Oracle® Multimedia

User's Guide

12*c* Release 2 (12.2)

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Presents information about using Oracle Database to store, manage, and retrieve images, audio, video, DICOM format medical images and other objects, or other heterogeneous media data in an integrated fashion with other enterprise information. Oracle Multimedia extends Oracle Database reliability, availability, and data management to multimedia content in traditional, Internet, electronic commerce, medical, financial, and other media-rich applications.

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Oracle Multimedia User's Guide, 12*c* Release 2 (12.2)

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Preface

This guide describes how to use Oracle Multimedia, which ships with Oracle Database. It describes the management and integration of audio, image, and video, or other heterogeneous media data with other Oracle tools and software, and with third-party tools and software.

In Oracle Database 11*g* Release 1 (11.1), the name Oracle *inter*Media was changed to Oracle Multimedia. The feature remains the same, only the name has changed.

The sample code in this guide might not match the code shipped with Oracle Database Examples media. To run examples that are shipped with Oracle Database Examples media on your system, use the files provided with Oracle Database Examples media. Do not attempt to compile and run the code in this guide.

See *Oracle Database New Features Guide* for information about Oracle Database and the features and options that are available to you.

Audience

This guide is for application developers and database administrators who are interested in storing, retrieving, and manipulating audio, image, video, and heterogeneous media data in a database, including developers of audio, heterogeneous media data, image, and video specialization options. After familiarizing yourself with the concepts presented in this guide, consult *Oracle Multimedia Reference* for API information.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc.

Access to Oracle Support

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info or visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs if you are hearing impaired.

Related Documents

Note:

For information added after the release of this guide, see the online `README.txt` file under your <*ORACLE_HOME*> directory. Depending on your operating system, this file may be in

<*ORACLE_HOME*>`/ord/im/admin/README.txt`

See your operating system-specific installation guide for more information.

For more information about using Oracle Multimedia in a development environment, see the following documents in the Oracle Database Online Documentation Library:

- *Oracle Multimedia Reference*
- *Oracle Multimedia DICOM Developer's Guide* (Deprecated)
- *Oracle Call Interface Programmer's Guide*
- *Oracle Database Development Guide*
- *Oracle Database SecureFiles and Large Objects Developer's Guide*
- *Oracle Database Concepts*
- *Oracle Database PL/SQL Language Reference*
- *Oracle Database Java Developer's Guide*
- *Oracle Database Error Messages*

For more information about using JDBC, see *Oracle Database JDBC Developer's Guide*.

For more information about using XML, see *Oracle XML DB Developer's Guide*.

For reference information about Oracle Multimedia Java classes in Javadoc format, see the following Oracle API documentation (also known as Javadoc) in the Oracle Database Online Documentation Library:

- *Oracle Multimedia Java API Reference* (Deprecated)
- *Oracle Multimedia Servlets and JSP Java API Reference* (Deprecated)
- *Oracle Multimedia DICOM Java API Reference* (Deprecated)
- *Oracle Multimedia Mid-Tier Java API Reference* (Deprecated)

For more information about Java, see the API documentation provided by Oracle.

Many of the examples in this guide use the sample schemas. See *Oracle Database Sample Schemas* for information about how these schemas were created and how you can use them.

Conventions

Although Boolean is a proper noun, it is presented as boolean in this guide when its use in Java code requires case-sensitivity.

The following text conventions are also used in this guide:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

Changes in This Release for Oracle Multimedia User's Guide

This preface lists changes in *Oracle Multimedia User's Guide*.

Changes in Oracle Database 12*c* Release 2 (12.2)

The following are changes in *Oracle Multimedia User's Guide* for Oracle Database 12*c* Release 2 (12.2).

New Features

The Oracle Multimedia PL/SQL API is new in this release.

Oracle Multimedia now provides a simplified PL/SQL API with functions and procedures for managing image, audio, and video media data stored in BLOBs and BFILEs in Oracle Database. This API allows metadata extraction and image processing operations to be more intuitively included in SQL and PL/SQL applications.

The PL/SQL API enables developers to include many common operations in their applications. Examples include creating thumbnail images, cropping images, and converting images to Web-friendly formats, as well as extracting metadata. Using this API along with a comprehensive set of database tools and features, developers can consolidate multimedia data with other types of data in the database, for easy display in reports and Web user interfaces. These advantages enable rapid development and deployment of all database applications that include multimedia data.

See *Oracle Multimedia Reference* for more information about the Oracle Multimedia PL/SQL Packages.

Deprecated Features

The Oracle Multimedia support for the SQL/MM Still Image standard is deprecated in this release, and may be desupported in a future release.

The following APIs are deprecated in this release, and may be desupported in a future release:

- Oracle Multimedia Java API
- Oracle Multimedia Servlets and JSP Java API
- Oracle Multimedia DICOM Java API
- Oracle Multimedia Mid-Tier Java API

The Oracle Multimedia support for DICOM is deprecated in this release, and may be desupported in a future release.

The DICOM support in ORDImage objects that was introduced in Oracle Database 10*g* Release 2 (10.2) was deprecated in Oracle Database 12*c* Release 1 (12.1), and may be desupported in a future release.

See Also:

- *Oracle Multimedia Reference* for more information about deprecated API components
- *Oracle Multimedia DICOM Developer's Guide* for more information about the DICOM feature

1

Introduction to Oracle Multimedia

This chapter provides an overview of Oracle Multimedia.

Oracle Multimedia (formerly Oracle interMedia) enables Oracle Database to store, manage, and retrieve images, DICOM format medical images and other objects, audio, video, or other heterogeneous media data in an integrated fashion with other enterprise information.

Oracle Multimedia extends Oracle Database reliability, availability, and data management to multimedia content in traditional, medical, Internet, electronic commerce, and media-rich applications. Oracle Multimedia does not control media capture or output devices; this function is left to application software.

Oracle Multimedia provides these services and support:

- Image services for the storage, retrieval, metadata extraction, and processing of two-dimensional, static, bit-mapped images. Images are stored efficiently using popular compression schemes in industry-standard image formats for desktop publishing.
- Digital Imaging and Communications in Medicine (DICOM) support for the storage, retrieval, metadata extraction, processing, writing, conformance validation, and making anonymous of medical images and other DICOM content. Note: DICOM support is deprecated in Oracle Database 12*c* Release 2 (12.2), and may be desupported in a future release.
- Audio and video services for the storage, retrieval, and metadata extraction of popular audio and video file formats.

This chapter includes these sections:

See Also:

- *Oracle Multimedia Reference* for detailed information about Oracle Multimedia APIs and their components
- *Oracle Multimedia DICOM Developer's Guide* for more information about Oracle Multimedia DICOM support

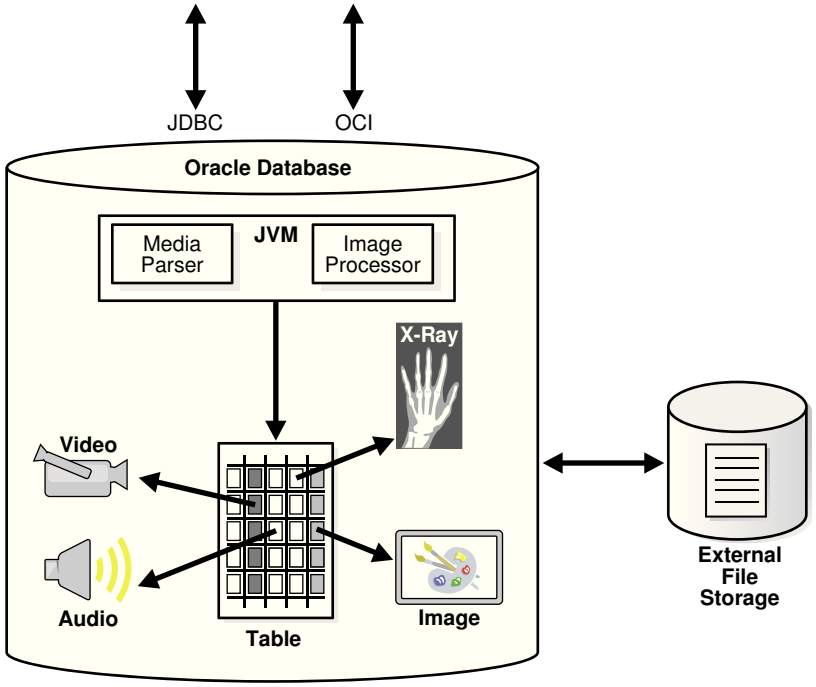
1.1 Oracle Multimedia Architecture

Oracle Multimedia is a single, integrated feature that extends the database by storing, managing, and retrieving image, audio, and video data.

The Oracle Multimedia architecture defines the framework through which media-rich content is supported in the database, along with traditional data. This content can then be securely shared across multiple applications written with popular languages and tools, easily managed and administered by relational database management and administration technologies, and offered on a scalable database that supports thousands of users.

The following figure illustrates the Oracle Multimedia architecture from the database perspective.

Figure 1-1 Oracle Multimedia Architecture



Using Oracle Multimedia, Oracle Database holds rich content in tables along with traditional data. As illustrated, rich content includes audio, image, video, and DICOM content, such as X-rays. Through a database-embedded JVM, a server-side media parser and an image processor are supported. The media parser supports format and application metadata parsing, and can be extended to support additional formats. The image processor provides image processing for operations such as producing thumbnail-size images, converting image formats, and image watermarking.

Using Oracle Multimedia procedures or methods enables import and export operations between the database and external file storage systems. The double-sided arrow connecting Oracle Database with External File Storage shows this data movement.

Using Oracle Multimedia enables Oracle Database to store, manage, process, and retrieve DICOM content in database tables. DICOM content includes single-frame and multiframe images, waveforms, slices of 3-D volumes, video segments, and structured reports.

See Also:

- *Oracle Multimedia DICOM Developer's Guide* for a view and description of the complete architecture for Oracle Multimedia DICOM

1.2 Object Relational Technology

Oracle Database is an object relational database management system that provides support for Oracle Multimedia data stored in BLOBs and BFILEs as well as for data associated with object types.

In addition to its traditional role in the safe and efficient management of relational data, Oracle Database provides support for the safe and efficient storage and management of large objects (LOBs) using SecureFiles LOBs.

Oracle Multimedia provides four PL/SQL packages, which contain functions and procedures for managing image, audio, and video data stored in binary large objects (BLOBs) and external large objects (BFILEs) in Oracle Database:

- ORD_AUDIO for audio data
- ORD_DOC for heterogeneous data
- ORD_IMAGE for image data
- ORD_VIDEO for video data

In addition, Oracle Multimedia provides the ORD_DICOM PL/SQL package to support DICOM content produced by medical devices.

Developers can use the PL/SQL packages to include common operations, such as these, in their applications:

- Creating thumbnail images
- Cropping images
- Converting images into Web-friendly formats
- Extracting information from multimedia data, either as an XML string or as XML and individual attributes
- Loading multimedia data from operating system files into Oracle Database
- Exporting multimedia data from Oracle Database into operating system files

Oracle Database also supports the definition of object types, including the data associated with objects and the operations (methods) that can be performed on them.

Complex objects include: digitized audio, image, video, and Digital Imaging and Communications in Medicine (DICOM) format medical images and other data.

Oracle Multimedia provides four object relational types, which store data source information in an object relational type known as ORDSource:

- ORDAudio, for audio data characteristics
- ORDDoc, for heterogeneous data characteristics
- ORDImage, for image data characteristics
- ORDVideo, for video data characteristics

In addition, Oracle Multimedia provides the ORDDicom object relational type, for characteristics of DICOM content produced by medical devices.

See Also:

- *Oracle Database SecureFiles and Large Objects Developer's Guide* for detailed information about using BLOBs and BFILEs
- *Oracle Multimedia Reference* for reference information about the PL/SQL packages and object types and methods for audio, heterogeneous, image, and video media, and for more information about the ORDSource object type and methods
- *Oracle Multimedia DICOM Developer's Guide* for reference and other information about the ORD_DICOM PL/SQL package and the ORDDicom object type and methods for DICOM format medical images and other data

1.3 Oracle Multimedia Capabilities

The capabilities of Oracle Multimedia include the storage, retrieval, management, and manipulation of multimedia data managed by Oracle Database.

Multimedia applications have common and unique requirements. Oracle Multimedia supports common application requirements and can be extended to address application-specific requirements. With Oracle Multimedia, multimedia data can be managed as easily as standard attribute data.

Database applications written in Java, C++, or traditional third-generation languages (3GLs) can interact with Oracle Multimedia through modern class library interfaces, or PL/SQL and Oracle Call Interface (OCI).

Oracle Multimedia supports storage of the popular file formats, including desktop publishing images, and streaming audio and video formats in databases. Oracle Multimedia provides the means to add audio, image, and video, or other heterogeneous media columns or objects to existing tables, and insert and retrieve multimedia data. This support enables database designers to extend existing databases with multimedia data, or to build new end-user multimedia database applications. Oracle Multimedia developers can use the basic functions provided here to build specialized multimedia applications.

Oracle Multimedia defines PL/SQL packages and object types, similar to Java or C++ classes, to describe and process multimedia data. The PL/SQL packages are named ORD_AUDIO, ORD_DOC, ORD_IMAGE, and ORD_VIDEO. The object types are called ORDAudio, ORDDoc, ORDImage, and ORDVideo. Users who wish to store

media data directly in BLOBs or BFILEs can use the Oracle Multimedia PL/SQL packages. Users who prefer media data and attributes to be encapsulated in a single object type can use the Oracle Multimedia object types.

The Oracle Multimedia PL/SQL packages contain functions and procedures for managing media data, including image, audio, and video data. The PL/SQL packages operate on media data stored in BLOBs and BFILEs. BLOBs store media data in the database under transaction control. Under transaction control, BFILEs store a pointer to the media data stored in an external file that is not under transaction control. The PL/SQL packages include procedures to extract metadata from media data. Metadata is information about the media data, such as object length, compression type, or format. Procedures are also provided to perform operations on the media data, such as getProperties( ) and scale( ).

An instance of the Oracle Multimedia object types consists of attributes, including metadata and the media data, and methods. Media data is the actual audio, image, or video, or other heterogeneous media data. Metadata is information about the data, such as object length, compression type, or format. Methods are procedures that can be performed on objects, such as getContent( ) and setProperties( ).

The Oracle Multimedia object types 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 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:

- File-based large object (BFILE)
- An HTTP server-based URL
- A user-defined source on a specialized media data server, or other server

Media data stored outside the database can provide a convenient mechanism for managing large, existing 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. Loading Multimedia Data (page 1-13) describes several ways of loading multimedia data into a database.

When using Oracle Multimedia object types, media metadata is stored in the database under transaction control. Whether media data is stored within or outside the database, Oracle Multimedia manages metadata for all the media object types and might automatically extract it for audio, image, and video. When storing media data in BLOBs or BFILEs and using the Oracle Multimedia PL/SQL packages, it is up to the application to decide how to manage metadata.

Media metadata includes these attributes:

- Storage information about audio, image, and video, or other heterogeneous media data, including the source type, location, and source name, and whether the data is stored locally (in the database) or externally
- Update time stamp information for audio, image, and video, or other heterogeneous media data
- Audio and video data description
- Audio, image, and video, or other heterogeneous media data format
- MIME type of the audio, image, and video, or other heterogeneous media data

- Audio characteristics: encoding type, number of channels, sampling rate, sample size, compression type, and play time (duration)
- Image characteristics: height and width, image content length, image content format, and image compression format
- Video characteristics: frame width and height, frame resolution, frame rate, play time (duration), number of frames, compression type, number of colors, and bit rate
- Extracted metadata in XML, such as the director or producer of a movie

In addition to metadata extraction procedures and object methods, a set of image manipulation procedures and object methods is provided. For images, this includes format conversion, page selection, quantize operations, compression, scaling, cropping, copying, flipping, mirroring, rotating, sharpening, adjusting the gamma (brightness), adding watermarks to images, removing metadata from images, and embedding metadata into images.

See Also:

Oracle Multimedia Reference for more information about image processing operations

Oracle Multimedia is a building block for various multimedia applications, rather than an end-user application. It consists of PL/SQL package procedures, and object types and their respective methods, for managing and processing multimedia data. Some example applications for Oracle Multimedia are:

- Repositories for digital check images
- Electronic health records, including DICOM medical images
- Call centers (for example, 911 and product call centers)
- Physical asset inventories
- Distance learning and online learning
- Real estate marketing
- Stock photography archives (for example, digital art galleries and professional photographers)
- Document imaging archives
- Financial news service customer information
- Web publishing
- Audio and video Web stores

1.3.1 Oracle Multimedia Support for CDBs

Oracle Database 12*c* Release 1 (12.1) introduced multitenant container databases (CDBs).

A CDB is a single, physical database that can contain zero, one, or many customer-created pluggable databases (PDBs). A PDB is a portable collection of schemas, schema objects, and nonschema objects that appears to an Oracle Net client as a non-CDB. A non-CDB is a traditional Oracle database that cannot contain PDBs. Oracle Multimedia is supported in both CDB and non-CDB architectures.

See Also:

- *Oracle Database Concepts* for information about the multitenant architecture
- *Oracle Database Administrator's Guide* for information about managing CDBs and PDBs

1.3.2 Data Guard Rolling Upgrade Support for Oracle Multimedia

During a rolling upgrade, you can run different releases of an Oracle database on the primary and logical standby databases while you upgrade them, one at a time, incurring minimal downtime on the primary database.

In addition to supporting media data stored in BLOBs and BFILEs, logical standby databases support these Oracle Multimedia data types during database rolling upgrades using Data Guard SQL Apply:

- ORDImage
- ORDSource
- ORDDicom
- ORDDataSource

See Also:

- *Oracle Multimedia DICOM Developer's Guide* for information about how this feature impacts the DICOM data model
- *Oracle Database Upgrade Guide* for information about database rolling upgrades
- *Oracle Data Guard Concepts and Administration* for information about these and other Oracle Data Guard features

1.4 Audio Concepts

This section contains information about digitized audio concepts, and information about using the ORD_AUDIO PL/SQL package and the ORDAudio object type to build audio applications.

Topics include:

- Digitized Audio (page 1-8)
- Audio Components (page 1-8)

1.4.1 Digitized Audio

Using the ORD_AUDIO PL/SQL package or the ORDAudio object type, audio data can be stored, retrieved, and managed in a database.

Audio may be produced by an audio recorder, an audio source such as a microphone, digitized audio, other specialized audio recording devices, or even by program algorithms. Audio recording devices take an analog or continuous signal, such as the sound picked up by a microphone or sound recorded on magnetic media, and convert it into digital values with specific audio characteristics such as format, encoding type, number of channels, sampling rate, sample size, compression type, and audio duration.

1.4.2 Audio Components

Digitized audio consists of the audio data (digitized bits) and attributes that describe and characterize the audio data.

Audio applications sometimes associate application-specific information, such as the description of the audio clip, date recorded, author or artist, and so on, with audio data by storing descriptive text in an attribute or column in the database table.

The audio data can have different formats, encoding types, compression types, numbers of channels, sampling rates, sample sizes, and playing times (duration) depending upon how the audio data was digitally recorded. Oracle Multimedia can store and retrieve audio data of any supported data format. Oracle Multimedia can automatically extract metadata from audio data of a variety of popular audio formats. Oracle Multimedia can also extract application attributes in XML form.

The size of digitized audio (number of bytes) tends to be large compared to traditional computer objects, such as numbers and text. Therefore, several encoding schemes are used that squeeze audio data into fewer bytes, thus putting a smaller load on storage devices and networks.

See Also:

Oracle Multimedia Reference for a list of supported data formats from which ORDAudio can extract and store attributes and other audio features

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1.5 ORDDoc or Heterogeneous Media Data Concepts

This section contains information about heterogeneous media data concepts, and information about using the ORD_DOC PL/SQL package and the ORDDoc object type to build applications.

Topics include:

1.5.1 Digitized Heterogeneous Media Data

Oracle Multimedia integrates the storage, retrieval, and management of heterogeneous media data in a database.

Using the ORD_DOC PL/SQL package or the ORDDoc object type, any heterogeneous media data including audio, image, and video, can be stored in a database column. Instead of having separate columns for audio, image, text, and video objects, you can use one column of type BLOB, BFILE, or ORDDoc to represent all types of multimedia.

1.5.2 Heterogeneous Media Data Components

Heterogeneous media data components consist of the data (digitized bits) and attributes that describe and characterize the heterogeneous media data.

Heterogeneous media data can have different formats, depending upon the application generating the media data. Oracle Multimedia can store and retrieve media data of any supported data format. The BLOB, BFILE, and ORDDoc types can be used in applications that require you to store different types of heterogeneous media data (such as audio, image, video, and any other type of media data) in the same column so you can build a common metadata index on all the different types of media data. Using this index, you can search across all the different types of heterogeneous media data. You cannot use this same search technique if the different types of heterogeneous media data are stored in different types of objects, in different columns of relational tables.

ORDDoc can automatically extract metadata from data of a variety of popular audio, image, and video data formats. ORDDoc can also extract application attributes and store them in the comments attribute of the object in XML form. ORDDoc is extensible and can be made to recognize and support other heterogeneous media data formats.

See Also:

- *Oracle Multimedia Reference* for a list of supported audio data formats from which ORDDoc can extract and store attributes
- *Oracle Multimedia Reference* for a list of supported image data formats from which ORDDoc can extract and store attributes
- *Oracle Multimedia Reference* for a list of supported video data formats from which ORDDoc can extract and store attributes

1.6 Image Concepts

This section contains information about digitized image concepts, and information about using the ORD_IMAGE PL/SQL package and the ORDImage object type to build image applications.

Topics include:

1.6.1 Digitized Images

Using the ORD_IMAGE PL/SQL package or the ORDImage object type, digitized images can be stored, retrieved, and managed in a database.

Oracle Multimedia supports two-dimensional, static, digitized raster images stored as binary representations of real-world objects or scenes. Images may be produced by a document or photograph scanner, a video source such as a digital camera or VCR connected to a video digitizer or frame grabber, other specialized image capture devices, or even by program algorithms. Capture devices take an analog or continuous signal such as the light that falls onto the film in a camera, and convert it into digital values on a two-dimensional grid of data points known as pixels. Devices involved in the capture and display of images are under application control.

1.6.2 Image Components

Digitized images consist of the image data (digitized bits) and attributes that describe and characterize the image data.

Image applications sometimes associate application-specific information, such as the name of the person pictured in a photograph, description of the image, date photographed, photographer, and so on, with image data by storing this descriptive text in an attribute or column in the database table.

The image data (pixels) can have varying depths (bits per pixel) depending on how the image was captured, and can be organized in various ways. The organization of the image data is known as the data format. ORDImage can store and retrieve image data of any data format. ORDImage can process and automatically extract properties of images of a variety of popular data formats. In addition, certain foreign images (formats not natively supported by ORDImage) have limited support for image processing.

The storage space required for digitized images can be large compared to traditional attribute data such as numbers and text. Many compression schemes are available to squeeze an image into fewer bytes, thus reducing storage device and network load. Lossless compression schemes squeeze an image so that when it is decompressed, the resulting image is bit-for-bit identical with the original. Lossy compression schemes do not result in an identical image when decompressed, but rather, one in which the changes may be imperceptible to the human eye. As compared with lossless compression schemes, lossy compression schemes generally provide higher compression.

The image interchange format describes a well-defined organization and use of image attributes, data, and often compression schemes, enabling different applications to create, exchange, and use images. Interchange formats are often stored as disk files. They can also be exchanged in a sequential fashion over a network and be referred to as protocols. There are many application subdomains within the digitized imaging world and many applications that create or use digitized images within these. ORDImage supports storage and retrieval of all image data formats, and processing and attribute extraction of many image data formats.

See Also:

Oracle Multimedia Reference for a list of supported data formats from which Oracle Multimedia can process, extract, and store attributes and other image features

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1.6.3 Metadata in Images

Oracle Database provides an image metadata feature in Oracle Multimedia. Metadata can be stored in a database, indexed, searched, and made available to applications using the standard mechanisms of Oracle Database.

The image metadata feature adds the ability to read (or extract) and write (or embed) application metadata in images. In addition, this feature adopts a standard way to represent metadata when it is separate from an image file. See Working with Metadata in Oracle Multimedia Images (page 5-1) for more information about the image metadata feature.

1.6.4 Medical Imaging (Deprecated)

Oracle Database includes medical imaging format and protocol support in Oracle Multimedia DICOM.

Medical imaging format and protocol support comprises these Oracle Multimedia DICOM features:

- Storage and retrieval of medical imaging data in the database to synchronize the DICOM data with the associated business data
- Full PL/SQL and object interfaces to Oracle Multimedia DICOM services
- Extraction of DICOM metadata according to user-specifiable XML documents
- Querying using associated relational data and extracted metadata
- Image processing, such as thumbnail generation
- Creation of new DICOM objects
- Conformance validation based on a set of user-specified conformance rules
- Making DICOM objects anonymous based on user-defined rules that specify the set of attributes to be made anonymous and how to make those attributes anonymous
- The ability to update run-time behaviors, such as the version of the DICOM standard supported, without installing a new release of Oracle Database
- A DICOM database network component for the DICOM protocol adapter

See Also:

Oracle Multimedia DICOM Developer's Guide for more information about Oracle Multimedia DICOM

1.6.5 Metadata Extraction

Oracle Multimedia provides the ability to extract format metadata from media sources.

Once metadata has been extracted and stored, you can index the metadata to allow media queries based on metadata.

See Also:

The setProperties( ) method in *Oracle Multimedia Reference* for more information about metadata extraction

1.6.6 Image Processing

Oracle Multimedia supports several types of image processing.

Oracle Multimedia image processing support includes format transcoding, cutting, scaling, generating thumbnail images, and applying watermarks. In addition, when the destination image file format is RAW Pixel (RPIX) or Microsoft Windows Bitmap (BMPF), Oracle Multimedia supports several operators for changing the format characteristics.

See Also:

Oracle Multimedia Reference for more information about image processing

1.7 Video Concepts

This section contains information about digitized video concepts, and information about using the ORD_VIDEO PL/SQL package and the ORDVideo object type to build video applications.

Topics include:

- Digitized Video (page 1-12)
- Video Components (page 1-12)

1.7.1 Digitized Video

Using the ORD_VIDEO PL/SQL package or the ORDVideo object type, video data can be stored, retrieved, and managed in a database.

Video may be produced by a video recorder, a video camera, digitized animation video, other specialized video recording devices, or even by program algorithms. Some video recording devices take an analog or continuous signal, such as the video picked up by a video camera or video recorded on magnetic media, and convert it into digital values with specific video characteristics such as format, encoding type, frame rate, frame size (width and height), frame resolution, video length, compression type, number of colors, and bit rate.

1.7.2 Video Components

Digitized video consists of the video data (digitized bits) and the attributes that describe and characterize the video data.

Video applications sometimes associate application-specific information, such as the description of the video training tape, date recorded, instructor's name, producer's name, and so on, within the video data.

The video data can have different formats, compression types, frame rates, frame sizes, frame resolutions, playing times, compression types, number of colors, and bit

rates depending upon how the video data was digitally recorded. Oracle Multimedia can:

- Automatically extract metadata from video data of a variety of popular video formats
- Extract application attributes and store them in the comments attribute of the object in XML form
- Be made to recognize and support additional video formats (because it is extensible)

The size of digitized video (number of bytes) tends to be large compared to traditional computer objects, such as numbers and text. Therefore, several encoding schemes are used that squeeze video data into fewer bytes, thus putting a smaller load on storage devices and networks.

See Also:

Oracle Multimedia Reference for a list of supported data formats from which Oracle Multimedia can extract and store attributes and other video features

1.8 Loading Multimedia Data

Multimedia data can be managed best by Oracle Database. Load your multimedia data into the database to take advantage of its reliability, scalability, availability, and data management capabilities.

To bulk load multimedia data into the database, you can use:

- SQL*Loader

  SQL*Loader is an Oracle utility that lets you load data, and in this case, multimedia data (LOB data), from external multimedia files into a table of a database containing BLOB or Oracle Multimedia object type columns.

- PL/SQL

  A procedural extension to SQL, PL/SQL is an advanced fourth-generation programming language (4GL) of Oracle. You can write PL/SQL procedures to load multimedia data from BLOB, file system, and URL media data sources into BLOB or Oracle Multimedia object type columns.

