MultiPhoto/Video Specification

Manifest, Metadata and Practices for Digital Photo-Video Collections

DRAFT LOGO

Technical Whitepaper

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ABSTRACT

The MultiPhoto/Video specification defines a manifest and metadata format and practices for processing and playback of collections of digital photo, video, and related audio and file content stored on an optical disc and other storage media such as memory cards and computer harddrives or exchanged via internet protocols.

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Chapter 1: Executive Summary

MultiPhoto/Video (MPV) is an open specification that makes easier the processing and playback of collections of photo-video content, including stills, stills with audio, still sequences, video clips, and audio clips. By analogy, MPV is added to the original data to enable slideshow and browsing tasks of photo-video content just as DPOF is added to the original data to enable printing of photo content.

Applications and devices and users that use MultiPhoto/Video benefit even when they only interact with still images in basic ways; when content like video clips and still sequences are added, as can be captured by a majority of the digital cameras introduced recently, the benefits expand.

MultiPhoto/Video uses a simple text-based format that is easily understood and also easy to produce and consume programmatically in firmware or computer software. MultiPhoto/Video does *not* tackle a large number of problems at once – instead, it focuses on a few key problems that it solves with simple but robust approaches. Where possible and practical, it makes use of established specifications and standards.

The development and promotion of MultiPhoto/Video is sponsored jointly by two industry-leading trade associations, the Optical Storage Technology Assocation (OSTA) and the International Imaging Industry Association (I3A). The specification development and promotion process is open to all members; all organizations and individuals are welcomed as members. These associations include over 100 member companies from all over the world that produce products that collectively represent a majority marketshare in mainstream consumer digital imaging and recordable optical storage categories.

MultiPhoto/Video is not only a specification. It also includes a compliance test suite and processes, compliance testing materials, and a logo program for compliant products. In addition, some sample open-source code implementations of key steps in processing MPV content are available. These materials and procedures are made available and administered by OSTA at a modest cost. OSTA and I3A charge no royalty for use of the specification or logo.

The specification is being developed in phases and results in "profiles". Each profile in MultiPhoto/Video defines only those formats and practices that are necessary for the key tasks targeted by the profile. A number of candidate profiles for development have been identified, including:

- **Basic Profile**: key tasks: defining content collections, renditions, identifiers, and access to other metadata
- **Presentation Profile**: two key tasks: viewing a slideshow and interactively browsing content collections
- **Internet Profile**: key task: interacting with and sending collections of photo-video content over the web and email
- **Capture Profile**: key task: writing new content to storage media and updating the collection info
- **Editing Profile**: key task: modifying existing collections of photo-video content.
- **Printing Profile:** key task: printing collections of photo-video content
- **Container Profile**: key task: storing photo-video content collections in containers

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This document introduces the Basic and Presentation Profiles of the MultiPhoto/Video specification, which may be implemented in consumer electronics devices, like DVD players, or application software to provide a firmware application that implements compelling playback of photo-video slideshows and interactive browsing of photo-video content.

MultiPhoto/Video technology has three central components: Collections, Metadata, and Identification. Each of these make reference in various ways to data files containing the photo-video content. This information is augmented with Presentation information that may be used by player applications and devices to provide an attractive user experience.

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Chapter 2: Introduction

2.1 Problem Overview

There is a strong trend towards combination digital cameras that capture rich content, including still photos, stills with audio, still photo sequences like rapid capture and panoramas, video clips, and audio clips. Some cameras also produce other associated data files and lower-resolution renditions of the original content.

The problem today is how to develop digital imaging systems supporting photo-video content that make all the primary user tasks -- capture, store, share, and print – easy and inexpensive to do. Two primary use cases are important: (a) no computer involved and (b) computer involved.

Today, a user of such a digital camera can easily capture a nice collection of photo-video content. After capture, the user can use the camera to interactively browse and playback content items in the order taken. Most such cameras also have a video-out jack and a slideshow mode, allowing the user to enjoy a photo-video slideshow on TV that plays back stills, stills and audio, video, and audio files in the order taken. Both browse and slideshow functions utilize in-camera firmware that understands the sequence, file system structure and formats of the digital content files.

However, once the digital files are removed from the camera – whether transferred to harddisk, burned onto recordable CD or DVD, stored on some other media, or simply inserted on a memory card into another device – the basic photo-video slideshow and browse experiences cannot be reproduced by computer software or consumer electronics (CE) devices without considerable user know-how and resources. Nor is there any standard way for software applications on computers or CE devices to discover the relationship between various files placed in the file system, nor to add additional information to files in a standard way.

Significantly, there is no standard representation for collections of photo-video content when stored on recordable CD or DVD, which today is among the best media for long-term storage of consumer digital content. This is important especially because of the strong trend to add new "playback applications" to DVD players – which are the fastest growing category of consumer devices – for playback of additional file formats and disc formats, such as JPEG and MP3 on multisession recordable CD.

Thus millions of recordable CDs and DVDs are being produced with photo-video content, yet the consumer electronics and computer software

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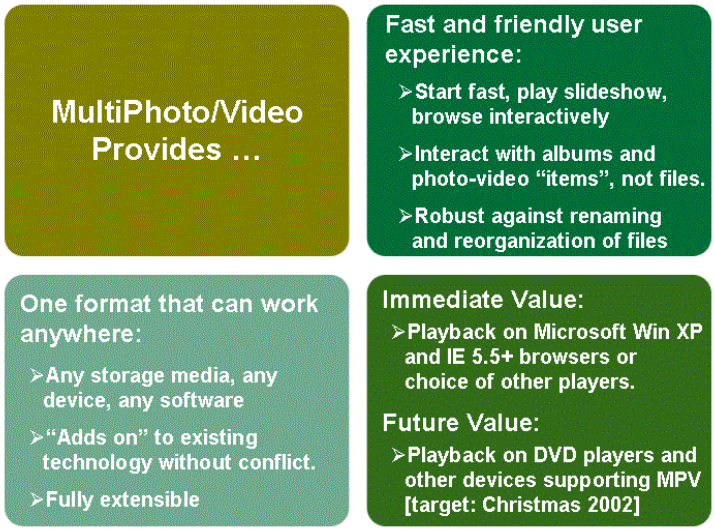
industries are unable to produce standard players or processors that can offer any more than the most rudimentary playback and interaction experiences. This runs completely counter to the outstanding interoperability, consistency, and ease of use provided by Audio CD (CD-DA), VideoCD and DVD-Video formats, which set the standard for consumer friendliness and value preservation. Yet the constraints of these very formats – requiring complicated, time consuming, and processing-rich production steps -- prevent them from achieving the capabilities, flexibility and ease of production that can be achieved simply by storing the original photo-video data on the discs.

Beyond discs, solid-state memory cards are becoming very affordable, widely deployed and easy to use -- but problems abound here as well. The first challenge of the industry has been simple interoperability based on physical format, which is likely to be addressed overtime by the marketplace either by adding a range of memory card slots or convergence on dominant formats. After the physical format, memory cards suffer also from a lack of application-layer formats that allow for the photo-video content stored on them to interoperate easily with devices and applications from many manufacturers.

2.2 Solution Overview

The MultiPhoto/Video (MPV) specification defines and promotes a standard manifest and metadata format for collections of digital photo-video content that can solve these problems for the industry. This will further promote digital camera adoption by enhancing consumer satisfaction and acceptance via improved ease-of-use and interoperability of photo-video content and applications that can utilize it. OSTA and I3A, the associations developing and promoting the specification, charge no royalty for use of the specification or associated logo.

Applications and devices and users that use MultiPhoto/Video benefit even when they only interact with still images in basic ways; when content like video clips and still sequences are added, as can be captured by a majority of the digital cameras introduced recently, the benefits expand.



MPV provides a manifest file and metadata format for digital photo, video, audio, and related file content on storage media, including recordable CDs and DVDs and memory cards. The format does not contain the content itself – MPV is an aggregation of information about the content, including references to the content, providing essentially a Table of Contents. The format is text-based, easy to understand and easy to produce and consume.

