A Standard for Interoperabitity and Exchange of Photo, Music and Video Collections

Open, Multi-platform, Royalty-Free

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1. Background

The switch from analog to digital media has taken all facets of consumer electronics industry by storm. Consumers are creating, managing and playing back large amounts of digital media files – not only on the PC but on a variety of consumer electronics devices. Digital still cameras now outsell film cameras and capture a variety of image-based content such as panoramas, multi-shot photos and even short videos. Camera phones are free to consumers signing up to yearlong service contracts giving consumers an easy and instant way to share digital photos. TVs and devices attached to the TV are also going digital. DVRs give consumers the ability to record TV shows and the latest DVD players have added the function to playback photo slideshows from CDs or DVDs. In the music arena, the popularity of Apple's iPod and mp3 players has made people convert their entire CD collection to the various compressed digital formats.

To help manage this explosion of personal content, companies have added many innovative media management features to their products. Most of this management occurs on the PC where the large screen and tremendous processing power simplify such tasks. Photo Management software allows users to tag and categorize photos and have incorporated CD/DVD burning engines to archive photos. DVRs are adding DVD burners to archive TV shows to DVDs from the rapidly-filling hard disk drives.

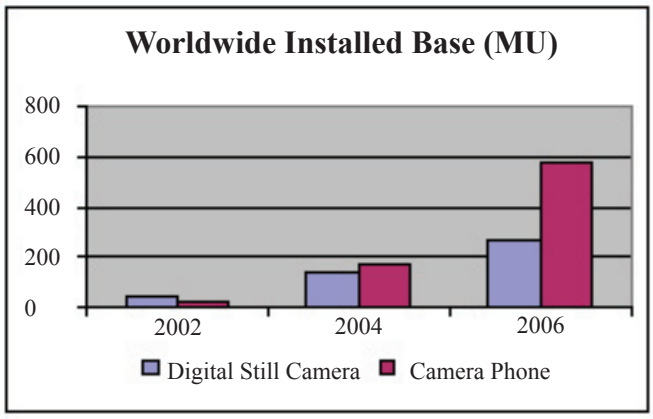

Figure 1: Worldwide Installed Base of Digital Imaging Devices. Source: Infotrends' 11/04 Worldwide Consumer Digital Camera Forecast Summary

As part of the management process, consumers spend time burning discs to archive thousands of photos of precious moments. However, when consumers insert these recorded DVDs with thousands of photos into their DVD players, they have a difficult time navigating through them. The device often shows a long list of filenames (often truncated for display or memory reasons) or thumbnails listed in alphabetical order. Any information the user may have added on the PC is often lost. This problem is caused by a lack

of an industry standard or universal way to represent collections of digital media files. Photo management software applications use proprietary ways to represent collections and to categorize the photos and individual companies do not have the reach to convince the DVD player manufacturers to work only with their format.

Another area where the lack of a standard causes unnecessary consumer intervention involves the advanced imaging formats captured by today's digital cameras. If a consumer shoots a panorama or multi-shot photo sequence and transfers the files to their PC, the photo management application usually loses the relational information – that is to say, the software doesn't understand that five or six sequential photos make up a panorama shot and the consumer must import these photos into a separate panorama-stitching software to create a single large panorama photo or a QuicktimeVR movie.

Another big management task is creating playlists of favorite music and transfering these playlists to portable jukeboxes for enjoyment on-the-go. Music players mostly support the .m3u playlist format but it is a very simple format that doesn't support the inclusion of more advanced metadata such as album cover art. The .M3U format lists the songs in a Playlist or album in order and is very dependant on the device subdirectory structure – if a user moves files through another application (say, in Windows Explorer), the .M3U files is then broken as the music application has no further way of finding these files.

Figure 2. Today's DVD Player UI playing a CD or DVD with photos

The lack of a collection standard has created additional headaches for device manufacturers and consumers. For example, when inserting a disc chockfull of photos (up to 10,000 can fit on a DVD) or mp3 files into a DVD player, the device must scan all the subdirectories and read all the files before displaying the contents on the TV screen. This process can take more than a minute – not a satisfactory consumer experience. It would be much simpler to playback the photos on the DVD if they were nicely categorized; for example, upon initialization, the TV could display a menu with choices like "My Trip to Italy" or "Buster's First Soccer Game". For devices to enable such navigation or playback features, DVD players today must read the metadata (ID3) tags on every single file on the disc before being able to present anything to the consumer. These issues could easily be solved by the availability of a universal "Playlist" format that was interchangeable from device to device independent of storage format or network/communication protocol.

2. MPV Overview

OSTA's MusicPhotoVideo or MPV defines a playlist or the order of playback for a series of digital media (music, photo or video) files. The playlist files also include location information (how to find the files for display and manipulation) and all the metadata (subject, description, creator name, file format, etc.) associated with the digital media files. Products such as DVD players or wireless networked media adapters simply have to locate, load and parse the information in this single file to know everything about the content on a CD/DVD, memory card or remote home media server. MPV is not a single specification but more a family of specifications or profiles each addressing either different media types or different product categories. MPV is XML based so it is easy to implement with "off-the-shelf" tools and extensible to future product categories and data types.

Example #1: Simple MPV file with three assets and their location (cont.)

