

# ORACLE MULTIMEDIA

*Oracle Multimedia (formerly Oracle interMedia) provides services for the management of rich content including images, audio, and video in Oracle Database 11g. With Oracle Multimedia, it is easy to manage rich content in an integrated fashion with traditional relational business information. Oracle Multimedia recognizes most popular web media formats, offers multiple storage alternatives, and provides object, purely relational, and standards compliant interfaces to its services. Oracle Multimedia also offers support for web application development and deployment, Java interfaces for application development, and multi modal (wireless) support.*

## SUMMARY

Oracle Multimedia enables Oracle Database 11g to manage image, audio, and video in an integrated fashion with other enterprise information. It extends Oracle Database 11g's reliability, availability, and data management to multimedia content in traditional, medical, financial, Internet, electronic commerce, and media-rich applications.

Oracle Multimedia enables open, standard SQL access using native image, audio, and video data type services, operators, and metadata management. It includes Internet support for popular Web authoring tools and popular Web servers including Oracle Application Server 10g.

Leading vendors and customers in the financial services, government, healthcare, and education sectors chose Oracle Multimedia to build reliable and scaleable solutions with Oracle Database 11g.

## Integrate Digital Media with Enterprise Data

It's often said that a picture is worth a thousand words and multimedia content can quickly and intuitively convey huge amounts of information. Applications such as web publishing, e-commerce, and media asset management have dramatically increased the generation and consumption of pictures, sounds, music, speech, and video.

Oracle Multimedia provides foundational support for image, audio, and video datatypes. For the first time, the security, administrative controls, performance, scalability, and open access of professionally managed enterprise information systems is available to multimedia content used in corporate Web sites and media-rich applications.

This creates opportunities to share, re-purpose, and integrate these media assets with traditional relational data and operational systems providing benefits of keeping them in synchronization and unifying their management.

### **Flexible Data Storage**

Oracle Multimedia uses object data types, similar to JAVA™ or C++ classes, to describe image, audio, and video data. Oracle Multimedia objects have a common media data storage model. The media data component of these objects can be stored in the database, in a BLOB under transaction control. The media data can also be stored outside of the database without transaction control. In this case, a pointer is stored in the database under transaction control and the media data is stored in an external BFILE (operating system flat file), in an HTTP server-based URL, in a specialized media data server, or in a user-defined source on other servers. Storage in the database provides considerable benefits including transaction control over the media content, access security, and ease of maintaining synchronizaton between the media and associated relational business information.

Media data stored outside the database can provide a convenient mechanism for managing large, preexisting or new, media repositories that reside as flat files on erasable or read-only media. This data can be imported into BLOBs at any time for transaction control or exported into BFILEs at any time.

### **Management of Object Attributes**

Object metadata, attributes, and methods are always stored in the database under Oracle Multimedia control. Whether media data is stored within or outside the database, Oracle Multimedia manages metadata for all the media types and automatically extracts it for image, audio, and video. This relieves application developers of the burden of learning format nuances.

### **SQL Access to Multimedia Data**

Consider an Internet music store application built using Oracle Multimedia, which offers customers the ability to search for music of interest, preview the music, and make purchases. Customers of this Internet music store can find an audio track by musician name, song title, CD title, and recording or publication date. A search for a particular CD review can be accomplished by full text, or theme searches using Oracle Text combined with relational attributes like song title or publishing date. Customers can play the associated audio clip, view a promotional music video, and read the critics' reviews, gathering information leading to a purchase.

Information kiosks can support queries like "play the best selling jazz CD, tell me if it is in stock, show me a picture of the CD and the artist, find any other CDs that contain this song and play those arrangements, or show me the location of all stores in the area carrying this CD".

## IMAGE SUPPORT

Oracle Multimedia image services support two-dimensional, static, digital images stored as binary representations of real world objects or scenes, in most popular file formats and compression schemes.

### File Formats

Users can easily store images created by applications without becoming experts in image file formats. Oracle Multimedia does not require the application to convert files to and from an internal format for storage and retrieval. Considering the volume of data in large databases, this significantly improves server performance.

Oracle Multimedia supports most popular desktop publishing image file formats including: TIFF, JFIF (more commonly referred to as JPEG), BMP, TARGA, EXIF, PCX, PICT, GIF, CALS, SUN RASTER, FPIX, PNGF, PPMF, PGMF, PBMF, WBMP, and RPIX (see complete list at end of document). RPIX is the Oracle Multimedia raw pixel format. Because it is not compressed, it is very easy to access individual pixels and perform image processing, for example to add a watermark. Oracle Multimedia also supports the DICOM medical imaging format DCM.