A typical implementation is a stand-alone file named "TOC.MPV" or "MPV_TOC.XML" and zero or more dependent files. The MPV format utilizes or references existing standards, including the Exif and DCF standards from JEITA and JCIA, the World Wide Web's (W3C) SMIL specification, the International Imaging Industry Association's (I3A) DIG35 standard for metadata for digital images, and Adobe's eXtensible Metadata Platform (XMP).

The MPV format can be "added on" to existing applications and conventions because it is extremely non-invasive, co-existing with all existing file system structures and formats. This provides compatibility with existing processes, devices, software, and services, while allowing the MPV-aware application to offer the user a better experience for enjoying and using the photo-video content. Typically, the manifest is located on the storage media and processed by a device, software, or application during the first steps of preparing to access the associated content.

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The manifest is designed for longevity and extensibility through the use of industry-standard XML, and an easy to understand text-based format that is also easy to produce and consume using a wide variety of commercial or open-source software tools. In addition, the MPV format includes support for write-only media, high-performance update, and use in low-memory, low-performance devices. The manifest can be produced and updated by devices, software, and services on-the-fly, such as with each click of a digital camera shutter button, or during a batch process, such as writing content onto optical storage media. It is designed to be written in a single pass to a write-only data stream. The format can be used with a range of storage media, such as memory cards, recordable or stamped CDs and DVDs, magnetic disks, or even for exchanging information between software applications or services.

MultiPhoto/Video is centered on content captured by consumers using digital cameras, but it is sufficiently general and extensible to support a variety of content origins, formats and application to accommodate specific industries and proprietary extensions.

Due to its design, the MPV format can deliver immediate value to millions of users of existing computer systems. For example, computers with the Microsoft Windows XP operating system can play an attractive slideshow of the photo-video content listed in a MPV manifest using their standard web browser application. Consumer electronics devices can be enhanced easily to support MPV using technology appropriate to their proproprietary platforms but which use the same data format also supported on Windows XP.

2.3 Example

The following is a simple but valid MPV manifest that enables a user to enjoy a slideshow of four still images with background music or to interactively browse the specified photos. Players that can't play the music just don't. Note that the sort order of the filenames is unimportant. This basic manifest can be enhanced easily to include useful things like titles, people, audio annotations, video clips, related files, selection lists, and more. Metadata from any XML-based metadata format can be embedded inline and ignored by applications that don't understand it.

```
<?xml version="1.0" encoding="UTF-8" ?>
<?xml-stylesheet type="text/xsl" href="showbrow.xsl"?>
<mpv:mpv xmlns:mpv="urn:osta-org:mpv:basic:1.0">
    <mpv:Album>
        <mpv:Background>
            <mpv:Audio  mpv:lastURL="C:/My Documents/My Music/Mood music.MP3"
                    mpv:contentID="urn:osta-org:mpv:dsig:all:md5:7026031D4AA9238483DD72B9A6ED4439" />
        </mpv:Background>
        <mpv:Foreground>
            <mpv:Still  mpv:lastURL="Pix from Polly.JPG"
                    mpv:contentID="urn:osta-org:mpv:dsig:body:md5:9926031D93FC4556B68D23B9A6AEC8DA" />
            <mpv:Still  mpv:lastURL="../Sept01/Lucy at Waldo Lake.JPG"
                    mpv:contentID="urn:osta-org:mpv:dsig:body:md5:342603ECD93EDE3493CD98B9A6C98DDC" />
            <mpv:Still  mpv:lastURL="../BestOf2001/The KEPM gang.JPG"
                    mpv:contentID="urn:osta-org:mpv:dsig:body:md5:55260334CD9E834C123524B9A6CD87DA" />
            <mpv:Still  mpv:lastURL="IMG_0023.JPG"
                    mpv:contentID="urn:osta-org:mpv:dsig:body:md5:23260398DD343DC4834D66B9A6884D3E" />
        <mpv:Foreground>
    </mpv:Album>
</mpv:mpv>
```

Many readers will realize that MPV collections can be damaged when referenced files are renamed or reorganized. This example MPV manifest also includes identifiers for each object that provide means to fixup broken pathnames robustly and without user interaction. These identifiers are computed without need to understand any aspect of the referenced file nor make any change to it. More extensive examples are provided later in this document.

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2.4 Motivation and Justification

Digital imaging is a technology that the foundation for a dynamic and exciting growth industry, and a rich diversity of capture devices and content formats exists. Digital still cameras and digital camcorders are exploding in popularity and rapidly adding support for capture of still images with and without audio, video clips with and without audio, and even just audio clips. Consumers need ways to organize, store, playback, and print collections of photo-video content across all manner of devices, software applications, and internet services.

At the same time, recordable optical storage discs (CDs, DVDs) are a recent technology success story – the writer devices and blank discs are broadly available worldwide at ever decreasing cost and boast a projected 300M users by 2004. They are robust and broadly compatible with a wide variety of installed base devices. Because of their capacity, low cost, and robustness, recordable optical storage discs are a natural storage medium for personal digital photos and video. Similarly, memory card slots and uses are exploding due to increasing storage capacities and falling prices.

Yet a lack of suitable standards in either the digital camera or optical storage or consumer electronics industries hinders broad consumer use and enjoyment of the content captured by these cameras. While many popular consumer electronics devices, computers, and services can produce optical discs containing photo-video content, few standards or even conventions exist for how to organize and structure that content. In fact, there is no format that exists today which can support a broad range of disc layouts, disc creation tools, and uses of photo-video content while also allowing for high usability, interoperability and compatibility.

This document specifies the MultiPhoto/Video (MPV) format, which provides means to organize and access a collections of photo, video, audio, and even arbitrary data content on optical storage discs, which may be used to provide users with a basic ability to interactively browse or watch a slideshow of their photo-video content on any device or with any software application, thus achieving high usability, interoperability, and compatibility with current and future products.

AREN'T ORIGINAL DATA FILES ENOUGH?

A simple user experience would allow a user to make a recordable data CD containing JPEG image files and MP3 audio files to use in a DVD player that can "play" a slideshow or interactively browse the collection of data files.

Does such a simple task require a manifest like MPV, one asks? It might seem that simple file name conventions would allow a slideshow to play the images, video, and audio in order. In actual practice, such simple filename-based approaches are unworkable for many reasons, including:

- the user's desire to retain original filenames [making sort order uncontrollable]
- not all the files are in the same location [spread over multiple folders]
- additional files are present that shouldn't be used [such as multiple renditions of the same file in thumbnail, screen, and full resolutions, or graphics used for HTML pages]
- the relationships are too complicated to be expressed easily by filename [these six files are a panorama sequence shot left-to-right].

For example, such a disc might contain not only full-resolution JPEG image files, but also thumbnails and screen resolution versions of the images; these lower-res files provide for higher performance interactivity and display.

Add in richer media types, and the disc might also contain preview thumbnails of the MPEG video in JPEG format. The WAV audio files might be ambient sound or audio annotations associated with specific images or video clips. The MP3 audio files might be background music to play during one or more slideshows. More than one slideshow might be on the disc.

A format is needed that can be shared among many applications and devices to help makes sense of all the content in a single standard way, enabling an application or device to quickly determine which files are of interest to it and how they are to be used.

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WHAT ABOUT DVD-VIDEO AND VIDEOCD?

DVD player devices have achieved the highest rate of consumer adoption in history. They provide an ideal viewing platform for photo-video content contained on optical storage discs in the DVD-Video and VideoCD formats. The DVD-Video format especially is proving tremendously successful for production and viewing of professional content. Yet these formats are highly focused on playback of precisely formatted presentations on consumer electronics devices and assume production processes that are highly involved, require significant computing resources, and impose constraints on the disc content and capabilities.

These formats and assumptions are not appropriate to many practical and desirable uses of photo-video content on optical discs. They don't support many desirable tasks, such as printing of photo-video content, exchanging content with other devices and internet services, low cost/resource disc authoring, multisession disc writing, and so on.

In response to these constraints and also because of price pressures on the DVD player marketplace, DVD player makers acknowledge are adding new firmware applications specifically for interacting with photo-video content on discs not formatted as DVD-Video or VideoCD.