An advantage of using SQL*Loader is that it is easy to create and test the control file that controls your data loading operation.

An advantage of using PL/SQL scripts to load your data is that you can call procedures or methods as you load data to generate thumbnail images, or extract properties.

See Also:

- *Oracle Database Utilities* for more information about SQL*Loader
- *Oracle Database PL/SQL Language Reference* for more information about PL/SQL procedures

1.9 Multimedia Storage and Querying

Media data can be stored directly in BLOBs or BFILEs, or in Oracle Multimedia object types.

The features of Oracle Multimedia are available to media stored in BLOBs and BFILEs using the Oracle Multimedia PL/SQL API. This PL/SQL API lets developers do the following with media data stored in BLOBs and BFILEs: move data between the local file system and the database; parse and extract the properties of the media data; and store these properties in an XMLType or an XML formatted CLOB, and optionally, in individual relational columns. Developers are not required to make changes to their existing application schema or to instantiate Oracle Multimedia object types to take advantage of the PL/SQL API. The Oracle Multimedia PL/SQL API can also be used to perform image processing operations such as cut, scale, compress, and convert format.

The ORDAudio, ORDDoc, ORDImage, and ORDVideo object types all contain an attribute of type ORDSource and methods for multimedia data source manipulation.

Note:

Do not call ORDSource methods directly. Instead, invoke the wrapper method of the media object corresponding to the ORDSource method. This information is presented for users who want to write their own user-defined sources.

The following subsections briefly describe storage and querying:

- Storing Multimedia Data (page 1-14)
- Querying Multimedia Data (page 1-15)

See Also:

Oracle Multimedia Reference for reference information about the Oracle Multimedia PL/SQL API and the Oracle Multimedia object types and methods for audio, heterogeneous, image, and video media, and for more information about the ORDSource object type and methods

---

1.9.1 Storing Multimedia Data

Oracle Multimedia can store multimedia data as an internal source within the database, under transactional control as a BLOB. It can also externally reference digitized multimedia data stored as an external source in an operating system-specific file in a local file system, as a URL on an HTTP server, or as a user-defined source on other servers, such as media servers. Although these external storage mechanisms are particularly convenient for integrating existing sets of multimedia data with a database, the multimedia data is not under transactional control if it is not stored in the database.

BLOBs are stored in the database tablespaces in a way that optimizes space and provides efficient access. Large BLOBs cannot be stored inline (BLOBs under 4 kilobytes can be stored inline) with other row data. Depending on the size of the BLOB, a locator is stored in the row and the actual BLOB (up to 8 terabytes to 128

terabytes, depending on the block size) is stored in other tablespaces. The locator can be considered a pointer to the actual location of the BLOB value. When you select a BLOB, you are selecting the locator instead of the value, although this is done transparently. An advantage of this design is that multiple BLOB locators can exist in a single row. For example, you might want to store a short video clip of a training tape, an audio recording containing a brief description of its contents, a syllabus of the course, a picture of the instructor, and a set of maps and directions to each training center all in the same row.

Because BFILEs are not under the transactional control of the database, users could change the external source without updating the database, thus causing an inconsistency with the BFILE locator.

Oracle Multimedia ORDAudio, ORDDoc, ORDImage, and ORDVideo object types provide wrapper methods over BLOBs and BFILEs to perform these source related functions:

- Set the source of the data as local or external
- Modify the time an object was last updated
- Set information about the external source type, location, and name of the data
- Transfer data into or out of the database
- Obtain information about the local data content such as its length, location, or its handle to the BLOB, put the content into a temporary BLOB, or delete it
- Access source data by opening it, reading it, writing to it, trimming it, and closing it

See Also:

- *Oracle Database SecureFiles and Large Objects Developer's Guide* for more information about BLOBs and BFILEs
- *Oracle Call Interface Programmer's Guide* for more information about BLOB and BFILE operations

1.9.2 Querying Multimedia Data

Once stored within a database, multimedia data can be queried and retrieved by using the various alphanumeric columns or object attributes of the table to find a row that contains the desired data. For example, you can select a video clip from the Training table where the course name is 'Oracle Database Concepts'.

Multimedia data can be queried by extracted metadata and by other relational table columns.

1.10 Accessing Multimedia Data

Applications access and manipulate multimedia data using SQL, PL/SQL, OCI, or Java.

SQL, PL/SQL, and OCI applications can manipulate and modify multimedia data by accessing the PL/SQL packages ORD_AUDIO, ORD_DOC, ORD_IMAGE, and ORD_VIDEO, or through the object relational types ORDAudio, ORDDoc, ORDImage, and ORDVideo

Java applications on any tier (client, application server, or database) can access, manipulate, and modify audio, image, and video data, or heterogeneous media data stored in a database by using anonymous PL/SQL code blocks that access the Oracle Multimedia PL/SQL packages or object relational types.

2

Oracle Multimedia Application Development

Oracle Multimedia enables you to develop either traditional client/server or two-tier applications, or multitier applications. Either method can then deploy Web applications to run on an application server tier, be tightly integrated with Oracle Database, and enable users to access the application from their desktop through a Web browser.

You can create production quality Oracle Multimedia applications for use in a production environment where users can interact with the application through either the standalone client interface or a Web browser. For Web applications, which are based on standards such as TCP/IP, HTTP, HTML, XML, and XHTML, this capability is facilitated by rapid developments in the underlying technology. As key software components become more tightly integrated, developers' tasks to design, create, and manage Web applications become faster, easier, and simpler to implement.

Several tools and languages can be used for application development with multimedia data. This chapter describes them in these sections:

See Also:

- Oracle Multimedia Photo Album Sample Application (page 3-1) for a description of the Oracle Multimedia Photo Album sample Web application, which uses PL/SQL scripts to demonstrate how to develop Web applications to upload and retrieve media data stored in a database
- Oracle Multimedia Code Wizard Sample Application for the PL/SQL Gateway (page 4-1) for a description of the Oracle Multimedia Code Wizard application, which lets you create PL/SQL stored procedures for the PL/SQL Gateway for uploading and retrieving media data stored in a database using Oracle Multimedia object types

2.1 Developing Multimedia Applications Using SQL Developer

Oracle SQL Developer is a tool that allows standalone graphical browsing and development of database schema objects. Oracle SQL Developer supports the BLOB

and BFILE data types. Using these data types to store multimedia data, users can take advantage of Oracle SQL Developer for their multimedia applications.

See *Oracle SQL Developer User's Guide* for more information about using SQL Developer with BLOBs and BFILEs and with multimedia data.

2.2 Developing Multimedia Applications Using Application Express

Oracle Application Express is a hosted declarative development environment for developing and deploying database-centric web applications. Thanks to built-in features such as user interface themes, navigational controls, form handlers, and flexible reports, Oracle Application Express accelerates the application development process.

Oracle Application Express provides support for BLOB and BFILE data types. Users who store their multimedia data in BLOBs or BFILEs can make use of Oracle Application Express for rapid application development.

See *Oracle Application Express App Builder User's Guide* for information about building multimedia applications with Oracle Application Express.

2.3 Developing Multimedia Applications Using Java and JDBC

Using the Java database connectivity (JDBC) interface, Oracle Multimedia enables users to embed anonymous PL/SQL code blocks to quickly develop Java applications for use on any tier (client, application server, or database) to manipulate and modify audio, image, and video data, or heterogeneous media data stored in a database.

The following subsections describe how to use Java and JDBC to develop multimedia applications:

- Setting Up Your Environment for Java (page 2-3)
- Media Upload in Java (page 2-5)
- Retrieval of Image Properties in Java (page 2-6)
- Thumbnail Image Creation in Java (page 2-8)
- Handling Oracle Multimedia Exceptions in Java (page 2-8)

The examples in this section assume a table, with these two columns: a numeric identifier (`id`), and a binary large object (BLOB) to hold the image itself (`image_blob`).

```
create table image_blob_table ( id number primary key, image_blob BLOB)
lob(image_blob) store as securefile;
```

See Also:

- *Oracle Database JDBC Developer's Guide* for more information about using JDBC
- *Oracle Multimedia Reference* for more information about the Oracle Multimedia PL/SQL packages and object interfaces
- *Oracle Multimedia DICOM Developer's Guide* for more information about Oracle Multimedia DICOM features and enhancements

2.3.1 Setting Up Your Environment for Java

Before you can begin using Oracle Multimedia with Java, you must set up your environment to compile and run Java programs.

Follow these steps:

1. Specify the environment variable CLASSPATH, and ensure that this variable includes the appropriate Oracle Java archive (JAR) files for the Oracle Multimedia features and any other features that you intend to use.

   For each Oracle JAR file, the following table lists the name of the file and its contents, the Oracle Multimedia and other features that require it, and details about the JDK version, the platform, and the path name under the *<ORACLE_HOME>* directory where you can obtain it.

Table 2-1 Java Archive Files for Oracle Multimedia

Oracle JAR File and Contents	Required By	JDK Version, Platform, and Location
Name: `ordim.jar` Description: Oracle Multimedia Java proxy classes **Deprecated**	Multimedia Java proxy classes BLOB and BFILE streaming	JDK 8 or later, on Linux and UNIX: *<ORACLE_HOME>*`/ord/jlib/ordim.jar` JDK 8 or later, on Windows: *<ORACLE_HOME>*`\ord\jlib\ordim.jar`
Name: `ojdbc8.jar` Description: Oracle JDBC library	All Oracle Multimedia features	JDK 8 or later, on Linux and UNIX: *<ORACLE_HOME>*`/jdbc/lib/ojdbc8.jar` JDK 8 or later, on Windows: *<ORACLE_HOME>*`\jdbc\lib\ojdbc8.jar`
Name: `xdb.jar` Description: Oracle XDB Java classes library	DICOM feature Oracle Multimedia metadata extraction	JDK 8 or later, on Linux and UNIX: *<ORACLE_HOME>*`/rdbms/jlib/xdb.jar` JDK 8 or later, on Windows: *<ORACLE_HOME>*`\rdbms\jlib\xdb.jar`
Name: `xmlparserv2.jar` Description: Oracle XML Parser library	DICOM feature Oracle Multimedia metadata extraction Mid-Tier Java API feature	JDK 8 or later, on Linux and UNIX: *<ORACLE_HOME>*`/lib/xmlparserv2.jar` JDK 8 or later, on Windows: *<ORACLE_HOME>*`\lib\xmlparserv2.jar`
Name: `orddcmmt.jar` Description: Oracle Multimedia Mid-Tier Java classes **Deprecated**	Mid-Tier Java API feature	JDK 8 or later, on Linux and UNIX: *<ORACLE_HOME>*`/ord/jlib/orddcmmt.jar` JDK 8 or later, on Windows: *<ORACLE_HOME>*`\ord\jlib\orddcmmt.jar`
Name: `ordimdcm.jar` Description: Oracle Multimedia DICOM Java library **Deprecated**	Mid-Tier Java API feature	JDK 8 or later, on Linux and UNIX: *<ORACLE_HOME>*`/ord/jlib/ordimdcm.jar` JDK 8 or later, on Windows: *<ORACLE_HOME>*`\ord\jlib\ordimdcm.jar`

Table 2-1 (Cont.) Java Archive Files for Oracle Multimedia

Oracle JAR File and Contents	Required By	JDK Version, Platform, and Location

Name: `orddicom.jar`
Description:
Oracle Multimedia DICOM Java proxy classes
Deprecated
	DICOM Java proxy classes	JDK 8 or later, on Linux and UNIX:
		`<ORACLE_HOME>/ord/jlib/orddicom.jar`
		JDK 8 or later, on Windows:
		`<ORACLE_HOME>\ord\jlib\orddicom.jar`

Name: `ordhttp.jar`
Description:
Oracle Multimedia Servlets and JSP Java HTTP classes
Deprecated
	Java servlets and JavaServer Pages (JSP) applications	JDK 8 or later, on Linux and UNIX:
		`<ORACLE_HOME>/ord/jlib/ordhttp.jar`
		JDK 8 or later, on Windows:
		`<ORACLE_HOME>\ord\jlib\ordhttp.jar`

Name: `orai18n.jar`
Description:
NLS Character Set Conversion library
(Optional)
	NLS character set conversion	JDK 8 or later, on Linux and UNIX:
		`<ORACLE_HOME>/jlib/orai18n.jar`
		JDK 8 or later, on Windows:
		`<ORACLE_HOME>\jlib\orai18n.jar`

If NLS character set conversion is required between the client application and the database, you must include the `orai18n.jar` file in the CLASSPATH variable. If NLS character set conversion is required, but the appropriate library is not specified, character-based metadata may be returned as hexadecimal-encoded strings. See *Oracle Database JDBC Developer's Guide* for more information about NLS character set conversion.

Note:

If you are using the JDBC OCI driver, specify the location of the JDBC OCI shared library in one of these variables:

- LD_LIBRARY_PATH (for Linux or UNIX)
- PATH (for Windows)

Depending on your platform, the JDBC OCI shared library can be found at one of these locations under the *<ORACLE_HOME>* directory:

<ORACLE_HOME>`/lib` (for `libocijdbc12.so` on Linux and UNIX)
<ORACLE_HOME>`\bin` (for `ocijdbc12.dll` on Windows)

Because this library path is shared, it may have been specified previously to enable the use of other client applications, such as SQL*Plus.

---

2. Add one or more of the following import statements to the Java program:

   Along with the standard JDBC classes included in the `java.sql` package, you must also import the Oracle JDBC extension class `oracle.jdbc.OracleResultSet`, as follows:

```
import oracle.jdbc.OracleResultSet;
```

If you are using the deprecated Oracle Multimedia Java proxy classes, you might also have to add one or more of the following import statements, depending on the type of media to be handled:

```
import oracle.ord.im.OrdAudio;
import oracle.ord.im.OrdDoc;
import oracle.ord.im.OrdImage;
import oracle.ord.im.OrdVideo;
```

2.3.2 Media Upload in Java

The following example shows how to import multimedia data from the file system into the database in a Java application.

```
public void writeImageToDatabase(int id, String fileName )
           throws SQLException, IOException
                     {
      //Define the PL/SQL block to insert the new row.

      final String INSERT_BLOB = "DECLARE "
                  + "    src_id        NUMBER; "
                  + "BEGIN "
                  + "    src_id := ?;"
                  + "    DELETE FROM image_blob_table WHERE id=src_id; "
                  + "    INSERT INTO image_blob_table t (id, image_blob) "
                  + "           VALUES(src_id, empty_blob()) "
                  + "           RETURNING t.image_blob INTO ?; "
                  + "END;";
      try {

            //Create the statement object.
            final OracleCallableStatement pstmt =
                  (OracleCallableStatement)connection.prepareCall
                  (INSERT_BLOB);

            //Binding the variables to the statement.
            pstmt.setInt(1, id); //ID
            pstmt.registerOutParameter(2, OracleTypes.BLOB);
            pstmt.execute(); //Execute the PL/SQL statement.

            //Get the BLOB locator from the table.
            BLOB blob = pstmt.getBLOB(2);
            File binaryFile = new File(fileName);
            FileInputStream instream = new FileInputStream(binaryFile);

            //Retrieve the ideal buffer size to use in writing to the BLOB.
            int size = 1024*1024; // 1MB.
            byte[] buffer = new byte[size];
            int read = -1;
            long position =1;

            //Read the file to the byte array buffer, then write it to the BLOB.
            while ((read = instream.read(buffer)) != -1)

               {
                     blob.setBytes(position,buffer,0,read);
                     position+=read;
               }

               instream.close();
               connection.commit();
```

```
        } catch (FileNotFoundException e) {
                throw new FileNotFoundException("File " + fileName +" not Found.");
        } catch (IOException e) {
                throw new IOException("Error while reading " + fileName);

        }

            }
```

Call writeImageToDatabase( ) passing the row id and source file path:

```
//Write data from a local file into a BLOB in the database.
quickstart.writeImageToDatabase(1, "flowers.jpg");
```

Note:

If the autoCommit flag on the connection is set to true, or is not set (the default is true), the following error is returned when you attempt to select a row with a BLOB column for update:

```
java.sql.SQLException: ORA-22990: LOB locators cannot span transactions
```

You can set the autocommit flag to false as follows:

```
conn.setautoCommit(false);
```

2.3.3 Retrieval of Image Properties in Java

After the image data is imported from the file system into the table `image_blob_table`, the database does not know what the binary bytes in the BLOB column `image_blob` represent. The following example shows how to use the ORDSYS.ORD_IMAGE.getProperties( ) procedure of the Oracle Multimedia PL/SQL package to extract the image properties into the Java application.

```
public HashMap <String, Object> getProperties_example_j(int id )
       throws SQLException
  {
//Define the PL/SQL block to extract the properties.
final String getPropertiesStmt = "DECLARE "
         + "    src                          BLOB; "
         + "    img_mimeType                 VARCHAR2(32); "
         + "    img_width                    INTEGER; "
         + "    img_height                   INTEGER; "
         + "    img_contentLength            INTEGER; "
         + "    img_fileFormat              VARCHAR2(32); "
         + "    img_contentFormat            VARCHAR2(32); "
         + "    img_compressionFormat       VARCHAR2(32); "
         + "BEGIN "
         + "    SELECT image_blob INTO src FROM image_blob_table"
         + "           WHERE id=?; "
         + "    ORDSYS.ORD_IMAGE.getProperties(src, "
         + "                   img_mimeType, "
         + "                   img_width, "
         + "                   img_height, "
         + "                   img_fileFormat, "
         + "                   img_compressionFormat, "
         + "                   img_contentFormat, "
```

```
          + "                  img_contentLength); "
          + "    ? := img_mimeType; "
          + "    ? := img_width; "
          + "    ? := img_height; "
          + "    ? := img_contentLength; "
          + "    ? := img_fileFormat; "
          + "    ? := img_contentFormat;"
          + "    ? := img_compressionFormat; "
          + "END;";

//Create the statement object.
final OracleCallableStatement pstmt =
     (OracleCallableStatement)connection.prepareCall(getPropertiesStmt);

//Binding the variables to the statement.
pstmt.setInt(1, id);
pstmt.registerOutParameter(2, OracleTypes.VARCHAR);
pstmt.registerOutParameter(3, OracleTypes.INTEGER);
pstmt.registerOutParameter(4, OracleTypes.INTEGER);
pstmt.registerOutParameter(5, OracleTypes.INTEGER);
pstmt.registerOutParameter(6, OracleTypes.VARCHAR);
pstmt.registerOutParameter(7, OracleTypes.VARCHAR);
pstmt.registerOutParameter(8, OracleTypes.VARCHAR);

//Execute the statement.
pstmt.execute();

//Create a HashMap object and populate it with the properties.
HashMap<String, Object> map = new HashMap<String, Object>();
map.put("mimeType", pstmt.getString(2));
map.put("width", pstmt.getInt(3) );
map.put("height", pstmt.getInt(4));
map.put("contentLength", pstmt.getInt(5));
map.put("fileFormat", pstmt.getString(6));
map.put("contentFormat", pstmt.getString(7));
map.put("compressionFormat", pstmt.getString(8));

return map;
   }
```

Call getProperties_example_j( ) passing the id, then iterate over the HashMap to print the properties.

```
System.out.println("Original image properties");
       HashMap<String, Object> attributesMap= quickstart.getProperties_example_j(1);
       //Iterate over the HashMap.
       for (Map.Entry<String, Object> entry : attributesMap.entrySet()) {
              System.out.println(entry.getKey() + " = " + entry.getValue());
       }
```

Note:

If the image data that is in the `image_blob` column is not a supported format for Oracle Multimedia (for example: PSD), the following error is returned.

```
     Exception in thread "main" java.sql.SQLException: ORA-29400: data
cartridge error
```

2.3.4 Thumbnail Image Creation in Java

The Oracle Multimedia ORD_IMAGE PL/SQL package includes several image processing operations that can be invoked within the database. To generate a thumbnail image from an existing image, the ORDSYS.ORD_IMAGE.thumbnail( ) procedure of the Oracle Multimedia PL/SQL package can be used.

The following example shows how to create a thumbnail image from a source BLOB.

```
public void thumbnail_example_j(int src_id, int dst_id ) throws SQLException
{
     //Define the PL/SQL block to create a thumbnail.
     final String createThumbnailStmt  = "DECLARE "
               + "    src_blob      BLOB;"
               + "    dst_blob      BLOB;"
               + "    src_id        NUMBER;"
               + "    dst_id        NUMBER;"
               + "BEGIN"
               + "    src_id := ?;"
               + "    dst_id := ?;"
               + "    DELETE FROM image_blob_table WHERE id = dst_id;"
               + "    INSERT INTO image_blob_table(id, image_blob) "
               + "           VALUES (dst_id, empty_blob()) "
               + "           RETURNING image_blob INTO dst_blob;"
               + "    SELECT image_blob INTO src_blob FROM image_blob_table"
               + "           WHERE id = src_id;"
               + "    ORDSYS.ORD_IMAGE.thumbnail(src_blob,dst_blob);"
               + "    UPDATE image_blob_table SET image_blob = dst_blob"
               + "           WHERE id = dst_id; "
               + "END;";

     final OracleCallableStatement pstmt =
          (OracleCallableStatement)connection.prepareCall(createThumbnailStmt);

     //Binding the variables to the statement.
     pstmt.setInt(1, src_id);
     pstmt.setInt(2, dst_id);
     //Execute the statement.
     pstmt.execute();
     connection.commit();
}
```

Call thumbnail_example_j( ) passing the source and destination ids.

```
     //Create a thumbnail.
  quickstart.thumbnail_example_j(1,2);
```

2.3.5 Handling Oracle Multimedia Exceptions in Java

Possible errors that can occur during run time should always be handled in your application. This practice enables the program to continue its operation even when it encounters a run-time error. This practice also enables users to know what went wrong during program operation. Proper error handling practices ensure that, whenever possible, you are always able to recover from an error while running an application. In addition, proper error handling provides you with the information you need so you always know what went wrong.

This section demonstrates proper error handling practices using code examples. These examples show how to handle some common Oracle Multimedia errors and other types of errors in Java programs.

When handling exceptions, Java uses the try/catch block. For example, in Java, the exception can appear as:

```
try {
    //<some program logic>)
}
catch (exceptionName a) {
//Exception logic
}
finally {
//Execute logic if try block is executed even if an exception is caught
}
```

When you design, code, and debug your application, you are aware of the places in your program where processing might stop due to a failure to anticipate an error. Those are the places in your program where you must add exception handling blocks to handle the potential errors.

The examples in this section describe exception handling using the try/catch block.

The following subsections provide additional details and examples of exception handling in Java:

- Handling the Setting of Properties for Unknown Image Formats in Java (page 2-9)
- Handling Image Processing for Unknown Image Formats in Java (page 2-9)

See Also:

- *Oracle Database Java Developer's Guide* for more information about handling Java exceptions
- *Oracle Database JDBC Developer's Guide* for more information about handling Java exceptions using JDBC

2.3.5.1 Handling the Setting of Properties for Unknown Image Formats in Java

The following try/catch block shows how to handle exceptions on the setProperties( ) method:

```
try
{
  img.setProperties();
  return true;
}
catch (SQLException e)
{
  return false;
}
```

If an exception is thrown, the setProperties( ) method returns false to indicate failure; otherwise it returns true.

2.3.5.2 Handling Image Processing for Unknown Image Formats in Java

If an application tries to process an image in cases when the image format is unknown, then when the application calls the processCopy( ) method, the application always

fails. To work around this potential problem, the application uses the following try/catch block to catch any SQL exceptions:

```
try
{
    image.processCopy( "maxScale=50,50", thumb );
}
catch ( SQLException e )
{
    thumb.deleteContent();
    thumb.setContentLength( 0 );
}
```

In this example, when the image format is unknown and a thumbnail image cannot be created, the application catches the SQL exception and calls the deleteContent( ) method to delete the content of the thumbnail image, and then calls the setContentLength( ) method to set its length to zero.

2.4 Developing Multimedia Applications Using PL/SQL

PL/SQL is a completely portable, high-performance transaction processing language that combines the data manipulation power of SQL with the data processing power of procedural languages.

This section briefly describes how to manipulate Oracle Multimedia database objects with the PL/SQL Application Programming Interface (API). The following Oracle Multimedia object types are available for storing media in the database:

- ORDAudio
- ORDDicom
- ORDDoc
- ORDImage
- ORDVideo

Although this section primarily discusses the Oracle Multimedia object types, the PL/SQL API can also be used to manipulate multimedia data stored directly in BLOBs or BFILEs. The following Oracle Multimedia PL/SQL packages are available for manipulating multimedia data in the database:

- ORD_AUDIO
- ORD_DICOM
- ORD_DOC
- ORD_IMAGE
- ORD_VIDEO

The examples in this section use the Oracle Database Sample Schemas, which are available on GitHub.

The following subsections describe how to develop multimedia applications using PL/SQL:

- Setting Up Your Environment for PL/SQL (page 2-11)

See Also:

Oracle Multimedia Reference for details about the Oracle Multimedia PL/SQL packages and object types

2.4.1 Setting Up Your Environment for PL/SQL

To access files with PL/SQL, you must create a directory object in the database that points to a directory that is accessible by the database server. For example, the following command creates the `MEDIA_DIR` directory in the sample schema:

```
CREATE DIRECTORY MEDIA_DIR AS
    'c:\oracle\product\10.2.0\db_1\demo\schema\product_media';
```

To retrieve media data from the database to a file, you must grant the write permission on the specified directory to the appropriate user. For example:

```
GRANT WRITE ON DIRECTORY MEDIA_DIR TO SCOTT;
```

To upload media data from a file to the database, you must grant the read permission on the specified directory to the appropriate user. For example:

```
GRANT READ ON DIRECTORY MEDIA_DIR TO SCOTT;
```

2.4.2 Media Upload in PL/SQL

Media upload means importing media data from the file system into the database tablespaces. The following series of steps is typical:

1. Insert a new row into the table, creating new objects by using the object constructor or the init method of the Oracle Multimedia object type.
2. Call the import method of the Oracle Multimedia object to bring the data from the file system into the database.
3. Call the setProperties method of the Oracle Multimedia object to determine and populate the attributes of the object.
4. Update the table so that the Oracle Multimedia object in the table contains the attribute values extracted in the previous step.

The PL/SQL code that implements these steps for inserting a new row in the `PM.ONLINE_MEDIA` table is shown in this example:

```
DECLARE
  img ORDImage;
  aud ORDAudio;
  vid ORDVideo;
  ctx RAW(64) := NULL;
BEGIN
  -- Insert a new row into the pm.online_media table.
```

```
  DELETE FROM pm.online_media WHERE product_id = 3003;
  INSERT INTO pm.online_media
         (product_id,
          product_photo,
          product_audio,
          product_video)
  VALUES (3003,
          ORDImage.init('FILE', 'MEDIA_DIR', 'laptop.jpg'),
          ORDAudio.init('FILE', 'MEDIA_DIR', 'laptop.mpa'),
          ORDVideo.init('FILE', 'MEDIA_DIR', 'laptop.rm'))
  RETURNING product_photo, product_audio, product_video
  INTO img, aud, vid;

  -- Bring the media into the database and populate the attributes.

    -- ORDImage.import also calls ORDImage.setProperties.
  img.import(ctx);

  aud.import(ctx);
  aud.setProperties(ctx);

  vid.import(ctx);
  vid.setProperties(ctx);

  -- Update the table with the properties we have extracted.
  UPDATE pm.online_media
  SET    product_photo = img,
         product_audio = aud,
         product_video = vid
  WHERE  product_id = 3003;

  COMMIT;
END;
/
```

2.4.3 Media Query in PL/SQL

You can include media attributes (for example: height, width, and MIME type) in standard SQL queries by using accessor methods (for example: getHeight, getWidth, and getMimeType). Example 2-1 (page 2-12), Example 2-2 (page 2-12), and Example 2-3 (page 2-12) show how to use these accessor methods to query one or more object attributes for image, audio, and video objects, respectively.