The RPIX format can also be used as a gateway to import certain proprietary and foreign image formats into Oracle Multimedia. A proprietary or foreign format can be converted to the documented RPIX format simply by using methods to pass the image format attributes to Oracle Multimedia. Once this has been done, Oracle Multimedia can process the image— storing, retrieving and applying image manipulation and conversion methods as needed.

Oracle Multimedia has the ability to store, manage and recognize medical images in the DICOM version 3 format. When Oracle Multimedia is instructed, it will populate the mimeType, fileFormat and contentLength attributes of the ORDImage object.

### Content Formats

The content format is made up of monochrome or bit depth, sample model (Band Interleaved by Plane, Band Interleaved by Line, Band Sequential), color model (Look Up Table, Direct), color space (GRAY, RGB), and special attributes such as alpha channel or transparency color. Oracle Multimedia can read and write image data at a variety of bit depths including Monochrome (1 bit), two, four, eight, twelve, sixteen, twenty four, thirty two, and forty eight bits.

### Metadata Extraction and Embedding

Java and PL/SQL methods have been added to the Oracle Multimedia OrdImage object to extract embedded content metadata from popular binary image formats. Content metadata does not describe the format of the image, but instead describes what the image is about and includes information such as who the photographer was and when the photo was taken.

Embedded metadata that can now be extracted includes the image metadata formats commonly referred to as IPTC (or IIM), EXIF, and XMP. IIM4 is a standard used extensively in the news gathering and press industries. The Exchangeable Image File Format, EXIF, is the standard for image file storage for digital still cameras. The Extensible Metadata Platform, XMP, is a standard format, developed by Adobe, for the creation, processing and interchange of metadata in a variety of applications.

Metadata extracted from images is represented as a collection of XML documents returned in XMLType objects. Each document corresponds to one of the embedded metadata types. Each returned document conforms to an XML schema that is registered with the database. Once this metadata has been extracted from the image, it can be stored in Oracle Database, indexed, searched and made available to applications using the standard mechanisms of XML DB or Oracle Text.

Oracle Multimedia can also write or embed metadata into popular image file formats. Metadata is provided as a schema-based XML document. Oracle Multimedia processes the XML document and writes the metadata into the image.

### **Efficient Compression**

Oracle Multimedia shields users from the complexities of compression technology, allowing users to simply request that images be compressed or decompressed on demand. Oracle Multimedia supports the most popular and efficient compression schemes, including CCITT G3 / G4 run length (Huffman encoding schemes, which are lossless and used for bitonal document images), ISO/CCITT JPEG encoding scheme, which is lossy and used for photographic (continuous tone) images, and several de facto schemes.

### **Format Conversions and Image Manipulation**

Because there are so many different image formats and many applications support only a subset of them, Oracle Multimedia provides conversion between formats (transcoding) on demand. Oracle Multimedia also provides a set of server-based manipulation functions, including scaling and cropping, that are useful in preparing image data for general purpose viewing or input to another process.

Oracle Multimedia can transcode from many DICOM images to web image formats, and perform many basic imaging operations on DICOM data in these web formats.

### Basic Image Processing

In addition to the rich set of formats supported, Oracle Multimedia provides a basic set of image processing operators that provide for server side image processing. Taken together, the scale and crop operators provide for an efficient and flexible thumbnail generation capability. Other image processing operations include: Arbitrary Image Rotate, Flip, and Mirror, Gamma Correction, Contrast Enhancement, Quantization Methods, Page Selection, and Alpha Channel.

### SQL Multimedia Standard Support

In addition to offering both object oriented and purely relational application programming interfaces, Oracle Multimedia offers a SQL multimedia standard compliant interface (ISO/IEC 13249-5:2001 SQL/MM Part 5: Still Image Standard). The standard defines object relational types for images and image characteristics. Each object type includes attributes, methods, and associated SQL functions and procedures.

### Digital Imaging and Communications in Medicine (DICOM)

Oracle Multimedia DICOM was introduced in Oracle Database 10.2. Oracle Database 11g adds the following Oracle Multimedia DICOM features:

- ORDDicom object type
- DICOM format support
- DICOM metadata extraction
- DICOM image processing
- DICOM object conformance validation
- Making DICOM objects anonymous
- Creating DICOM objects
- Run-time, updatable DICOM data model

### AUDIO AND VIDEO

Oracle Multimedia manages industry-standard audio data stored in AIFF, AIFF-C, AUFF, WAV, MPEG I, MPEG II, MPEGIV, 3GP, Microsoft ASF and Real Networks Real Audio formats (see full list of file formats at end of document). It extracts metadata information from these formats on demand and stores it in attributes of the Oracle Multimedia audio object. The audio data itself, can either be stored locally in Oracle or referenced from the external sources previously mentioned.

