

Let's take an outdoor religious celebration event that is comprised primarily of musical performances. Should that be categorized and tagged as a "Music" or "Religion" genre item? Whichever you choose, the other will likely be attached as a secondary tag. The fact that it takes place outdoors is probably not worth a high-priority tag, but might be added as a useful keyword.

Within the category of "Music" in the context of "Religion," many sub-categories are needed to further classify the musical style. There are probably 25 quite distinct Contemporary Christian Musical styles. Some of those are applicable to secular music, too. This is large enough industry sector to qualify as a genre category in its own right (CCM). There are CCM music charts and CCM sections in major record stores.

Categorization and tagging requires us to attach multiple hierarchies if we want to use anything other than a list of relevant keywords. Figure 2-2 shows how that might be done in our object model.

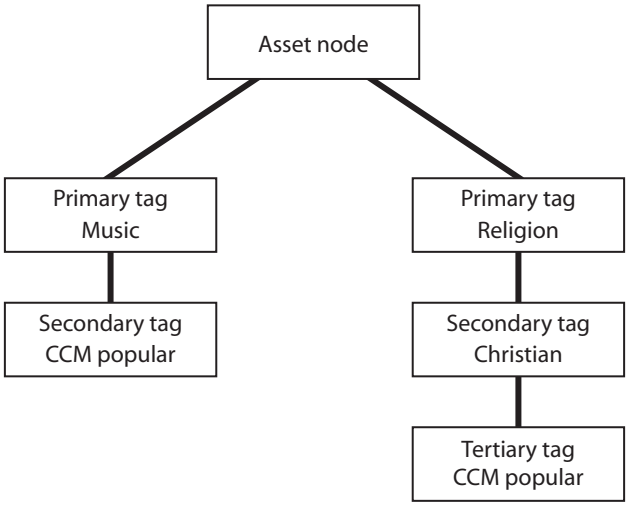


**Figure 2-2** Alternative tagging chains

The P/META standards working group has begun to publish some useful tagging vocabularies on the EBU web site. There are many categories of data that would benefit from a tag vocabulary. An EBU standard describes the different roles that people contribute to a production.

One approach is to use the tagging as search keys regardless of whether they are arranged hierarchically or not. Then the hierarchical organization can be used to rank the results. It is a useful compromise that works with all kinds of tagging.

## Organizing Metadata Elements

Metadata elements might be better understood and managed by your workflow if you group them into sets or categorize them. Table 2-5 illustrates how the BBC Standard Media Exchange Framework (SMEF) data model organizes some Dublin Core Metadata Initiative elements into groups.

*EBU role codes: http://www.ebu.ch/en/technical/metadata/specifications/role_codes.php*

**Table 2-5 Grouping of Dublin Core elements in SMEF**

| *Content* | *Ownership* | *Containment* |
|---|---|---|
| Coverage | Contributor | Date |
| Description | Creator | Format |
| Type | Publisher | Identifier |
| Relation | Rights | Language |
| Source | Commercial details | Storage |
| Subject | | Ingest process |
| Title | | |
| Included material | | |
| Participating actors | | |

## Metadata Roles and Duties

There are many roles and responsibilities. Who does what? The answer depends on your business model and what industry you are working in.

Consider the roles shown in Table 2-6 as a starting point. Several roles are listed with the connotations describing what those roles might mean.

**Table 2-6 Metadata roles and responsibilities**

| *Role* | *Description* |
|---|---|
| Creator | The author of the original content. The author would provide any original and authoritative source form, but the delivery format may be derived from that source form. The first entry in the change history would denote the creator. |
| Owner | Someone who receives monetary rewards for fee-based deployment of the content. The metadata contains the owner's name in the copyright message. |
| Editor | The person responsible for making changes as opposed to having editorial authority. Often the custodian or curator as well, but the duties may be split in large organizations. Any change history records would denote the editor. |
| Curator | The agent of the owner who administers and looks after specific content on a day-to-day basis. The contact person for inquiries about the asset controlled by the metadata. |
| Librarian | A person whose general duty is organizing assets and keeping a collection neat and tidy. Metadata describing the collection as a whole might provide contact details for the librarian. |
| Custodian | The person who has official or technical responsibility for making sure a system works or content is available. Any metadata related to the storage, schema, or architecture might be addressed to the custodian. |

The roles described in Table 2-6 are generic. Your business might identify some other specific roles and duties not listed here that relate to metadata that is unique to your company or industry.