Example 2-1 Image Query (Height, Width, and MimeType Attributes)

```
SELECT t.product_id                  id,
       t.product_photo.getHeight()   height,
       t.product_photo.getWidth()    width,
       t.product_photo.getMimeType() mimetype
  FROM pm.online_media t;
```

Example 2-2 Audio Query (MimeType Attribute)

```
SELECT t.product_id                  id,
       t.product_audio.getMimeType() mimetype
  FROM pm.online_media t;
```

Example 2-3 Video Query (MimeType Attribute)

```
SELECT t.product_id                  id,
       t.product_video.getMimeType() mimetype
  FROM pm.online_media t;
```

2.4.4 Media Download in PL/SQL

To download media from the database into a file on the file system, call the export method of the Oracle Multimedia object. The following code example exports the image in the row with product_id `3117` to a file named `3117.jpg` in the directory `MEDIA_DIR`. This code example highlights in bold the PL/SQL statements where this export operation takes place.

```
DECLARE
  img ORDImage;
  ctx RAW(64) := NULL;
BEGIN
  SELECT  product_photo
    INTO  img
    FROM  pm.online_media
    WHERE product_id = 3117;
  img.export(ctx, 'FILE', 'MEDIA_DIR', '3117.jpg');
END;
/
```

2.4.5 Handling Oracle Multimedia Exceptions in PL/SQL

Possible errors that can occur during run time should always be handled in your application. This practice enables the program to continue its operation even when it encounters a run-time error. This practice also enables users to know what went wrong during program operation. Proper error handling practices ensure that, whenever possible, you are always able to recover from an error while running an application. In addition, proper error handling provides you with the information you need so you always know what went wrong.

This section demonstrates proper error handling practices using code examples. These examples show how to handle some common Oracle Multimedia errors and other types of errors in PL/SQL programs. These examples are extracted from the PL/SQL sample applications that are described in Oracle Multimedia Photo Album Sample Application (page 3-1) and Oracle Multimedia Code Wizard Sample Application for the PL/SQL Gateway (page 4-1).

When handling exceptions, PL/SQL uses exception blocks. For example, in PL/SQL, the exception can appear as:

```
BEGIN
<some program logic>
EXCEPTION
     WHEN OTHERS THEN
     <some exception logic>
END;
```

When you design, code, and debug your application, you are aware of the places in your program where processing might stop due to a failure to anticipate an error. Those are the places in your program where you must add exception handling blocks to handle the potential errors.

The following subsections provide additional details and examples of exception handling in PL/SQL:

- Handling the Setting of Properties for Unknown Image Formats in PL/SQL (page 2-14)
- Handling Image Processing for Unknown Image Formats in PL/SQL (page 2-14)

See Also:

Oracle Database PL/SQL Language Reference for more information about handling PL/SQL exceptions

2.4.5.1 Handling the Setting of Properties for Unknown Image Formats in PL/SQL

If your program tries to set the properties of an uploaded image (it reads the image data to get the values of the object attributes so it can store them in the appropriate attribute fields) and the image format is not recognized, then the setProperties( ) method fails. To catch this exception and work around this potential problem, the application uses the following exception block:

```
BEGIN
   new_image.setProperties();
EXCEPTION
   WHEN OTHERS THEN
         new_image.contentLength := upload_size;
         new_image.mimeType := upload_mime_type;
END;
```

In this example, this exception handler sets the MIME type and length of the image based on the values from the upload table described at the beginning of the `insert_new_photo` procedure. The browser sets a MIME type header when the file is uploaded. The application reads this header to set the ORDImage field.

2.4.5.2 Handling Image Processing for Unknown Image Formats in PL/SQL

If your program tries to process an image in cases when the image format is unknown, the processCopy( ) method always fails. To work around this potential problem, the application uses the following exception block:

```
BEGIN
   new_image.processCopy( 'maxScale=50,50', new_thumb);
EXCEPTION
   WHEN OTHERS THEN
      new_thumb.deleteContent();
      new_thumb.contentLength := 0;
END;
```

In this example from the Oracle Multimedia PL/SQL Web Toolkit Photo Album application, when the image format is unknown and a thumbnail image cannot be created, this exception handler deletes the content of the thumbnail image and sets its length to zero.

2.5 Developing PL/SQL Web Applications

This section describes how to use PL/SQL Gateway and PL/SQL Web Toolkit to develop PL/SQL Web applications. See Oracle Multimedia PL/SQL Photo Album Sample Application (page 3-1) for an example of an application that uses PL/SQL Gateway and PL/SQL Web Toolkit.

Note:

The use of the PL/SQL Gateway and PL/SQL Web Toolkit is suitable for applications that require tight control of the HTTP communication and HTML generation. For other applications, consider using Oracle Application Express, which provides more features and a convenient graphical interface to ease application development.

See Also:

- *Oracle Application Express App Builder User's Guide* for information about using Oracle Application Express
- *Oracle Database Development Guide* for more information about using PL/SQL Gateway and PL/SQL Web Toolkit

Developing Web applications using PL/SQL consists of developing one or more PL/SQL packages consisting of sets of stored procedures that interact with Web browsers through HTTP. Stored procedures can be executed in several ways:

- From a hypertext link that calls a stored procedure when it is selected
- By clicking **Submit** on an HTML form to denote the completion of a task such as filling out a form supplied on the HTML page
- By passing parameters to a stored procedure based on user choices from a list

Information in the stored procedure, such as tagged HTML text, is displayed in the Web browser as a Web page. These dynamic Web pages are generated by the database and are based on the database contents and the input parameters passed in to the stored procedure. Using PL/SQL stored procedures is especially efficient and powerful for generating dynamic Web page content.

Use Oracle Multimedia when media data such as images, audio, video, or combinations of all three are to be uploaded into and retrieved from database tables, using the functions and procedures in the Oracle Multimedia PL/SQL packages or the Oracle Multimedia object types and their respective sets of methods.

Media upload procedures first perform a SQL INSERT operation to insert a row of data in the media table, which also initializes instances of the respective multimedia columns with an empty BLOB. Next, a SQL SELECT FOR UPDATE operation selects the multimedia columns for update. Finally a SQL UPDATE operation updates the multimedia columns. Oracle Multimedia procedures or methods are called to perform these tasks:

- Initialize the multimedia columns with an empty BLOB.
- Set attributes to indicate media data is stored internally in a BLOB, when using Oracle Multimedia object types.
- Get values of the multimedia attributes and store them.
- When exceptions occur, determine the length of the BLOB content and its MIME type.

Media retrieval operations involve these tasks:

- Retrieving the multimedia data from the database
- Checking the cache validity of the multimedia data based on its updated time in contrast to that of the HTTP header time
- Determining where the media data is located: in the database, in a BFILE, or at a URL location; then, getting the media, and downloading it for display on an HTML page

The following subsection describes how to use the PL/SQL Gateway and PL/SQL Web toolkit:

- Using the PL/SQL Gateway and PL/SQL Web Toolkit (page 2-16)

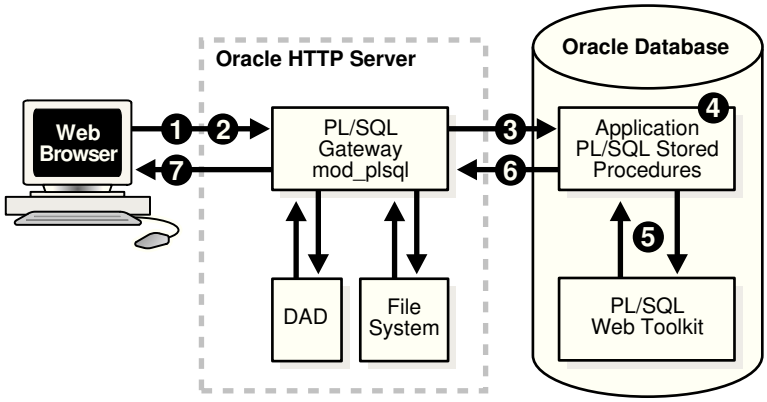
2.5.1 Using the PL/SQL Gateway and PL/SQL Web Toolkit

You can use the mod_plsql Gateway (a plug-in of Oracle HTTP Server) or the embedded version of the PLSQL Gateway that runs in the XML DB HTTP Listener in the database, to listen for browser requests, to execute stored PL/SQL procedures in the database, and to generate an HTML page containing data and code for the response returned to the Web browser for display.

Oracle HTTP Server serves mainly the static HTML files, images, and so on, that a Web application uses, and is usually located in the file system where Oracle HTTP Server is installed. Oracle HTTP Server contains modules or plug-ins that extend its functions. One of these modules supplied by Oracle is the mod_plsql module, also known as the PL/SQL Gateway. The PL/SQL Gateway serves data dynamically from the database to Web browsers by calling PL/SQL stored procedures. The PL/SQL Gateway receives requests from a Web browser that are mapped to PL/SQL stored procedure calls. PL/SQL stored procedures retrieve data from the database and generate an HTTP response containing the data and code from the PL/SQL Web Toolkit to display the generated Web page in a Web browser. The PL/SQL Web Toolkit contains a set of packages (including `htp`, `htf`, and `owa`) that can be used in the stored procedures to get information about the request, construct HTML tags, and return header information to the client Web browser.

The following figure shows these main components: Oracle HTTP Server, the Web browser, and the database.

Figure 2-1 Components of a PL/SQL Web Application



The numbers in the preceding figure represent steps that describe how a client Web browser request is turned into a Web page response from the execution of the PL/SQL procedure:

1. A client Web browser sends a PL/SQL server page or servlet request to Oracle HTTP Server.
2. Oracle HTTP Server routes the request to the PL/SQL Gateway (mod_plsql).
3. The PL/SQL Gateway forwards the request to the database using configuration information stored in the database access descriptor (DAD) and connects to the database.
4. The PL/SQL Gateway prepares the call parameters and invokes the PL/SQL package and the PL/SQL stored procedure in the application.
5. The PL/SQL procedure generates an HTML page using data from the database and special packages in the PL/SQL Web Toolkit accessed from the database. The PL/SQL Web Toolkit contains a set of packages, including `htp`, `htf`, and `owa`, which are used in the stored procedures to get information about the request, construct HTML tags, and return header information to the client Web browser as the response returned to the PL/SQL Gateway.
6. The PL/SQL Gateway sends the response to Oracle HTTP Server.
7. Oracle HTTP Server sends the response to the client Web browser for display as a formatted Web page.

Example 2-4 URL Format to Invoke mod_plsql in a Web Browser

```
protocol://hostname[:port number]/DAD-name/[[!][schema name.]
 [package name.]procedure_name[?query_string]]
```

Example 2-5 URL Format to Invoke mod_plsql for the Photo Album Application

```
protocol://<hostname>[:<port-number>]/DAD-name/]procedure_name
```

Usually, the returned formatted Web page has one or more additional links, and each link, when selected, sends another request to the database through the PL/SQL Gateway to execute one or more stored procedures. The generated response displays data on the client Web page usually with additional links, which, when selected, execute more stored procedures that return the generated response for display as yet another formatted Web page, and so on.

Web application developers who use the PL/SQL Gateway create a PL/SQL package specification and body that describe procedures and functions that comprise the application. The package specification defines the procedures and functions used by the application, and the package body is the implementation of each procedure and function. All packages are compiled and stored in the database to perform specific operations for accessing data in the database and formatting HTML output for Web page presentation.

Oracle HTTP Server maps a URL entered in a browser to a specific PL/SQL procedure stored in the database. It does this by storing specific configuration information in a DAD for each stored procedure. Thus, each DAD contains the database connection information that the Web server requires to translate the URL entered into a database connection to call the stored procedure.

Oracle HTTP Server listens for a request, routes the request to the PL/SQL Gateway, which forwards it to the database. Configuration information values stored in a DAD determine the database alias to use, the connection string to use for remote access, the procedure to use for uploading or downloading documents, and the user name and password information to enable access to the database. From the Web browser, the

user specifies the URL that invokes the PL/SQL Gateway. The URL has a defined format for specifying all the required and optional parameters, including the location of the DAD and the name of the PL/SQL stored procedure to run, as shown in Example 2-4 (page 2-17).

To use the Oracle Multimedia Photo Album sample application and the PL/SQL Web Toolkit described in Oracle Multimedia PL/SQL Photo Album Sample Application (page 3-1) and Oracle Multimedia Code Wizard Sample Application for the PL/SQL Gateway (page 4-1), the URL can be simplified to the format shown in Example 2-5 (page 2-17).

When the URL is entered in the Web browser, it includes the protocol (HTTP or HTTPS), the name of the hosting Web server, and the port number on which it is listening to handle requests. Next, the specified virtual path includes `/pls/<DAD-name>` to indicate that the Web server is configured to invoke mod_plsql, and the location of the DAD on the Web server.

In Example 2-4 (page 2-17), the last five parameters include the exclamation point (!) character, schema name, package name, procedure name, and query string. From the syntax, the exclamation point, schema name, package name, and query string parameters are optional; only the procedure name is required.

The exclamation point indicates that flexible parameter passing is being used. The schema name, if omitted, is resolved based on the user name. The package name, if omitted, means the procedure is standalone. The query string parameters are for the stored procedure and follow a special format. Of these five parameters, the procedure name must be specified in both the DAD and the URL. The other four parameters are specified in either the DAD or the URL, or not at all, depending on the application.

The URL displays the home page for the specified DAD. When the URL is entered in the address field of the Web browser page, it invokes either the specified DAD location only, or the specified DAD location along with the procedure name, or the specified DAD location along with the `schema.package.procedure` name. The response is returned as an HTML page. The HTML page contains the requested data and any other specified code for display in the client's Web browser. The Code Wizard described in Oracle Multimedia Code Wizard Sample Application for the PL/SQL Gateway (page 4-1) demonstrates how this operation works. For example, to invoke the Code Wizard administration URL, enter the following URL shown in that chapter:

```
http://<hostname>:<port-number>/pls/ordcwadmin
```

The virtual path includes `pls` to indicate that the Web server is configured to invoke mod_plsql, followed by the name of the DAD used for the Code Wizard administrator, `ordcwadmin`.

When the HTML page is displayed, it resolves to the following URL for the Code Wizard administrator:

```
http://<hostname>:<port-number>/pls/ordcwadmin/ORDCWPKG.menu
```

`ORDCWPKG.menu` represents the `package.procedure` name, which is specified as the default home page in the `ordcwadmin` DAD.

When the PL/SQL Gateway is invoked, it uses the stateless model and does not permit a transaction to span across multiple HTTP requests. In this stateless model, applications typically can create a session to maintain state by using one of these techniques: HTTP cookies, a hidden HTML field as an HTML form element of the HTML Form package, or storage of vital information in database tables for query.

See Oracle Multimedia PL/SQL Photo Album Sample Application (page 3-1) and Oracle Multimedia Code Wizard Sample Application for the PL/SQL Gateway (page 4-1) for examples of applications that use the PL/SQL Gateway and PL/SQL Web Toolkit.

See Also:

Oracle Database Development Guide for more information about developing PL/SQL Web applications

3

Oracle Multimedia Photo Album Sample Application

The Oracle Multimedia PL/SQL Web Toolkit Photo Album sample application is a media upload and retrieval Web application using Oracle Multimedia object types. This application uses the PL/SQL Gateway and PL/SQL Web Toolkit.

This application assumes the following:

- You are familiar with developing PL/SQL applications using the PL/SQL Gateway and PL/SQL Web Toolkit.
- You have installed and configured the Oracle Multimedia PL/SQL Web Toolkit Photo Album sample application.

See the `README.txt` file for this sample application for installation and configuration information.

See Also:

Oracle Multimedia Code Wizard Sample Application for the PL/SQL Gateway (page 4-1) for a sample application that creates media upload and retrieval procedures for the PL/SQL Gateway

3.1 Oracle Multimedia PL/SQL Photo Album Sample Application

The Oracle Multimedia PL/SQL Web Toolkit Photo Album sample application demonstrates how to perform the following operations:

- Use the Oracle Multimedia image object type to upload, retrieve, and process media data stored in Oracle Database.
- Combine the image metadata methods of Oracle Multimedia with the XML document management capabilities of Oracle XML DB and the full-text indexing and search features of Oracle Text to create a solution that can extract, store, and search metadata that is embedded in binary image files.
- Collect new metadata from a user, format the metadata into an XML document, and store the document in the binary image using the Oracle Multimedia image object type.

When installed, this photo album application creates several schema objects that are important to the following discussion. These objects include the `photos` table, which is defined by the following CREATE TABLE statement:

```
CREATE TABLE photos( id           NUMBER PRIMARY KEY,
                     description  VARCHAR2(40) NOT NULL,
                     metaORDImage XMLTYPE,
```

```
                    metaEXIF     XMLTYPE,
                    metaIPTC     XMLTYPE,
                    metaXMP      XMLTYPE,
                    image        ORDSYS.ORDIMAGE,
                    thumb        ORDSYS.ORDIMAGE )
--
-- store full-size and thumbnail images as SecureFiles LOBS
--
LOB(image.source.localdata)  STORE AS SECUREFILE
LOB(thumb.source.localdata)  STORE AS SECUREFILE
--
-- and bind the XMLType columns to the Oracle Multimedia metadata schemas
XMLType COLUMN metaORDImage
  STORE AS SecureFile CLOB
  XMLSCHEMA "http://xmlns.oracle.com/ord/meta/ordimage"
  ELEMENT "ordImageAttributes"
XMLType COLUMN metaEXIF
  STORE AS SecureFile CLOB
  XMLSCHEMA "http://xmlns.oracle.com/ord/meta/exif"
  ELEMENT "exifMetadata"
XMLType COLUMN metaIPTC
  STORE AS SecureFile CLOB
  XMLSCHEMA "http://xmlns.oracle.com/ord/meta/iptc"
  ELEMENT "iptcMetadata"
XMLType COLUMN metaXMP
  STORE AS SecureFile CLOB
  XMLSCHEMA "http://xmlns.oracle.com/ord/meta/xmp"
  ELEMENT "xmpMetadata";
```

The data types for the `image` and `thumb` columns are defined as Oracle Multimedia image object types. These columns are used to store the full-size images and the generated thumbnail images, respectively. The LOB storage clauses direct the database to store the full-size and thumbnail images in SecureFiles LOBs, which are the highest performing storage option for binary data.

The table also defines four columns of type `XMLType` to store XML documents that contain four different kinds of image metadata. Each column is bound to a specific Oracle Multimedia metadata schema. Each metadata schema defines precisely the data model of the metadata document. These schemas are registered with Oracle XML DB when the database is created. The column definitions specify that the database uses unstructured storage to manage the XML metadata documents. Some advantages of using unstructured storage to manage XML include fast retrieval of the complete document and the ability to use XMLIndex indexes to improve the performance of XPath-based queries.

When installed, this photo album application also creates other schema objects. These schema objects include two types of indexes that accelerate metadata searches: a `CONTEXT` text index and an `XMLIndex` index.

The `CONTEXT` type is a text index over all columns that contain descriptive information about the image. These columns include `PHOTOS.DESCRIPTION`, which is a VARCHAR2 data type, and these four `XMLType` columns: `PHOTOS.METAIPTC`, `PHOTOS.METAEXIF`, `PHOTOS.METAXMP`, and `PHOTOS.METAORDIMAGE`. The `CONTEXT` text index is used to accelerate metadata searches by implementing the photo album search feature that enables users to search for photographs by keyword or phrase.

The `CONTEXT` text index is created by the following statements. (This example assumes that this photo album application has been installed in the SCOTT schema.)

```
-- Create preference PA_CTXIDX.
ctx_ddl.create_preference('SCOTT.PA_CTXIDX', 'MULTI_COLUMN_DATASTORE');
```

```
-- Create a multicolumn datastore.
ctxcols := 'description, '                   ||
            'SCOTT.photo_album.getClob(METAIPTC), ' ||
            'SCOTT.photo_album.getClob(METAEXIF), ' ||
            'SCOTT.photo_album.getClob(METAXMP), '  ||
            'SCOTT.photo_album.getClob(METAORDIMAGE)';
ctx_ddl.set_attribute( ctxpref, 'COLUMNS', ctxcols );


-- Create the CONTEXT text index.
create  index pa_ctx_idx on photos(description)
indextype is ctxsys.context
parameters ( 'DATASTORE SCOTT.PA_CTXIDX' );
```

The `XMLIndex` index is used to accelerate metadata searches by permitting users to search only certain types of image metadata and limiting the search to specific portions of an XML document. For example, the following statements create three indexes of type `XMLIndex` to speed up existsNode( ) queries on columns of type `XMLType`:

```
create index pa_path_iptc_idx  on photos( metaIptc )
 indextype is XDB.XMLIndex;

create index pa_path_exif_idx  on photos( metaExif )
 indextype is XDB.XMLIndex;

create index pa_path_xmp_idx  on photos( metaXMP )
 indextype is XDB.XMLIndex;
```

During the installation, as prescribed by the PL/SQL Gateway, a document upload table is defined by the following CREATE TABLE statement:

```
CREATE TABLE PHOTOS_UPLOAD( name           VARCHAR2(256) UNIQUE NOT NULL,
                            mime_type      VARCHAR2(128),
                            doc_size       NUMBER,
                            dad_charset    VARCHAR2(128),
                            last_updated   DATE,
                            content_type   VARCHAR2(128),
                            blob_content   BLOB )
--
-- store BLOBs as SecureFiles LOBs
--
LOB(blob_content)  STORE AS SECUREFILE;
```

Each image uploaded using the PL/SQL Gateway is stored in the `PHOTOS_UPLOAD` table. An upload procedure (`insert_new_photo`) automatically moves the uploaded image from the specified `PHOTOS_UPLOAD` table to the photo album applications table called `photos`.

After installing the Oracle Database Examples media, the sample application files and `README.txt` file are located at:

<ORACLE_HOME>`/ord/http/demo/plsqlwtk` (on Linux and UNIX)

<ORACLE_HOME>`\ord\http\demo\plsqlwtk` (on Windows)

See the `README.txt` file for additional requirements and instructions on installing and using this sample application.

The following subsections provide more information about the PL/SQL Photo Album application:

See Also:

- *Oracle XML DB Developer's Guide* for more information about XML DB and `XMLIndex` indexes
- *Oracle Text Application Developer's Guide* for more information about creating and using text indexing

3.1.1 Running the PL/SQL Photo Album Application

After you have completed the setup tasks and have built the PL/SQL Photo Album application, including creating a database access descriptor (DAD) entry (as described in the `README.txt` file), you are ready to run this application.

In the address field of your Web browser, enter the following URL:

`<protocol><hostname:port-number>/photoalbum`

1. In the `<protocol>` field, enter `http://`.
2. In the `<hostname:port-number>` field, enter the host name and port number of the system where your HTTP server is running.

When first invoked, this photo album application displays any images that are currently stored in the album. By default, the photo album is empty when first installed. To upload a new photograph, select **Upload photo**. Enter a description of the photograph and the name of the image file, or browse to its directory location. Then, click **Upload photo**.

The contents of the photo album are displayed, along with a picture of the new photograph. Click the thumbnail image to view the full-size version of the photograph. When this photo album application displays the text **view image** instead of its thumbnail image, the image format that was uploaded was not recognized by Oracle Multimedia. Click **view image** to display the full-size image.

You can now begin to load your photo album application with your favorite photographs.

3.1.2 Description of the PL/SQL Photo Album Application

The PL/SQL Photo Album application is implemented as a set of PL/SQL procedures and functions, organized in a single PL/SQL package. These procedures combine several database features to create the application. Oracle Multimedia is used to store and process image data. It is also used to extract metadata from images and embed new metadata into images. The XMLType feature is used to store and process the XML metadata documents. Oracle Text indexes are used to accelerate two kinds of metadata searches. Finally, the PL/SQL Web Toolkit is used to create HTML pages and deliver media content.

The user interface for the PL/SQL Photo Album application consists of a set of Web pages. You can use these Web pages to perform a set of tasks. The tasks and the Web pages are introduced in this topic and described in further detail in the following sections.

You can explore this photo album application using the navigation bar near the top of each Web task page. The leftmost entry of the navigation bar displays the name of the current Web page. On the right, there are links to other Web pages you can access from the current page. Each Web task page contains a link to the **View album** page, which is the home page for the application.

Pages in the PL/SQL Photo Album Sample Application

The following topics, which are summarized here, describe each page in the PL/SQL Photo Album application:

- Browsing the Photo Album (page 3-6)

  Use the **View album** page to display thumbnail-size versions of all the images in the photo album and a description link positioned under each thumbnail image. When you select a thumbnail image, the full-size image is displayed. When you select the description link for an image, all the metadata for that image is displayed. The **View album** page is the home page for the application.

- Adding Images to the Photo Album (page 3-9)

  Use the **Upload photo** page to display a simple form to collect a description for a new image, and the directory path to the location of the image on the local computer. When you click the **Upload photo** button, the browser sends the image to the Web server and the image is stored in the database.

- Searching for Images by Keyword or Phrase (page 3-14)

  Use the **Search album** page to display a search album form to collect keywords or phrases to initiate full-text searches through all image metadata. The application queries the database for all images with metadata that contains the specified keywords or phrases. The search results are displayed as a set of thumbnail images. The search album form is also available from the **View album** page.

- Viewing Full-Size Images (page 3-14)

  Use the **View entry** page to display the full-size image of a specified photograph, including any description text that was entered for that image when it was uploaded.

- Examining Image Metadata (page 3-16)

  Use the **View metadata** page to display all the metadata that was extracted from the image when it was uploaded. Up to four types of metadata can be displayed.

- Writing New XMP Metadata to Images (page 3-17)

  Use the **Write XMP metadata** page to display a form to collect input for five metadata attributes. These attributes are formatted into an XML document that is embedded within the binary image. The new XMP metadata overwrites any existing XMP metadata.

- Searching for Images That Contain Specific Metadata Attributes (page 3-20)

  Use the **Search metadata** page to collect input and perform advanced metadata searches. You can specify the type of metadata to be searched. Optionally, you can also limit the search to a specific XML tag within the specified document. The search results are displayed as a set of thumbnail images.

See Also:

- *Oracle XML DB Developer's Guide*
- *Oracle Text Application Developer's Guide*
- *Oracle Database Advanced Application Developer's Guide*

3.1.2.1 Browsing the Photo Album

The home page for this photo album application, **View album**, displays the contents of the photo album as thumbnail images in four-column format. Each thumbnail image is also a link to the **View entry** page. When you click a thumbnail image link, the application displays the full-size image on a View entry page. Included under each thumbnail image on the **View album** page is the image description that was entered when the image was uploaded to the album. The description is also a link to the **View metadata** page where all the metadata for this photograph can be examined.

Near the top of the **View album** page, there is a text entry field (in the shape of a rectangular box) that accepts user input for a full-text search through all the photo album metadata. The **Search** button to the right of the text field initiates the search. The search results are displayed on the **Search album** page, which is discussed in Searching for Images by Keyword or Phrase (page 3-14).

At the top of the **View album** page, there is a navigation bar, which includes links to other photo album pages. From the **View album** page, you can navigate to the **Search metadata** page or the **Upload photo** page. These pages are described in Searching for Images That Contain Specific Metadata Attributes (page 3-20) and Adding Images to the Photo Album (page 3-9), respectively.

Figure 3-1 (page 3-6) shows the **View album** page for an album that contains several images.

Figure 3-1 View album Page with Uploaded Images

The PL/SQL procedures `view_album`, `print_album`, `print_image_link`, and `deliver_media` are the primary application components that implement the **View album** page. The `view_album` procedure is a public procedure that takes a single optional argument. By default, the argument has a `NULL` value. Or, it can have the value of the string entered in the text entry field on the **Search album** page. When the search argument is `NULL`, the SELECT statement retrieves the `id,description`, and

thumb columns for all entries in the photos table. When the search string is not NULL, the SELECT statement uses the CONTAINS operator to restrict the result set to only images with metadata that matches the search string. (Oracle Multimedia PL/SQL Photo Album Sample Application (page 3-1) describes how the application creates a multicolumn text index over the four XMLType columns PHOTOS.METAIPTC, PHOTOS.METAEXIF, PHOTOS.METAXMP, and PHOTOS.METAORDIMAGE as well as the PHOTOS.DESCRIPTION column.)

Example 3-1 (page 3-7) contains some relevant lines of code in the view_album procedure.

The SELECT statement is bound to the cursor variable album_cur and passed to the procedure print_album, which creates the HTML output.

The print_album procedure uses the HTP and HTF packages from the PL/SQL Web Toolkit to create the HTML tags that format the output into a four-column table. Each cell in the table contains two links or anchor tags. The first link is to the **View entry** page, which displays the full-size version of the image. This anchor is implemented by PHOTO_ALBUM.VIEW_ENTRY, and passes entry_id as a query string input argument. If the thumbnail image has a nonzero length, then procedure print_image_link is called to create an HTML <img> tag that is the content (the thumbnail image) of the anchor link. The string thumb and the entry_id are passed to procedure print_image_link, along with the image description, and the height and width of the thumbnail image. These values are used to create the <img> tag.