MultiPhoto/Video is complementary to the DVD-Video and VideoCD formats and does not diminish nor constrain the use and value of the DVD-Video and VideoCD formats on optical discs; indeed, it tacitly acknowledges and leverages their ubiquity.

MPV enables and embraces the use of optical discs containing photo-video content in a broader array of devices, software, and services that deliver more capabilities than DVD-Video and VideoCD can support. MPV also enables users of photo-video content on optical discs to receive similar usability and interoperability to that which DVD-Video and VideoCD have achieved and which has so benefited the consumer, content publishers, and the electronics industry alike.

WHAT ABOUT MEMORY CARD FORMATS?

Memory cards are used in most digital cameras and are becoming widely adopted in other consumer electronics devices. All memory cards provide a basic file system. Emerging efforts by adopters of some memory card formats also define "application layer" conventions for how files should be stored in the file system – precise directives about directory and file system structure and names – and about file formats. The intent is to allow for interoperability of content between devices that all support the same memory card format.

This is an important objective -- the same objective that motivates MultiPhoto/Video. However, MPV takes a very different approach than that taken by many memory card specifications. Instead of constraining names and locations of files and directories, MPV provides a way to list the names and locations of the files, whatever they may be. The processing application then fetches the files from wherever they are. Instead of constraining which formats of files may be used, MPV provides a way to identify the formats whatever they may be. The processing application then must decide if it can handle the given format.

MPV is compatible with the requirements and formats specified by some memory cards. It can be "added on" to implementations that conform to memory card specifications without damaging compatibility.

2.5 Scope

The MultiPhoto/Video specification includes the following elements:

- normative definition of format structure and content
- required and best practices and recommendations for use and implementation

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FOCUS ON METADATA

MPV defines metadata representations for collections of digital photo-video content. MPV emphasizes declarative metadata describing the properties and associations of the photo-video content while largely avoiding procedural or proscriptive metadata that mandates visual appearance or behaviour. This enables a diversity of implementations and uses of the metadata by devices, software, and services.

MPV does not concern itself with vendor-specific proprietary metadata or particular application domains. These may be defined outside the scope of this specification, yet still be integrated seamlessly into a given MPV implementation. Devices, software, and services will ignore metadata in MPV that it cannot identify. This preserves broad interoperability of MPV-based solutions.

The MPV format is not a filesystem replacement. MPV structures typically are stored as files in a filesystem supported by the storage medium. MPV also does not place any constraints on content placement in a filesystem. Consequently, support for MPV can be added into most existing devices, software, and services that produce discs of photo-video content without requiring major changes to existing software and firmware. Furthermore, devices, software, and services that consume discs with photo-video content and which are not MPV-aware can continue to interact with the filesystem content.

FOCUS ON PHOTO-VIDEO CONTENT

The MPV format does NOT specify the format of nor contain any digital photo-video content itself. However, it is designed to represent and organize photo-video content of the following forms:

- collections of content (albums)
- still images with zero to many associated audio clips
- still sequences, such as from cameras that capture rapid capture sequences or panoramas
- video clips
- audio clips
- data files

FOCUS ON STORAGE

Photo-video collections are typically multi-Megabyte in size and can reside on any storage media. They also need to move smoothly and without any reprocessing from media type to media type, such as from memory card to recordable optical disc.

The characteristics of the MPV format are entirely general purpose and designed for use with any storage media and to be robust when moved across storage media. Without any changes to an existing MPV file, it can move across and be used on all kinds of storage media, such as memory cards, magnetic disks, or even for exchanging information between software applications or services. Broad use of the MPV format will facilitate use and exchange of photo-video content collections without regard to physical storage media while retaining the user value provided by the MPV format.

Defining and establishing the MPV format for use on optical storage discs is the reason for its sponsorship by OSTA, the Optical Storage Technology Association. Because recordable optical discs are robust, broadly compatible with a wide variety of existing devices, high capacity and low cost, they are a natural and important storage medium for personal digital photos and video.

A particular opportunity exists also for digital camera makers. Most digital cameras today store their photo-video content on a memory card according to the guidelines of the “Design Rule for Camera File System” specification [DCF-1999]. These guidelines are fairly loose and each vendor has their own implementation practices. By adding the MPV format to a memory card while retaining its existing file system structure, compatibility with existing processes, devices, software, and services is maintained while allowing MPV-aware application to offer the user a better experience for enjoying and using the photo-video content.

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2.6 Terms of Use

This section of the whitepaper is descriptive and not intended to be complete nor definitive. Please refer to the definitive statement of licensing terms at the beginning of the MultiPhoto/Video specification document for a precise and legal description.

The MultiPhoto/Video specification is developed using an open process. The resulting specification is available at no or modest cost from OSTA and I3A. No royalty is charged by OSTA or I3A for use of the specification. The overall desire is to develop a specification that is not subject to separate licensing requirements or royalty. During the development process, the expectation is that all participants contribute their efforts and intellectual property without any expectation or requirement for compensation. However, OSTA and I3A does not warrant that the specification is not or will not be subject to such claims by other parties.

MultiPhoto/Video is not only a specification. It also includes a compliance test suite and processes, compliance testing materials, and a logo program for compliant products. In addition, some sample open-source code implementations of key steps in processing MPV content are available. These materials and procedures are made available and administered by OSTA at a modest cost. OSTA and I3A charge no royalty for use of the specification or logo.

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Chapter 3: Use Cases/Scenarios

The following use cases do not describe all possible scenarios and tasks, but they do describe core experiences that should be considered mainstream. Note that the use cases span multiple profiles of the MultiPhoto/Video specification. This provides the context in which to understand any given profile's use.

3.1 No Computer #1 – Play, Print, Store

A basic use case that motivates the playback specification and use of the MPV format is as follows. It describes a complete digital imaging system that does not involve a computer. One of the key assumptions is that the user wants to do as little as possible, either during capture or playback.

An individual:

- acquires personal photo-video content in digital form using a digital camera or on an optical disc produced in some way

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  - the camera or disc producer writes original data in whatever formats it uses, e.g. Exif, DCF, AVI MJPEG, WAV, RAW, etc
  - the camera or disc producer, without any user involvement, also writes an MPV file defining the collection of content as the exact sequence in which the user captured the content and specifying the asset type according to the capture mode used by the user, e.g. still, still with audio, rapid still sequence, panorama still sequence, video clip, audio clip
  - optionally, the card or disc may be an output from other use cases, such as the Computer Ease-of-Use Case: Basic Editing.
- inserts the memory card into a printer to get prints.
  - The DPOF format on the card [if present] instructs the printer which photos to print.
- inserts the memory card or disc into a DVD player
- the DVD player, which has a Photo Manager application in firmware, utilizes only information already on the card / disc and lets the user perform a variety of tasks, including:
  - choose among one or more collections on the memory card / disc
  - for a given collection
    - play a multimedia "slideshows" of the content
      - by default, the only audio is audio captured by the user, e.g. still with audio, video clip with audio, audio clip.
      - optionally, the content source or user may have configured the slideshow to use transition effects between photo-video items.
      - optionally, the user may have configured the camera or DVD player with a choice of background music, such as a track extracted from an audio CD.
      - optionally, the memory card or disc may also have a pre-rendered video stream containing an "enhanced" slideshow of the collection. The presentation may be arbitrarily complex, as all effects are rendered in the video stream, including transitions.
    - interactively browse the individual content items, interacting with each item at the level the user specified when using the camera: still, still with audio, still sequence, panorama, video clip, audio clip
    - while playing the show or browsing, mark one or more content items to use in some task
    - print the whole collection or marked items in the collection using direct interaction with an attached printer
    - access an internet service for the collection or marked items, such as photo site upload or emailing
  - for a given content item in a collection
    - mark/unmark a content item
    - rotate an item
    - print a content item
    - access an internet service for the item, such as photo site upload or emailing
- writes the photo-video content to a new or existing write-once or rewritable optical storage disc using the Photo Manager application on the DVD player, thus creating a permanent archive [assumption: DVD player is also a CD recorder].
  - Only the data on the memory card that is referenced by the MPV collection manifest is copied to the disc, but this includes all miscellaneous data files such as a DPOF file
  - Marked items in a collection are also recorded
  - All the tasks described above continue to work with the new / updated disc.