Album.pvm file:

```
<?xml version="1.0" encoding="UTF-8"?>
<file:Manifest
      xmlns:file="http://ns.osta.org/manifest/1.0/"
      xmlns:mpv="http://ns.osta.org/mpv/1.0/"
      xmlns:mpvp="http://ns.osta.org/mpv/basic/1.0/"
      xmlns:nmf="http://ns.osta.org/nmf/1.0/" >
 <nmf:Metadata>
  <Properties xmlns="http://ns.osta.org/manifest/1.0/">
   <ProfileBag>
     <Profile>http://ns.osta.org/mpv/basic/1.0/</Profile>
   </ProfileBag>
  </Properties>
 </nmf:Metadata>
 <mpv:AssetList>
  <mpv:Still mpv:id="ID1000">
   <mpv:LastURL>images/album1_1.jpg</mpv:Last-
URL>
  </mpv:Still>
  <mpv:Still mpv:id="ID0101">
   <mpv:LastURL>images/album1_2.jpg</mpv:Last-
URL>
  </mpv:Still>

  <mpv:Still mpv:id="ID0102">
   <mpv:LastURL>images/album1_3.jpg</mpv:Last-
URL>
  </mpv:Still>
 </mpv:AssetList>
</file:Manifest>
```

MPV has been designed such that it can be implemented on a spectrum of products of varying capabilities. MPV uses a Normalized Metadata Format (NMF) that makes it easy to implement with or without a full database since it can be implemented with either XML-Schema, RDF-Schema or an SQL database environment – see document titled "MPV Normalized Metadata Format Spec 1.01" for more about NMF.

MPV makes attempts, wherever possible, to avoid duplicating efforts of existing specifications by referring to them within MPV. For example, the common metadata properties in MPV are based on the Dublin Core – see document titled "MPV Dublin Core NMF Profile Spec 1.01."At the heart of MPV are the Core Specification and Basic Profile. The Core Specification defines the MPV assets and the Basic Profile instantiates these core assets by adding the definition an "album" – a collection of assets (photos, videos or music). Various types of profiles are built upon the Core Specification:

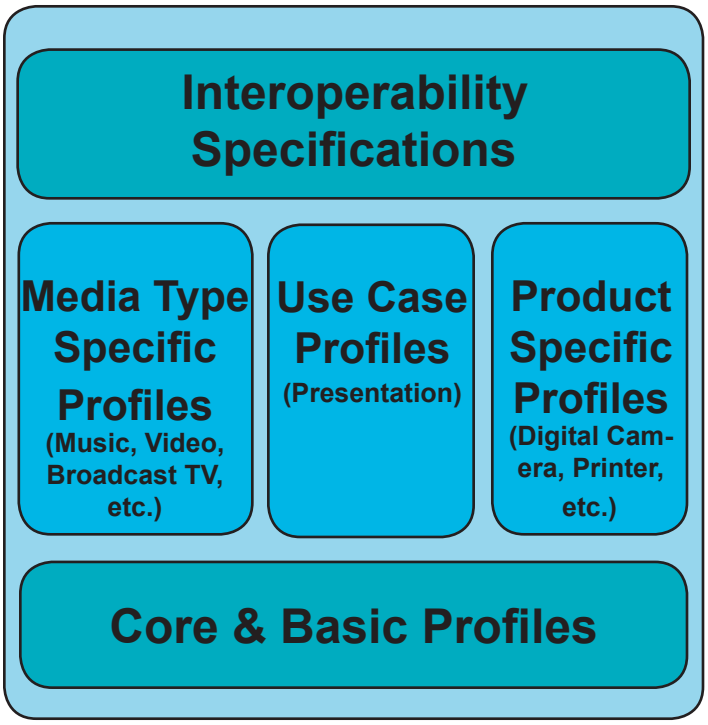

Figure 3. MPV Architecture Block Diagram

1. Specific use cases (Presentation or Photo Slideshow, Portable Storage profiles)
2. Media-specific Profiles (Music, TV video) and
3. Product specific Profiles (digital camera, printer).

In addition, the MPV committee has created an Interoperability Specification that is more rigorous or narrow implementations of the specifications to accommodate playback and recording of MPV files by consumer electronics devices. Unlike PCs, consumer electronics devices have limited processing power and resources. A full-blown implementation of MPV could completely tax its capabilities resulting in a negative consumer experience. By limiting the use of various elements of MPV, OSTA ensures interoperability and a great consumer experience tailored to the capabilities of these lower performance devices. MPV is designed to solve real interoperability problems with a real world approach.

Target Devices for MPV	
● Digital Cameras ● Camera phones ● Photo Management Applications ● CD/DVD mastering applications ● Photo Retail Kiosks ● Photo-sharing websites	● Digital Media Receivers ● DVD players ● TVs with memory card slots ● PVRs ● DVD Recorders ● Archive devices

Table 1. Target Devices for MPV

3. Use Cases & Profiles

Use Case #1: Photo and Slideshow CD Playback on DVD Player

An important use case -- and a significant problem that MPV solves -- involves the playback of CDs or DVDs with multimedia files on DVD players. Today, consumers' collections of digital media are growing dramatically. They own multiple digital cameras – a standalone and a camera phone each capturing photos. They "rip" and compress their audio CD collections for portability. Digital video camcorders are reaching the $300 price and new models record directly to disc or in MPEG4 format to flash memory cards.

The central hub to store, edit and manage this proliferation of user-generated content is the PC. The PC -- with its tremendous processing power, large storage space, high-speed Internet connectivity and its ability to load the latest and best software -- makes for a great media management device. However, it is stuck in the office or den. Consumers want to play back their music and share their memories on other devices that may be in a better setting; for example, sharing photos with guests in the family room or playing music while exercising either on the go or on the treadmill.

Music files very often have the metadata information (track name, artist name, music genre, etc.) inserted automatically by a service such as Gracenote's CDDB. For photos, however, it is the consumer who spends arduous time editing, entering descriptions or subjects, creating categories and "tagging" each photo correspondingly to their category system. Consumers also create slideshows or multimedia presentations with transitions from photo to photo or background music. Then, they burn these collections on a CD or DVD for playback on their TV.

Many current DVD players come with the capability to playback file formats previously associated only with PCs; for example, JPG photos or mp3 music files. The DVD players ignore any categorization or slideshow features defined by the consumer in their PC-based software application.