## Metadata Evolution Over Time

Roles and responsibilities, and the metadata for which they are responsible, will change over time. Consider some metadata that relates to a news story. At what point does today's news become tomorrow's historical archive? Bear in mind that news has a tendency to come back into the foreground when an event later on evokes some earlier issue. Perhaps a war zone flares up again, or a very important trial commences the prosecution of a criminal who committed a crime some years earlier. We need to consider when a news story reverts from being historical archive to a live story again. Does that alter the ownership from information and archives back to an editorial responsibility?

## Dark Metadata

You may import a file, which contains metadata entities, and essence data for which you have no corresponding storage designed into your repository. This is called *dark metadata*, and you might be able to safely ignore it, but beware. Provided you are only ingesting and never intend to forward that metadata package, you could discard the things you don't need.

If you have to turn the content around and send it onwards, then you must ensure that all of the metadata is safely preserved for onwards delivery.

This can happen when new properties are added to a standard you are already using. Upgrading standards requires some diligence on your part to ensure that your system is able to cope correctly with the new information.

You should watch out for numerical and namespace clashes when dark metadata is present and you are creating your own properties. If you choose a property name and that then later on shows up in some dark metadata, unpredictable things may happen.

The MXF file format standard has some special header support called a Primer Pack. It describes how user-defined tags that are represented as 16-bit values are mapped to the global key structures that are 16 bytes long. This is designed to alleviate the pain and grief that dark metadata can cause.

There are some mechanisms where special tags can be embedded to carry dark metadata. In web pages, we might use **<DIV>** and **<SPAN>** tags and set their display attribute to "none" or perhaps hidden **<INPUT>** fields in a **<FORM>** structure.

## Black Metadata

Dark metadata is syntactically and semantically correct and may conform to the standard even if your application doesn't support it. The term *black metadata* is occasionally used to describe dark metadata but describes something quite different.

The documents that mention black metadata describe mechanisms for appending nonstandardized metadata to existing storage formats after the logical end-of-file (EOF). This would allow software to read the file in the normal way and totally ignore anything following its end-of-valid-data marker. Black metadata-aware applications could then continue reading onwards to access the additional data. This takes advantage of the fact that file buffers are block structured, and all kinds of garbage might be tagged onto the end of a file when it is closed.

**Don't break the standards purposely. Extending the standard with your own ideas and to make it incompatible with the rest of the world is a bad idea.**

Storing black metadata in your files and implementing mechanisms to support it in your application is a very bad idea! It compromises the integrity of the file format by adding what might appear to be spurious data to the end of the file.

If you need to carry metadata that is not described as part of the standard, then you should explore the proper extension and escape mechanisms provided by the standards and use them as they were intended. Purposely breaking a file structure with proprietary extensions is completely unsupportable.

Hijacking tags for the wrong reason, storing data in nonstandard ways, and creating *de facto*, application-specific ways to transport metadata is the sort of dirty trick that companies use to lock you into their software, and it should be challenged at every opportunity.

**Just when you thought you had learned the jargon, along comes a weird inconsistency in nomenclature. XSL stands for eXtensible Stylesheet Language. CSS stands for Cascading Style Sheets. When you refer to an XML styling mechanism, use the single word 'stylesheet'. Separate it into two words when you describe the styling used with HTML. Consistency? Pah!**

## Cross-walking the Standards

Cross-walking between different metadata standards can be accomplished with eXtensible Stylesheet Language (XSL) if you are operating in an XML-based environment. XSL is useful because it describes how to format and transform the target data. The transformation converts one XML tree into a different XML tree or a plain text form. XSL provides a method for selecting, reordering, and outputting specific nodes from the tree. The ability to move data from one XML representation to another makes XSL an important tool for building XML-based workflows.

# How is Metadata Created?

At almost every stage in the lifecycle of a program's creation, and often long afterwards, there are opportunities to add metadata.

Some of the metadata may be created automatically by the equipment being used. Other data may be the result of something that an operator does. Perhaps some metadata is created through an editorial process. The lifecycle of the metadata goes on indefinitely for many years after the essence data itself has been completed.

## Creating Metadata on Location

The earliest opportunity to create new metadata is when the footage is shot, with the camera inserting information about the type of camera, the exposure settings, the lens type, and the GPS location. Beware of what the camera (or camera operator) puts into the metadata records. At this point, the tape cartridge being used should already have been logged with the master librarian system. Although, that could be done as the tape is ingested for the first time.