3.2 Computer Ease-of-Use #1 – Play, Print, Store

A basic use case that motivates the playback specification and use of the MPV format is as follows. It describes a complete digital imaging system that does involve a computer. One of the key assumptions is that the user wants to do as little as possible, either during capture or playback.

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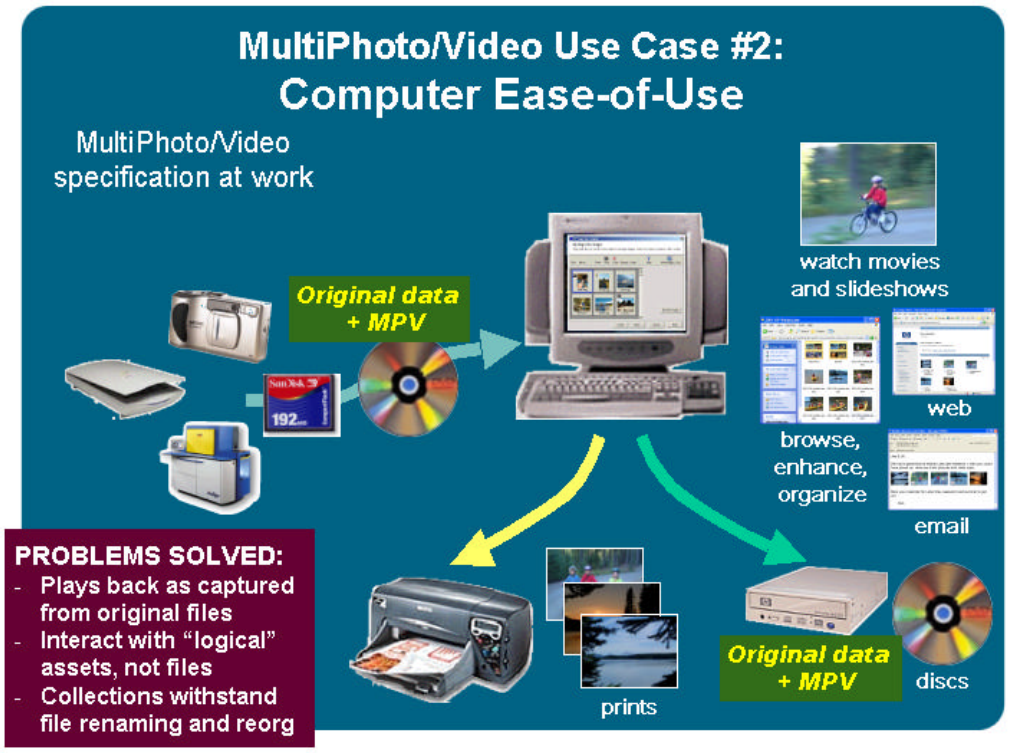

An individual:

- Performs all but the last task [write data to CD] described in No Computer Use Case #1, except using the player application software instead of the DVD player.
    - Assume that the computer has access to a player application, e.g. on disc or previously installed
    - Assume that the user may use a "camera unload" application to remove the photo-video data from the camera or memory card. This application may rename and reorganize the data files, such as removing the DCF structure and renaming the files with a different basename. Assume the MPV collection datafile is unloaded onto the computer, but the MPV collection information is not updated by the unloader.
        - All the user tasks described above continue to work using the MPV player application, even though the filenames and structure of the files is changed. However, application startup time may be lengthened in order to reconstruct the links to use the current filenames and locations.
- Writes the photo-video content to a new or existing write-once or rewritable optical storage disc, creating a permanent archive.
    - This may occur using the dedicated CD or DVD burning application on the computer or by the photo manager application using OS-provided CD burning capabilities, such as on WindowsXP.
    - In addition to the photo-video content files, the MPV collection and other files are also written to the disc.
    - All the tasks described above continue to work.
- Copies all the data on the memory card / disc to the computer
    - All the tasks described above continue to work.

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3.3 Computer Ease-of-Use #2 – Basic Edit

A more advanced use case that motivates the playback specification and use of the MPV format is as follows. One of the key assumptions is that the user will do some basic editing tasks. This use case is a variation on the Computer Ease-of-Use scenario above.

An individual:

- performs all the tasks Computer Ease-of-Use Case #1.
- uses the memory card / disc with a photo-video editing application and utilizes MPV information already on the memory card or disc to recover previous settings, then performs a variety of read/write tasks, including:
    - create or modify collections
        - create, modify, or delete collections on the card / disc
            - select background image for collections page
        - select, add, remove and sequence content items
        - add, remove, or edit information about the collection
            - one or more lines of title
            - one or more background music tracks to play for each collection
            - specify transition effects
    - modify content items in a collection
        - add, remove, or edit an item
        - add, remove, or edit information about the item
            - filename
            - folder location
            - one or more lines of title
            - audio annotations
            - optionally, also metadata content supported by the content item, e.g. Exif, XMP, DIG35, IPTC, …
            - [editing the content data itself may break the link in the collection unless the MPV collection datafile is updated.]
    - produce a rendered video stream representing an "enhanced" slideshow of the collection
        - slideshow presentation may be arbitrarily complex, as all effects are rendered in the video stream
- Writes the modified photo-video collections to a new or existing write-once or rewritable optical storage disc or memory card, creating a permanent archive.
    - All the tasks described above continue to work.
- gives the disc or a copy of the disc to someone else. That person wants to be able to use the disc in the same ways as the first person.
- view a history of how and when the content was added to each collection

3.4 Interoperability and Transformation

Photo-video collections exist within a complex and dynamic ecosystem of existing and new applications, devices, services, formats, and storage locations. A key use case for MultiPhoto/Video is to facilitate the interoperability of that content across those variable contexts in a way that preserves as much functionality and data as is practical and is straightforward and relatively low-cost to implement.

A typical use case is that an existing product already creates and operates on collections of photos, video, and other content. It may do so based simply on conventions for file and directory names; this is quite common, such as with applications that utilize the [DCF] structures and Exif metadata. It may also have additional metadata formats.

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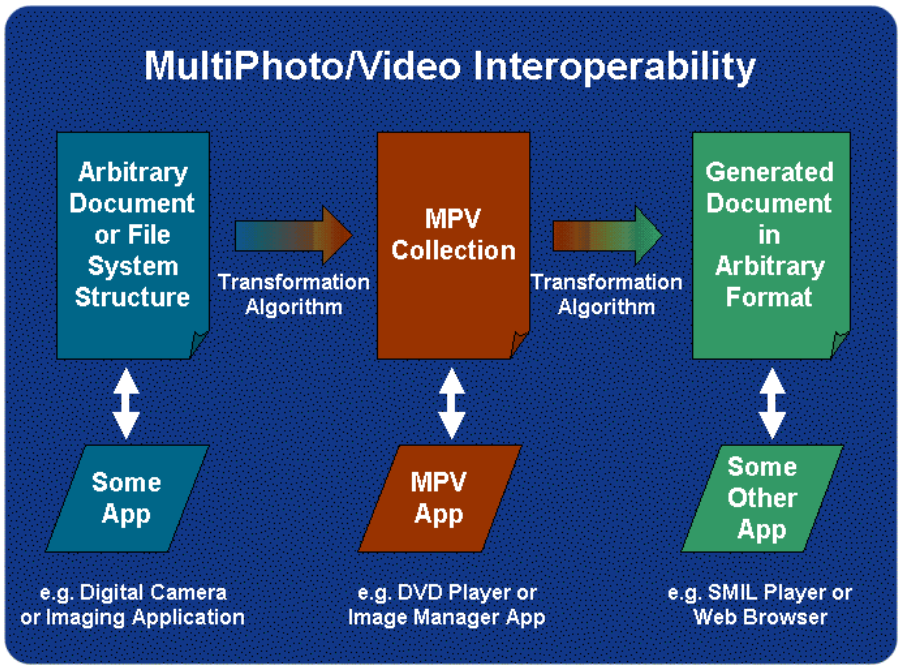
To enhance the ease-of-use and interoperability of this content, the product could be enhanced or a special "translator" product offered to produce the MPV collection document in addition to the existing content. This is readily done in most cases by implementing a transformation algorithm that examines the current data formats and structures and outputs the MPV collection.