If an image is in a format that Oracle Multimedia does not support, the application cannot create a thumbnail version of the image. In this case, the content of the anchor link is the text **view image**.

Example 3-2 (page 3-8) contains some relevant lines of code in the print_album procedure.

The procedure print_image_link uses the height and width arguments to populate the height and width attributes of the <img> tag. The description argument is used to create text for the alt attribute. If the description argument is empty, a default string is constructed. Finally, the src attribute is set to the URL PHOTO_ALBUM.DELIVER_MEDIA with two query string arguments, media and entry_id. The media argument controls whether the thumbnail or full-size version of the image is delivered. The entry_id argument identifies the image to be delivered.

Example 3-3 (page 3-8) contains some relevant lines of code in the print_image_link procedure.

The procedure deliver_media fetches the image content from the database. The If-Modified-Since HTTP request header is compared to the last modification time of the image. If the image has not been modified, a response is sent that the browser can display the image from its cache. Otherwise, the image MIME type and last modified time are sent to the Web server, along with the image content.

Example 3-4 (page 3-9) contains some relevant lines of code in the deliver_media procedure.

Example 3-1 Procedure view_album

```
--
-- no search criteria so fetch all entries
--
IF search IS NULL THEN
  OPEN album_cur FOR
    SELECT id, description, thumb
```

```
    FROM photos
    ORDER BY id;
  print_album( album_cur, 'The photo album is empty.' );
  CLOSE album_cur;
ELSE
--    -- use the full-text index to select entries matching the search criteria
--
  OPEN album_cur FOR
    SELECT id, description, thumb
    FROM photos
    WHERE CONTAINS( description, trim(search) ) > 0
    ORDER BY id;
  print_album( album_cur, 'No photos were found.' );
  CLOSE album_cur;
END IF;
```

Example 3-2 Procedure print_album

```
    -- escape the description text
    sc_description := htf.escape_sc( entry.description );

    --
    -- Display the thumbnail image as an anchor tag which can be used
    -- to display the full-size image. If the image format is not
    -- supported by Oracle Multimedia, then a thumbnail would not have been
    -- produced when the image was uploaded, so use the text '[view
    -- image]' instead of the thumbnail.
    --

    htp.print( '<td headers="c' || colIdx || '" align="center" >
                <a href="PHOTO_ALBUM.VIEW_ENTRY?entry_id=' ||
                entry.id || '">' );
    IF entry.thumb.contentLength > 0
    THEN
        print_image_link( 'thumb', entry.id, sc_description,
                          entry.thumb.height, entry.thumb.width );
    ELSE
        htp.prn( '[view image]' );
    END IF;
    htp.print( '</a>' );

    -- Create link to the metadata
    htp.prn('<br>');
    htp.anchor( curl=>'PHOTO_ALBUM.VIEW_METADATA?entry_id=' || entry.id,
                ctext=>sc_description );
    htp.prn('</td>');
```

Example 3-3 Procedure print_image_link

```
-- add height and width to tag if non zero
IF height > 0 AND width > 0 THEN
  attributes := attributes || ' height=' || height || ' width=' || width;
END IF;

-- create an alt text if none given
IF alt IS NULL THEN
  IF type = 'thumb' THEN
    alt2 := 'thumb-nail image ';
  ELSE
    alt2 := 'full-size image ';
  END IF;
  alt2 := alt2 || 'for album entry ' || entry_id;
```

```
ELSE
  alt2 := alt;
END IF;

htp.img( curl=>'PHOTO_ALBUM.DELIVER_MEDIA?media=' || type ||
                 ampersand || 'entry_id=' || entry_id,
           calt=>alt2, cattributes=>attributes );
```

Example 3-4 Procedure deliver_media

```
  --
  -- Fetch the thumbnail or full-size image from the database.
  --
  IF media = 'thumb'
  THEN
      SELECT thumb INTO local_image FROM photos WHERE id = entry_id;
  ELSE
      SELECT image INTO local_image FROM photos WHERE id = entry_id;
  END IF;

  --
  -- Check update time if browser sent If-Modified-Since header
  --
  IF ordplsgwyutil.cache_is_valid( local_image.getUpdateTime() )
  THEN
    owa_util.status_line( ordplsgwyutil.http_status_not_modified );
    RETURN;
  END IF;

  --
  -- Set the MIME type and deliver the image to the browser.
  --
  owa_util.mime_header( local_image.mimeType, FALSE );
  ordplsgwyutil.set_last_modified( local_image.getUpdateTime() );
  owa_util.http_header_close();

  IF owa_util.get_cgi_env( 'REQUEST_METHOD' ) <> 'HEAD' THEN
    wpg_docload.download_file( local_image.source.localData );
  END IF;
```

3.1.2.2 Adding Images to the Photo Album

The **Upload photo** page is used to add new images to the photo album. The page displays a form with two text entry fields. In the **Description:** field, you can optionally enter a word or short phrase that describes the image. In the **File name:** field, enter the name of the image file or click **Browse...** to locate the image file to be uploaded. The **Upload photo** button under the **File name:** field starts the upload operation. When the image is successfully uploaded, the **View album** page appears. From that page, you can display the contents of the photo album, as described in Browsing the Photo Album (page 3-6).

At the top of the **Upload photo** page, there is a navigation bar, which includes links to other photo album pages. From the **Upload photo** page, you can return to the **View album** page or select the **Search metadata** page. These pages are described in Browsing the Photo Album (page 3-6) and Searching for Images That Contain Specific Metadata Attributes (page 3-20), respectively.

Figure 3-2 (page 3-10) shows an **Upload photo** page with all the entry fields completed.

Figure 3-2 Completed Upload photo Page

The PL/SQL procedures `view_upload_form`, `print_upload_form`, and `insert_new_photo` are the primary application components that implement the **Upload photo** page. Together, view_upload_form and print_upload_form create the HTML page that is displayed. The page contains a form tag, a portion of which is shown in Example 3-5 (page 3-11). The target of the form is PHOTO_ALBUM.INSERT_NEW_PHOTO.

Example 3-5 (page 3-11) contains some relevant lines of code in the `print_upload_form` procedure.

Procedure `insert_new_photo` receives the form, processes the inputs, and stores the new image in the database.

First, the `insert_new_photo` procedure checks that a file name was entered into the upload form. The image size, MIME type, and BLOB locator for the image content are selected from the document upload table, and the size is checked to ensure that the image is not of zero length. If the `description` field is blank, a description is created using the file name.

Next, the ORDSYS.ORDIMAGE.INIT( ) function is called to initialize the `thumb` and `image` ORDImage object type columns with an empty BLOB for the new row to be stored in the `photos` table. A SQL SELECT FOR UPDATE statement fetches the newly initialized thumbnail image and full-size image object type columns for updating. A DBMS_LOB.COPY operation loads the image from the upload table into the `image` ORDImage object type column.

The ORDImage object method setProperties( ) reads the image and sets the image object attributes. Because some browsers cannot display some image formats inline, in this sample application, BMP formatted images are converted to a JPEG image format (for images with more than 8 bits of color), or a GIFF image format (for images with less than 9 bits of color) by calling the `get_preferred_format` function. A processCopy( ) operation is performed on the full-size image to create the thumbnail image.

The ORDImage object getMetadata( ) method is called to extract all supported types of image metadata. The root element of each XML document in the return vector is examined to discover the metadata type so that the documents can be stored in the correct columns.

Then, a SQL UPDATE statement stores the full-size image, the thumbnail image, and the image metadata documents in the database. Procedure `sync_indexes` is called to force an update of the text indexes. Finally, the form data input is deleted from the document upload table. A success message is returned to the browser, and the browser is redirected to the **View album** page.

Example 3-6 (page 3-11) contains some relevant lines of code in the `insert_new_photo` procedure.

Example 3-5 Procedure print_upload_form

```
<form action="PHOTO_ALBUM.INSERT_NEW_PHOTO"
method="post"
enctype="multipart/form-data">
database.
```

Example 3-6 Procedure insert_new_photo

```
--
-- Make sure a file name has been provided. If not, display an error
-- message, then re-display the form.
--
IF new_photo IS NULL OR LENGTH( new_photo ) = 0
THEN
    print_page_header;
    print_error( 'Please supply a file name.' );
    print_upload_form;
    print_page_trailer( TRUE );
    return;
END IF;

--
-- Get the length, MIME type and the BLOB of the new photo from the
-- upload table.
--
SELECT doc_size,
       mime_type,
       blob_content
INTO   upload_size,
       upload_mime_type,
       upload_blob
FROM photos_upload
WHERE name = new_photo;

--
-- Make sure we have a valid file.
--
IF upload_size = 0
THEN
    print_page_header;
    print_heading( 'Error message' );
    htp.print( '<hr size="-1"><p>Please supply a valid image file.</p>' );
    print_upload_form;
    print_page_trailer( TRUE );
    return;
END IF;

--
-- If the description is blank, then use the file name.
--
IF c_description IS NULL
THEN
    c_description := new_photo;
    pos := INSTR( c_description, '/', -1 );
    IF pos > 0
    THEN
        c_description := SUBSTR( c_description, pos + 1 );
    END IF;
```

```
    c_description := SUBSTR( 'Image from file: ' ||
                     c_description || '.', 1, 40 );
END IF;
--
-- Insert a new row into the table, returning the newly allocated sequence
-- number.
INSERT INTO photos ( id, description, metaExif, metaIPTC, metaXMP,
                     image, thumb )
VALUES ( photos_sequence.nextval, c_description, NULL, NULL, NULL,
             ORDSYS.ORDIMAGE.INIT(), ORDSYS.ORDIMAGE.INIT() )
RETURN id
INTO new_id;

--
-- Fetch the newly initialized full-size and thumbnail image objects.
--
SELECT image,
       thumb
INTO new_image,
     new_thumb
FROM photos
WHERE id = new_id
FOR UPDATE;

--
-- Load the photo from the upload table into the image object.
--
DBMS_LOB.COPY( new_image.source.localData, upload_blob, upload_size );
new_image.setLocal();
--
-- Set the properties. If the image format is not recognized, then
-- the exception handler will set the MIME type and length from the
-- upload table.
--
BEGIN
    new_image.setProperties();
EXCEPTION
    WHEN OTHERS THEN
         new_image.contentLength := upload_size;
         new_image.mimeType := upload_mime_type;
END;

--
-- Some image formats are supported by Oracle Multimedia but cannot be
-- displayed inline by a browser. The BMP format is one example.
-- Convert the image to a GIF or JPEG based on number of colors in the
-- image.
--
IF new_image.contentFormat IS NOT NULL AND
   ( new_image.mimeType = 'image/bmp' OR
     new_image.mimeType = 'image/x-bmp' )
THEN
    BEGIN
        new_image.process(
                     'fileFormat=' ||
                     get_preferred_format( new_image.contentFormat ) );
    EXCEPTION
        WHEN OTHERS THEN
            NULL;
    END;
END IF;
```

```
--
-- Try to copy the full-size image and process it to create the thumbnail.
-- This may not be possible if the image format is not recognized.
--
BEGIN
    new_image.processCopy( thumb_scale, new_thumb );
EXCEPTION
    WHEN OTHERS THEN
        new_thumb.deleteContent();
        new_thumb.contentLength := 0;
END;
--
-- fetch the metadata and sort the results
--
BEGIN
  metav := new_image.getMetadata( 'ALL' );
  FOR i IN 1..metav.count() LOOP
    meta_root := metav(i).getRootElement();
    CASE meta_root
      WHEN 'ordImageAttributes' THEN xmlORD := metav(i);
      WHEN 'xmpMetadata'  THEN xmlXMP  := metav(i);
      WHEN 'iptcMetadata' THEN xmlIPTC := metav(i);
      WHEN 'exifMetadata' THEN xmlEXIF := metav(i);
      ELSE NULL;
    END CASE;
  END LOOP;
EXCEPTION
  WHEN OTHERS THEN
    NULL;
END;

--
-- Update the full-size and thumbnail images in the database.
-- Update metadata columns
--
UPDATE photos
SET image = new_image,
    thumb = new_thumb,
    metaORDImage = xmlORD,
    metaEXIF = xmlEXIF,
    metaIPTC = xmlIPTC,
    metaXMP = xmlXMP
WHERE id = new_id;

--    -- update the text indexes
--    sync_indexes;

--
-- Delete the row from the upload table.
--
DELETE FROM photos_upload WHERE name = new_photo;
COMMIT;

--
-- Redirect browser to display full album.
--    print_page_header(
    '<meta http-equiv="refresh" content="2;url=PHOTO_ALBUM.VIEW_ALBUM">' );
print_heading( 'Photo successfully uploaded into photo album' );
```

3.1.2.3 Searching for Images by Keyword or Phrase

You can use the **View album** and **Search album** pages to perform a keyword or phrase search of the metadata stored in the photo album. On either of these pages, enter the keyword or phrase in the **Full text search:** text entry field and click **Search**. This photo album application uses the `CONTEXT` text index to locate images that have metadata containing the text you entered. If the search is successful, the thumbnail versions of the matching images are displayed in a four-column table. Select the thumbnail image to view the full-size version, or select the description link below the thumbnail image to view the metadata for the image. If the search fails, the message "No photos were found" is displayed.

At the top of the **Search album** page, there is a navigation bar, which includes links to other photo album pages. From the **Search album** page, you can return to the **View album** page or select the **Search metadata** or **Upload photo** pages. These pages are described in Browsing the Photo Album (page 3-6), Searching for Images That Contain Specific Metadata Attributes (page 3-20), and Adding Images to the Photo Album (page 3-9), respectively.

Figure 3-3 (page 3-14) shows a **Search album** page that contains the results of a successful search operation.

Figure 3-3 Search album Page Showing Results

Full-text searching of the photo album is implemented by the `view_album` procedure. See Browsing the Photo Album (page 3-6) for a discussion of this procedure.

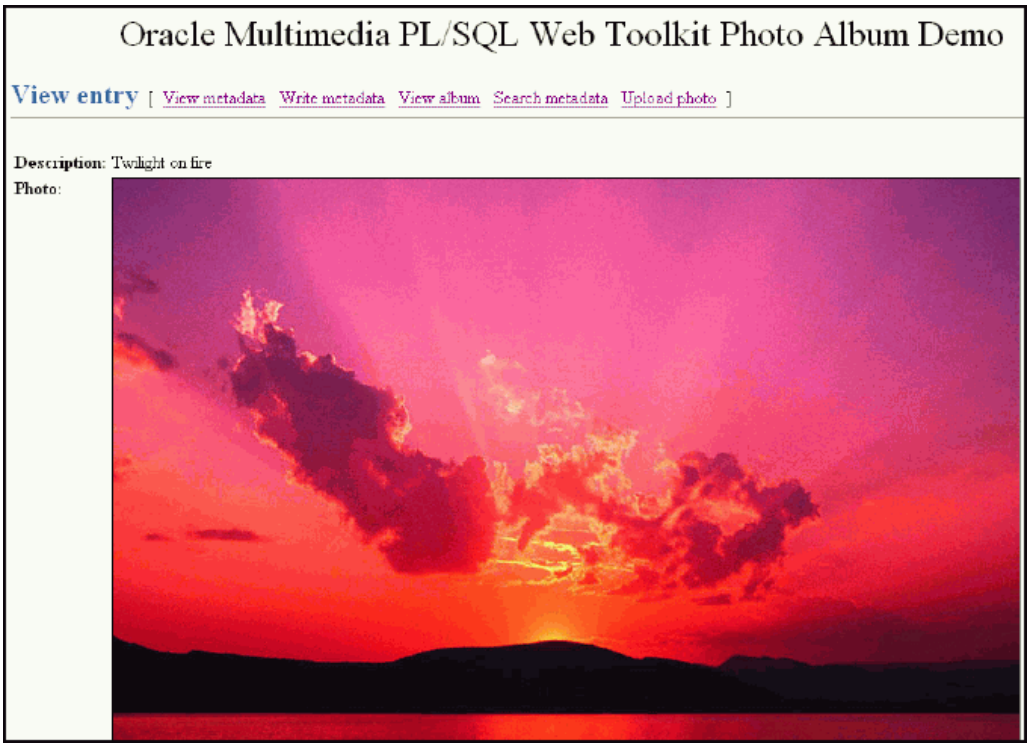
3.1.2.4 Viewing Full-Size Images

When you select a thumbnail image, the application directs you to the **View entry** page. This page displays the description of the image and the full-size version of the image.

At the top of the **View entry** page, there is a navigation bar, which includes links to other photo album pages. From the **View entry** page, you can return to the **View album** page, or select any of the **View metadata**, **Write metadata**, **Search metadata**, or **Upload photo** pages. These pages are described in Browsing the Photo Album (page 3-6), Examining Image Metadata (page 3-16), Writing New XMP Metadata to Images (page 3-17), Searching for Images That Contain Specific Metadata Attributes (page 3-20), and Adding Images to the Photo Album (page 3-9), respectively.

Figure 3-4 (page 3-15) shows a **View entry** page that contains the description and the full-size version of an image.

Figure 3-4 View entry Page with a Full-Size Image



The PL/SQL procedures `view_entry`, `print_image_link`, and `deliver_media` are the primary application components that implement the **View entry** page. The procedure `view_entry` takes a single parameter, `entry_id`, which uniquely locates the image in the `photos` table. The description and image object are fetched from the `photos` table. The procedure `print_image_link` creates the HTML `<img>` tag, and then calls procedure `deliver_media` to fetch the image content. See Browsing the Photo Album (page 3-6) for more information about the `print_image_link` and `deliver_media` procedures.

Example 3-7 (page 3-15) contains some relevant lines of code in the `view_entry` procedure.

Example 3-7 Procedure view_entry

```
--
-- Fetch the row.
--
BEGIN
  SELECT htf.escape_sc(description), image
  INTO sc_description, photo
  FROM photos
  WHERE id = entry_id;
  EXCEPTION
  WHEN no_data_found THEN
    print_error( 'Image <b>' || htf.escape_sc(entry_id) ||
                 '</b> was not found.</p>' );
    print_page_trailer( TRUE );
    return;
END;

print_image_link( 'image', entry_id, sc_description,
                  photo.height, photo.width );
```

3.1.2.5 Examining Image Metadata

You can use the **View metadata** page to examine all the metadata for a specific image. Typically, you access this page from the **View album** page by selecting the description link below a thumbnail image. You can also access this page by selecting the **View metadata** link from the navigation bar. The **View metadata** page displays the thumbnail version of the image. To the right of the thumbnail image, there is a list of the metadata documents for this image. Each entry in the list is a link that takes you to the metadata document on the **View metadata** page.

At the top of the **View metadata** page, there is a navigation bar, which includes links to other photo album pages. From the **View metadata** page, you can return to the **View album** page, or select any of the **View entry**, **Write metadata**, **Search metadata**, or **Upload photo** pages. These pages are described in Browsing the Photo Album (page 3-6), Viewing Full-Size Images (page 3-14), Writing New XMP Metadata to Images (page 3-17), Searching for Images That Contain Specific Metadata Attributes (page 3-20), and Adding Images to the Photo Album (page 3-9), respectively.

Figure 3-5 (page 3-16) shows a **View metadata** page that contains two types of metadata (XMP and ORDIMAGE) for an image.

Figure 3-5 View metadata Page with Metadata for an Uploaded Image

The PL/SQL procedures `view_metadata` and `print_metadata` are the primary application components that implement the **View metadata** page. The procedure `view_metadata` is passed the argument `entry_id`, which uniquely identifies the image in the `photos` table. A SELECT statement retrieves all the `XMLtype` metadata columns for the specified entry. If the metadata column is not `NULL`, procedure `print_metadata` is called to display the XML document inside an HTML `<pre>` tag.

Example 3-8 (page 3-17) contains some relevant lines of code in the `view_metadata` procedure.

The `print_metadata` procedure accepts an XMLType document as an argument. It uses the getClobVal( ) method to access the document as a CLOB. The content of the CLOB is read in a loop and formatted in the HTML page using the `htp.prints` procedure. The `htp.prints` procedure escapes the '<' and '>' characters so that they are rendered properly by the Web browser.

Example 3-9 (page 3-17) contains some relevant lines of code in the `print_metadata` procedure.

Example 3-8 Procedure view_metadata

```
--
-- Fetch the row.
--
SELECT metaOrdImage, metaEXIF, metaIPTC, metaXMP
INTO   metaO, metaE, metaI, metaX
FROM   photos
WHERE  id = entry_id;

-- display the EXIF metadata
IF metaE IS NOT NULL THEN
  htp.print( '<span class="bigBlue" id="exifMetadata">EXIF</span>' );
  htp.print( '<br><pre>' );
  print_metadata( metaE );      htp.print( '</pre>' );
END IF;
```

Example 3-9 Procedure print_metadata

```
metaClob := meta.getClobVal();
len := dbms_lob.getLength( metaClob );
IF bufSize > len THEN
  bufSize := len;
END IF;
WHILE len > 0 LOOP
  dbms_lob.read( metaClob, bufSize, pos, buf );
  htp.prints( buf );
  pos := pos + bufSize;
  len := len - bufSize;
END LOOP;
```

3.1.2.6 Writing New XMP Metadata to Images

You can use the **Write XMP metadata** page to write new or replace existing XMP metadata in an image. Oracle Multimedia provides support for writing XMP metadata only. You can access the **Write XMP metadata** page by selecting the **Write metadata** link in the navigation bar from either the **View entry** page or the **View metadata** page.

The **Write XMP metadata** page displays the thumbnail version of the image to be modified. The page also displays an input form to collect metadata attributes in these five text entry fields:

- **Title:** Specify a title for the photograph.
- **Creator:** Enter the name of the person who took the photograph. This field is optional.
- **Date:** Enter the date the photograph was taken. This field is optional.
- **Description:** Enter a description, such as the subject of the photograph. This field is optional.

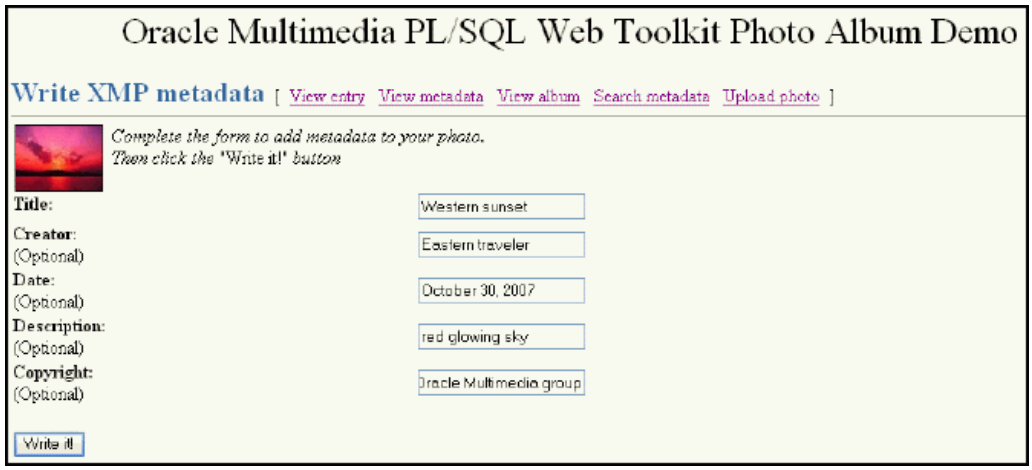
- **Copyright:** Enter the month and year when the photograph was taken. This field is optional.

Click **Write it!** to send the form to the application and embed the metadata in XMP format in the image.

At the top of the **Write XMP metadata** page, there is a navigation bar, which includes links to other photo album pages. From the **Write XMP metadata** page, you can return to the **View album** page, or select any of the **View entry**, **View metadata**, **Search metadata**, or **Upload photo** pages. These pages are described in Browsing the Photo Album (page 3-6), Viewing Full-Size Images (page 3-14), Examining Image Metadata (page 3-16), Searching for Images That Contain Specific Metadata Attributes (page 3-20), and Adding Images to the Photo Album (page 3-9), respectively.

Figure 3-6 (page 3-18) shows a **Write XMP metadata** page with completed entries for an image.

Figure 3-6 Completed Write XMP metadata Page with XMP Metadata for an Uploaded Image



The PL/SQL procedure `write_metadata` receives the form input fields from the browser. The procedure creates an XML document (as a string buffer) that is valid to the Oracle Multimedia XMP schema `http://xmlns.oracle.com/ord/meta/xmp`. The string buffer is used to create an XMLType object.

A SELECT FOR UPDATE statement retrieves the image to be modified. The Oracle Multimedia method putMetadata( ) is called to embed the XML document into the image. The modified image is stored back to the photos table. Finally, procedure `sync_indexes` is called to update the text indexes.

Example 3-10 (page 3-19) contains some relevant lines of code in the `write_metadata` procedure.

The input data shown in Example 3-10 (page 3-19) would result in the storage of the following metadata in the image:

```
<xmpMetadata xmlns="http://xmlns.oracle.com/ord/meta/xmp"
             xsi:schemaLocation="http://xmlns.oracle.com/ord/meta/xmp
             http://xmlns.oracle.com/ord/meta/xmp"
             xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
 <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
   <rdf:Description about="" xmlns:dc="http://purl.org/dc/elements/1.1/">
     <dc:title>Story time</dc:title>
     <dc:creator>father</dc:creator>
     <dc:date>July 4, 2001</dc:date>
```

```
    <dc:description>family reading</dc:description>
    <dc:copyright>mother</dc:copyright>
   </rdf:Description>
 </rdf:RDF>
</xmpMetadata>
```

Example 3-10 Procedure write_metadata

```
   -- Create the XMP packet it must be schema valid
   -- to "http://xmlns.oracle.com/ord/meta/xmp"
   -- and contain an <RDF> element. This example uses
   -- the Dublin Core schema as implemented by Adobe XMP
   buf := '<xmpMetadata xmlns="http://xmlns.oracle.com/ord/meta/xmp"
            xsi:schemaLocation="http://xmlns.oracle.com/ord/meta/xmp
            http://xmlns.oracle.com/ord/meta/xmp"
            xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" >
     <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
     <rdf:Description about="" xmlns:dc="http://purl.org/dc/elements/1.1/">
     <dc:title>' || htf.escape_sc(title) || '</dc:title>';

   IF c_creator IS NOT NULL THEN
     buf := buf || '<dc:creator>' || htf.escape_sc(c_creator)
                || '</dc:creator>';
   END IF;
   IF c_date IS NOT NULL THEN
     buf := buf || '<dc:date>' || htf.escape_sc(c_date)
                || '</dc:date>';
   END IF;
   IF c_description IS NOT NULL THEN
     buf := buf || '<dc:description>' || htf.escape_sc(c_description)
                || '</dc:description>';
   END IF;
   IF c_copyright IS NOT NULL THEN
     buf := buf || '<dc:copyright>' || htf.escape_sc(c_copyright)
                || '</dc:copyright>';
   END IF;
   buf := buf || '
     </rdf:Description>
     </rdf:RDF>
     </xmpMetadata>';

   xmp := XMLType.createXML(buf, 'http://xmlns.oracle.com/ord/meta/xmp');

   --    -- select image for update
   -- description is selected to force update of CTX index
   --
   SELECT image, description
   INTO img, des
   FROM photos
   WHERE id = entry_id
   FOR UPDATE;

   --
   -- write the metadata
   --
   img.putMetadata( xmp, 'XMP' );

   --
   -- save updated image and new metadata to table
   -- description updated to force update of CTX index
   --
```

```
UPDATE photos
SET image = img,
    metaXMP = xmp,
    description = des
WHERE id = entry_id;

-- update the text indexes
sync_indexes;
```

3.1.2.7 Searching for Images That Contain Specific Metadata Attributes

You can use the **Search metadata** page to search a specific metadata type and to limit your search to a specific tag within a metadata document. You can access the **Search metadata** page by selecting the **Search metadata** link in the navigation bar of any photo album application Web page.

The **Search metadata** page displays a form with four fields to define how the search is to be performed. Use the menu in the **Search in metadata:** field to select the type of metadata (**EXIF**, **IPTC**, or **XMP**) to be searched. When this field is changed, the fields **Search in tag:** and **Search method:** are initialized with values that are appropriate to the type of metadata search.