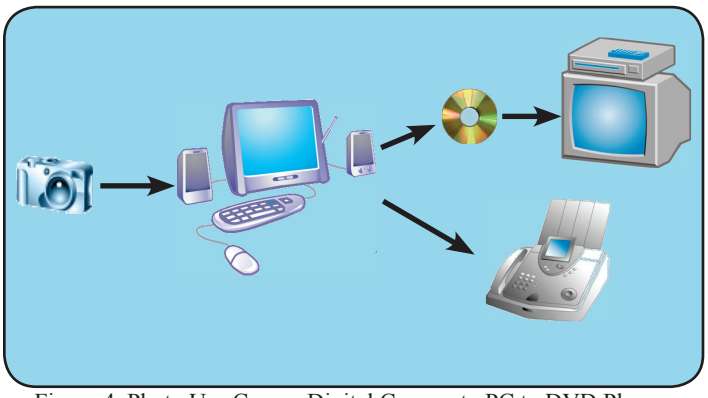

Figure 4. Photo Use Case -- Digital Camera to PC to DVD Player

Furthermore, the DVD player doesn't know which photos may be multi-photo and panorama shots. The DVD player simply displays a list of file names or some thumbnails views of the first few photos on the disc. The consumer frustration mounts as their time was wasted managing their photo collection when the information stays locked in the PC.

Since CDs and DVDs hold large quantities of multimedia files, it is important for the devices to have an easy user interface to navigate through thousands of photos and hundreds of songs. By having a single, easily accessible and readable "control" or "table of contents" file that details the entire contents of the disc, these consumer electronics devices can initialize quicker since they don't have to read every single file before presenting a menu. The devices can use the metadata (genre or artist for music) and groupings (pre-defined categories or slideshow names for photos) in the control file to create a fast and simple navigation

system.

MPV improves three things in this use case: 1). initialization time when reading discs with multimedia files, 2). easier navigation and 3). the availability of rich metadata as originally entered and intended by the consumer. Users can create slideshows with background music on discs and be sure they'll play back in the intended fashion on a DVD player or other MPV-enabled device.

Example #2: MPV Presentation Profiles File.

```
<?xml version="1.0" encoding="UTF-8"?>
<file:Manifest
      xmlns:file="http://ns.osta.org/manifest/1.0/"
      xmlns:mpv="http://ns.osta.org/mpv/1.0/"
      xmlns:mpvp="http://ns.osta.org/mpv/presentation/1.0/"
      xmlns:nmf="http://ns.osta.org/nmf/1.0/" >
 <nmf:Metadata>
  <Properties xmlns="http://ns.osta.org/manifest/1.0/">
   <ProfileBag>
     <Profile>http://ns.osta.org/mpv/basic/1.0/</Profile>
     <Profile>http://ns.osta.org/mpv/presentation/1.0/</Pro-
file>
   </ProfileBag>
  </Properties>
 </nmf:Metadata>

<mpvp:Album>
 <mpvp:Background>
<mpv:AudioRef mpv:idRef="ID011000" />
 </mpvp:Background>
  <mpvp:Foreground>
    <mpv:StillRef mpv:idRef="ID001000"/>
    <mpv:StillRef mpv:idRef="ID001001"/>
    <mpv:StillRef mpv:idRef="ID001002"/>
    <mpv:StillRef mpv:idRef="ID001003"/>
    <mpv:StillRef mpv:idRef="ID001004"/>
    <mpv:StillRef mpv:idRef="ID001005"/>
    <mpv:StillRef mpv:idRef="ID001006"/>
  </mpvp:Foreground>
  <nmf:Metadata>
        <Properties xmlns="http://purl.org/dc/elements/1.1/">
              <title>Trip to Italy</title>
              <creator>John Doe</creator>
        </Properties>
        <Properties xmlns="http://purl.org/dc/terms/">
              <created>2004-10-02T20:55:50Z</created>
        </Properties>
```

Example #2: MPV Presentation Profiles File (cont.)

```
  </nmf:Metadata>
 </mpvp:Album>
<mpv:AssetList>
  <mpv:Still mpv:id="ID001000">
   <mpv:LastURL mpv:filesystem="ISO9660-1">images/al-
bum1_1.jpg</mpv:LastURL>
   <mpv:LastURL mpv:filesystem="Joliet">images/album1_
1.jpg</mpv:LastURL>
   <mpv:LastURL mpv:filesystem="NTFS">images/album1_
1.jpg</mpv:LastURL>
    <nmf:Metadata>
     <Properties xmlns="http://purl.org/dc/1.0">
      <title>Verona</title>
     </Properties>
    </nmf:Metadata>
  </mpv:Still>

 ...

  <!-- Background Audio -->
 <mpv:Audio mpv:id="ID010000000001000">
    <mpv:LastURL mpv:filesystem="ISO9660-1">images/
b_audio_1.mp3</mpv:LastURL>
    <mpv:LastURL mpv:filesystem="Joliet">images/b_au-
dio_1.mp3</mpv:LastURL>
    <mpv:LastURL mpv:filesystem="NTFS">images/b_au-
dio_1.mp3</mpv:LastURL>
   </mpv:Audio>

</mpv:AssetList>

</file:Manifest>
```

Applicable Profiles: Core, Basic, Presentation, Music, Interoperability Specification

Use Case #2: Video Archival and Retrieval on Next-Generation PVR

Another use case addressed by MPV involves the archival and retrieval of video files recorded on DVDs in next-generation Personal Video Recorders. Consumers en masse are finally enjoying the benefits of PVRs to record shows or video segments from cable, satellite and broadcast TV. However, PVRs have limited hard drive space and, even with 60 or 80 gigabytes in the current systems, the consumer will

quickly run out of space.