MPV could be a primary format in which an application could store and represent not only photo-video collections but also host its own data; however this is not required or even expected. MPV can and very often will be used as an intermediate or derived format that provides for richer interoperability of applications, devices, services, and formats than is currently possible.

Existing MPV collections also need to interoperate with an ecosystem of other applications. A typical use case is that an existing application would benefit from the ability to support MPV collections. The transformation of the MPV collection into a format consumable by the application should be straightforward and reasonably low-cost to implement.

One key use case to focus on is playback on existing Windows and Macintosh operating systems. Achieving support for playback of MPV on an installed-base of players would be attractive.

One use case of installed-base applications deserving attention, for example, is Microsoft Internet Explorer 5.5 and above, which is widely deployed. This browser has some built-in ability to transform XML content into arbitrary presentations and the ability to present photo-video content presentations using the HTML+Time format. The ability to play an MPV document in IE5.5 and above as an attractive slideshow, for example, is a powerful use case. It may be possible to support SMIL-based players using similar approaches.

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Chapter 4: Examples

4.1 Produced Directly by a Digital Camera

This example shows a MPV collection containing a list of the following set of most commonly used photo-video content items:

- still image
- still image with audio file
- still image multishot sequence
- still image panorama sequence
- video clip with still thumbnail rendition
- audio clip
- arbitrary document

This MPV example may be considered typical simple usage of MPV, such as might be produced directly by a digital camera. A typical in-camera implementation would update the MPV manifest with every shutter click so that the memory card could be removed at any time and the MPV manifest would be up-to-date.

4.1.1 File System Representation

The example describes the following collection of files from a real digital camera. Note that the date and alphanumeric sort orders are different. The "add on" MPV representation is found in MPV_TOC.XML.

DATE ORDER:

```
/DCIM/100DSCAM/SHOWBROW.XSL
/DCIM/100DSCAM/IMG_0023.JPG
/DCIM/100DSCAM/IMG_0024.JPG
/DCIM/100DSCAM/IMG_0024.WAV
/DCIM/100DSCAM/IMG_0025.JPG
/DCIM/100DSCAM/IMG_0026.JPG
/DCIM/100DSCAM/IMG_0027.JPG
/DCIM/100DSCAM/STA_0028.JPG
/DCIM/100DSCAM/STB_0029.JPG
/DCIM/100DSCAM/STC_0030.JPG
/DCIM/100DSCAM/MOV_0031.AVI
/DCIM/100DSCAM/MOV_0031.THM
```

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```
/DCIM/100DSCAM/AUD_0032.WAV
/DCIM/100DSCAM/MPV_TOC.XML
/MISC/AUTPRINT.MRK
```

ALPHANUM ORDER:

```
/DCIM/100DSCAM/AUD_0032.WAV
/DCIM/100DSCAM/IMG_0023.JPG
/DCIM/100DSCAM/IMG_0024.JPG
/DCIM/100DSCAM/IMG_0024.WAV
/DCIM/100DSCAM/IMG_0025.JPG
/DCIM/100DSCAM/IMG_0026.JPG
/DCIM/100DSCAM/IMG_0027.JPG
/DCIM/100DSCAM/MOV_0031.AVI
/DCIM/100DSCAM/MOV_0031.THM
/DCIM/100DSCAM/MPV_TOC.XML
/DCIM/100DSCAM/SHOWBROW.XSL
/DCIM/100DSCAM/STA_0028.JPG
/DCIM/100DSCAM/STB_0029.JPG
/DCIM/100DSCAM/STC_0030.JPG
/MISC/AUTPRINT.MRK
```

4.1.2 MPV Representation

This is the MPV representation, as it would exist on a storage device along with the photo-video content. Absolutely no additional content has been generated other than the MPV file, which now faithfully represents the full set of files created by that camera as a single MPV collection.

Simple MPV example, such as a digital camera might produce directly	Notes
<?xml version="1.0" encoding="UTF-8" ?>	Identifies file has XML in it
<?xml-stylesheet type="text/xsl" href="showbrow.xsl"?>	IE5.5+ to use this stylesheet
<mpv:mpv xmlns:mpv="**urn:osta-org:mpv:basic:1.0**">	Defines mpv namespace
<mpv:Album mpv:instanceID="**AB893AEF-B6B3-44DB-871B-AF09B17D9342B**"	Album starts
<mpv:Foreground>	Foreground
<mpv:Still	Still image
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17D239BC**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:body:md5:EF886AEFA3B340da971BAF09B17DBC122**"	MD5 bithash signature
mpv:lastURL="**IMG_0023.JPG**">	Last known location
</mpv:Still>	
<mpv:StillWithAudio	Still Image with Audio
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B173834BE**">	UUID assigned document ID
<mpv:Still	Still mage
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17DBC134**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6B88B34**"	MD5 bithash signature
mpv:lastURL="**IMG_0024.JPG**" />	Last known location
<mpv:Audio	Audio
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17DBC183**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6B88B5D**"	MD5 bithash signature
mpv:lastURL="**IMG_0024.WAV**" />	Last known location
</mpv:StillWithAudio>	
<mpv:StillMultishotSequence	Still Multishot Sequence
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B1794DB32**">	UUID assigned document ID
<mpv:Still	Still image
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B1792DDE1**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6B9ABD3**"	MD5 bithash signature
mpv:lastURL="**IMG_0025.JPG**" />	Last known location
<mpv:Still	Still image
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17D902EC**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6B92341**"	MD5 bithash signature
mpv:lastURL="**IMG_0026.JPG**" />	Last known location
<mpv:Still	Still image
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17D23B9A**"	UUID assigned document ID

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mpv:contentID="**urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6BAB9CE**"	MD5 bithash signature
mpv:lastURL="**IMG_0027.JPG**" />	Last known location
<mpv:CaptureDur>**FrameToFrame:0.3**</mpv:CaptureDur>	Frame rate
</mpv:StillMultishotSequence>	
<mpv:StillPanoramaSequence	Image Panorama Sequence
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B1794BB39**">>	UUID assigned document ID
<mpv:Still	Still image
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17A6E3C9**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:body:md5:7026031D-3DDD4556B68D72B9A692BCA3**"	MD5 bithash signature
mpv:lastURL="**STA_0028.JPG**" />	Last known location
<mpv:Still	Still image
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17D9CE92**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6B9BC61**"	MD5 bithash signature
mpv:lastURL="**STB_0029.JPG**" />	Last known location
<mpv:Still	Still image
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17D126BC**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6BBB3CB**"	MD5 bithash signature
mpv:lastURL="**STC_0030.JPG**" />	Last known location
<mpv:CapturePath>**FixedPt:270Y0P0R**</mpv:CapturePath>	Panorama capture path RtoL
</mpv:StillPanoramaSequence>	
<mpv:Video	Video
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17DBC198**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6B88B5D**"	MD5 bithash signature
mpv:lastURL="**MOV_0031.AVI**">	Last known location
<mpv:Rendition mpv:renditionUsage="**thumbnail**">	Thumbnail Rendition of video
<mpv:Still	Still image
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17D126AB**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6B89342**"	MD5 bithash signature
mpv:lastURL="**MOV_0031.THM**" />	Last known location
</mpv:Rendition>	
</mpv:Video>	
<mpv:Audio	Audio
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17DAA939**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6B923AB**"	MD5 bithash signature
mpv:lastURL="**AUD_0032.WAV**" >	Last known location
</mpv:Audio>	
</mpv:Foreground>	
<mpv:Related>	Related to album
<mpv:Document	document
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17BBAA93**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6AC3998**"	MD5 bithash signature
mpv:lastURL="**SHOWBROW.XSL**">	Last known location
</mpv:Document>	
<mpv:Document	document
mpv:documentID="**urn:osta-org:uuid:AB893AEF-B6B3-44DB-871B-AF09B17DEE112**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6B22BBD**"	MD5 bithash signature
mpv:lastURL="**../../MISC/AUTPRINT.MRK**">	Last known location
</mpv:Document>	
</mpv:Related>	
</mpv:Album>	
</mpv:mpv>	

4.1.3 Discussion

The MPV representation enables a player application to determine immediately and without exploring the file system, which photo-video content items are to be shown and it what order and grouping.

The first thing to notice is that each time the user clicked the shutter button, a new collection object was created in the MPV representation. The following object types were used. These correspond exactly with the camera's capture mode. Knowing the capture mode helps the player produce the appropriate playback experience.

- Still
- StillWithAudio
- StillMultishotSequence
- StillPanoramaSequence
- Video
- Audio

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Notice also how additional documents related to the album are included in the collection, including the the DPOF file created by the user's actions and the SHOWBROW.XSL stylesheet used by the MPV collection itself.

The *lastURL* attribute points to the last known location of the file, relative to the MPV_TOC.XMLfile. It can reference a local file or be a complete URL. The term "lastURL" is used because it is a hint and not definitive. It is easy for the file that is referenced to be renamed or reorganized, breaking the lastURL reference. When used on recordable CDs, a filename reference can be broken because the active CD file system is unable to represent the filename accuractely and appears different from the name in the MPV collection.

When the *lastURL* reference is broken, the MPV player will use identifiers to search for the associated file. Several types of identifiers may be used. The *contentID* identifier is used to check for a match, while the *documentID* identifier could be used to determine which file to use to generated new renditions.

4.2 Exploring MPV Capabilities

This example shows a number of MPV features. Typically, an photo-video experience authoring application might enable a user to select and specify the components of this album, which are then represented in MPV format for interoperability. Some applications may choose to migrate their native data representation to MPV, utilizing proprietary extensions as needed to represent capabilities specific to that application.

This example shows:

- album metadata for author, title, date
- two songs of background music
- presentation metadata to guide playback
- an image, with screen and thumbnail resolutions
- an image with proprietary metadata
- a pre-rendered slideshow video for an album
- a pre-generated index print for an album

4.2.1 XML Representation

This is an XML representation, as it would exist on a disc.

Example exploring MPV capabilities, such as an authoring application might produce	Notes
<?xml version="1.0" encoding="UTF-8" ?>	Identifies file has XML in it
<?xml-stylesheet type="text/xsl" href="showbrow.xsl"?>	IE5.5+ to use this stylesheet
<mpv:mpv xmlns:mpv="**urn:osta-org:mpv:basic:1.0**"	Defines mpv namespace
xmlns:xap="**urn:osta-org:mpv:basic:1.0:xmp:xap**"	
xmlns:xapDyn="**urn:osta-org:mpv:basic:1.0:xmp:xapDyn**"	
xmlns:mpvp="**urn:osta-org:mpv:presentation:1.0**"	
xmlns:mpvpTrans="**urn:osta-org:mpv:presentation:1.0:Trans**"	
xmlns:stuff="**urn:mycompany-com:myapp:6.3:stuff**">	
<mpv:Album mpv:instanceID="**AB893AEFB6B344DB871BAF09B17D9342B**"	Album starts
<mpv:XMP>	XMP-style metadata
<xap>	XMP Core schema
<xap:Title>**Acme Parts Catalog**</xap:Title>	album title
<xap:Author>**Wiley E.**</xap:Author>	album author
<xap:CreateDate>**2002-03-25T21:07:00Z**</xap:CreateDate>	album creation date
</xap>	
</mpv:XMP >	
<mpv:Background>	Background content
<mpv:XMP>	XMP-style metadata
<mpvp>	
<mpvp:BackgroundColor>**Blue**</mpvp:BackgroundColor>	background color
</mpvp>	
</mpv:XMP >	
<mpv:Audio	1st background audio

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```
            mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17DAA939"        UUID assigned document ID
            mpv:contentID="urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6B923AB"  MD5 bithash signature
            mpv:lastURL="C:/My Documents/My Music/Puchini takeout.MP3" >                Last known location
        </mpv:Audio>
        <mpv:Audio                                                                     2nd background audio
            mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17DAA939"        UUID assigned document ID
            mpv:contentID="urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6B923AB"  MD5 bithash signature
            mpv:lastURL="Track 07.WMA" >                                               Last known location
        </mpv:Audio>
    <mpv:Background>
    <mpv:Foreground>                                                                   Foreground
        <mpv:XMP>                                                                      XMP-style metadata
            <mpvp>                                                                     Presentation metadata
             <mpvp:Fit>meet<mpvp:Fit>                                                  Maintain aspect ratio on view
             <mpvp:TransitionFilter>                                                   Default transition filter
                  <mpvpTrans:mpvpTrans>
                     <mpvpTrans:type>barWipe</mpvpTrans:type>                        barWipe transition
                  <mpvpTrans:mpvpTrans>
             </mpvp:TransitionFilter>
            </mpvp>
        </mpv:XMP>
       <mpv:Still                                                                      Still image
            mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17D239BC"       UUID assigned document ID
            mpv:contentID="urn:osta-org:dsig:body:md5:EF886AEFA3B340da971BAF09B17DBC122"  MD5 bithash signature
            mpv:lastURL="part_3429-88323453.JPG">                                      Last known location
            <mpv:XMP>
                <xap>
                   <xap:Title>Part 3429-88323453</xap:Title>                           image title
                <xap>
            </mpv:XMP >
            <mpv:Metadata>                                                             App-specific metadata
              <stuff>
                 <stuff:PartNumber>3429-88323453</stuff:PartNumber>                    part number
                 <stuff:Vendor>Acme</stuff:Vendor>                                     vendor name
                 <stuff:Price>$23.93</stuff:Price>                                     price
              <stuff>
            </mpv:Metadata>
            <mpv:Rendition mpv:renditionUsage="thumbnail">                             Thumbnail Rendition
                <mpv:Still                                                             still image
                    mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17D239BC"  same docID as parent
                    mpv:contentID="urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6ADD38B"  MD5 bithash signature
                    mpv:lastURL="thumbs/IMG_0023.JPG" />                               Last known location
            </mpv:Rendition>
            <mpv:Rendition mpv:renditionUsage="screen">                                Screen Rendition
                <mpv:Still                                                             still image
                    mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17D239BC"  same docID as parent
                    mpv:contentID="urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A69823BA"  MD5 bithash signature
                    mpv:lastURL="screen/IMG_0023.JPG" />                               Last known location
            </mpv:Rendition>
       </mpv:Still>                                                                    Video
        <mpv:Video                                                                     UUID assigned document ID
            mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17DBC198"       MD5 bithash signature
            mpv:contentID="urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6B88B5D"  Last known location
            mpv:lastURL="MOV_0031.AVI">
            <mpv:XMP>
              <xapDyn>
                 <xapDyn:NTracks value="1" />                                          Has 1 track
                 <xapDyn:Tracks>
                     <xapDyn:Tracks-li>
                         <xapDyn:start->                                               Start playing at 3.4 sec offset
                             <xapDyn:length>3.4</xapDyn:length>
                             <xapDyn:unit>seconds</xapDyn:unit>
                         </xapDyn:start>
                         <xapDyn:length>
                             <xapDyn:length>15.0</xapDyn:length>                       Play for 15 seconds from start
                             <xapDyn:unit>seconds</xapDyn:unit>
                         </xapDyn:length>
                     <xapDyn:Tracks-li>
                  <xapDyn:Tracks>
              </xapDyn>
            </mpv:XMP>
        </mpv:Video>
    </mpv:Foreground>
```

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<mpv:Rendition mpv:renditionUsage="**show**">	Show rendition of Album
<mpv:Video	Video
mpv:documentID="**urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17DBC198**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6B89342**"	MD5 bithash signature
mpv:lastURL="**Slideshow.MPG**" />	Last known location
</mpv:Rendition>	
<mpv:Rendition mpv:renditionUsage="**print**">	print rendition of album
<mpv:Print	Print
mpv:documentID="**urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17DDB83C**"	UUID assigned document ID
mpv:contentID="**urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A634AA98**"	MD5 bithash signature
mpv:lastURL="**IndexPrint.PDF**">	Last known location
<mpv:XMP>	
<xap>	
<xap:Title>**Index print of the album**</xap:Title>	Title
</xap>	
</mpv:XMP >	
</mpv:Print>	
</mpv:Rendition>	Related to album
<mpv:Related>	document
<mpv:Document	UUID assigned document ID
mpv:documentID="**urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17BBAA93**"	MD5 bithash signature
mpv:contentID="**urn:osta-org:dsig:all:md5:7026031D3DDD4556B68D72B9A6AC3998**"	Last known location
mpv:lastURL="**SHOWBROW.XSL**">	
</mpv:Document>	
</mpv:Related>	
</mpv:Album>	
</mpv:mpv>	

4.2.2 Discussion

[TODO]

4.3 Creating a List of MPV Albums

This example shows a number of MPV features:

- references to local and remote albums
- image background to an album list
- thumbnail rendition of an album

4.3.1 XML Representation

This is as it would be written to a MPV file.