Metadata becomes important at this point. It can help to avoid overwriting valuable original footage. Add descriptive electronic metadata to that tape before you take it out of the camera. When you send it back to base by courier, and the sticky label falls off, at least there is some information recorded on the tape to describe what is on it. If there is no label on the case and no metadata on the tape, you can't rely on the automation systems preventing it from being recycled inadvertently.

Other important information needs to be recorded aside from the GPS. Date and time are obvious candidates. The location of the subject matter may be some distance away from the observer's position. The GPS location of the camera may be less relevant than the location of the subject being filmed. The distance might be some tens of feet or several miles. Figure 2-3 shows how a very long-range shot can be incorrectly logged when relying on GPS by itself.

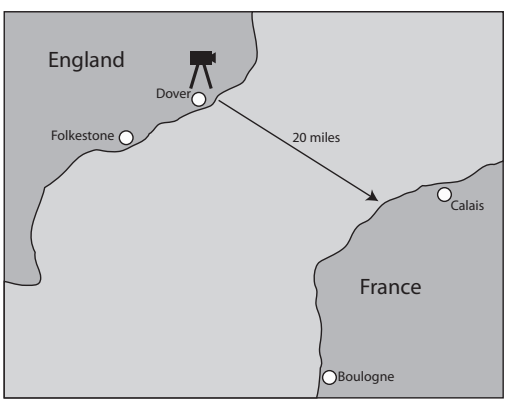


**Figure 2-3** Filming France from Dover

The distance between camera and subject could be thousands of miles—from the earth to the moon.

Here are some potential metadata tags and properties that could be entered on location:

- Camera operator name and details.
- Date.
- Time.
- News slug.
- Story.
- Location.
- Tape/reel number.
- Tape format.
- Shot list.
- Shot location on tape.
- Type of shoot.
- Details of cut away shots, vox pops, and stock shots.
- Shot flagging (good, not good).
- Names of participants.
- Contact details of participants.
- Description of the key action.
- Times and time codes.
- Crew list.
- In and out words.
- Transport method (courier or online).
- Working hours logged for chargeback.

## Creating Metadata in the Studio

Camera-based metadata generation may be a useful part of your workflow when shooting on location. It is less useful in the studio, because the recordings would likely not be done by a handycam with its own built-in recording mechanism.

Studio-based cameras may still have some useful data to be recorded. Motion tracking is useful when creating virtual studio sets. Knowing the zoom factor of the lens and its focus setting, as well as its aperture, all helps to provide insights that a virtual reality studio system can use to accurately match-move the presenter against 3D-generated environments.

Here are some potential metadata tags and properties that could be added in the studio:

- Camera operator name and details.
- Date.
- Time.
- News slug.
- Story.
- Studio location.
- Server file name where recording is stored.
- Shot list.
- Shot quality flagging (good, not good).
- Names of participants.
- Contact details of participants.
- Description of the key action.
- Times and time codes.
- Gallery crew list.
- In and out words.

## Creating Metadata During Ingest

When the material arrives back at the studio from an outside broadcast or is fed from an external service, it will be ingested through processors that extract meaning and metadata. The operator has the opportunity to add more metadata about whom, when, and where. Proxy copies may be created at this time. They need to be noted in the content system and tracked back to the parent via appropriate provenance metadata links. The proxy copies will be used for desktop browsing and possibly editing.

Some ingest systems, such as Virage VideoLogger, will create huge amounts of additional metadata. Virage performs optical character recognition, facial recognition, and voice recognition, all of which add to the value of the ingesting process.

Telestream FlipFactory is an alternative that is strong on its technical capabilities to convert many different formats of incoming video, but does not apply as much analysis as VideoLogger. It won't deliver as much metadata for you to load.

Here are some potential metadata tags and properties that could be added to the metadata at ingest time:

- Frame rates.
- Aspect ratio.
- Tape details.
- Source format.
- Clip details.
- Extracted metadata.
- Picture size.
- Aspect ratio.

## Creating Metadata with Speech Recognition

Fast-Talk is a useful voice recognition tool for ingesting audio feeds. It performs a clever phonetic analysis that is resilient when ambient noise interrupts the audio. This is useful when you are searching audio archives.