PVR manufacturers are adding DVD recorders into their next-generation products. When the PVR hard drive fills up, consumers can archive seldom-watched shows onto DVDs. This again creates a media management problem. As consumers amass a large collection of recorded DVDs, they will need a way to find particular shows. The DVD Video format itself doesn't have easily accessible metadata. A standard method of representing this metadata both on the discs and in the PVR vastly improves the consumer experience by providing the exact location of any archived show.

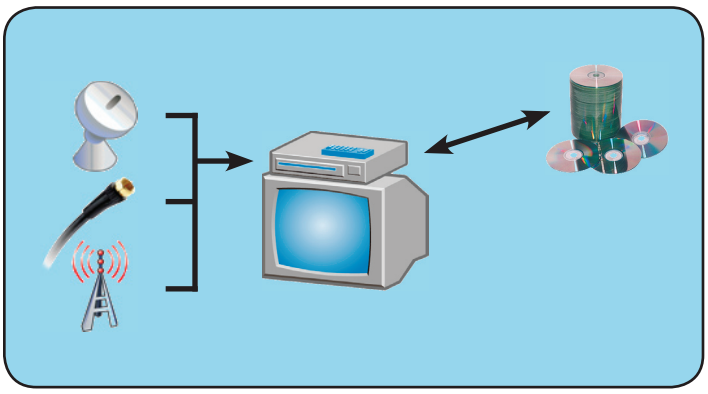

Figure 5. Broadcast TV Use case -- archive from PVR hard disk to optical storage

The MPV BroadcastTV Profile enables this by allowing the PVR manufacturer to store all the rich information – show name, synopsis, actors, director, etc. -- about archived shows on the hard disk drive including all the contents of archived discs. Thus, a consumer can do a complex search and immediately find when and where a particular show was archived. For example, a consumer may remember an episode of the cartoon "The Simpsons" where the guest actor was Ron Howard. A search for "Simpsons" and "Ron Howard" would quickly find the show. Conversely, sports-related content could be browsed in very flexible manners -- by teams (eg. Valencia vs. Arsenal) or by event (eg. WC2002)

Figure 6. Next-Generation PVR Screen - MPV Enabled

Applicable Profiles: Core, Basic, BroadcastTV, Interoperability Specification

Use Case #3: Digital Camera connected to a variety of products such as Printers, archival device

With the advent of PictBridge™, digital still cameras connect directly to printers or backup/archive devices. MPV can enable advanced and complex features as this new use model develops. For example, print templates such as card borders can be applied and selected for printing from the camera.

With camera phones -- always on, always connected devices – metadata is easily associated with photos. Carrier services can offer automatic GPS tagging of photos with the location of each shot. The keyboard allows for immediate manual addition of metadata. Many photoblog sites already already translate the subject and mail body of a photo sent by MMS into the Title and Description of the photo on the photoblog or photo-sharing site. Smartphone software is already available to categorize and create albums on the phone. All of these uses of metadata are currently vendor specific. A standard like MPV could enable the bulk upload of photos from a camera phone to online services as well as ensure that all the metadata, painstaking entered by the user, transfers along with

the photos to these online services or backup devices.

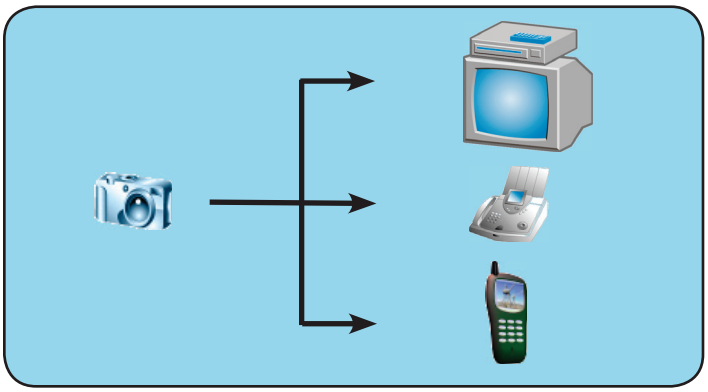

Figure 7. Digital Camera connected directly to other devices

MPV is extensible such that existing or new Working Groups in the MPV Committee or external organizations can adopt and extend MPV for additional "Use Cases" addressing issues particular to its member companies' industries. See Section 7. (Standards & Specifications based on MPV) below for Use Cases in the Audiobooks and Photo Retail Kiosk markets.

4. Profiles Under Development

One of the main benefits of MPV is that it is XML-based and can be easily adapted to new problems or use cases. OSTA's MPV Committee meets quarterly face-to-face but the MPV Working Groups hold periodic conference calls and have lively discussions on the various email reflectors. These are some profiles currently in development by the MPV working groups:

MPV Portable Storage

One of most important features of any digital photography solution is its method of preserving or archiving the photos. These are often personal memories and will be viewed over and over again in the future. In digital imaging, the most common forms of archiving are on optical storage (CD or DVD) or hard disk drive storage. For these archive formats, the file system structure is of utmost importance since they hold a large number of files. In addition, since digital data can be easily copied, it tends to be dispersed over time throughout various CDs, DVDs and hard disk drives. Without rules for managing files, the image sets may be scattered in the process of iterative updates. As a result, the reliability and ease of finding digital media may become more and more difficult over time.

The upcoming Portable Storage Profile creates standard practices for the archival of large collections of photos; that is to say, a repository of photos that has many updates and additions. It defines the basic structure of the storage system -- the minimum requirements of a directory tree structure suitable for storing and managing thousands of digital still pictures and video over a long period of time. In order to maintain the structure, it provides guidelines for the file handling rules such as importing, exporting, modification, and migration procedures to a new medium.