Oracle Multimedia manages industry-standard video data stored in QuickTime, AVI, MPEGI, MPEGII, MPEGIV, 3GP, Real Networks Real Video format, and Microsoft ASF format. It enables applications to store metadata information in attributes of the Oracle Multimedia video object. The video data can either be

stored locally in Oracle Database 11g, or referenced from the external sources previously mentioned. Support for these de-facto standard formats ensures that applications may store their data in an Oracle database in a natural and efficient fashion.

### **Compression**

Where support is defined by the preceding interchange format standards, Oracle Multimedia recognizes compression schemes including ADPCM and MU-LAW for audio, and AVI Indeo for video.

### **Streaming Audio/Video**

Oracle Multimedia can interoperate with streaming servers like the Real Networks Server and the Microsoft Streaming Server to deliver audio/ video on demand.

If the audio/video data is stored in the streaming server, Oracle Multimedia can supply the application with connection information for the streaming server and a "pointer" to the data in the server. The Real Networks Server and Microsoft Server can also deliver audio/video stored locally in Oracle11g.

### **Batch Audio/Video**

If a streaming server is unavailable, Oracle Multimedia can deliver the multimedia information directly to the client in "download and play" mode. The entire audio or video clip is sent to the application, which then launches the appropriate player.

## **SUPPORT FOR WEB APPLICATION DEVELOPMENT**

Oracle Multimedia combined with Oracle and partner application development tools, delivers a powerful, enterprise-level Web application development and deployment platform.

### **Internet Integration**

Using Oracle Multimedia support for Web technologies, you can easily integrate multimedia data into Web and Java applications. You can also store, retrieve, and manage rich media content in a database. Oracle Multimedia provides a Servlets and JSP Java API that facilitates the upload and retrieval of multimedia data stored in a database using the Oracle Multimedia OrdAudio, OrdDoc, OrdImage, and OrdVideo object types.

Oracle Multimedia Servlets and JSP Java API uses Oracle Multimedia Java API to access data stored in the Oracle Multimedia object types. However, Oracle Multimedia Servlets and JSP Java API can also be used to handle upload and retrieval of data using BLOBs directly

### **Integration with Oracle Application Server Portal**

Oracle Application Server Portal is used to create useful and appealing enterprise portals. A key feature of the Oracle Application Server Portal is used to create useful and appealing enterprise portals. A key feature of the Oracle Application

Server Portal framework are portlets, which provide a convenient way to access any type of data, including rich content such as images, audio, and video. Oracle Application Server Portal has components that give the developer a declarative way to create objects that capture, act upon, and display data from an Oracle table or view. These Oracle Application Server Portal components can be connected together to create Web applications that can be applied directly to enterprise databases. And, as Oracle Multimedia objects are stored in Oracle tables, they can be included in the types of data available to Oracle Application Server Portal components.

## **Integration with Oracle Application Server Development Framework**

### **Business Components**

For rapid development of media-rich Web applications, Oracle offers developers a Java integrated development environment (IDE), Oracle JDeveloper, that maximizes developer productivity. Oracle JDeveloper enables developers to build multi-tier, component-based Internet applications in Java that use Oracle Multimedia features to create visually attractive applications. Oracle Application Development Framework Business Components (ADF Business Components) is the component of JDeveloper that provides a set of intelligent software building blocks to manage common facilities.

An Oracle Multimedia/ADF Business Components integration package includes media-specific domain classes and a set of utilities. The domain classes are wrappers of the classes of Oracle Multimedia Java API, and inherit all the underlying multimedia retrieval, upload, and manipulation methods. The domain classes support the ADF Business Components APIs and provide built-in integrated multimedia capabilities, while the utility classes support the retrieval, rendering, and uploading of multimedia content. Together, they provide a fully featured, integrated application development environment that enables a developer to create a wide variety of media-rich applications.

### **Java Classes for Servlets and JSP or Multimedia Tag Library**

Deciding whether to use Oracle Multimedia Java Classes for servlets and JSP or Multimedia Tag Library depends on the type of application you want to develop as well as your level of experience with Java programming.

Java servlets and JSP pages offer flexibility by enabling you to customize the application output. This customization requires a moderate level of skill with the Java programming language, and with servlet and JSP technology. Thus, servlets and JSP pages are best suited for complex applications developed by reasonably experienced Java programmers.

The tags provided by Multimedia Tag Library offer speed and ease of use, allowing you to write simple Java applications requiring little or no customization. JSP tags are appropriate for less experienced Java programmers who want to develop common applications quickly, using limited Java code.

### **Integration with Oracle Application Express**

Oracle Multimedia can be used with Oracle Application Express. Oracle Application Express (Oracle APEX), formerly called HTML DB, is a rapid web development tool for Oracle database. A user with limited programming experience can develop professional applications that are fast and secure, using only a web browser.