Example listing MPV albums	Notes
<?xml version="1.0" encoding="UTF-8" ?>	Identifies file has XML in it
<?xml-stylesheet type="text/xsl" href="showbrow.xsl"?>	IE5.5+ to use this stylesheet
<mpv:mpv xmlns:mpv="**urn:osta-org:mpv:basic:1.0**"	Defines mpv namespace
xmlns:xap="**urn:osta-org:mpv:basic:1.0:xmp:xap**"	
xmlns:mpvp="**urn:osta-org:mpv:presentation:1.0**">	
<mpv:Album mpv:instanceID="**AB893AEFB6B344DB871BAF09B17D9342B**"	Album starts
<mpv:XMP>	
<xap>	
<xap:Title>**Recently viewed albums**</xap:Title>	album title
<xap:Author>**Pieter van Zee**</xap:Author>	album author
<xap:CreateDate>**2001-08-23T22:13:09Z**</xap:CreateDate>	album creation date
<xap:ModifyDate>**2002-03-25T21:07:00Z**</xap:ModifyDate>	album modify date
</xap>	
</mpv:XMP >	
<mpv:Background>	Background content

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```
<mpv:XMP>
  <mpvp>
    <mpvp:BackgroundColor>Blue</mpvp:BackgroundColor>                    background color
    <mpvp:Fit>meet<mpvp:Fit>                                             Maintain aspect ratio on view
  </mpvp>
</mpv:XMP >
<mpv:Still                                                               background still image
    mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17DAA939"  UUID assigned document ID
    mpv:contentID="urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6B923AB"  MD5 bithash signature
    mpv:lastURL="Backdrop.JPG" >                                         Last known location
</mpv:Still>
<mpv:Background>
<mpv:Foreground>                                                         Foreground
  <mpv:Albumref                                                          Album reference
    mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17349987"  UUID assigned document ID
    mpv:contentID="urn:osta-org:dsig:body:md5:EF886AEFA3B340da971BAF09B1711ACD9"  MD5 bithash signature
    mpv:lastURL="Yr2000/BestOf2000/mpv_toc.xml">                         Last known location
    <mpv:XMP>
      <xap>
        <xap:Title value="Best of 2000" />                               album ref title
      </xap>
    </mpv:XMP >
    <mpv:Rendition mpv:renditionUsage="thumbnail">                       Thumbnail Rendition
      <mpv:Still                                                         still image
        mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17349987"  same docID as parent
        mpv:contentID="urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6993322"  MD5 bithash signature
        mpv:lastURL="Yr2000/BestOf2000/albumthm.jpg" />                  Last known location
    </mpv:Rendition>
  </mpv:Albumref>
  <mpv:Albumref                                                          Album reference
    mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17D239BC"  UUID assigned document ID
    mpv:contentID="urn:osta-org:dsig:body:md5:EF886AEFA3B340da971BAF09B17DBC122"  MD5 bithash signature
    mpv:lastURL="http://www.photosharingsite.com/george/public/9-27-01-Soccer-Game/">  Last known location
    <mpv:XMP>
      <xap>
        <xap:Title value="9/27/01 Soccer Game" />                        album ref title
      </xap>
    </mpv:XMP >
    <mpv:Rendition mpv:renditionUsage="thumbnail">                       Thumbnail Rendition
      <mpv:Still                                                         still image
        mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17D239BC"  same docID as parent
        mpv:contentID="urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6ADD38B"  MD5 bithash signature
        mpv:lastURL="C:/My Documents/My Pictures/Recently Visited/9342532.jpg" />  Last known location
    </mpv:Rendition>
  </mpv:Albumref>
</mpv:Foreground>
<mpv:Related>                                                            Related to album
  <mpv:Document                                                          document
    mpv:documentID="urn:osta-org:uuid:AB893AEFB6B344DB871BAF09B17BBAA93"  UUID assigned document ID
    mpv:contentID="urn:osta-org:dsig:body:md5:7026031D3DDD4556B68D72B9A6AC3998"  MD5 bithash signature
    mpv:lastURL="SHOWBROW.XSL">                                          Last known location
  </mpv:Document>
</mpv:Related>
</mpv:Album>
</mpv:mpv>
```

4.3.2 Discussion

[TODO]

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Chapter 5: Specification Profiles

5.1 Basic Profile

[TODO]

5.2 Presentation Profile

[TODO]

5.3 Other Profiles

[TODO]

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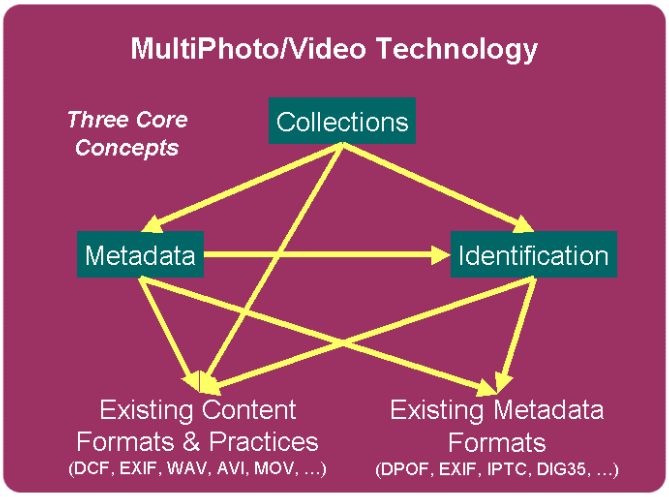
Chapter 6: MultiPhoto/Video Specification Overview

MultiPhoto/Video has some key concepts and approaches.

The Basic Profile has three core concepts centered on Collections, Metadata, and Identification. The Presentation Profile adds in Presentation information.



6.1 Collections

Collections are assembled using a few basic concepts.

ALBUM

A collection is an ordered group of objects called an Album. Albums can reference other albums. Multiple albums can be grouped together in one file or isolated in separate files. Album references use URIs, allowing reference to local or remote albums. Albums may have renditions and related documents.

ALBUM ITEMS

Album items are objects at the top-level of a collection. Typically, users interact conceptually with album items. Albums and album items may also contain additional content, including renditions and related documents. Additional content may enhance the performance, scope, presentation, and other characteristics of an album but do not fundamentally change it from a user's perspective.

SIMPLE MEDIA OBJECTS

An album may contain the following types of media objects. MPV does not constrain which formats of these media objects may be in a collection. Simple media objects correspond to physical storage entities, i.e. files.

- AlbumRef
- Audio
- Document
- Still
- Print
- Text

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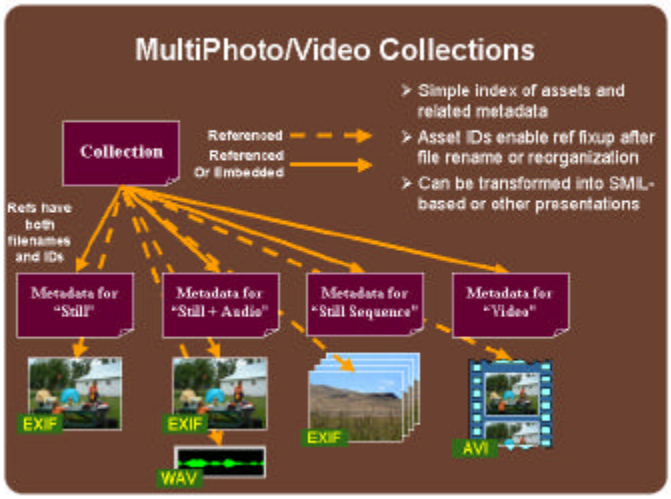
- Video

Any media object may contain renditions and related documents.



COMPOSITE MEDIA OBJECTS

In addition to the simple media objects, MPV also defines composite objects, which are semantically meaningful groups of media objects. These correspond to typical capture modes of digital cameras.

- StillWithAudio
- StillMultishotSequence
- StillPanoramaSequence
- Par
- Seq

Composite media objects may be album items, renditions, or related documents. The Seq and Par objects allow for arbitrary expression of other media objects but lack the direct association with the user's capture mode.

RENDITIONS

Any simple or composite media object and the album itself may have one or more renditions. Typically, original object is the master rendition and is usually defined implicitly. Renditions other than the master rendition are derived versions of the original media object. The relationship between the original rendition and the derived renditions is captured in metadata. The derived version may be direct, as in a screen resolution image of a hi-res image, or indirect, as in a video stream or print rendition of a collection.

RELATED DOCUMENTS

All simple and composite media objects and the album itself may have one or more related documents. Such documents may have any relation to the media object, including other objects used in constructing the object or additional metadata related to the object.