The specification also defines common guidelines for grouping pictures based on today's use cases; for example, "one roll of film", "a common location", "a common event", or "one memory card". Finally, the guidelines delineate common naming conventions and handling methods for files and directories to reduce the chance of name conflict in migration, as well as to preserve the above-mentioned grouping information for the future. Look forward to the release of the Portable Storage Profile in August 2005.

Print Profile

With the advent of PictBridge, digital cameras are being connected directly to printers. The "instant gratification" of this use model has ensured rapid deployment of the PictBridge standard in both digital cameras and printers. Additional standards activity such as MIPC (Mobile Imaging and Printing Consortium) extend this notion to camera phones which may connect wirelessly to a printer. The MPV Print Profile will augment PictBridge and MIPC by providing asset-management functionality based on MPV's Core specification. A mobile device using the

MPV Print Profile may implement several XHTML-Print templates and applications on the device in order to generate XHTML-Print documents with less effort. Users may select suitable print template from a wide variety of selections which can easily be updated via a wireless connection to a central server.

Since MPV Print Profile is XML-based it is extremely flexible and capable of enabling rich applications with more complex control of information.

MPV Digital Camera Guidelines & Profile

OSTA's Digital Camera Working Group is currently working on simple guidelines for implementing MPV in digital cameras. The Digital Camera Guidelines will be published by the end of 2005. The guidelines will address some advanced functionality now commonly present in digital cameras. In particular, the Digital Camera Guidelines will describe a common method to represent compound image sets such as panoramas and multi-shot photos. Digital Still Cameras are adding slideshow functions to playback subsets of the photos when connected through the A/V out directly to a television set. Having a common way to represent these functions will pave the way for the Digital Camera Working Group's follow-on effort – Digital Camera Profile which will cover use cases where such data is connected and transferred to various devices including PCs, archive devices, websites and camera phones.

5. Developing With MPV

Implementing MPV in consumer electronics products is straightforward. XML tools, parsers and sample source code abound on the market easing the development process. Solutions by OSTA member companies have shown that MPV requires a small code size -- approximately 50KB (compressed) is needed for a MPV Photo and Music Player (including the XML parser) for a consumer electronics firmware. This same implementation requires less than 2MB to run the MPV firmware. Processing a MPV file only requires a small amount of processing power on playback. Tests from implementing companies show playback requirements at 58.1 MIPS when playing a photo slideshow from a CD and 28.4 MIPS for firmware to play music from a MPV Music CD – the same processing requirements as a MP3 player. These requirements are well below the 150 MIPS found in many of today's DVD players or the excess of 250 MIPS found in today's camera phones.

Although CPU performance is becoming less of an issue as Moore's Law shifts from PCs to consumer electronics, it is important to implement MPV intelligently to avoid unnecessary processing. For example, always use the "mpv:id" attribute to reference the assets because it is much easier to generate than other attributes such as mpv:documented or mpv:instanceID

Example #3: Sample code using mpv:id

```
<file:Manifest>
 …
 <mpv:AssetList>
  <mpv:Still mpv:id=”still001”>
   …
  </mpv:Still>
  <mpv:Audio mpv:id=”audio001”>
   …
  </mpv:Audio>
  …
 </mpv:AssetList>
</file:Manifest>
```

When specifying pathnames, it is important to always to ensure the attribute mpv:LastURL is well-formed by using the URI syntax. In other words, avoid using absolute filenames in DOS or in Windows Long Filename format. The recommended solution is using relative pathnames with the URI syntax. This ensures that disc-based solutions work appropriately when moved from device to device. The MPV Core specification makes some "Best Practice" recommendations regarding the establishment of the Base URI for relative pathnames (for more, please refer to MPV-Core section 11.3).

Bad Examples:
<mpv:LastURL>A:\STILL.JPG</mpv:LastURL>

Good Examples (absolute pathname):
<mpv:LastURL>file:///A:/STILL.JPG</mpv:LastLURL>

Best Examples (relative pathname):
<mpv:LastURL>../STILL.JPG</mpv:LastURL>

When specifying pathnames, it is important to always to ensure the attribute mpv:LastURL is well-formed by using the URI syntax. In other words, avoid using absolute filenames in DOS or in Windows Long Filename format. The recommended solution is using relative pathnames with the URI syntax. This ensures that disc-based solutions work appropriately when moved from device to device.

Bad Examples:
<mpv:LastURL>A:\STILL.JPG</mpv:LastURL>

Good Examples (absolute pathname):
<mpv:LastURL>file:///A:/STILL.JPG</mpv:LastLURL>

Best Examples (relative pathname):
<mpv:LastURL>../STILL.JPG</mpv:LastURL>

There are many XML metadata standards available to represent the user or device generated information about photos or music. MPV uses the Dublin Core to represent extended metadata. It is recommended that developers stay away from more obscure XML metadata schemes and use the DC-NMF:

Not Recommended:
```
<mpv:Still mpv:id=”still001”>
  <nmf:Metadata>
    <XXX:MediaProp>
      <XXX:width>33</XXX:width>
    </XXX:MediaProp>
  </nmf:Metadata>
  …
</mpv:Still>
```

Recommended:
```
<mpv:Still mpv:id=”still001”>
  <nmf:Metadata>
    <dc:Properties>
      <dc:title>My first shot</dc:title>
      …
    </dc:Properties>
  </nmf:Metadata>
</mpv:Still>
```

MPV offers solutions for devices to represent composite assets; tags such as <mpv:Seq> or <mpv:Par> refer to other assets which opens the possibility of cyclic referencing. Special attention must be taken to avoid such cyclic referencing as it can quickly exhaust a consumer electronics device’s resources.