### **Application Development Environments**

Oracle Multimedia is accessible to applications through both relational and object interfaces. Database applications written in JAVA, C++, or traditional 3GLs can interface to Oracle Multimedia through modern class library interfaces, or PL/SQL and OCI. These applications can easily add image, audio, and video columns to store objects in existing and new relational tables. Applications can use Oracle Multimedia to query and retrieve multimedia data in the same manner as any other relational data.

In addition, applications with a JMF player can access and play audio/video from Oracle Multimedia. Oracle Designer can generate C++ classes that enable C++ applications running on the client or the application server to call Oracle Multimedia methods.

### **BUILT ON ORACLE DATABASE 11g**

Oracle Multimedia is fully integrated with Oracle Database 11g to capitalize on all of the attributes of the Oracle server that support business-critical 24x365 applications. This is a significant departure from the traditional approach to managing digital media information in proprietary data stores, where there is a tight link to a specific application, or in generic file systems and off-line physical storage.

Information stored in Oracle Database 11g can be accessed by millions of users. It can be shared securely across multiple applications and developed using dozens of leading programming languages and tools. Oracle 11g includes replication facilities, proven tuning, management, and administration technologies to manage petabytes of information. It delivers this information with unsurpassed reliability, ensuring that whenever information is needed, it is available to the people who depend on it. Oracle is the undisputed leader in managing critical information used by enterprises around the world.

### **PARTNER and CUSTOMER APPLICATIONS**

Oracle Multimedia provides foundational services required by traditional, Web and other applications that demand the use of rich data types. Oracle Multimedia presents application providers with a unique opportunity to enhance and differentiate solutions by incorporating media into traditional applications. Media rich applications including financial, medical, digital archives, customer care, document/image management, and training benefit because application systems are



easier to integrate with enterprise systems, easier to manage, easier to implement across the enterprise and on the Web, more scalable and less costly to support. Partners and customers benefit from lower software development costs by eliminating unique application code needed to handle complex data types.

## KEY FEATURE SUMMARY

### Platform Requirements

- Oracle Multimedia is part of Oracle Database 11g

### Object Data Storage Options with Automatic Metadata Extraction from Object Header

- BLOBs
- File-based large objects, or BFILEs stored in local operating system-specific file-systems.
- URLs containing audio, image, and video data stored on any HTTP server such as the Oracle Application Server.
- Any other specially formatted multimedia data stored in BLOBs and any user-defined sources on other servers.

### Application Development

- PL/SQL and Oracle® Call Interface
- JAVA
- C++
- Support for the WebDAV protocol, allowing use with popular Web authoring tools
- Support for the Oracle Application Server Portal
- JSP Tag Library for ease of application development

### AUDIO FEATURES

- Client access via Java Media Framework (JMF)
- Audio delivery in batch mode or through streaming server such as the RealNetworks Helix Server or Microsoft Windows Media Services Streaming Server
- Basic parsing of AUFF, AIFF, AIFF-C, WAVE, MPEGI, MPEGII, MPEGIV, RealNetworks Audio and Microsoft ASF formats

### IMAGE FEATURES

- Conversion among image and compression formats.
- Support for basic manipulation functions including scaling and cropping (see below).
- Client access via JAVA Advanced Imaging

**Content Formats**

- LUT or Direct
- Big & Little Endian
- 1 / 2 / 4 / 8 / 12 / 16 / 24 / 32 / 48 bits deep
- Band Interleaved by Plane · Band Interleaved by Line
- Band Sequential

**Compression Formats**

- CCITT G3
- CCITT G4
- DEFLATE
- HUFFMAN
- JPEG
- LZW
- PACKBITS
- RLE

**File Formats**

- TIFF
- JPEG, JPEG 2000
- BMP
- TARGA
- EXIF
- PCX
- PICT
- GIF
- CALS
- SUN RASTER
- FPIX
- PNGF
- PPMF
- PGMF
- PBMF
- PNMF
- WBMP

- DICM
- RPIX. - A Raw Pixel Format allows direct access to pixel data, which simplifies image processing

### Image Metadata Formats

- EXIF
- IPTC
- XMP

### Processing

- Scale
- Adjust Compression quality
- Crop
- Arbitrary Image Rotate
- Flip and Mirror
- Gamma Correction
- Contrast Enhancement
- Quantization Methods
- Page Selection
- Alpha Channel

### Transcoding

- Between supported image formats
- On demand

### VIDEO FEATURES

- Client access via Java Media Framework (JMF)
- Video delivery in batch mode or through streaming server including the Real Networks Video and Microsoft Streaming Server
- Management of popular video formats with basic parsing of AVI, QuickTime, MPEGI, MPEGII, MPEGIV, 3GP, Microsoft ASF, and RealNetworks Video

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