Use the drop-down list in the **Search in tag:** field to limit the search to a specific XML element within a metadata document. The list is populated with element names that are appropriate for the selected metadata type. When the value **--Any tag--** is showing, the search looks at all elements within the document type. When the **XMP** metadata type is selected, searches are limited to Description elements within the parent RDF element. If the metadata document is properly constructed, selecting **RDF/Description** in this field searches all relevant metadata within XMP documents.

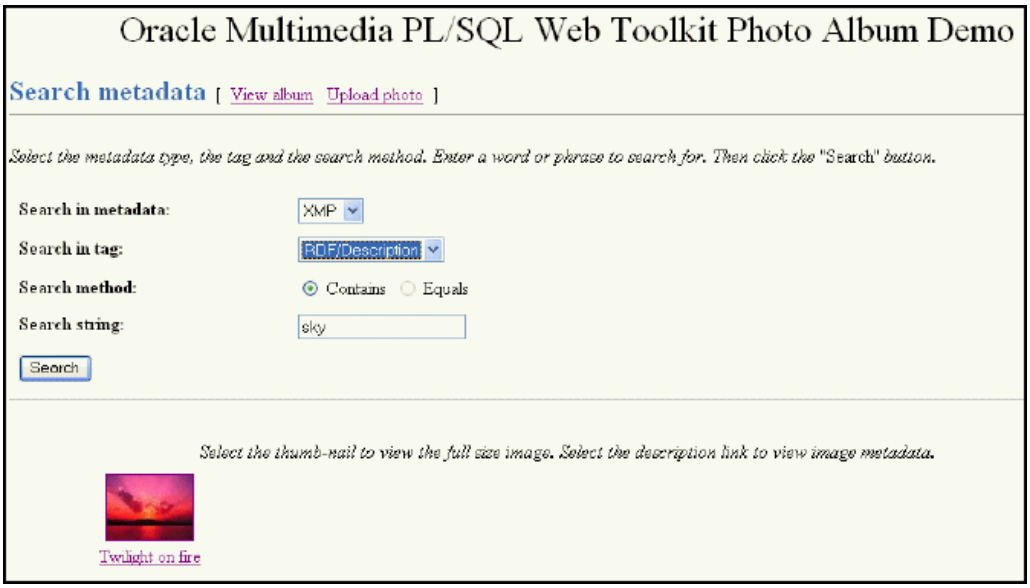
In the **Search method:** field, select **Contains** to specify a search where an element contains the search string. Select **Equals** to specify a search where element values are matched exactly to the search string. For searches in XMP metadata, only the **Contains** search method is available.

Finally, enter a keyword or phrase in the **Search string:** field and click **Search**. If the search is successful, the thumbnail versions of the matching images are displayed in a four-column table. Select the thumbnail image to view the full-size version of an image. Or, select the description link below the thumbnail image to view the metadata for the image. If the search fails, the message "No photos matched the search criteria." is displayed.

At the top of the **Search metadata** page, there is a navigation bar, which includes links to other photo album pages. From the **Search metadata** page, you can return to the **View album** page or select the **Upload photo** page. These pages are described in Browsing the Photo Album (page 3-6) and Adding Images to the Photo Album (page 3-9), respectively.

Figure 3-7 (page 3-21) shows a **Search metadata** page that contains sample search criteria and results from a successful search operation.

Figure 3-7 Completed Search metadata Page for an Uploaded Image



The PL/SQL procedure `search_metadata` receives the form input fields from the Web browser. The search parameters are used to build a query to find images that contain the desired metadata. The search is accomplished using the SQL function XMLExists. The XMLExists function is used to search an XML document for content that matches a given XQuery expression. The function returns `TRUE` if the document matched the search, and `FALSE` otherwise.

For example, assume that the `search_metadata` procedure receives input that specifies to search the `caption` tag in IPTC metadata for an exact match of the word "farm". The query to accomplish this search is as follows:

```
SELECT id, description, thumb
FROM photos
WHERE xmlexists('declare default element namespace ' ||
                ' "http://xmlns.oracle.com/ord/meta/iptc"; $x' ||
                '/iptcMetadata[//caption="farm"]' passing metaIptc as "x");
```

The XPath component of the XQuery expression, `'/iptcMetadata[//caption="farm"]'`, specifies a search for all `<caption>` elements under the root element `<iptcMetadata>` where the `<caption>` content is `"farm"`.

See Also:

Oracle XML DB Developer's Guide for more information about the XMLExists function

---

Example 3-11 (page 3-21) contains some relevant lines of code in the `search_metadata` procedure.

Example 3-11 Procedure search_metadata

```
-- Set up search variables for EXIF documents.
IF mtype = 'exif' THEN
  IF op = 'equals' THEN
    xpath  := '/exifMetadata[//' || tag || '="' || c_search || '"]';
  ELSE  -- default to contains
```

```
    xpath  := '/exifMetadata//' || tag ||
              '[contains(., "' || c_search || '")]';
  END IF;

  xquery := 'declare default element namespace ' ||
            ' "http://xmlns.oracle.com/ord/meta/exif"; $x' || xpath;

  OPEN album_cur FOR
    SELECT id, description, thumb
    FROM photos
    WHERE xmlexists(xquery passing metaExif as "x");

-- Set up search variables for IPTC documents.
ELSIF mtype = 'iptc' THEN
  IF op = 'equals' THEN
    xpath  := '/iptcMetadata[//' || tag || '="' || c_search || '"]';
  ELSE  -- default to contains
    xpath  := '/iptcMetadata//' || tag ||
              '[contains(., "' || c_search || '")]';
  END IF;

  xquery := 'declare default element namespace ' ||
        ' "http://xmlns.oracle.com/ord/meta/iptc"; $x' || xpath;

  OPEN album_cur FOR
    SELECT id, description, thumb
    FROM photos
    WHERE xmlexists(xquery passing metaIptc as "x");

-- Set up search variables for XMP documents.
ELSIF mtype = 'xmp' THEN
  -- default to contains
  xpath  := '//rdf:Description//*[contains(., "'
            || c_search || '")]';

  -- Add rdf namespace prefix.
  xquery := 'declare namespace rdf = ' ||
         ' "http://www.w3.org/1999/02/22-rdf-syntax-ns#"; ' ||
         'declare default element namespace ' ||
         ' "http://xmlns.oracle.com/ord/meta/xmp"; $x' || xpath;

  OPEN album_cur FOR
    SELECT id, description, thumb
    FROM photos
    WHERE xmlexists(xquery passing metaXMP as "x");

ELSE
  errorMsg := 'Search domain is invalid: ' || htf.escape_sc(mtype);
END IF;

print_search_form( mtype, tag, op, c_search );
htp.print('<hr size="-1">');
print_album( album_cur, 'No photos matched the search criteria.' );
```

4

Oracle Multimedia Code Wizard Sample Application for the PL/SQL Gateway

The Oracle Multimedia Code Wizard sample application for the PL/SQL Gateway creates PL/SQL procedures for the PL/SQL Gateway to upload and retrieve multimedia data stored in a database using Oracle Multimedia object types.

This application assumes the following:

- You are familiar with developing PL/SQL applications using the PL/SQL Gateway.
- You have installed and configured the Oracle Multimedia Code Wizard sample application.

You can install the Oracle Multimedia Code Wizard sample application from the Oracle Database Examples media, which is available for download from the Oracle Technology Network (OTN). After installing the Oracle Database Examples media, the sample application files and `README.txt` file are located at:

`<ORACLE_HOME>/ord/http/demo/plsgwycw` (on Linux and UNIX)

`<ORACLE_HOME>\ord\http\demo\plsgwycw` (on Windows)

This chapter describes how to run the Code Wizard sample application. See the `README.txt` file for additional requirements and instructions on installing and configuring this sample application.

This chapter includes these sections:

See Also:

Oracle Multimedia Photo Album Sample Application (page 3-1) for a Photo Album sample Web application that uses PL/SQL scripts to upload and retrieve media using Oracle Multimedia object types.

4.1 Running the Code Wizard Sample Application

To use the Code Wizard sample application to create and test media access procedures, you must perform these steps:

1. Create a new database access descriptor (DAD) or choose an existing DAD for use with the Code Wizard.
2. Authorize use of the DAD using the Code Wizard's administration function.
3. Create and test media upload and retrieval procedures.

The following sections describe these steps and other related topics in more detail.

4.2 Description of the Code Wizard Sample Application

The Oracle Multimedia Code Wizard sample application lets you create PL/SQL stored procedures for the PL/SQL Gateway to upload and retrieve media data (images, audio, video, and general media) stored in a database using these Oracle Multimedia object types and their respective methods:

- ORDImage
- ORDAudio
- ORDVideo
- ORDDoc

The Code Wizard guides you through a series of self-explanatory steps to create either a media retrieval procedure or a media upload procedure. You can create and compile standalone media access procedures. Or, you can create the source of media access procedures for inclusion in a PL/SQL package. Finally, after creating media access procedures, you can customize them to meet your specific application requirements.

These processes are similar to how the Oracle Multimedia PL/SQL Web Toolkit Photo Album application uses the `insert_new_photo` procedure as the image upload procedure, and the `deliver_media` procedure as the image retrieval procedure (see Oracle Multimedia PL/SQL Photo Album Sample Application (page 3-1)).

The following subsections describe how to use the Code Wizard application:

4.2.1 Creating a New DAD or Choosing an Existing DAD

To create media upload or retrieval procedures, you must select one or more DADs for use with the Code Wizard. To prevent the unauthorized browsing of schema tables and to prevent the unauthorized creation of media access procedures, you must authorize each DAD using the Code Wizard administration function. Depending on your database and application security requirements, you can create and authorize one or more new DADs specifically for use with the Code Wizard. Or, you can authorize the use of one or more existing DADs.

Oracle recommends that any DAD authorized for use with the Code Wizard employ some form of user authentication mechanism. The simplest approach is to create or use a DAD that uses database authentication. To use this approach, select **Basic Authentication Mode** and omit the password in the DAD specification. Alternatively, you can use a DAD that specifies an existing application-specific authentication mechanism.

See Also:

Oracle Database Development Guide for more information about configuring DADs

---

The following example describes how to create a DAD that enables you to create and test media upload and retrieval procedures in the `SCOTT` schema.

Note:

To test media upload procedures, you must specify the name of a document table in the DAD. When testing an upload procedure, you can choose either the DAD you used to create the procedure or the DAD you used to access the application. You can choose a document table name when you create a DAD, edit a DAD to specify the document table name at a later time, or use an existing DAD that specifies a document table name. This example shows how to specify the document table name when you create the DAD.

---

1. Set your Web browser to the Oracle HTTP Server Home page. Select **PL/SQL Properties** in the Administration page to open the mod_plsql Services page.
2. Scroll to the DAD Status section on the mod_plsql Services page. Then, click **Create** to open the DAD Type page.
3. Select the DAD type to be **General**. Then, click **Next** to open the Database Connection page.
4. Enter `/scottcw` in the DAD Name field. Enter `SCOTT` for the database account, and leave the password blank. Enter the connection information in the Database Connectivity Information section. Enter `ORDCWPKG.MENU` in the Default page field, and leave the other fields blank. Then, click **Next** to open the Document, Alias, and Session page.
5. Enter `MEDIA_UPLOAD_TABLE` for the Document Table on the Document, Alias, and Session page. Then, click **Apply.**
6. Restart Oracle HTTP Server for the changes to take effect.

4.2.2 Authorizing a DAD

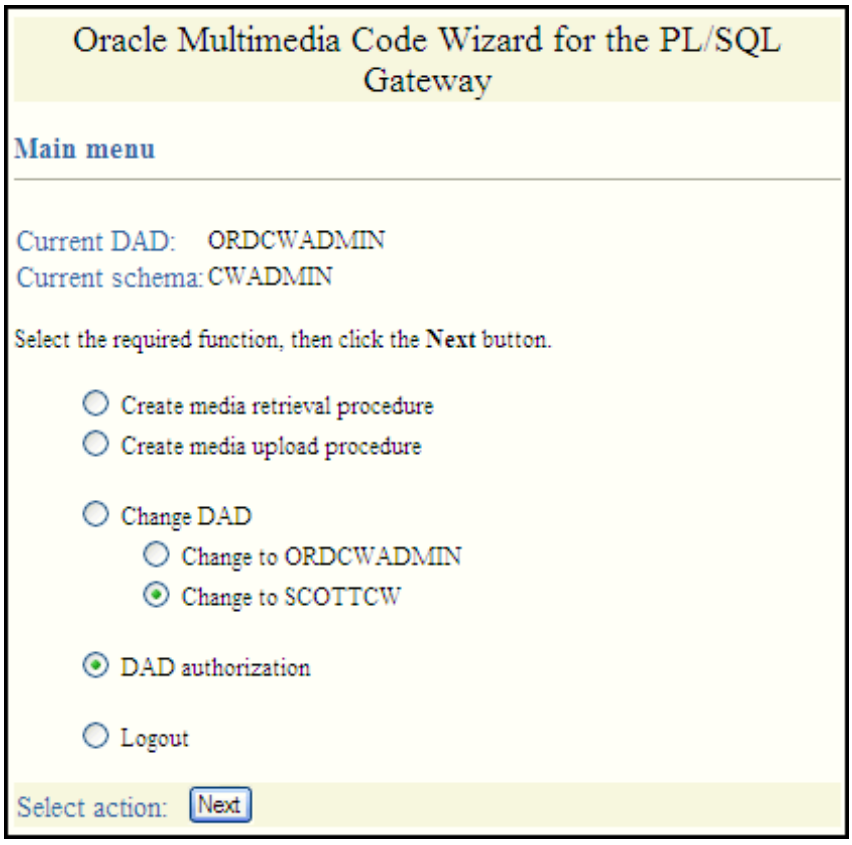
To authorize a DAD for use with the Code Wizard, perform these steps:

1. Enter the Code Wizard's administration URL into the location bar for your browser. For example:

   `http://<host-name>:<port-number>/ordcwadmin`

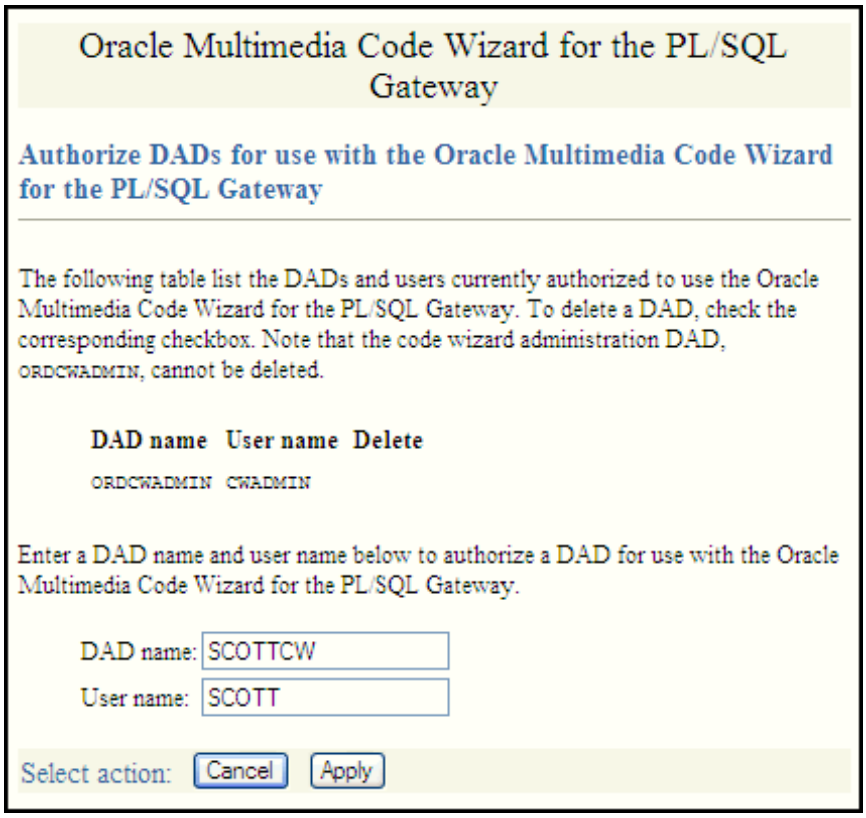
2. Enter the user name and password when prompted by the browser.
3. Select **DAD authorization** from the **Main menu**, as shown in the following figure. Then, click **Next**.

Figure 4-1 Main Menu for the Code Wizard



4. Enter the name of the DAD you want to authorize along with the user name, as shown in the following figure. Then, click **Apply**.

Figure 4-2 Authorize the SCOTTCW DAD



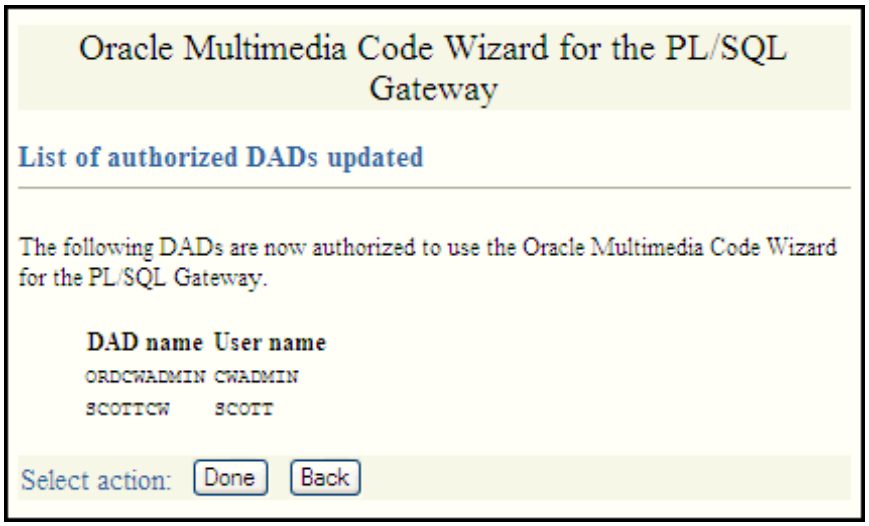
Note:

Duplicate DADs are not permitted, and each authorized DAD must indicate which database schema the user is authorized to access with the Code Wizard, using the DAD. Use this same page to delete the authorization for any existing DADs that no longer require the Code Wizard.

---

5. Review the updated list of DADs that are authorized to use the Oracle Multimedia Code Wizard, as shown in the following figure. Then, click **Done**.

Figure 4-3 List of Authorized DADs



6. Select **Logout** from the **Main menu** to log out (clear HTTP authentication information), then click **Next**. The log out operation redirects the request to the PL/SQL Gateway built-in `logmeoff` function.

See Also:

Oracle Database Development Guide for more information about configuring DADs

---

4.2.3 Creating and Testing Media Upload and Retrieval Procedures

After you have completed the setup tasks (as described in Creating a New DAD or Choosing an Existing DAD (page 4-2), Authorizing a DAD (page 4-3), and the `README.txt` file), you are ready to run this application.

To start the Code Wizard, follow these steps:

1. Enter the appropriate URL into the address field of your Web browser.

   For example:

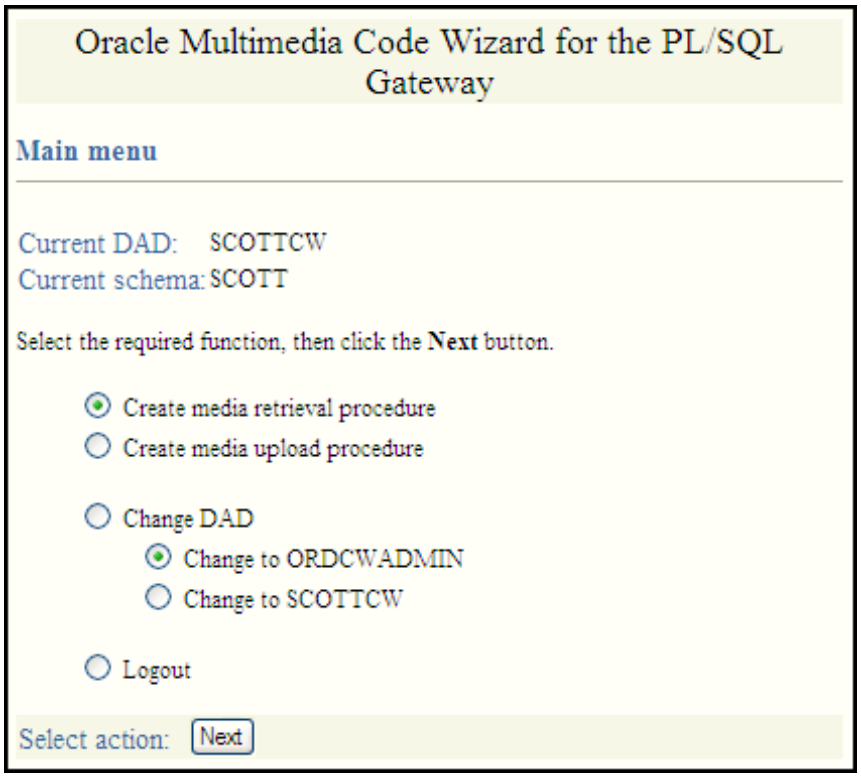
   `http://<hostname>:<port-number>/scottcw`

   or

   `http://<hostname>:<port-number>/mediadad/ordcwpkg.menu`

2. Enter the user name and password when prompted by the browser. The **Main menu** page of the Oracle Multimedia Code Wizard for the PL/SQL Gateway is displayed, as shown in the following figure.

Figure 4-4 Use the SCOTTCW DAD



3. If the DAD is configured specifically for use with the Code Wizard, enter the DAD name. To use another DAD, enter the DAD name along with the Code Wizard package name and **Main menu** procedure name (`ORDCWPKG.MENU`) after the DAD name.

4. After logging in, you can log out (clear HTTP authentication information) at any time by selecting **Logout** from the **Main menu**, then clicking **Next**. The logout operation redirects the request to the PL/SQL Gateway built-in `logmeoff` function.

See Also:

Oracle Database Development Guide for more information about using the embedded PL/SQL Gateway

---

To create a media upload procedure (see Creating a Media Upload Procedure (page 4-8)) or a media retrieval procedure (see Creating a Media Retrieval Procedure (page 4-13)), select the appropriate option from the **Main menu** page, then click **Next**. The Code Wizard then guides you through a series of self-explanatory steps to create the procedure.

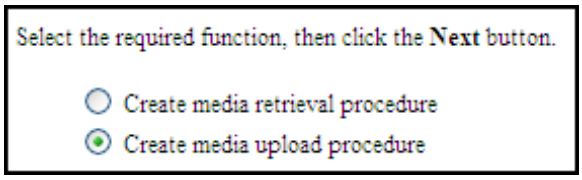
If you create a standalone media upload or retrieval procedure, you will have the opportunity to view the contents of the procedure and test it. Sample Session: Using Images (page 4-18) includes a sample session that demonstrates how to create and test a media upload procedure and a media retrieval procedure.

4.2.4 Creating a Media Upload Procedure

To create a media upload procedure using the Oracle Multimedia Code Wizard for the PL/SQL Gateway, perform these steps:

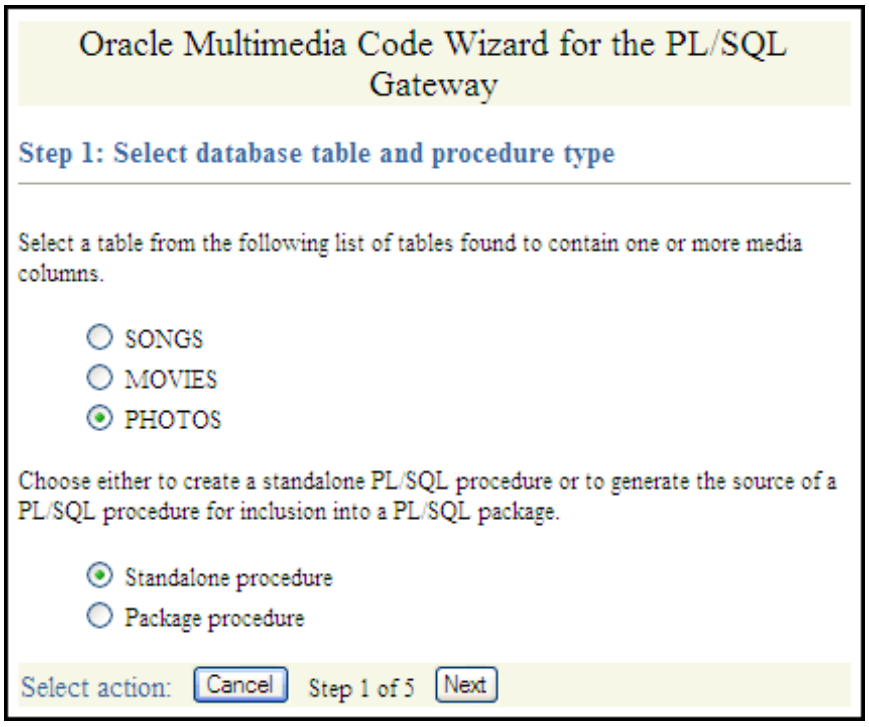
1. Select **Create media upload procedure** from the **Main menu** page, as shown in Figure 4-5 (page 4-8). Then, click **Next**.

Figure 4-5 Create a Media Upload Procedure



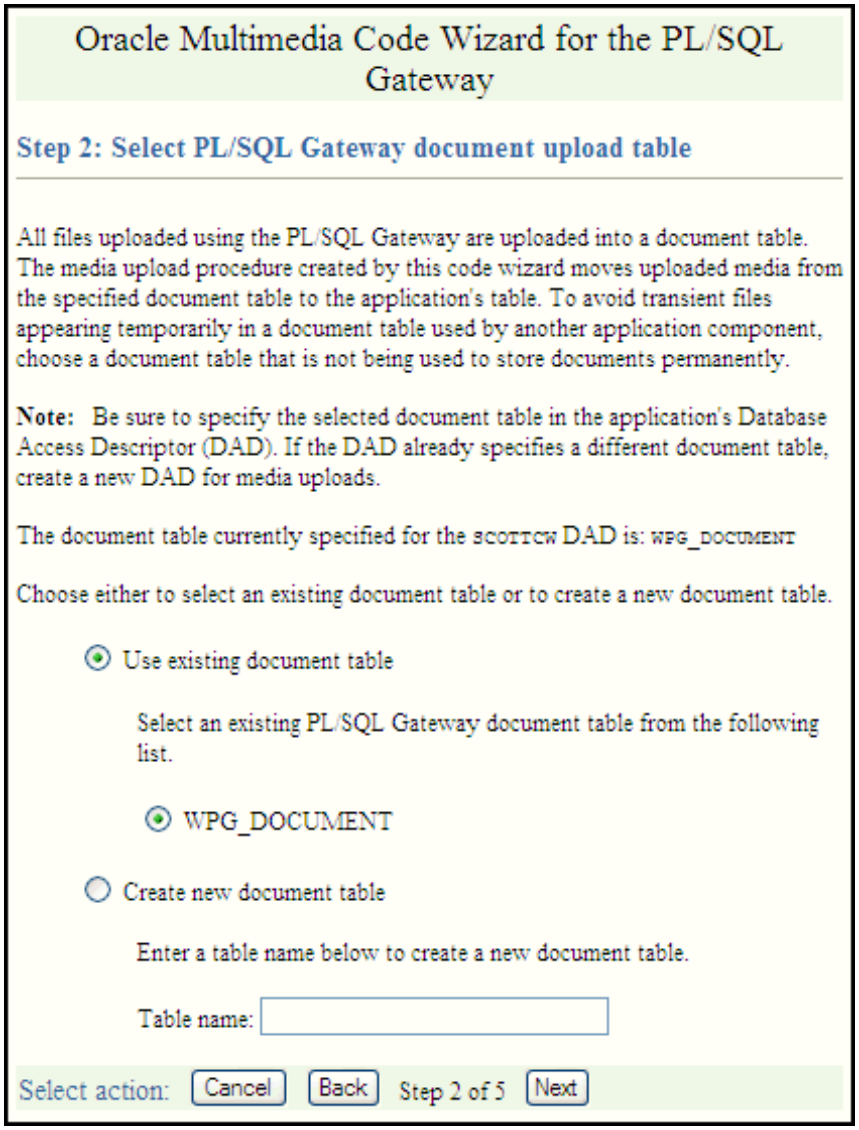
2. Select **PHOTOS** and **Standalone procedure** from **Step 1: Select database table and procedure type**, as shown in Figure 4-6 (page 4-8). Then, click **Next**.