Voice recognition is not quite good enough to publish directly as a transcript for subtitles. It is evident that broadcasters are using it that way when you watch some programs though.

If you have the script available, then the speech recognition tools can marry up the text with the video and synchronize the two. The open-source Thistle speech recognition system has been demonstrated by BBC research engineers as a way to synchronize an Autocue to the spoken audio track. The Autocue script can have embedded lighting controls and camera moves. We can close the loop on studio automation systems by combining audio, metadata, and speech recognition together.

Emerging standards such as the W3C Timed Text Authoring Format (TT AF) are an obvious candidate for output file formats for these systems.

Here are some potential metadata tags and properties that can be added as the audio is analyzed:

- Length of recording.
- Audio format.
- Number of tracks (stereo/mono).
- Length and duration of clips.
- Time codes, etc.
- Date and time.
- Location.
- Names of participants.
- Sound recordist.
- Equipment used.

## Creating Metadata During Postproduction

Editing a proxy produces an edit decision list (EDL) that can be applied to the full-quality video in a craft editing workstation. The NLE must also preserve any metadata and store it in or with the EDL.

The editing process should be nondestructive. Cropped versions of the video become child clips that are created as references to the original footage. There is no need to render this footage again until we are conforming the final program. Several child clips can be joined together with transitions and other source materials (titles and graphics) to create a completely new material item. This is related to the source clips, and their provenance needs to be maintained. Because of the transitions, the clips are not a direct image copy. Metadata needs to propagate through this system and will be added to and enhanced along the way.

Eventually, the program is finished and more metadata, such as production team names and duties, is added to describe it. Copyright stamping for the compilation and production branding could happen here. Some rights control relating to commercial issues might be added at this stage too. Then, the program can be added to a catalogue of products for sale.

This is an opportunity to apply quality assurance and check that any surviving metadata that made it through the editing process is genuinely needed. I would classify this is a vital piece of editorial checking at this point. **Tutorial 51** addresses this issue as a use case study and illustrates what could happen accidentally.

Here are some potential metadata tags and properties to add during post-production:

- NLE system.
- Location of master copy if proxy used.
- Location of EDL file.
- Provenance relationship to parent clips.
- Music details.
- Frame rates.
- Compression method used.
- Noise reduction.
- Color correction applied.
- Dubbing details.
- Aspect ratio.

## Creating Metadata for Traffic Scheduling

Metadata can be embedded into the program material and used during the broadcasting process. Storing a reference to a subtitle data file within the video container is an example. Directly embedding the subtitle data into a text track means that everything you need at broadcast time is readily at hand.

Here are some tracks containing data that could be added:

- Additional enhancements.
- Interactivity.
- Game play.
- Linked content.
- Hint tracks.
- URL tracks cross-links.

Here are some potential traffic scheduling metadata tags and properties:

- Scheduled airtime for broadcast.
- Channel to be broadcast on.
- Location of master tape/server containing video file.
- Contact in case of emergency.
- Producer/director.
- Tagging info.
- Interactive event data.
- Interactive spool file for carousel loading.
- Subtitle data.
- URL crosslink data.

## Creating Metadata During Play-out

At broadcasting time (sometimes referred to as play-out), we want to store the airdate, channel (or portal), and other information about how the program is presented.

Some useful metadata can be embedded into the transmission stream. All users who receive the broadcast can access and store the information and use it to make some decisions about how to access the essence data.

Here are some potential metadata tags and properties to note during broadcast:

- Actual time the program was broadcast.
- Actual channel.
- Person controlling the play-out.
- Compliance information.
- Report of any technical issues during play-out.

## Creating Metadata During Deployment

For Internet-delivered content, the equivalent to scheduling a broadcast is the deployment of the content on a public-facing web server. Then it is ready for demand-driven consumption.

You might publish metadata describing that content to a static file on a server that your end users can access. RSS feeds can be used to detect new metadata automatically.

Here are some potential metadata tags and properties to note when publishing to the Internet:

- URI style location of published file.
- Time taken to process publication.
- Master ID of story in database.
- List of related pages that point to this asset.
- Date of publication.
- Date and time when last checked for access.
- HTTP status result from last access check.
- Access time measurement for performance metrics.
- Feedback from log analysis on asset popularity.