Example #: Cyclick Referencing in MPV using composite asset tags

```
<mpv:Seq mpv:id=”seq000”>
  <mpv:SeqRef mpv:idRef=”seq001”/>
</mpv:Seq>

<mpv:Seq mpv:id=”seq001”>
  <mpv:SeqRef mpv:idRef=”seq002”/>
</mpv:Seq>

<mpv:Seq mpv:id=”seq002”>
  <mpv:SeqRef mpv:idRef=”seq000”/>
</mpv:Seq>
```

6. Development Tools

OSTA and its member companies have created open source code and sample applications and made them available at http://sourceforge.net/projects/mpvtools. There are two main components:

6.1 MPV C SDK

The MPV C SDK is a set of ANSI C libraries that provides basic support for reading and writing MPV documents. The MPV C SDK is assumes programmers are familiar with C programming. The MPV C SDK

contains two libraries along with a set of example programs and reference documentation and support for Unicode with non-ASCII string processing.

The C source code includes support for plugable system functions such as memory, file, and directory traversal. This allows an embedded application to have very little overhead for desktop versions of these functions. Utility functions for checksum generation (MD5) and image dimensions (JPEG) are available in their own separate libraries.

Another interesting feature involves constructing and writing out the in-memory representation. This allows bi-directional processing of MPV. Applications can be developed that either read in an existing MPV file into the in-memory representation, or build up the in-memory representation from scratch. The application can then modify it and write it out to an MPV file.

The MPV C SDK has support for two XML parsers. The first is Expat, an open source ANSI C parser. It is fast, free and has a relatively small footprint (~100K). The second is the Unicoi System Fusion XML Micro-parser, a commercial product with a very small ROM footprint (~15K).

The MPV parser is designed to allow the underlying XML parsers to be linked in to provide basic XML processing. The choice of which parser to use is made at compile time for both the MPV library and the application. The two parsers and how they are configured are described below:

Expat
Expat is the de facto industry standard parser for C development. It is supported across a vast set of platforms and programming environments. The Expat version used in the latest (2.1) release of the MPV C SDK is 195.6. Information about Expat included downloads can be found on the Expat project page at http://expat.sourceforge.net/.

Unicoi
Unicoi Systems has a commercial XML parser that is part of their Fusion Web product. Information about the parser can be found at: http://www.unicoi.com/fusion_web/fusion_xml_sax_microparser.htm

Note that the version of the Fusion microparser that the MPV C SDK was designed for is not the most recent version and there may be some differences in the build process and programming model.

6.2 DHTML Playback Code (browse.htm)

This is a MPV playback application that reads a MPV file and plays back the MPV content. It supports the MPV Core, Basic, Presentation and Music profiles. Upon opening an MPV file, it parses the file and displays image thumbnails that are clickable to full-screen. It also supports advanced features such as Slideshow and Print functions.

The application plays back in Internet Explorer only and makes use of DHTML and JavaScript. The source code is freely distributable using a GPL license and already used on the market by leading software developers.

7. Standards and Specifications Based on MPV

OSTA has a long history of outreach to other industry organizations and standards bodies. As the standard body behind the Universal Disk Format (UDF), OSTA works with other bodies to ensure continued adoption of the latest UDF revisions. In a similar fashion, OSTA's MPV Committee has worked with various industry bodies and standards groups to create additional profiles that address their areas of need. Some are detailed below:

Consumer Electronics Association – R6WG11 Spoken Audio

CEA has based its Audiobook standard – CEA2003B -- on the MPV Music Profile. The audiobooks market, like most content, is undergoing a major transition to digital technology. The physical delivery of audiobooks is shifting from the traditional AudioCDs (redbook audio) to compressed audio CDs -- data CDs with files compressed into a common audio

format such as MP3, WMA or AAC. In the online space, services such as Audible.com offer downloads of digital audiobooks and other spoken word programming to the consumer's PC or directly to a portable audio player.

Audiobooks today span multiple AudioCDs – it is not uncommon for audiobooks to come in a set of up to 20 or 25 CDs. By moving to a compressed digital audio format, an audiobook provider can reduce the number of discs in a particular audiobook dramatically lowering their manufacturing costs. An entire 20 CD collection can now be delivered on a single disc since spoken word content can be compressed in mono at 64kbps or 96kbps.

Figure 8. Today's Audiobook spanning multiple discs

However, this means that there can be hundreds for files on a CD. Quick initialization and easy navigation through the chapters need be as fast and easy as today's CD player. MPV provided the perfect solution.

Audiobooks publishers were using the existing metadata systems (for example, ID3 tags used in MP3 files) for this new breed of audiobooks. However, the existing solutions – designed and developed for music -- lacked certain metadata unique to audiobooks and spoken word content. For example, an audiobook publisher may hire famous professional talent to narrate an audiobook (as an example, a Star Trek audiobook may be narrated by Patrick Stewart who played Captain Jean-Luc Picard on the TV show). The publisher would require a new metadata field for narrator such that it can be displayed in playback devices. The extensibility of MPV offered a solution for the Audiobooks industry to create a solution for this problem by adding extra metadata fields specific to their industry. The Audiobooks Publishing Association has endorsed the specification recommending its members publish in this format and that mobile devices begin to read this new format.

For more information about CEA R6WG11 Spoken Word, please refer to the following link:

http://www.ce.org/standards/CommitteeDetails.aspx?Id=000010087196

The MPV-based CEA specification, "CEA-2003-B – Digital Audiobook File Format and Player Requirements", may be obtained for $94.00 from the IHS Global website at:

http://global.ihs.com -- search for "CEA-2003" as the Document Number in the top left Search.