Figure 4-6 Media Upload Step 1: Select Database Table and Procedure Type



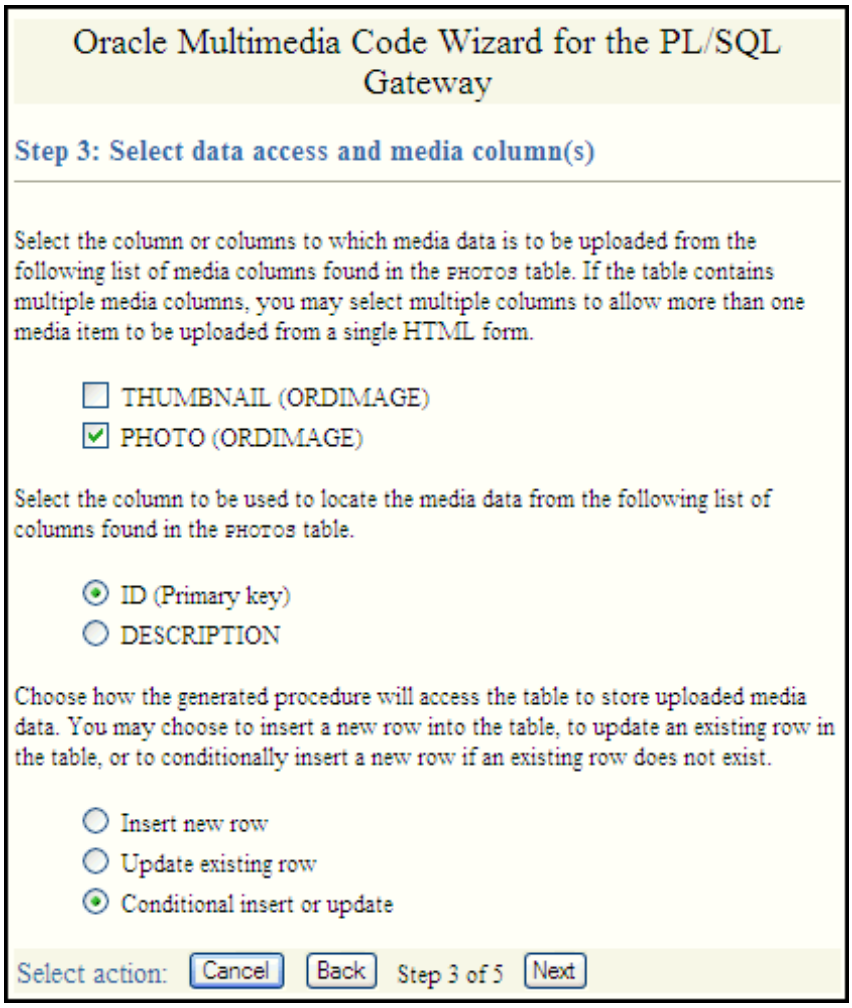
3. Select **Use existing document table** from **Step 2: Select PL/SQL Gateway document upload table**, as shown in Figure 4-7 (page 4-9), because the `SCOTTCW` DAD is configured to use this document table. Then, click **Next**.

Figure 4-7 Media Upload Step 2: Select PL/SQL Gateway Document Upload Table



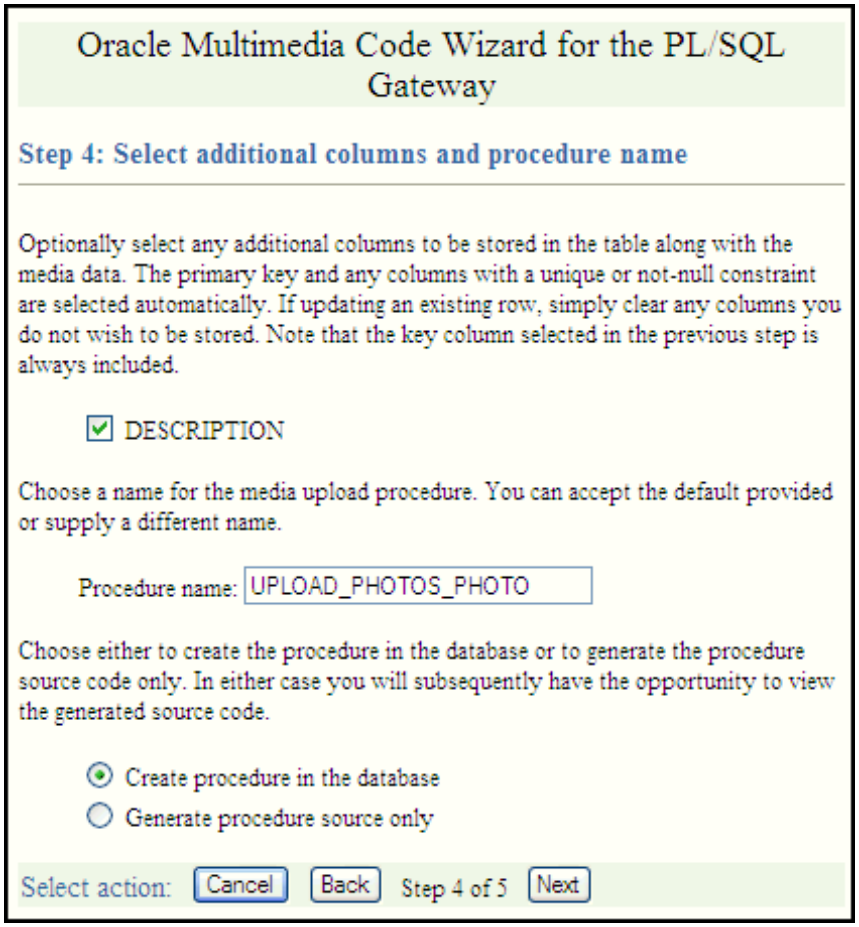
4. Check **PHOTO (ORDIMAGE),** select **ID (Primary key)**, and select **Conditional insert or update** from **Step 3: Select data access and media column(s)**, as shown in Figure 4-8 (page 4-10). Then, click **Next**.

Figure 4-8 Media Upload Step 3: Select Data Access and Media Column(s)



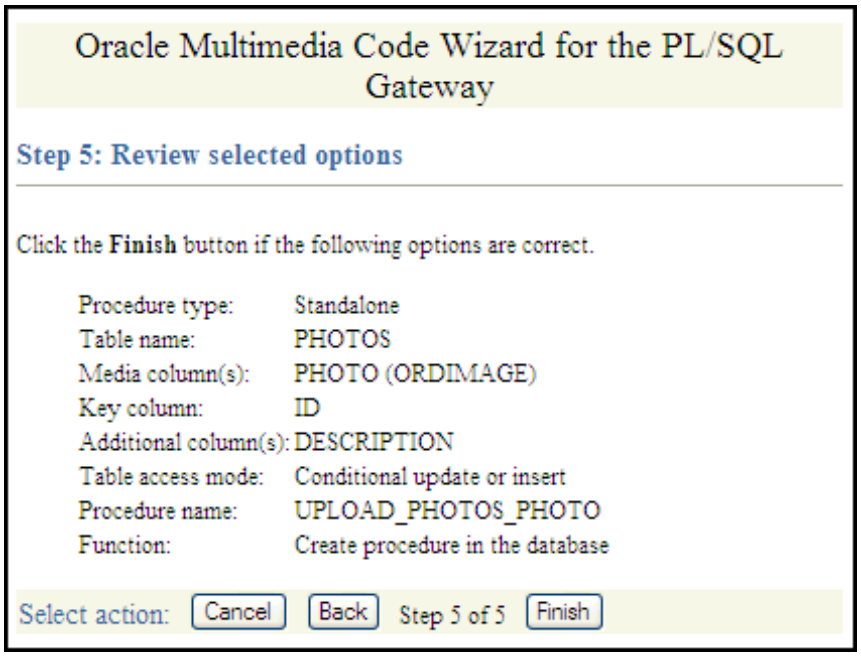
5. Check **DESCRIPTION**, accept the default procedure name, **UPLOAD_PHOTOS_PHOTO**, and select **Create procedure in the database** from **Step 4: Select additional columns and procedure name**, as shown in Figure 4-9 (page 4-11). Then, click **Next**.

Figure 4-9 Media Upload Step 4: Select Additional Columns and Procedure Name



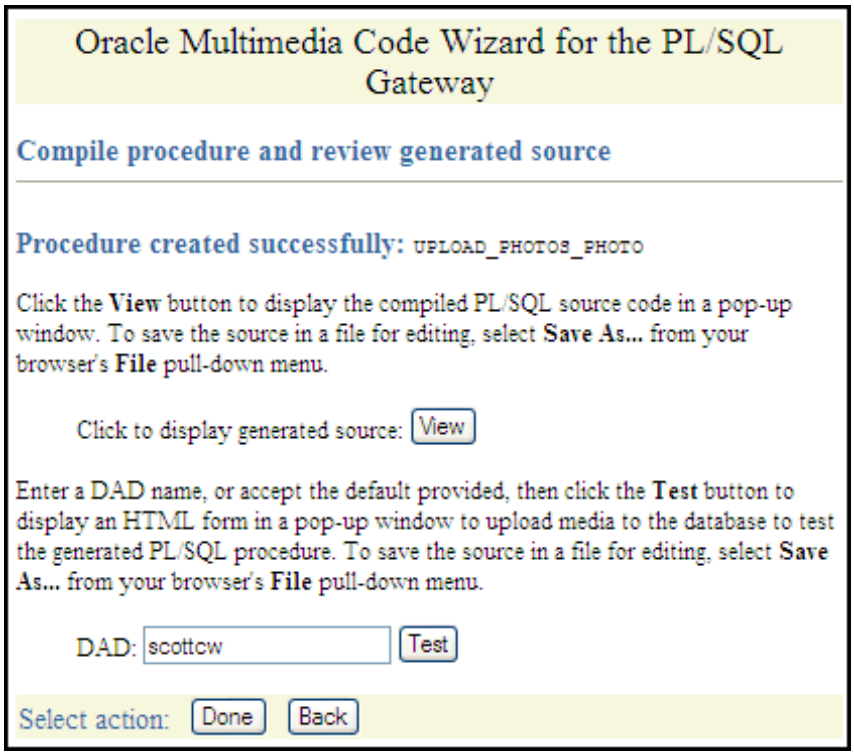
6. Review the options you selected from **Step 5: Review selected options**, as shown in Figure 4-10 (page 4-12). If the options selected are correct, click **Finish**.

Figure 4-10 Media Upload Step 5: Review Selected Options



7. The message `Procedure created successfully: UPLOAD_PHOTOS_PHOTO` is displayed on the **Compile procedure and review generated source** page, as shown in Figure 4-11 (page 4-12).

Figure 4-11 Compiled Upload Procedure with Success Message



To review the compiled PL/SQL source code in another window, click **View** (see Sample Session 1: Using Images (page 4-18) for a copy of the generated upload procedure). Assuming you have configured the `SCOTTCW` DAD and specified

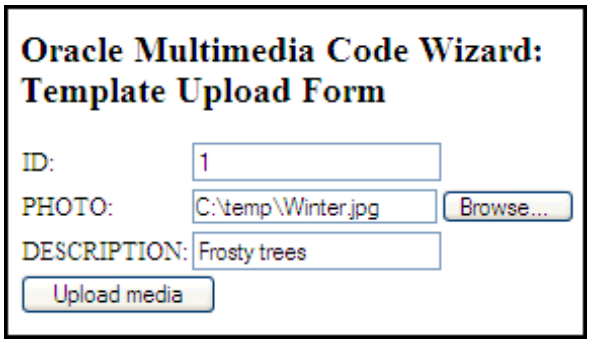
`MEDIA_UPLOAD_TABLE` as the document table, in the **DAD:** field, the DAD name `scottcw` is displayed by default.

To test the PL/SQL procedure created, click **Test**.

The **Oracle Multimedia Code Wizard: Template Upload Form** is displayed in another window.

8. Enter the value `1` in the **ID** field on the **Oracle Multimedia Code Wizard: Template Upload Form** window. Click **Browse...** to find and select the image you want to upload in the **PHOTO** field, and enter a brief description of the image to be uploaded in the **DESCRIPTION** field, as shown in Figure 4-12 (page 4-13). Then, click **Upload media**.

Figure 4-12 Template Upload Form for the Code Wizard



The image is uploaded into the table row, and this message is displayed:

```
Media uploaded successfully.
```

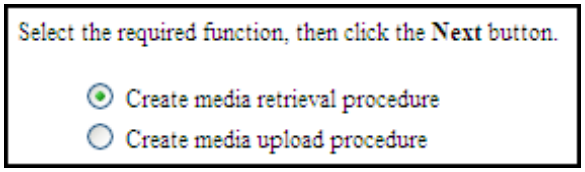
9. Return to the **Compile procedure and review generated source** page. If you are finished testing, click **Done** to return to the **Main menu** page.

4.2.5 Creating a Media Retrieval Procedure

To create a media retrieval procedure using the Oracle Multimedia Code Wizard for the PL/SQL Gateway, perform these steps:

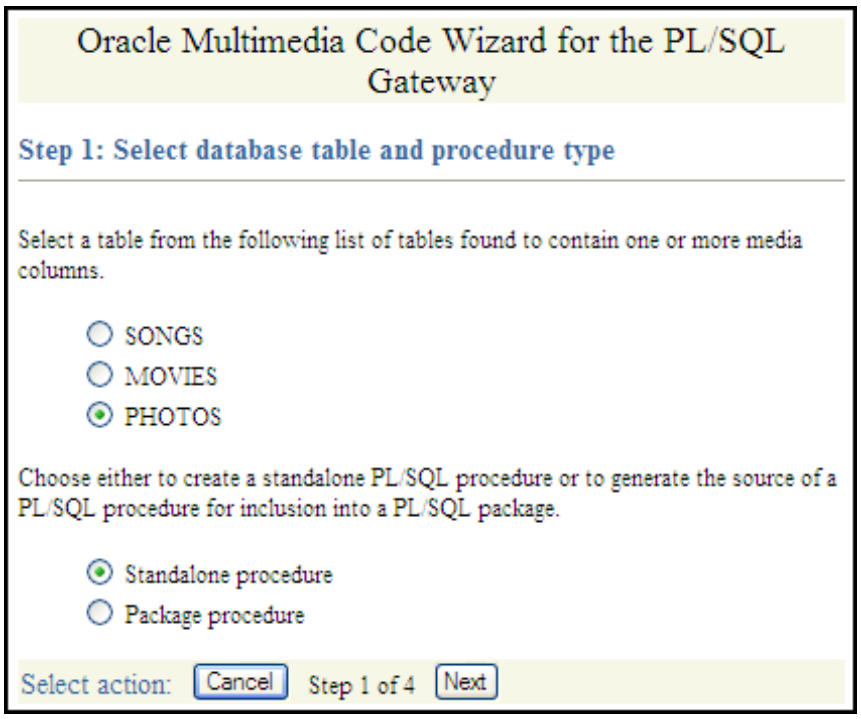
1. Select **Create media retrieval procedure** from the **Main menu** page, as shown in Figure 4-13 (page 4-13). Then, click **Next**.

Figure 4-13 Create a Media Retrieval Procedure



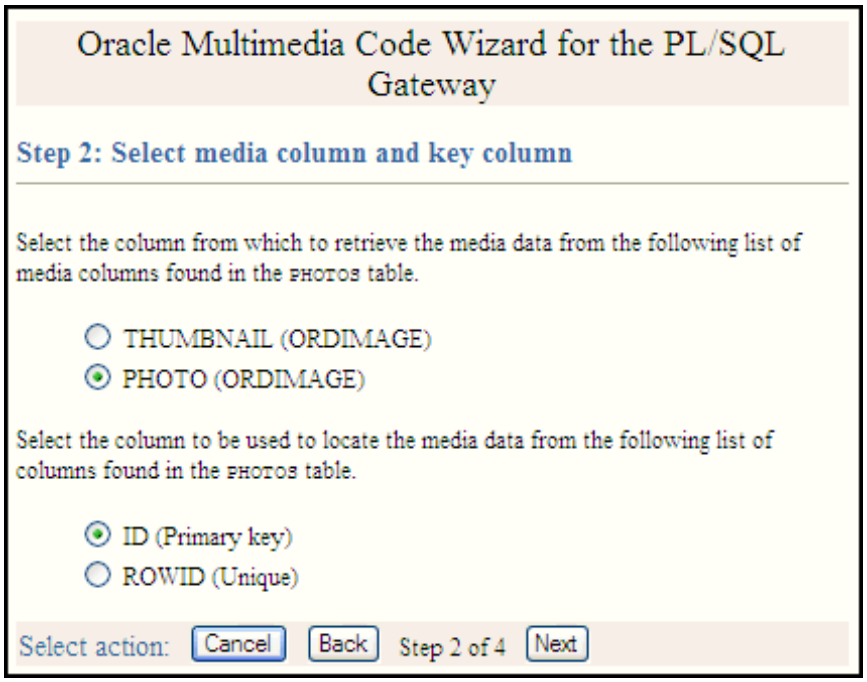
2. Select **PHOTOS** and **Standalone procedure** from **Step 1: Select database table and procedure type**, as shown in Figure 4-14 (page 4-14). Then, click **Next**.

Figure 4-14 Media Retrieval Step 1: Select Database Table and Procedure Type



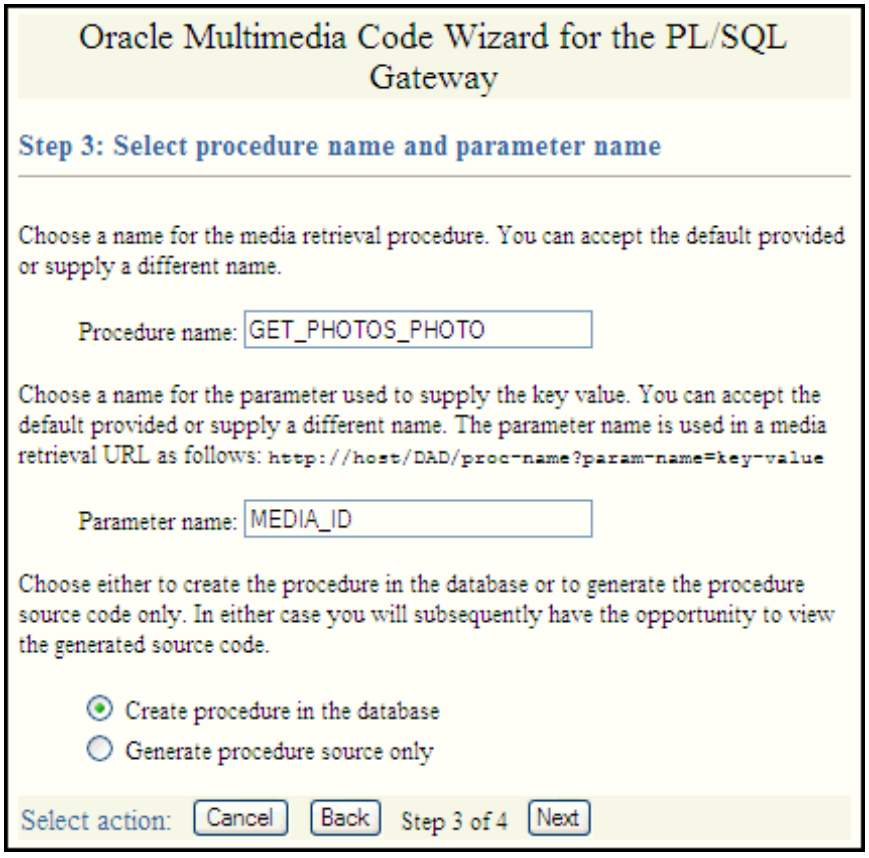
3. Select **PHOTO (ORDIMAGE)** and **ID (Primary key)** from **Step 2: Select media column and key column**, as shown in Figure 4-15 (page 4-14). Then, click **Next**.

Figure 4-15 Media Retrieval Step 2: Select Media Column and Key Column



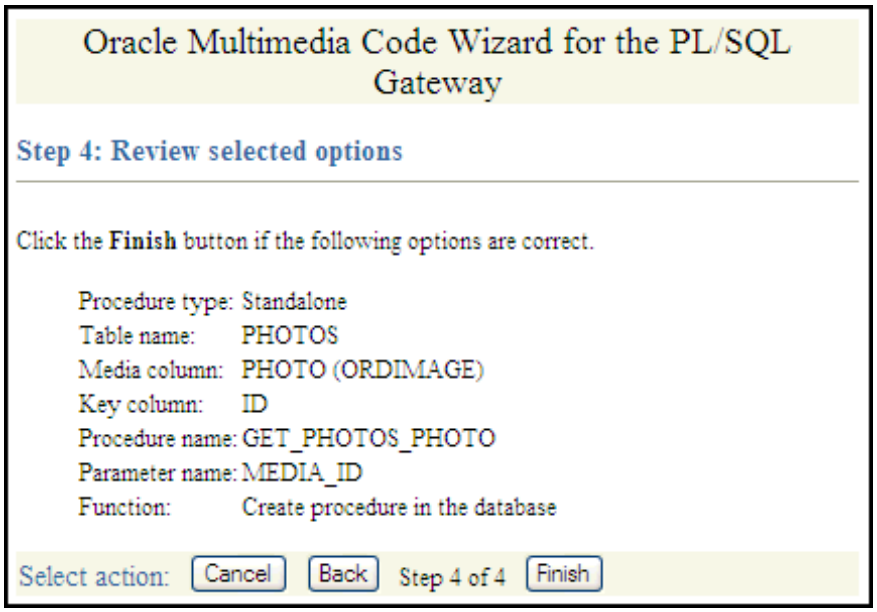
4. Accept the default procedure name, `GET_PHOTOS_PHOTO`, the default parameter name, `MEDIA_ID`, and **Create procedure in the database** from **Step 3: Select procedure name and parameter name**, as shown in Figure 4-16 (page 4-15). Then, click **Next**.

Figure 4-16 Media Retrieval Step 3: Select Procedure Name and Parameter Name



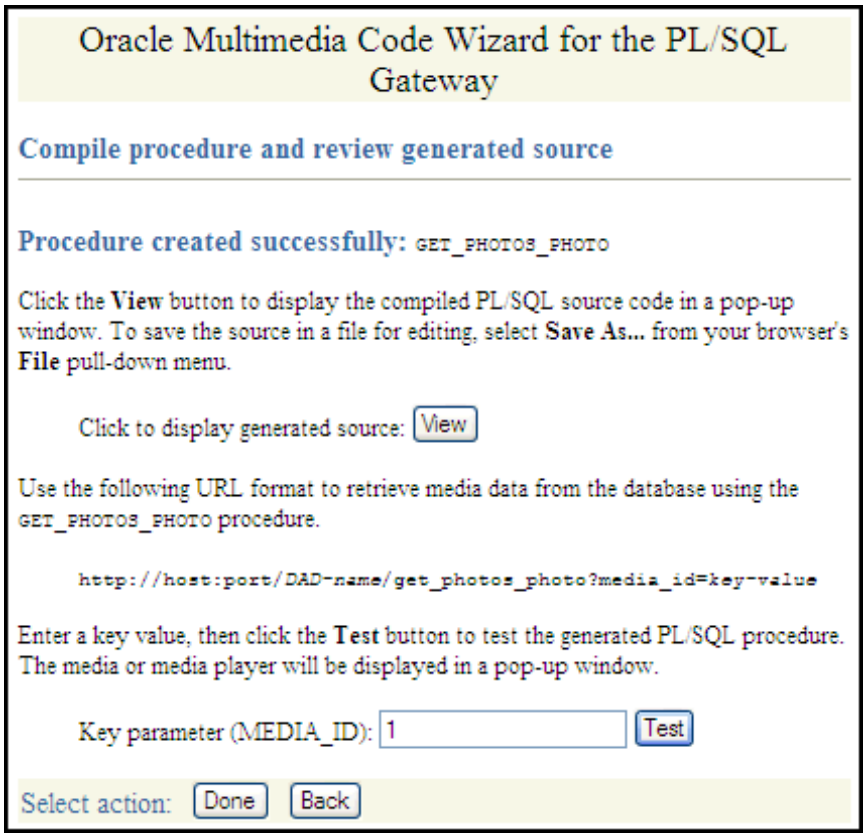
5. Review the options you selected from **Step 4: Review Selected Options**, as shown in Figure 4-17 (page 4-15). If the options selected are correct, click **Finish**.

Figure 4-17 Media Retrieval Step 4: Review Selected Options



6. The message `Procedure created successfully: GET_PHOTOS_PHOTO` is displayed in the **Compile procedure and review generated source** page, as shown in Figure 4-18 (page 4-16).

Figure 4-18 Compiled Retrieval Procedure with Success Message



To review the compiled PL/SQL source code in another window, click **View** (see Sample Session 1: Using Images (page 4-18) for a copy of the generated retrieval procedure).

To test the PL/SQL procedure created, assuming you have an image loaded in the database with an ID value of `1`, enter the value `1` for the Key parameter (`MEDIA_ID`), then click **Test**.

The image is retrieved from the table row and displayed in another window.

7. Click **Done** to return to the **Main menu** page.

4.2.6 Using the PL/SQL Gateway Document Table

All files uploaded using the PL/SQL Gateway are stored in a document table. Media upload procedures created by the Code Wizard automatically move uploaded media from the specified document table to the application's table. To avoid transient files from appearing temporarily in a document table used by another application component, use a document table that is not being used to store documents permanently.

Specify the selected document table in the application's database access descriptor (DAD). If the DAD specifies a different document table, create a new DAD for media upload procedures. If you choose to create a new document table, the Code Wizard creates a table with the following format:

```
CREATE TABLE document-table-name
  ( name           VARCHAR2(256) UNIQUE NOT NULL,
    mime_type      VARCHAR2(128),
    doc_size       NUMBER,
    dad_charset    VARCHAR2(128),
    last_updated   DATE,
    content_type   VARCHAR2(128),
    blob_content   BLOB )
--
-- store BLOBs as SecureFiles LOBs
--
LOB(blob_content)  STORE AS SECUREFILE;
```

See Also:

Oracle Database Development Guide for more information about file upload and document tables

4.2.7 How Time Zone Information Is Used to Support Browser Caching

User response times are improved and network traffic is reduced if a browser can cache resources received from a Web server and subsequently use those cached resources to satisfy future requests. This section describes at a very high level, how the browser caching mechanism works and how the Code Wizard utility package is used to support that mechanism. When reading this discussion, keep in mind that all HTTP date and time stamps are expressed in Coordinated Universal Time (UTC).

All HTTP responses include a Date header, which indicates the date and time when the response was generated. When a Web server sends a resource in response to a request from a browser, it can also include the Last-Modified HTTP response header, which indicates the date and time when the requested resource was last modified. The Last-Modified header must not be *later* than the Date header.

After receiving and caching a resource, if a browser must retrieve the same resource again, it sends a request to the Web server with the If-Modified-Since request header specified as the value of the Last-Modified date, which was returned by the application server when the resource was previously retrieved and cached. When the Web server receives the request, it compares the date in the If-Modified-Since request header with the last update time of the resource. Assuming the resource still exists, if the resource has not changed since it was cached by the browser, the Web server responds with an HTTP `304 Not Modified` status with no response body, which indicates that the browser can use the resource currently stored in its cache. Assuming again that the resource still exists, if the request does not include an If-Modified-Since header or if the resource has been updated since it was cached by the browser, the Web server responds with an HTTP `200 OK` status and sends the resource to the browser.

The ORDImage, ORDAudio, ORDVideo, and ORDDoc objects all possess an updateTime attribute stored as a DATE in the embedded ORDSource object. Although the DATE data type has no support for time zones or daylight savings time, Oracle Database does support time zones and also provides functions for converting a DATE value stored in a database to UTC.

When a response is first returned to a browser, a media retrieval procedure sets the Last-Modified HTTP response header based on the updateTime attribute. If a request for media data includes an If-Modified-Since header, the media retrieval procedure compares the value with the updateTime attribute and returns an appropriate

response. If the resource in the browser's cache is still valid, an HTTP `304 Not Modified` status is returned with no response body. If the resource has been updated since it was cached by the browser, then an HTTP `200 OK` status is returned with the media resource as the response body.Media retrieval procedures created by the Code Wizard call the utility package to convert a DATE value stored in the database to UTC. The utility package uses the time zone information stored with Oracle Database and the date and time functions to convert database date and time stamps to UTC. To ensure that the resulting date conforms to the rule for the Last-Modified date described previously, the time zone information must be specified correctly.