## Creating Metadata in the Receiver

Eventually, an end-user receives and watches a program but may also record it on a PVR, computer or iPod on a temporary or permanent basis. More metadata could be added here to uniquely identify that copy so that piracy issues can be addressed.

Here are some potential metadata tags and properties for implementation inside the consumer device:

- Date recorded/downloaded.
- Unique ID of material.
- Tagging info.
- Channel or portal the content was recorded from.
- Broadcaster whose portal it was recorded from.
- Other metadata that came packaged with the program.
- File name on local storage.
- Embargo details.
- Rights of access.
- Rating of content.
- Links to other media (IMDB, CDDB, etc.).
- Compression format.
- Aspect ratio switch.
- Surround sound settings.

## Creating Metadata After Broadcast

Sometimes a community of users develops around a program, and collectively they add more information that is potentially useful metadata. This clearly happened with *Star Trek*, *Star Wars*, *Lord of the Rings* and *Doctor Who*. It can happen with any programs with additional and useful related content becoming available long after the program was completed, especially where there is a cult or community developed around the program.

Perhaps some production notes come to light long after production is finished. It is not unusual for directors to house all their papers in an archive and donate them to a college or museum as a lasting legacy. These need to be collated together, carefully preserved, and linked with the original movie or TV program that they directed—possibly some tens of years previously.

Here are some potential aftermarket and post-broadcast metadata tags and properties. Some of these may be generated by a community of interested fans rather than the production company. That can present some interesting rights issues because the fan created metadata describes the essence that the production company owns. The fans own the rights in the metadata that they produce but they must be creating genuinely new intellectual property:

- Links to fanzines and web sites.
- E-commerce links for merchandizing.
- Actor biographies.
- Crew biographies.
- Season episode listings.
- Stills gallery.
- Filmographies.
- News of follow-up or otherwise related programs.
- Recommended other viewing.

## Recycling and Repurposing

Recycling of previously used material may add to or alter certain aspects of the metadata. Should we preserve the previous information so there is an audit trail? Journaling the changed data is worthwhile and useful, especially considering that the differences are probably textual and might only occupy a small amount of the available storage capacity. It seems a worthwhile trade off to make in return for being able to trace the provenance more effectively and to track down some later changes if that becomes necessary.

Referencing back to earlier material means that you need to consider the long-term scale and scope of your repository. We should have learned that much from the millennium bug, which was the consequence of trying to save a few meager bytes of memory in some computer systems developed in the early part of the information revolution.

Forward thinking needs to happen when examining the data model for your metadata in order to allow the system scope to increase significantly beyond what might seem to be the expected range of values.

## Further Study

There are a bewildering and increasing number of metadata standards, profiles, exchange file formats, and *de facto* implementations for you to consider. The list is increasing all the time. You cannot hope to stay abreast of every new development. Table 2-7 lists some places where you can look from time to time for some useful new technologies.

**Table 2-7 Further study opportunities**

| *Organization* | *Relevant work* |
|---|---|
| Adobe Labs | Public trials of research prototypes of its image-editing tools, some of which will make it into production. You can test these when they are at a prototype stage. The Lightroom metadata controls a nondestructive picture editor. |
| EBU | The European Broadcasting Union publishes new standards documents all the time. |
| ETSI | European Telecommunications Standards Institute. |
| ISO | The International Standards Organization's standards steering process usually operates in collaboration with working groups belonging to other bodies. |
| DVB | The Digital Video Broadcasting project does European digital TV standards work. |
| SMPTE | The Society of Motion Picture and Television Engineers does primarily US-based film and television standards work. |
| W3C | The Worldwide Web Consortium's web-based standards work is published here. |
| ATSC | Advanced Television Standards Committee. |
| Google | Scan the Google database occasionally when you come across an unfamiliar term. |
| Wikipedia | The content is provided by the public and not always considered authoritative. Political and commercial material needs to be weighed carefully, but technical information is rich and deep and appears to be mostly of a high quality. A good jumping-off point for further investigation. |

## Boiling It Down

We have toured around the metadata world, briefly looking at some of the processes involved in multimedia production. There are many alternative standards in other industries, but the problems that engineers face are very similar.

Bear in mind that some metadata schemes are highly organized while others are not much more than a collection of tag values. There is a big difference between a hierarchy and a vocabulary.

The quality of the service you deliver depends on how well you implement the software that processes the values stored in a metadata scheme. The next chapter looks at modeling the system design before we begin to implement anything.