Picture Archive and Sharing Standard (PASS)

PASS is a digital imaging industry initiative by Fuji Photo Film Co., Ltd, Konica Minolta Photo Imaging, Inc, and Eastman Kodak Company aimed at optimizing the digital imaging experience for consumers. In much the same way that today's consumer can get nearly any brand of film processed at any location, the PASS group wants to ensure that digital images can be retrieved from any digital device or storage medium. These companies will soon be promoting and providing PASS compliant digital image storage discs. The images can be preserved and transitioned to future media technologies for decades through PASS unique migration features and support from key members of the photographic industry.
PASS uses MPV as a common "table of contents" for the discs but extends it further to ensure compatibility. PASS extends MPV in various ways to speed and enhance searches and by defining which file formats must be supported to be PASS compliant.
The PASS version 1.0 specification suite includes:

- PASS Logical Disc Specification. This

specification describes the logical components or data structures that are found on a PASS disc.
- PASS Originating/Authoring System Requirements Specification. This specification describes the capabilities needed by a system that creates PASS discs.
- PASS Receiving/Playback System Requirements Specification. This specification describes the capabilities needed by a system that plays the content of a PASS disc.

More information on PASS can be obtained from the following: Frank Ranalletti of Eastman Kodak Company (frank.ranalletti@kodak.com), Tatsuo Heki of Fuji Photo Film Co., Ltd.(thfpf@tokyo.fujifilm.co.jp) or Yutaka Ueda (ytk.kmpi@konicaminolta.jp) of Konica Minolta Photo Imaging, Inc.

8. MPV Interoperability Specification (MPV-IS)

The MPV profiles have been designed to solve many problems involving personal collections of media. The early implementations of MPV on the market were using MPV as a method to manage large collections of photo or music between products of the same company; that is to say, they were used in controlled environments. For example, an image photo application on the PC uses MPV to represent sub-collections or slideshows to upload to the user's space on the company's photo-sharing website. Another example is a portable music device that comes bundled with a PC application that manages the consumer's music collection and transfers subsets to the portable jukebox. However, companies are now starting to develop products that create MPV data that can be transferred between applications or devices from various manufacturers. For example, photo management applications now burn discs with the MPV manifest.

In an open environment, where products have a wide range of capabilities, it is important to have guidelines to ensure that MPV truly is interoperable. In particular, devices with limited performance (CPU power, system memory, etc.) may not be able to adequately process complex MPV structures such as nested files where one XML file points to another one. In such circumstances, a low-cost consumer electronics device, such as a CD player, having to process all the MPV data may use up all the memory causing an error or take so much time to process that the user experience is not up to consumer's expectations.

The MPV Interoperability Specification (MPV-IS) defines certain guidelines for implementing MPV to ensure interoperability on all consumer electronics devices including those with limited performance. The MPV-IS is a list of Do's and Don'ts that must be implemented in products. The guidelines' do's and don'ts are classified into three imperative levels:

- Level 1: MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT
- Level 2: SHOULD, SHOULD NOT
- Level 3: RECOMMENDED, MAY, OPTIONAL

To date, the guidelines cover three profiles; Basic, Presentation and Music. Products that use the MPV-IS must undergo a series of validation tests to ensure they meet the guidelines. Companies that pass the compliance tests (see Compliance section below) are then eligible to license the MPV logo and trademarks and use them within the products or documentation to indicate said compliance.

Products using the MPV-IS indicate so to other products by adding the specification to the MPV manifest's profile bag. For each profile used following the MPV-IS guidelines, a reference to the MPV-IS profile version must be added to the Profile Bag section of the MPV manifest.

Example #4: MPV file indicating compliance to Interoperability Specification for Basic Profile (shown in Bold Italics)

```
<?xml version="1.0" encoding="UTF-8"?>
<file:Manifest
        xmlns:file="http://ns.osta.org/manifest/1.0"
        xmlns:file2="http://ns.osta.org/manifest/2.0"
        xmlns:mpvp="http://ns.osta.org/mpv/1.0"
        xmlns:mpvm="http://ns.osta.org/mpv/presentation/1.0"
        xmlns:mpv="http://ns.osta.org/mpv/music/1.0"
        xmlns:nmf="http://ns.osta.org/nmf/1.0"
  <nmf:Metadata>
        <file:ManifestProperties>
          <file:ProfileBag>
                <file:Profile>http://ns.osta.org/mpv/basic/1.0/</file:Profile>
                <file:Profile>http://ns.osta.org/mpv/basic/is/1.0/</file:Profile>

…
          </file:ProfileBag>
        </file:ManifestProperties>
  </nmf:Metadata>
  …
  <mpv:AssetList>
    …
  </mpv:AssetList>
</file:Manifest>
```

For the most part, the MPV-IS limits or disallows the use of various elements and attributes. For example, only one Album (<mpvp:Album>) element may be used. Also, the attribute "mpv:manifestLinkIdRef" must not be used. This ensures that all the assets within the single album (<mpvp:Album>) are present and referenced by one asset list (<mpv:AssetList>). This allows applications to work very efficiently since they don't need to search another MPV manifest. The application does not need to read multiple MPV manifests simultaneously. In addition, functions such as import, export, move, delete and insert from one device to another become much simpler since the application needs only to track these within one manifest file. It also avoids broken references. The MPV-IS also defines a strict naming convention for the MPV files easing the effort in locating the files on large hard disk drives.

9. Compliance: MPV Validation Tools, Certification and Trademark Licensing

Companies that wish to release products for sale using the MPV Interoperability Specification must undergo a certification process comprised of passing the validation tests and sending the positive results along with an administrative fee to OSTA's MPV License Administrator. The company must self-certify each product using the MPV Validation tools.