See Also:

- `http://www.w3.org/Protocols/` for more information about the HTTP specification
- *Oracle Database Administrator's Guide* for more information about how to set a time zone for a database
- *Oracle Database SQL Language Reference* for more information about date and time functions

4.3 Sample Session: Using Images

The following sample session uses the `SCOTT` schema to demonstrate the creation of image media upload and retrieval procedures. To use a different schema, substitute a different schema name and password. Or, if you have changed the password for the `SCOTT` schema, use your new password.

See Also:

Oracle Database Security Guide for more information about creating secure passwords

Perform these steps:

Step 1. Create a table to store images for the application after connecting to a schema with privileges to create a table.
For example:

```
SQL> CREATE TABLE cw_images_table( id NUMBER PRIMARY KEY,
                                   description VARCHAR2(30) NOT NULL,
                                   location VARCHAR2(30),
                                   image ORDSYS.ORDIMAGE )
--
-- store media as SecureFiles LOBs
--
LOB(image.source.localdata)  STORE AS SECUREFILE;
```

Step 2. Create the `SCOTTCW` DAD to be used to create the procedures.

1. Set your Web browser to the Oracle HTTP Server Home page. Select **PL/SQL Properties** in the Administration page to open the mod_plsql Services page.

2. On the mod_plsql Services page, scroll to the DAD Status section. Then, click **Create** to open the DAD Type page.
3. Select the DAD type to be **General**. Then, click **Next** to open the Database Connection page.
4. Enter `/scottcw` in the DAD Name field. Enter `SCOTT` for the database account, and leave the password blank. Enter the connection information in the Database Connectivity Information section. Enter `ORDCWPKG.MENU` in the Default page field, and leave the other fields blank. Then, click **Next** to open the Document, Alias, and Session page.
5. On the Document, Alias, and Session page, enter `MEDIA_UPLOAD_TABLE` for the Document Table. Then, click **Apply.**
6. Restart Oracle HTTP Server for the changes to take effect.

Step 3. Authorize the use of the `SCOTTCW` DAD and `SCOTT` schema with the Code Wizard.

1. Enter the Code Wizard's administration URL into your browser's location bar, then enter the `ORDSYS` user name and password when prompted by the browser, for example:

   `http://<hostname>:<port-number>/ordcwadmin`

2. Select the DAD authorization function from the Code Wizard's **Main menu** and click **Next**. Enter the name of the demonstration DAD, `SCOTTCW`, and the user name `SCOTT`, then click **Apply**. Click **Done** when the confirmation window is displayed.

Step 4. Change DADs to the `SCOTTCW` DAD.

1. Click **Change DAD** from the Code Wizard's **Main menu**.
2. Click Change to SCOTTCW, if it is not already selected, then click **Next**.
3. Enter the user name `SCOTT` and the password for the user SCOTT when prompted for the user name and password, then click **OK**.

   The **Main menu** now displays the current DAD as `SCOTTCW` and the current schema as `SCOTT`.

Step 5. Create and test the media upload procedure.
Click **Create media upload procedure** from the **Main menu**, then click **Next**.

1. Select the database table and procedure type.
   a. Click the **CW_IMAGES_TABLE** database table.
   b. Click **Standalone procedure**.
   c. Click **Next**.
2. Select the PL/SQL document upload table.

   If there are no document tables in the `SCOTT` schema, the Code Wizard displays a message indicating this situation. In this case, accept the default table name provided, `CW_SAMPLE_UPLOAD_TABLE`, then click **Next**.

If there are existing document tables, but the CW_SAMPLE_UPLOAD_TABLE is not among them, click **Create new document table**, accept the default table name provided, CW_SAMPLE_UPLOAD_TABLE, then click **Next**.

If the CW_SAMPLE_UPLOAD_TABLE document table already exists, ensure that the **Use existing document table** and the **CW_SAMPLE_UPLOAD_TABLE** options are selected. Click **Next**.

3. Select the data access and media columns.

   a. Click **IMAGE (ORDIMAGE)**.

   b. Click **ID (Primary key)**.

   c. Click **Conditional insert or update**.

   d. Click **Next**.

4. Select additional columns and procedure names.

   a. Ensure that **DESCRIPTION** checkmarked because this column has a NOT NULL constraint. (The **LOCATION** column is not checkmarked by default as there are no constraints on this column.)

   b. Accept the procedure name provided, UPLOAD_CW_IMAGES_TABLE_IMAGE.

   c. Click **Create procedure in the database**.

   d. Click **Next**.

5. Review the following selected procedure creation options that are displayed:

```
Procedure type:        Standalone
Table name:            CW_IMAGES_TABLE
Media column(s):       IMAGE (ORDIMAGE)
Key column:            ID
Additional column(s):  DESCRIPTION
Table access mode:     Conditional update or insert
Procedure name:        UPLOAD_CW_IMAGES_TABLE_IMAGE
Function:              Create procedure in the database
```

   Click **Finish**.

6. Compile the procedure and review the generated source information.

   The Code Wizard displays this message:

```
Procedure created successfully: UPLOAD_CW_IMAGES_TABLE_IMAGE
```

   a. At the option **Click to display generated source:**, click **View** to view the generated source in another window. A copy of the generated source is shown at the end of Step 5, substep 6g.

   b. Close the window after looking at the generated source.

   c. Accept the **DAD:** name provided, SCOTTCW, then click **Test** to produce another window that displays a template file upload form that you can use to test the generated procedure.

d. To customize the template file upload form, select **Save As...** from your browser's **File** menu to save the HTML source for editing.

e. To test the template upload form, enter this information:

- For the **ID:** column, enter the number `1` as the row's primary key.
- For the **IMAGE** column, click **Browse...** and choose an image file to upload to the database.
- For the **DESCRIPTION** column, enter a brief description of the image.
- Click **Upload media**.

The Code Wizard displays a template completion window with the heading **Oracle Multimedia Code Wizard: Template Upload Procedure**, and, if the procedure is successful, the message: `Media uploaded successfully`.

f. Close the window.

g. Click **Done** on the **Compile procedure and review generated source** window to return to the **Main menu** of the Code Wizard.

A copy of the generated image upload procedure follows:

```
CREATE OR REPLACE PROCEDURE UPLOAD_CW_IMAGES_TABLE_IMAGE
  ( in_ID IN VARCHAR2,
    in_IMAGE IN VARCHAR2 DEFAULT NULL,
    in_DESCRIPTION IN VARCHAR2 DEFAULT NULL )
AS
  local_IMAGE ORDSYS.ORDIMAGE := ORDSYS.ORDIMAGE.init();
  local_ID CW_IMAGES_TABLE.ID%TYPE := NULL;
  upload_size     INTEGER;
  upload_mimetype VARCHAR2( 128 );
  upload_blob     BLOB;
BEGIN
  --
  -- Update the existing row.
  --
  UPDATE CW_IMAGES_TABLE mtbl
    SET mtbl.IMAGE = local_IMAGE,
        mtbl.DESCRIPTION = in_DESCRIPTION
    WHERE mtbl.ID = in_ID
    RETURN mtbl.ID INTO local_ID;
  --
  -- Conditionally insert a new row if no existing row is updated.
  --
  IF local_ID IS NULL
  THEN
    --
    -- Insert the new row into the table.
    --
    INSERT INTO CW_IMAGES_TABLE ( ID, IMAGE, DESCRIPTION )
      VALUES ( in_ID, local_IMAGE, in_DESCRIPTION );
  END IF;
  --
  -- Select Oracle Multimedia object(s) for update.
  --
  SELECT mtbl.IMAGE INTO local_IMAGE
    FROM CW_IMAGES_TABLE mtbl WHERE mtbl.ID = in_ID FOR UPDATE;
```

```
  --
  -- Store media data for the column in_IMAGE.
  --
  IF in_IMAGE IS NOT NULL
  THEN
    SELECT dtbl.doc_size, dtbl.mime_type, dtbl.blob_content INTO
           upload_size, upload_mimetype, upload_blob
      FROM CW_IMAGE_UPLOAD_TABLE dtbl WHERE dtbl.name = in_IMAGE;
    IF upload_size &gt; 0
    THEN
      dbms_lob.copy( local_IMAGE.source.localData,
                     upload_blob,
                     upload_size );
      local_IMAGE.setLocal();
      BEGIN
        local_IMAGE.setProperties();
      EXCEPTION
        WHEN OTHERS THEN
          local_IMAGE.contentLength := upload_size;
          local_IMAGE.mimeType := upload_mimetype;
      END;
    END IF;
    DELETE FROM CW_IMAGE_UPLOAD_TABLE dtbl WHERE dtbl.name = in_IMAGE;
  END IF;
  --
  -- Update Oracle Multimedia objects in the table.
  --
  UPDATE CW_IMAGES_TABLE mtbl
    SET mtbl.IMAGE = local_IMAGE
    WHERE mtbl.ID = in_ID;
  --
  -- Display the template completion message.
  --
  htp.print( '&lt;html&gt;' );
  htp.print( '&lt;title&gt;Oracle Multimedia Code Wizard: Template Upload
Procedure&lt;/title&gt;' );
  htp.print( '&lt;body&gt;' );
  htp.print( '&lt;h2&gt; Oracle Multimedia Code Wizard:
Template Upload Procedure&lt;/h2&gt;' );
  htp.print( 'Media uploaded successfully.' );
  htp.print( '&lt;/body&gt;' );
  htp.print( '&lt;/html&gt;' );
END UPLOAD_CW_IMAGES_TABLE_IMAGE;
```

The previous image upload procedure declares these input parameters and variables:

a. In the declaration section, the procedure declares three input parameters: `in_ID`, `in_IMAGE`, and `in_DESCRIPTION`, then initializes the latter two to `NULL`.

b. In the subprogram section, the following variables are declared:

- The variable `local_IMAGE` is assigned the data type ORDSYS.ORDIMAGE and initialized with an empty BLOB using the ORDIMAGE.init( ) method.

- The variable `local_ID` takes the same data type as the `ID` column in the table `CW_IMAGES_TABLE` and is initialized to `NULL`.
- Three additional variables are declared `upload_size`, `upload_mimetype`, and `upload_blob`, which are later given values from comparable column names `doc_size`, `mime_type`, and `blob_content` from the document table `CW_IMAGE_UPLOAD_TABLE`, using a SELECT statement in preparation for copying the content of the image BLOB data to the ORDSYS.ORDIMAGE.source.localData attribute.

Within the outer BEGIN...END executable statement section, the following operations are executed:

a. Update the existing row in the table `CW_IMAGES_TABLE` for the `IMAGE` and `DESCRIPTION` columns and return the value of `local_ID` where the value of the `ID` column is the value of the `in_ID` input parameter.

b. If the value returned of `local_ID` is `NULL`, conditionally insert a new row into the table `CW_IMAGES_TABLE` and initialize the instance of the ORDImage object type in the `image` column with an empty BLOB.

c. Select the ORDImage object column `IMAGE` in the table `CW_IMAGES_TABLE` for update where the value of the `ID` column is the value of the `in_ID` input parameter.

d. Select a row for the `doc_size`, `mime_type`, and `blob_content` columns from the document table and pass the values to the `upload_size`, `upload_mimetype`, and `upload_blob` variables where the value of the document table `Name` column is the value of the `in_IMAGE` input parameter.

e. Perform a DBMS_LOB copy of the BLOB data from the table `CW_IMAGE_UPLOAD_TABLE` into the ORDSYS.ORDIMAGE.source.localData attribute, then call the setLocal( ) method to indicate that the image data is stored locally in the BLOB, and ORDImage methods are to look for corresponding data in the source.localData attribute.

f. In the inner executable block, call the ORDImage setProperties( ) method to read the image data to get the values of the object attributes and store them in the image object attributes for the ORDImage object.

g. If the setProperties( ) call fails, catch the exception and call the contentLength( ) method to get the size of the image and call the mimeType( ) method to get the MIME type of the image.

h. Delete the row of data from the document table `CW_IMAGE_UPLOAD_TABLE` that was copied to the row in the table `CW_IMAGES_TABLE` where the value of the `Name` column is the value of the `in_IMAGE` input parameter.

i. Update the ORDImage object `IMAGE` column in the table `CW_IMAGES_TABLE` with the content of the variable `local_IMAGE` where the value of the `ID` column is the value of the `in_ID` input parameter.

j. Display a completion message on the HTML page to indicate that the media uploaded successfully using the `htp.print` function from the PL/SQL Web Toolkit.

Step 6. Create and test a media retrieval.
Select **Create media retrieval procedure** from the **Main menu**, then click **Next**.

1. Select the database table and procedure type.
   a. Click **CW_IMAGES_TABLE**.
   b. Click **Standalone procedure**.
   c. Click **Next**.
2. Select the media column and key column.
   a. Click **IMAGE (ORDIMAGE)**.
   b. Click **ID (Primary key)**.
   c. Click **Next**.
3. Select the procedure name and parameter name.
   a. Accept the procedure name provided, `GET_CW_IMAGES_TABLE_IMAGE`.
   b. Accept the parameter name provided, `MEDIA_ID`.
   c. Click **Create procedure in the database**.
   d. Click **Next**.
4. Review the following selected procedure creation options:
5. ```
   Procedure type:       Standalone
   Table name:           CW_IMAGES_TABLE
   Media column(s):      IMAGE (ORDIMAGE)
   Key column:           ID
   Procedure name:       GET_CW_IMAGES_TABLE_IMAGE
   Parameter Name:       MEDIA_ID
   Function:             Create procedure in the database
   ```

   Click **Next**.
6. Compile the procedure and review the generated source.

   The Code Wizard displays this message:

   ```
   Procedure created successfully: GET_CW_IMAGES_TABLE_IMAGE
   ```

   a. Click **View** to view the generated source in another window. Close the window after looking at the generated source. A copy of the generated source is shown at the end of Step 6, substep 5e.
   b. Review the URL format used to retrieve images using the `GET_CW_IMAGES_TABLE_IMAGE` procedure.
   c. Enter the number `1` as the Key parameter, then click **Test** to test the procedure by retrieving the image uploaded previously.

      The retrieved image is displayed in another window.
   d. Close the window.
   e. Click **Done** to return to the **Main menu**.

   A copy of the generated image retrieval procedure follows:
   ```

```
CREATE OR REPLACE PROCEDURE GET_CW_IMAGES_TABLE_IMAGE (
 MEDIA_ID IN VARCHAR2 )
AS
  localObject ORDSYS.ORDIMAGE;
  localBlob  BLOB;
  localBfile BFILE;
  httpStatus NUMBER;
  lastModDate VARCHAR2(256);
BEGIN
  --
  -- Retrieve the object from the database into a local object.
  --
  BEGIN
    SELECT mtbl.IMAGE INTO localObject FROM CW_IMAGES_TABLE mtbl
      WHERE mtbl.ID = MEDIA_ID;
  EXCEPTION
    WHEN NO_DATA_FOUND THEN
      ordplsgwyutil.resource_not_found( 'MEDIA_ID', MEDIA_ID );
      RETURN;
  END;

  --
  -- Check the update time if the browser sent an If-Modified-Since header.
  --
  IF ordplsgwyutil.cache_is_valid( localObject.getUpdateTime() )
  THEN
    owa_util.status_line( ordplsgwyutil.http_status_not_modified );
    RETURN;
  END IF;

  --
  -- Figure out where the image is.
  --
  IF localObject.isLocal() THEN
    --
    -- Data is stored locally in the localData BLOB attribute.
    --
    localBlob := localObject.getContent();
    owa_util.mime_header( localObject.getMimeType(), FALSE );
    ordplsgwyutil.set_last_modified( localObject.getUpdateTime() );
    owa_util.http_header_close();
    IF owa_util.get_cgi_env( 'REQUEST_METHOD' ) &lt;&gt; 'HEAD' THEN
      wpg_docload.download_file( localBlob );
    END IF;
  ELSIF UPPER( localObject.getSourceType() ) = 'FILE' THEN

    --
    -- Data is stored as a file from which ORDSource creates
    -- a BFILE.
    --
    localBfile  := localObject.getBFILE();
    owa_util.mime_header( localObject.getMimeType(), FALSE );
    ordplsgwyutil.set_last_modified( localObject.getUpdateTime() );
    owa_util.http_header_close();
    IF owa_util.get_cgi_env( 'REQUEST_METHOD' ) &lt;&gt; 'HEAD' THEN
      wpg_docload.download_file( localBfile );
    END IF;

  ELSIF UPPER( localObject.getSourceType() ) = 'HTTP' THEN    --
```

```
    -- The image is referenced as an HTTP entity, so we have to
    -- redirect the client to the URL that ORDSource provides.
    --
    owa_util.redirect_url( localObject.getSource() );
  ELSE
    --
    -- The image is stored in an application-specific data
    -- source type for which no default action is available.
    --
    NULL;
  END IF;
END GET_CW_IMAGES_TABLE_IMAGE;
```

The image retrieval procedure shown previously declares these input parameters and variables:

a. In the declaration section, the procedure declares one input parameter: `MEDIA_ID`.

b. In the subprogram section, the following variables are declared:

- The variable `localObject` is assigned the data type ORDSYS.ORDIMAGE.
- The variable `localBlob` is a BLOB data type, the variable `localBfile` is a BFILE data type, `httpStatus` is a NUMBER, and `lastModDate` is a VARCHAR2 with a maximum size of 256 characters.

Within the outer BEGIN...END executable statement section, the following operations are executed:

a. Select the ORDImage object column `IMAGE` in the table `CW_IMAGES_TABLE` where the value of the `ID` column is the value of the `MEDIA_ID` input parameter.

b. In the inner executable block, when no data is found, raise an exception and call the `resource_not_found` function of the PL/SQL Gateway and get the value of the `MEDIA_ID` input parameter.

c. Check the update time if the browser sent an If-Modified-Since header by calling the getUpdateTime( ) method passed into the `cache_is_valid` function of the PL/SQL Gateway.

d. If the cache is valid, send an HTTP status code to the client using the PL/SQL Web Toolkit `owa_util` package `status_line` procedure passing in the call to the `http_status_not_modified` function.

e. Determine where the image data is stored; call the ORDImage isLocal( ) method, which returns a Boolean expression of true if the image data is stored locally in the BLOB, then get the handle to the local BLOB.

- If the value is true, assign the variable `localBlob` the ORDImage getContent( ) method to get the handle of the local BLOB containing the image data.

- Call the ORDImage getMimeType( ) method to determine the image's MIME type and pass this to the `owa_util.mime_header` procedure and keep the HTTP header open.
- Call the ORDImage getUpdateTime( ) method to get the time the image was last modified and pass this to the `ordplsgwyutil.set_last_modified` procedure.
- Close the HTTP header by calling the `owa_util.http_header_close( )` procedure.
- Call the `owa_util.get_cgi_env` procedure and if the value of the request method is not `HEAD`, then use the `wpg_docload.download_file` procedure to pass in the value of `localBlob` that contains the LOB locator of the BLOB containing the image data to download the image from the database.

f. If the ORDImage isLocal( ) method returns false, call the ORDImage getSourceType( ) method to determine if the value is `FILE`; if so, then the image data is stored as an external file on the local file system. Then, get the LOB locator of the BFILE containing the image data.

- Assign the variable `localBfile` the ORDImage getBfile( ) method to get the LOB locator of the BFILE containing the image data.
- Call the ORDImage getMimeType( ) method to determine the image's MIME type and pass this to the `owa_util.mime_header` procedure and keep the HTTP header open.
- Call the ORDImage getUpdateTime( ) method to get the time the image was last modified and pass this to the `ordplsgwyutil.set_last_modified` procedure.
- Close the HTTP header by calling the `owa_util.http_header_close()` procedure.
- Call the `owa_util.get_cgi_env` procedure and if the value of the request method is not `HEAD`, then use the `wpg_docload.download_file` procedure to pass in the value of `localBfile` that contains the LOB locator of the BFILE containing the image data to download the image from the file.

g. If the ORDImage isLocal( ) method returns false, call the ORDImage getSourceType( ) method to determine if the value is `HTTP`; if so, then the image data is stored at an HTTP URL location, which then redirects the client to the URL that ORDSource provides using the `owa_util.redirect_url` procedure.

h. If the ORDImage isLocal( ) method returns false, call the ORDImage getSourceType( ) method to determine if the value is `FILE` or `HTTP`; if it is neither, then the image is stored in an application-specific data source type that is not recognized or supported by Oracle Multimedia.

4.4 Known Restrictions of the Oracle Multimedia Code Wizard

The following restrictions are known for the Oracle Multimedia Code Wizard:

- Tables with composite primary keys are not supported.

To use a table with a composite primary key, create an upload or download procedure, then edit the generated source to support all the primary key columns. For example, for a media retrieval procedure, this might involve adding an additional parameter, then specifying that parameter in the `where` clause of the SELECT statement.

- User object types containing embedded Oracle Multimedia object types are not recognized by the Oracle Multimedia Code Wizard.

5

Working with Metadata in Oracle Multimedia Images

Image files can contain information about the content of the images, the image rasters, and image metadata.

In general, data about data is referred to as metadata. In this case, metadata refers to additional information about the actual images, which is stored in the image files along with the images.

This chapter includes these sections:

5.1 Metadata Concepts

Several types of metadata can be stored in an image file, and each type can serve a different purpose. One type, technical metadata, is used to describe an image in a technical sense. For example, technical metadata can include attributes about an image, such as its height and width, in pixels, or the type of compression used to store it. Another type, content metadata, can further describe the content of an image, the name of the photographer, and the date and time when a photograph was taken.

Metadata is stored in image files using a variety of mechanisms. Digital cameras and scanners automatically insert metadata into the images they create. Digital photograph processing applications like Adobe Photoshop enable users to add or edit metadata to be stored with the image. Annotating digital images with additional metadata is a common practice in photographic and news gathering applications, for image archiving usages, and at the consumer level.

Storing metadata with image data in the same containing file provides encapsulation. With encapsulation, both types of data can be shared and exchanged reliably as one unit. Metadata that is stored in the image file format is referred to as embedded metadata.

5.2 Oracle Multimedia Image Metadata Concepts

For a number of image file formats, Oracle Multimedia can extract and manage a limited set of metadata attributes. These attributes include: height, width, contentLength, fileFormat, contentFormat, compressionFormat, and mimeType. For a limited number of image file formats, Oracle Multimedia can extract a rich set of metadata attributes. This metadata is represented in schema-based XML documents. These XML documents can be stored in a database, indexed, searched, updated, and made available to applications using the standard mechanisms of Oracle Database.

Oracle Multimedia can also write or embed metadata supplied by users into a limited number of image file formats. The application provides the metadata as a schema-based XML document. Oracle Multimedia processes the XML document and writes the metadata into the image file.

5.3 Image File Formats

Oracle Multimedia supports metadata extraction and metadata embedding for the GIF, TIFF, and JPEG file formats.

See Also:

Oracle Multimedia Reference for information about the image file formats supported by Oracle Multimedia

5.4 Image Metadata Formats

The term image metadata format refers to the standard protocols and techniques used to store image metadata within an image file. The following subsections describe the embedded image metadata formats supported by Oracle Multimedia:

- EXIF (page 5-2)
- IPTC–IIM (page 5-2)
- XMP (page 5-3)

5.4.1 EXIF

The Exchangeable Image File Format (EXIF) is the standard for image file storage for digital still cameras. It was developed by the Japan Electronic Industry Development Association (JEIDA) as a standard way of storing images created by digital cameras and metadata about the images. EXIF image metadata can be stored in TIFF and JPEG format images. Oracle Multimedia supports the extraction of EXIF metadata from TIFF and JPEG file formats.

5.4.2 IPTC–IIM

The International Press Telecommunications Council-Information Interchange Model (IPTC-IIM) Version 4 is a standard developed jointly by the International Press Telecommunications Council and the Newspaper Association of America. This metadata standard is designed to capture information that is important to the activities of news gathering, reporting, and publishing. These information records are commonly referred to as IPTC tags.

The use of embedded IPTC tags in image file formats became widespread with the use of the Adobe Photoshop tool for image editing. IPTC metadata can be stored in TIFF and JPEG format images. Oracle Multimedia supports the extraction of IPTC metadata from TIFF and JPEG file formats.

5.4.3 XMP

The Extensible Metadata Platform (XMP) is a standard metadata format, developed by Adobe, for the creation, processing, and interchange of metadata in a variety of applications. XMP uses Resource Description Framework (RDF) technology for data modeling. XMP also defines how the data model is serialized (converted to a byte stream), and embedded within an image file. Oracle Multimedia supports the extraction of XMP metadata from GIF, TIFF, and JPEG file formats. Oracle Multimedia also supports writing XMP data packets into GIF, TIFF, and JPEG file formats.

See Also:

- `http://www.adobe.com/` for more information about the Extensible Metadata Platform
- `http://www.w3.org/RDF/` for more information about Resource Description Framework technology

5.5 Representing Metadata Outside Images

After metadata has been extracted from the binary image file, the next step is to represent the metadata in a form that can be easily stored, indexed, queried, updated, and presented. Oracle Multimedia returns image metadata in XML documents. These documents are based on XML schemas that Oracle Multimedia registers with the database. Each type of image metadata has a separate XML schema. These XML schemas are used by the metadata procedures and methods of the ORD_IMAGE PL/SQL package and the ORDImage object type, respectively.

The XML documents can be stored in XMLType columns within the database. These documents are easily searched and processed using the wide range of standards-based XML technologies provided by Oracle XML DB.

See Also:

- *Oracle Multimedia Reference* for complete definitions of the XML schemas supported by Oracle Multimedia
- *Oracle XML DB Developer's Guide* for more information about the XML technologies provided by Oracle XML DB

5.6 Oracle Multimedia Image Metadata Examples

The following examples of metadata extraction and embedding use the `photos` table, which is defined by the Photo Album sample application. The implementation of the Photo Album sample application is defined in the PL/SQL package `PHOTO_ALBUM`. See Oracle Multimedia PL/SQL Photo Album Sample Application (page 3-1) for a complete description of the Oracle Multimedia PL/SQL Web Toolkit Photo Album sample application.

The photos table stores two instances of an image: the full-size photograph and a thumbnail image. This table can also store up to four different image metadata documents. These documents are stored in the columns named metaORDImage, metaEXIF, metaIPTC, and metaXMP, and represent image metadata from the ORDImage, EXIF, IPTC, and XMP metadata formats, respectively. The metadata columns are of type XMLType, and they are bound to the corresponding metadata XML schemas that Oracle Multimedia provides.

The following subsections describe some operations you can perform with image metadata using the ORDImage object type:

- Creating a Table for Metadata Storage (page 5-4)
- Extracting Image Metadata (page 5-5)
- Embedding Image Metadata (page 5-6)

Note: These examples could have used BLOBs to store the image and thumbnail image, and the ORD_IMAGE PL/SQL package instead of ORDImage object methods.

5.6.1 Creating a Table for Metadata Storage

Before you can extract or embed metadata, you must create the table and columns where the metadata is to be stored. The following PL/SQL code segment creates the photos table with four XMLTYPE columns (metaORDImage, metaEXIF, metaIPTC, and metaXMP) to store each type of image metadata, and two ORDIMAGE columns (image and thumb) for the original image and the thumbnail image, respectively. Although this example shows the use of the ORDImage object type, the columns image and thumb could be of type BLOB rather than ORDImage.

Each metadata column is bound to its corresponding metadata schema. For example, the column metaEXIF is bound to the XML schema with namespace http://xmlns.oracle.com/ord/meta/exif, and is defined as the XML element exifMetadata.