6.2 Metadata

MPV IS METADATA, NOT DATA

MPV provides metadata to describe photo/video object collections. It does not contain the actual asset data files themselves. The set of MPV metadata defines collections, identifiers, simple and composite objects, and a basic set of presentation information.

XML PACKETS

MPV uses XML packets to provide for embedding and extracting MPV metadata in arbitrary files. The XML packet format is defined by Adobe's XMP specification.

OTHER METADATA

Generally speaking, MPV recommends that metadata about basic media objects be embedded in the asset. Recommended practices are provided for using existing metadata formats in typical media file formats, such as Exif, JFIF, TIFF, WAV, MP3, MPG, AVI, and MOV. Metadata for composite media objects often cannot reside only in the basic media objects because it spans multiple asset files. This information is often stored in various established

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metadata formats such as I3A's DIG35 and Adobe's XMP. This type of metadata may be embedded within an MPV document, even when it is not part of the MPV schema.

NAMESPACES AND NAMING EQUIVALENCE

XML namespaces are a means to allow elements of the same name that exist in different schema to co-exist within the same document.

MPV requires that the MPV namespace prefixes on all elements and attributes be used in all XML encodings; by convention, the namespace "mpv:" is used. For older existing XML-based applications and schema, MPV can be encoded using a pseudo namespace by prefixing all elements and attributes with the string "mpv_".

MPV Basic and Presentation profiles make use of two XML namespaces. These are:

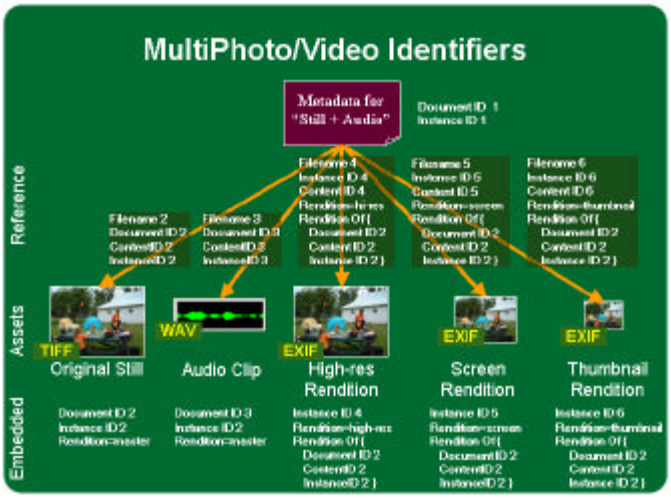
- xmlns:mpv=”urn:osta-org:mpv:basic:1.0”
- xmlns:mpvp=”urn:osta-org:mpv:presentation:1.0”

6.3 Identifiers

TYPES OF IDENTIFIERS

Identifiers are the means by which references are made between a collection and the assets it references. All basic and composite media objects in a collection are identified by two or more identifiers. There are four kinds of identifiers:

- lastURL – last known location
- contentID – unique identifier for a document that can also be used to reference to elements in an XML document
- documentID – the same for all renditions
- contentID – different for each rendition



More than one of each kind of identifier may be used. For example, multiple lastURLs may be provided to allow for different filenames in different file systems, such as on a CD. Multiple contentIDs may be provided that utilize different computation algorithms with various tradeoffs of speed and robustness.

The lastURL can be a local filename or remote URL. Significantly, lastURL is not a robust reference; it is broken easily by the user renaming or rearranging the referenced assets. Equally, the lastURL can be broken easily when a collection and assets are transferred across devices, storage formats and file systems.

To be robust against broken lastURL names, MPV provides identifier mechanisms and practices that allow the lastURL values to be fixed up when broken by searching for files with identifiers that match those contained in the collection. The ability to fixup broken references is a key contribution that MPV makes to industry practices for representing collections.

COMPUTING IDENTIFIERS

Identifiers can be computed and inserted in media objects in a variety of ways.

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- arbitrary identifiers – computed in some manner independent of the asset data and assigned to the asset. Arbitrary identifiers are typically quick to generate and compare but are fragile because if they are damaged or lost, they cannot be reconstructed.
- content-based identifiers – computed in some manner dependent on the asset data. Content-based identifiers are typically slower to generate and compare, but are more robust and also less invasive because they can be regenerated based on the content itself.

Arbitrary identifiers are computing using a variety of algorithms typically available in the operating system. MPV uses the UUID 128-bit identifier which is readily generated by most modern operating systems. Sample source code for computing an assigned identifer is provided and can be used for firmware implementations.

Many content-based identifier computation methods exist. MPV specifies the MD5 algorithm as the basic algorithm that should always be supported. MD5 computes a 128-bit hash of the byte values in an arbitrary set of content.

6.4 Presentation

The MPV Basic Profile defines how to represent collections. The MPV Presentation Profile defines how to present them.

USER TASKS

Primary user tasks for collections are to allow the user to play a slideshow of or interactively browse the primary objects in the collection. The MPV Presentation Profile extends the spec with very basic presentation information to enhance the user's experience.

PRESENTATION CONTROL

The overall approach for representing presentation information derives from SMIL, a powerful XML format for representing presentations from the World Wide Web Consortium (W3C). MPV Presentation Profile is a very constrained derivative of SMIL that provides just a basic level of presentation control. A MPV document can be mechanically translated into any of the common SMIL profiles. This makes MPV a good intermediate representation and also suggests a MPV playback strategy on platforms that also have SMIL players.

Because MPV also allows arbitrary metadata to be embedded or referenced, it is possible to embed additional presentation information in SMIL or other presentation languages. These may be used by players aware of these formats and practices.

XML LEVERAGE

MPV is well-formed XML. This allows the MPV collection document to be used with standard XML processing environments. For example, when opened in the Microsoft Internet Explorer 5.5 and above web browser, an MPV document with associated style sheet can present an attractive user interface for playback of MPV photo-video collections. Similarly, straight forward XSLT translation can convert an MPV document into a SMIL-based presentation for playback with an appropriate player.

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Annex A: What Is XML?

Extensible Markup Language (XML) is a subset of SGML (ISO standard). Its goal is to enable generic SGML to be processed on the Web in the same way that is now possible with HTML. XML has been designed for ease of implementation compared to SGML.

XML defines document structure and embeds it directly within the document through the use of markups. A markup is composed of two kinds of tags which encapsulate data : open tags and closed tags. XML is similar to HTML but the tags can be defined by the user. The definition of valid document structure is expressed in a language called the DTD (Document Type Definition) or a Schema Language (e.g., XML Schema, RDF Schema).

The XML 1.0 specification defines the concepts of well formedness and validity. XML well-formedness requires that document tags are correctly nested. XML validity requires that a document follow the constraints expressed in its associated document type definition (DTD) or schema.

[MORE TODO]

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