MPV Validation tools for self-certification are developed, provided and supported by third-party tools vendors. For a current list of available validation tools, please refer to http://www.osta.org/mpv/public/validationtools.htm. For information about becoming an approved third-party Validation Tool developer for OSTA, please refer to http://www.osta.org/mpv/public/toolvendproc.htm

The validation tools run tests, requirement by requirement from the MPV-IS. Each requirement test and result is represented by its number and title in the Output file. The body of the requirement is output if the user has specified the 'verbose' option (-v on the command line). The status of each test in the given requirement is then output. For example, the reporting for section PLW100-2 is as follows:

The requirements title for PLW100-2 is:

"PLW100-2 (Section 3.1.2) Basic Profile IS Profile Identifier."

The requirements body (only displayed using -v) for PLW100-2 is:

" Declare IS-Compliant Profile. A MPV Manifest that complies with the requirements of the MPV Basic Profile Interoperability Specifications (this section) MUST declare that compliance by listing the Basic Profile IS Profile identifier in a <file:Profile> entry in the <file:ManifestProperties>."

The requirements test result for PLW100-2 is:

" Profile Found." if the IS Profile element was found, and:

" Level 1: ERROR - Profile not found! This MUST be fixed!" if it was not.

Example 5: Sample Output.txt file from MPV Validation Tool

```
==========================================
Copyright (c) 2003-2005 Software Architects, Inc. All rights
reserved.
MPV IS Validation tool version 1.0.0b2
for revision 1.00 of the MPV Interoperability Specification.

==========================================

Searching for file: index.pvm
Searching for file: indexmpv.xml
Searching for file: album.pvm
Found File: album.pvm

==========================================

Parsing File: album.pvm
…
Found asset list.
  Asset Entry Count = 0
  Manifest Link Count = 4
------------------------------------------------------------------

Validating XML

PLW100-1 (Section 3.1.1) Support MPV Basic Profile.
  Profile Found.

PLW100-2 (Section 3.1.2) Basic Profile IS Profile Identifier.
  Level 1: ERROR - Profile not found!
  This MUST be fixed!

PLW100-4 (Section 3.1.4) Provide only one <mpv:AssetList>.
  One Asset List Found.
…
======================================
```

For validation testing, the keyword imperative levels defined in the MPV-IS are treated as warning levels, with the following meaning:

- Level 1: Error -- MUST be fixed.
- Level 2: Severe Warning -- SHOULD be fixed to enhance compatibility.
- Level 3: Warning RECOMMEND to be fixed. Not critical to compatibility.

MPV-IS compliant products must have no Level 1 Errors as shown in the Validation Tool Summary Report at the end of the output file (output.txt).

Example #6: Validation Tool Summary Report

```
==========================================
Copyright (c) 2003-2005 Software Architects, Inc.All rights
reserved.
MPV IS Validation tool version 1.0.0b2
for revision 1.00 of the MPV Interoperability Specification.

==========================================

Parsing MPV Manifest

Searching for file:
  "/Projects/MPV Validators/MPV Samples/Sample/index.pvm"
Searching for file:
  "/Projects/MPV Validators/MPV Samples/Sample/indexmpv.
xml"
Searching for file:
  "/Projects/MPV Validators/MPV Samples/Sample/album.
pvm"
Found File:
  "/Projects/MPV Validators/MPV Samples/Sample/album.
pvm"

==========================================

Parsing MPV Manifest File:
  "/Projects/MPV Validators/MPV Samples/Sample/album.
pvm"
Found asset list.
    Asset Entry Count = 0
  Manifest Link Count = 4

----------------------------------------------------------
Validating XML

PLW100-1 (Section 3.1.1) Support MPV Basic Profile.
  Basic Profile found.  Good.
```

```
...
==========================================

Summary Report
  Total Tests Performed: 339
  Level 1 - Errors Found: 33
  Level 2 - Severe Warnings Found: 153
  Level 3 - Warnings Found: 45

==========================================
```

Companies interested in licensing the MPV logo and trademarks (MPV™ and MusicPhotoVideo™) for use on their product or marketing material (documentation, packaging, website, etc.) must sign the MPV Licensing Agrement (available at http://www.osta.org/mpv/public/is/mpv-is.htm) and send in the following to the MPV Licensing Administrator:

1. The signed MPV Licensing Agreement
2. The output file from the MPV-IS Validation Tool
3. Thee necessary administrative fees.

Figure 9: MPV Logo

10. About the Optical Storage Technology Association (OSTA)

OSTA was incorporated as an international trade association in 1992 to promote the use of recordable optical technologies and products. The organization's membership includes optical product manufacturers and resellers from three continents, representing more than 85 percent of worldwide writable optical product shipments.

OSTA was responsible for the definition of UDF -- Universal Disk Format – adopted for the DVD format. OSTA manages the on-going development of the UDF specification which is fully compliant with the ISO 13346 standard and is intended for developers who intend to implement UDF to enable file interchange among different operating systems.

The OSTA committees work to shape the future of the optical storage industry through regular meetings of Commercial Optical Storage Applications (COSA), DVD Compatibility, MPV (MusicPhotoVideo), UDF, and a new adhoc Blue Laser committee. Interested companies worldwide are invited to join the organization and participate in its committees and programs.

The MPV Committee meets on a quarterly basis. It is comprised of various working groups each chaired by an expert in their field.

MPV Committee & Working Groups		
Chairman: Felix Nemirovsky, Chuba Consulting		
Working Group	Company	Chair
MPV Core Specifications	Hewlett-Packard	Pieter van Zee
Camera WG	Olympus	Kenji Ichimura
Portable Storage WG	Konica Minolta	Po-Chieh Hung
Broadcast TV WG	TV Guide On-Screen	Eric Shalkey
Interoperability WG	Samsung	Youngyoon Kim
Print WG	Epson	Fumio Nagasaka
Music WG	Jadugar Consulting	Raza Zaidi

Table 2. MPV Committee and Working Groups

Visit http://www.osta.org/mpv for the schedule of the quarterly meetings or send an email to mpvinfo@osta.org to freely attend the next meeting.