The code statements where the image metadata columns are defined and bound to XML schemas are highlighted in bold.

```
--
-- Create the PHOTOS table
--
CREATE TABLE photos( id           NUMBER PRIMARY KEY,
                     description  VARCHAR2(40) NOT NULL,
                     metaORDImage XMLTYPE,
                     metaEXIF     XMLTYPE,
                     metaIPTC     XMLTYPE,
                     metaXMP      XMLTYPE,
                     image        ORDSYS.ORDIMAGE,
                     thumb        ORDSYS.ORDIMAGE )
--
-- store full-size images and thumbnail images as SecureFiles LOBs
--
LOB(image.source.localdata) STORE AS SECUREFILE
LOB(thumb.source.localdata) STORE AS SECUREFILE
-- and bind the XMLType columns to the Oracle Multimedia metadata schemas
XMLType COLUMN metaORDImage
  XMLSCHEMA "http://xmlns.oracle.com/ord/meta/ordimage"
```

```
  ELEMENT "ordImageAttributes"
XMLType COLUMN metaEXIF
  XMLSCHEMA "http://xmlns.oracle.com/ord/meta/exif"
  ELEMENT "exifMetadata"
XMLType COLUMN metaIPTC
  XMLSCHEMA "http://xmlns.oracle.com/ord/meta/iptc"
  ELEMENT "iptcMetadata"
XMLType COLUMN metaXMP
  XMLSCHEMA "http://xmlns.oracle.com/ord/meta/xmp"
  ELEMENT "xmpMetadata";
```

5.6.2 Extracting Image Metadata

The following PL/SQL procedure extracts metadata from an image and stores it in the specified columns in the `photos` table you created. This procedure demonstrates the getMetadata( ) method, which returns an array of XML documents. The root element of each document is examined to determine the metadata type. The UPDATE statement stores the documents in the corresponding columns in the `photos` table.

The code statement where the getMetadata( ) method is called is highlighted in bold.

```
--
-- fetch the metadata and sort the results
--
PROCEDURE extractMetadata(inID IN INTEGER)
IS
  img ORDSYS.ORDIMAGE;
  metav XMLSequenceType;
  meta_root VARCHAR2(40);
  xmlORD XMLType;
  xmlXMP XMLType;
  xmlEXIF XMLType;
  xmlIPTC XMLType;

BEGIN

-- select the image
SELECT image
INTO img
FROM PHOTOS
WHERE id = inID;

-- extract all the metadata
metav := img.getMetadata( 'ALL' );

-- process the result array to discover what types of metadata were
returned
FOR i IN 1..metav.count() LOOP
  meta_root := metav(i).getRootElement();
  CASE meta_root
    WHEN 'ordImageAttributes' THEN xmlORD := metav(i);
    WHEN 'xmpMetadata' THEN xmlXMP := metav(i);
    WHEN 'iptcMetadata' THEN xmlIPTC := metav(i);
    WHEN 'exifMetadata' THEN xmlEXIF := metav(i);
    ELSE NULL;
  END CASE;
END LOOP;

-- Update metadata columns
--
UPDATE photos
```

```
SET metaORDImage = xmlORD,
    metaEXIF = xmlEXIF,
    metaIPTC = xmlIPTC,
    metaXMP = xmlXMP
WHERE id = inID;

END extractMetadata;
```

5.6.3 Embedding Image Metadata

The following PL/SQL procedure demonstrates the putMetadata( ) method. This procedure accepts six arguments. The `entry_id` argument identifies the image in the `photos` table to be updated. The remaining arguments (`title`, `creator`, `date`, `description`, and `copyright`) are strings to be formatted into an XMP packet and embedded within the target image.

This example creates an XML document instance based on the Oracle Multimedia XML schema for XMP metadata. (This schema is preregistered with Oracle XML DB. See *Oracle XML DB Developer's Guide* for more information.) The schema for XMP metadata defines a single, global element `<xmpMetadata>`. The <xmpMetadata> element contains a single, well-formed RDF document. The RDF document contains a single `<RDF>` element, which is derived from the `rdf` namespace. This RDF document is constructed using elements defined by the Dublin Core schema.

The call to the putMetadata( ) method embeds the metadata document into the image file. The UPDATE statement stores the new image and the new metadata back in the `photos` table.

The code statement where the putMetadata( ) method is called is highlighted in bold.

```
--
-- write the metadata to the image
--
PROCEDURE write_metadata( entry_id IN VARCHAR2,
                          title IN VARCHAR2,
                          creator IN VARCHAR2,
                          date IN VARCHAR2,
                          description IN VARCHAR2,
                          copyright IN VARCHAR2 )
IS
  img ORDSYS.ORDImage;
  xmp XMLType;
  buf VARCHAR2(5000);
BEGIN
-- select the image
SELECT image
INTO img
FROM PHOTOS
WHERE id = entry_id FOR UPDATE;

-- Create the XMP packet it must be schema valid
-- to "http://xmlns.oracle.com/ord/meta/xmp"
-- and contain an <RDF> element. This example uses
-- the Dublin Core schema.

/* An example XML instance document

<xmpMetadata xmlns="http://xmlns.oracle.com/ord/meta/xmp"
              xsi:schemaLocation="http://xmlns.oracle.com/ord/meta/xmp
              http://xmlns.oracle.com/ord/meta/xmp"
              xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
```

```
  <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
    <rdf:Description about="" xmlns:dc="http://purl.org/dc/elements/1.1/">
      <dc:title>A Winter Day</dc:title>
      <dc:creator>Frosty S. Man</dc:creator>
      <dc:date>21-Dec-2004</dc:date>
      <dc:description>a sleigh ride</dc:description>
      <dc:copyright>North Pole Inc.</dc:copyright>
    </rdf:Description>
  </rdf:RDF>
</xmpMetadata>

*/

buf := '<xmpMetadata xmlns="http://xmlns.oracle.com/ord/meta/xmp"
         xsi:schemaLocation="http://xmlns.oracle.com/ord/meta/xmp
         http://xmlns.oracle.com/ord/meta/xmp"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" >
  <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
  <rdf:Description about="" xmlns:dc="http://purl.org/dc/elements/1.1/">';

IF title IS NOT NULL THEN
  buf := buf || '<dc:title>' || htf.escape_sc(title) || '</dc:title>';
END IF;

IF creator IS NOT NULL THEN
  buf := buf || '<dc:creator>' || htf.escape_sc(creator)
             || '</dc:creator>';
END IF;
IF date IS NOT NULL THEN
  buf := buf || '<dc:date>' || htf.escape_sc(date)
             || '</dc:date>';
END IF;
IF description IS NOT NULL THEN
  buf := buf || '<dc:description>' || htf.escape_sc(description)
             || '</dc:description>';
END IF;
IF copyright IS NOT NULL THEN
  buf := buf || '<dc:copyright>' || htf.escape_sc(copyright)
             || '</dc:copyright>';
END IF;

buf := buf || '
  </rdf:Description>
  </rdf:RDF>
  </xmpMetadata>';

-- create the XML document
xmp := XMLType.createXML(buf, 'http://xmlns.oracle.com/ord/meta/xmp');

-- write the metadata
img.putMetadata( xmp, 'XMP' );

-- update the image
UPDATE photos
SET image = img,
    metaXMP = xmp
WHERE id = entry_id;

END write_Metadata;
```

5.7 Metadata References

The following Web sites provide information about standards and technologies related to working with metadata in images.

- Dublin Core, a standard schema for Dublin core elements

  `http://dublincore.org/2003/03/24/dces`

- Extensible Metadata Platform (XMP)

  `http://www.adobe.com/`

- Resource Description Framework (See *RDF Primer*)

  `http://www.w3.org/RDF/`

6

Oracle Multimedia Tuning Tips for DBAs

This chapter provides information and advice for Oracle DBAs who want to achieve more efficient storage and management of multimedia data in the database when using Oracle Multimedia.

The goals of your Oracle Multimedia application determine the resource requirements and how to allocate those resources. Because application development and design decisions have the greatest effect on performance, standard tuning methods must be applied to the system planning, design, and development phases of the project to achieve optimal results for your Oracle Multimedia application in a production environment.

Multimedia data consists of a variety of media types including images, audio clips, video clips, line drawings, and so on. All these media types are typically stored in LOBs. LOBs can be either internal BLOBs (stored in an internal database tablespace) or BFILEs (external LOBs in operating system files outside of the database tablespaces). This chapter discusses the management of audio, image, and video data stored in BLOBs only.

This chapter includes these sections:

See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for more information about performance tuning when using LOBs in Oracle Database

6.1 Understanding the Performance Profile of Oracle Multimedia Operations

Multimedia data, and the operations that can be performed on that data, differs significantly from traditional types of data commonly stored in relational databases. A basic understanding of the performance profile of Oracle Multimedia operations can help you make better decisions when tuning your database for media performance.

The tables in this section summarize the general performance profiles for a set of commonly performed operations. There are two primary components to each profile. The I/O pattern is a general characterization of the primary type of I/O access and of how much of the media data the operation reads or writes. Because some operations involve two media objects, the I/O pattern is described for both the source and

destination media objects. The second component is a general characterization of the level of CPU usage for the operation.

Note:

The information in these tables describes general characterizations and I/O patterns, thus CPU usage may vary considerably for some media formats.

The following table shows the profile for loading and retrieving data, which applies to all Oracle Multimedia media types.

Table 6-1 Performance Profile For All Multimedia Types

Operation	I/O Pattern (Source)	I/O Pattern (Destination)	I/O Pattern (Amount)	CPU Usage
Load new media data into a database	N/A	Sequential write	All	Low
Retrieve media from a database	Sequential read	N/A	All	Low

The following table shows the profile for commonly used functions and procedures of the ORD_IMAGE PL/SQL package.

Table 6-2 Performance Profile for ORD_IMAGE PL/SQL Package Functions and Procedures

Package Procedure	I/O Pattern (Source)	I/O Pattern (Destination)	I/O Pattern (Amount)	CPU Usage
getProperties( )	Sequential read	N/A	Media header	Low to medium
getMetadata( )	Sequential read	N/A	Media header	Low to medium
putMetadata( )	Sequential read	Sequential write	All	Low to medium
process( )	Sequential read	Sequential write	All	High
processCopy( )	Sequential read	Sequential write	All	High
convert( )	Sequential read	Sequential write	All	High
crop( )	Sequential read	Sequential write	All	High
scale( )	Sequential read	Sequential write	All	High

Table 6-2 (Cont.) Performance Profile for ORD_IMAGE PL/SQL Package Functions and Procedures

Package Procedure	I/O Pattern (Source)	I/O Pattern (Destination)	I/O Pattern (Amount)	CPU Usage
thumbnail( )	Sequential read	Sequential write	All	High

The following table shows the profile for commonly used methods of the ORDImage type.

Table 6-3 Performance Profile For ORDImage Methods

Object Method	I/O Pattern (Source)	I/O Pattern (Destination)	I/O Pattern (Amount)	CPU Usage
setProperties( )	Sequential read	N/A	Media header	Low to medium
getMetadata( )	Sequential read	N/A	Media header	Low to medium
putMetadata( )	Sequential read	Sequential write	All	Low to medium
process( )	Sequential read	Sequential write	All	High
processCopy( )	Sequential read	Sequential write	All	High

The following table shows the profile for commonly used functions and procedures of the ORD_DICOM PL/SQL package.

Table 6-4 Performance Profile for ORD_DICOM PL/SQL Package Functions and Procedures

Package Procedure	I/O Pattern (Source)	I/O Pattern (Destination)	I/O Pattern (Amount)	CPU Usage
extractMetadata( )	Sequential read	N/A	Media header	Low to medium
writeMetadata( )	Sequential read	Sequential write	All	Low to medium
makeAnonymous( )	Sequential read	Sequential write	All	Low to medium
process( )	Sequential read	Sequential write	All	High
processCopy( )	Sequential read	Sequential write	All	High

The following table shows the profile for commonly used methods of the ORDDicom type.

Table 6-5 Performance Profile For ORDDicom Methods

Object Method	I/O Pattern (Source)	I/O Pattern (Destination)	I/O Pattern (Amount)	CPU Usage
setProperties( )	Sequential read	N/A	Media header	Low to medium
extractMetadata( )	Sequential read	N/A	Media header	Low to medium
writeMetadata( )	Sequential read	Sequential write	All	Low to medium
makeAnonymous( )	Sequential read	Sequential write	All	Low to medium
process( )	Sequential read	Sequential write	All	High
processCopy( )	Sequential read	Sequential write	All	High

The following table shows the profile for commonly used procedures of the ORD_AUDIO, ORD_DOC, and ORD_VIDEO PL/SQL packages.

Table 6-6 Performance Profile for ORD_AUDIO, ORD_DOC, and ORD_VIDEO PL/SQL Package Procedures

Package Procedure	I/O Pattern (Source)	I/O Pattern (Destination)	I/O Pattern (Amount)	CPU Usage
getProperties( )	Sequential read	N/A	Media header	Low

The following table shows the profile for commonly used methods of the ORDAudio, ORDDoc, and ORDVideo types.

Table 6-7 Performance Profile For ORDAudio, ORDDoc, and ORDVideo Methods

Object Method	I/O Pattern (Source)	I/O Pattern (Destination)	I/O Pattern (Amount)	CPU Usage
setProperties( )	Sequential read	N/A	Media header	Low
getProperties( )	Sequential read	N/A	Media header	Low

6.2 Choosing LOB Storage Parameters for Multimedia LOBs

The choices you make for specifying LOB storage attributes during table creation can significantly affect the performance of media load, retrieval, and processing operations. This section describes the most important options to consider and shows how the performance profile of Oracle Multimedia operations can affect the choice of LOB storage parameters.

The following subsections describe the LOB storage parameters and include examples of how to use them:

See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for detailed information about LOBs

6.2.1 SecureFiles LOBs

Oracle recommends using SecureFiles LOBs for storing media data whenever possible. SecureFiles LOBs are identified by specifying the SQL parameter SECUREFILE.

6.2.2 TABLESPACE

You can achieve the best performance for LOBs by specifying storage for LOBs in a different tablespace than the one used for the table that contains the LOB. If many different LOBs are to be accessed frequently, you can also specify a separate tablespace for each LOB column or attribute to reduce device contention.

6.2.3 CACHE, NOCACHE, and CACHE READS

The cache option is a part of the STORE AS clause, and determines whether LOB pages are stored in the buffer cache.

- When the option has the value `CACHE`, Oracle places LOB pages in the buffer cache where they can be shared among multiple users. Over time and if the LOB pages are no longer accessed, the pages are eventually removed from the buffer cache.
- For the value `NOCACHE`, LOB pages are not placed in the buffer cache.
- For the value `CACHE READS`, LOB pages are placed in the cache for read operations only.

If your application performs multiple read operations on a media object (for example: invoking the getProperties( ) procedure or the setProperties( ) method and then generating a thumbnail image), enable read caching for the source media LOB.

6.2.4 LOGGING and NOLOGGING

The logging option is a part of the STORE AS clause and determines if REDO data is logged when a LOB is updated. If the [NO]LOGGING clause is omitted, neither NOLOGGING nor LOGGING is specified and the logging attribute of the table or table partition defaults to the logging attribute of the tablespace in which it resides.

There is another alternative depending on how the cache option is specified.

- If CACHE is specified and [NO]LOGGING is omitted, LOGGING is automatically implemented (because you cannot have CACHE NOLOGGING).
- If CACHE is not specified and [NO]LOGGING is omitted, the [NO]LOGGING value is obtained from the tablespace in which the LOB segment resides.

Specify NOLOGGING only when you do not care about media recovery. However, if the disk, tape, or storage media fails, you will not be able to recover your changes from the log because those changes were not logged.

NOLOGGING can be useful for bulk loading of media data. For instance, when loading data into the LOB, if you do not care about the redo operation and you can start the load over if it fails, set the LOB data segment storage characteristics to NOCACHE NOLOGGING. This option provides good performance for the initial loading of data.

After you finish loading data, if necessary, you can use the ALTER TABLE statement to modify the LOB storage characteristics for the LOB data segment for normal LOB operations (for example: to CACHE or NOCACHE LOGGING).

Note:

Oracle Data Guard Redo Apply technology uses logging to populate the standby database. Thus, do not specify NOLOGGING when using this Data Guard technology.

6.2.5 Example of Setting LOB Storage Options

This section describes a simple example that shows how to use the performance profiles of Oracle Multimedia operations (see Table 6-1 (page 6-2) through Table 6-7 (page 6-4)) to guide your usage of LOB storage options.

In this example, Company X wants to build an archive for digital images. The archive stores a full resolution copy of the original image, and two Web-ready, JPEG format versions of the original at reduced scales, one at 50% of the original size and another at 25% of the original size. The database team plans to use the SQL*Loader utility to bulk load all the initial images. Then, they can use a PL/SQL program to initialize the image data. Initialization consists of setting the properties for the original image and generating the scaled images. After initialization, the table is prepared for the primary application, which retrieves images for Web-based users.

The following example shows a table definition for storing the images. The table stores the binary image data using SecureFiles in tablespace `tbs2`. All the other table data is stored in tablespace `tbs1`. Although this example uses the ORDImage object type for storing the images, the concepts apply to images stored directly in BLOB columns.

```
create table images(id       integer primary key,
                    original ordsys.ordimage,
                    scale50  ordsys.ordimage,
                    scale25  ordsys.ordimage)
tablespace tbs1
lob(original.source.localdata)store as secureFile (tablespace tbs2)
lob(scale50.source.localdata)store as secureFile (tablespace tbs2)
lob(scale25.source.localdata)store as secureFile (tablespace tbs2);
```

After the table is created, the image data can be loaded. Loading image data generates a sequential write pattern to the LOB. Because no applications are reading the data during the load operation, caching it is not required. You can also improve load

performance by disabling logging for the column that is loaded. The following command dynamically alters the table to prepare the original image column LOB for loading.

```
alter table images modify lob(original.source.localdata) (nocache nologging);
```

After loading, the next step is to set the image properties for the `original` column and generate the scaled versions to be stored in the `scale50` and `scale25` columns. In this step, the source images are fully read twice to generate the scaled versions. The scaled images that are generated are written but not read. The following command dynamically alters the table to enable read caching for the source image, and disables caching and logging for the destination images.

```
alter table images modify lob(original.source.localdata) (cache reads);
alter table images modify lob(scale50.source.localdata) (nocache nologging);
alter table images modify lob(scale25.source.localdata) (nocache nologging);
```

After running the program to set the properties of the `original` image and generate the scaled versions, the LOB storage attributes can be optimized for the main application that retrieves images for users to view in a Web browser. Because the archive contains millions of images, users are not expected to view the same image simultaneously. Thus, there is little benefit to caching the image data. The following command reenables logging for the LOBs and disables caching.

```
alter table images modify lob(original.source.localdata) (nocache logging);
alter table images modify lob(scale50.source.localdata) (nocache logging);
alter table images modify lob(scale25.source.localdata) (nocache logging);
```

6.3 Setting Database Initialization Parameters

Choosing LOB Storage Parameters for Multimedia LOBs (page 6-4) points out that you can disable logging of LOB data at the column level to reduce the amount of I/O to the redo log. However, if logging cannot be disabled, additional database tuning may be required. For example, you may have to increase the size of the redo log buffer to prevent load processes from waiting.

The initialization parameter LOG_BUFFER specifies the amount of memory (in bytes) that Oracle uses when buffering redo entries to a redo log file. Redo log entries contain a record of the changes that have been made to the database block buffers. The LGWR process writes redo log entries from the log buffer to a redo log file.

See Also:

- *Oracle Database Performance Tuning Guide* for more information about configuring the database redo log buffer
- *Oracle Database Reference* for comprehensive information about setting database initialization parameters
- *Oracle Database Administrator's Guide* for more information about managing initialization parameters

A

Managing Oracle Multimedia Installations

This appendix describes how to manage Oracle Multimedia installations.

This appendix includes these sections:

Note:

See the Oracle Multimedia `README.txt` file located in `<ORACLE_HOME>/ord/im/admin` for the latest information.

A.1 Oracle Multimedia Installed Users and Privileges

The Oracle Multimedia installation procedure performs these functions:

- Creates the database users shown in Table A-1 (page A-1) with the privileges required by Oracle Multimedia.

Table A-1 Installed Database Users

Name of User	Type of User
`ORDSYS`	Oracle Multimedia
`ORDPLUGINS`	Oracle Multimedia
`SI_INFORMTN_SCHEMA`	Oracle Multimedia
`ORDDATA`	Oracle Multimedia
`MDSYS`	Oracle Spatial and Graph/Oracle Multimedia Location Services

- Creates the default passwords shown in Table A-2 (page A-2) for the Oracle Multimedia and `MDSYS` user accounts, and then locks the accounts and marks their default passwords as expired.

Table A-2 User Accounts and Default Passwords

User Account	Installation Password
ORDSYS	*ORDSYS*
ORDPLUGINS	*ORDPLUGINS*
SI_INFORMTN_SCHEMA	*SI_INFORMTN_SCHEMA*
ORDDATA	*ORDDATA*
MDSYS	*MDSYS*

Caution:

Oracle does not recommend logging in directly to the user accounts shown in Table A-2 (page A-2).

- Grants the EXECUTE privilege to the user group PUBLIC for the Oracle Multimedia packages and objects installed in these schemas:
  - ORDSYS
  - ORDPLUGINS
  - SI_INFORMTN_SCHEMA
  - MDSYS

A.2 Installing and Configuring Oracle Multimedia

Oracle Multimedia is automatically installed and configured with Oracle Database.

The following subsections describe the steps to perform before manual installation and configuration of Oracle Multimedia, and the steps for manually installing and configuring it:

- Preinstallation Steps (page A-3)
- Installation and Configuration Steps (page A-4)

Caution:

Performing any of these unsupported and prohibited actions could cause internal errors and security violations in the database management system.

These users are created during database installation, and might change in future releases:

- Users in which Oracle-supplied Oracle Multimedia is installed: `ORDSYS`, `ORDPLUGINS`, `SI_INFORMTN_SCHEMA`, and `ORDDATA`
- User in which Oracle Multimedia Locator is installed if Oracle Spatial and Graph is not installed: `MDSYS`

Do not delete any of these users.

Do not connect to, modify, or change the privileges of any of these users or their contents (which are supplied by Oracle Multimedia and reserved by Oracle), with these exceptions:

- You can add user-defined packages to the user `ORDPLUGINS` (see Extending Oracle Multimedia (page B-1)).
- DICOM administrators can store user-defined DICOM data model configuration documents in the user `ORDDATA`, using the DICOM data model repository API. See *Oracle Multimedia DICOM Developer's Guide* for more information about inserting documents into the data model repository.

A.2.1 Preinstallation Steps

Before installing and configuring Oracle Multimedia manually, perform these steps:

1. Install Oracle Database, including PL/SQL, Oracle JVM, Oracle XML Database, and Oracle XDK.
2. Create the database.
3. Start the database.
4. Verify that the required software is correctly installed and valid, as follows:
   a. Run SQL*Plus, connect as SYSDBA, and enter these queries:

```
SQL> select version, status from dba_registry where comp_id='JAVAVM';
SQL> select version, status from dba_registry where comp_id='XDB';
SQL> select version, status from dba_registry where comp_id='XML';
```

   b. Examine the results of the queries to ensure that each `version` value is identical to the version of Oracle Multimedia that you are installing and each `status` value is `VALID`.

See Also:

Oracle Database Installation Guide for your operating system for more detailed information

A.2.2 Installation and Configuration Steps

These steps are not required if you use the Database Configuration Assistant.

To install and configure Oracle Multimedia manually, perform these steps:

Note:

In these steps, `<ORACLE_HOME>` is replaced with the location of the Oracle home directory.

---

1. Use Oracle Universal Installer to install the files that comprise Oracle Multimedia on your system.
2. Decide which tablespace to use for the Oracle Multimedia users, and which tablespace to use for the Oracle Spatial and Graph/Oracle Multimedia Location Services user (see Table A-1 (page A-1)). Oracle recommends using the SYSAUX tablespace for all these users.
3. Use the Perl script `catcon.pl` to run the Oracle Multimedia installation scripts. The `catcon.pl` script is in the directory `<ORACLE_HOME>/rdbms/admin`.
   a. Run the script to create the users and grant the appropriate privileges.

      If you are using a tablespace other than SYSAUX, replace the SYSAUX parameters with the tablespaces you have chosen. The first parameter is the tablespace for Oracle Multimedia; the second parameter is the tablespace for Oracle Spatial and Graph.

      ```
      perl catcon.pl -u SYS -d <ORACLE_HOME>/ord/admin -b ordinst ordinst.sql '--
      pSYSAUX' '--pSYSAUX'
      ```

   b. Run the script to install the Oracle Multimedia types and packages.

      ```
      perl catcon.pl -u SYS -d <ORACLE_HOME>/ord/im/admin -b catim catim.sql
      ```

Now Oracle Multimedia is ready for use.

A.3 Verifying an Installed Version of Oracle Multimedia

After installing or upgrading Oracle Multimedia, you can verify the Oracle Multimedia installation by calling the Oracle Multimedia validation procedure.

To run the Oracle Multimedia validation procedure, perform these steps:

1. Start SQL*Plus and connect as SYSDBA.
2. Execute the procedure `sys.validate_ordim`:

   ```
   SQL> execute sys.validate_ordim;
   ```

   If the validation procedure detects invalid objects, it lists the first few invalid objects and sets the registry entry to `INVALID`; otherwise, it silently sets the Oracle Multimedia registry entry to `VALID`.
3. Verify that the registry entry for Oracle Multimedia is correct, as follows:
   a. Enter this query from SQL*Plus, while you are connected as SYSDBA:

```
SQL> select version, status from dba_registry where comp_id='ORDIM';
```

b. Examine the result of the query to ensure that the `version` value is correct and the `status` value is `VALID`.

A.4 Upgrading an Installed Version of Oracle Multimedia

If you upgrade a database from an earlier release of Oracle Database, Oracle Multimedia is upgraded automatically if it is detected in the source database.

See Also:

Oracle Database Upgrade Guide for detailed upgrading instructions

A.5 Downgrading an Installed Version of Oracle Multimedia

Oracle Multimedia is automatically downgraded when you downgrade a database with the Oracle Multimedia feature installed.

Caution:

Do not modify your DICOM data model repository until you are sure that you are not going to downgrade from the new release of Oracle Database back to the source release.

Changes to the Oracle Multimedia DICOM data model repository (such as document insertions or deletions) that you make after a database upgrade are lost after a database downgrade.

See Also:

Oracle Database Upgrade Guide for detailed downgrading instructions

B

Extending Oracle Multimedia

This appendix describes various methods for extending the Oracle Multimedia object types.

Oracle Multimedia object types can be extended to support:

- Other external sources of media data not currently supported
- Other media data formats not currently supported
- Media (audio and video) data processing

For each unique external media data source or each unique ORDAudio, ORDDoc, or ORDVideo data format you want to support, you must:

1. Design your new data source or new ORDAudio, ORDDoc, or ORDVideo data format.
2. Implement your new data source or new ORDAudio, ORDDoc, or ORDVideo data format.
3. Install your new plug-in into the `ORDPLUGINS` schema.
4. Grant EXECUTE privileges on your new plug-in to `PUBLIC`.

This appendix includes these sections:

B.1 Supporting Other External Sources

To implement your new data source, you must implement the required interfaces in the `ORDX_<srcType>_SOURCE` package in the `ORDPLUGINS` schema (where `<srcType>` represents the name of the new external source type). Use the package body example in Extending Oracle Multimedia to Support a New Data Source (page B-5) as a template to create the package body. Then, set the source type parameter in the setSourceInformation( ) call to the appropriate source value to indicate to the ORDAudio, ORDImage, ORDDoc, or ORDVideo object that package `ORDPLUGINS.ORDX_<srcType>_SOURCE` is available as a plug-in. Use the `ORDPLUGINS.ORDX_FILE_SOURCE` and `ORDPLUGINS.ORDX_HTTP_SOURCE` packages as guides when you extend support to other external audio, image, video, or other heterogeneous media data sources.

The following subsection presents reference information on the packages or PL/SQL plug-ins provided:

B.1.1 Packages or PL/SQL Plug-ins

Plug-ins must be named as ORDX_<name>_<module_name> where the <module_name> is SOURCE for ORDSource. For example, the FILE plug-in described in ORDPLUGINS.ORDX_FILE_SOURCE Package (page B-2) is named ORDX_FILE_SOURCE and the HTTP plug-in described in ORDPLUGINS.ORDX_HTTP_SOURCE Package (page B-4) is named ORDX_HTTP_SOURCE and <name> is the source type. Both source type names, FILE and HTTP, are reserved to Oracle.

Use the `ORDPLUGINS.ORDX_FILE_SOURCE` and `ORDPLUGINS.ORDX_HTTP_SOURCE` packages as a guide in developing your new source type package.

The following subsections provide examples and more information about extending the supported external sources of audio, image, video, or other heterogeneous media data:

B.1.1.1 ORDPLUGINS.ORDX_FILE_SOURCE Package

The `ORDPLUGINS.ORDX_FILE_SOURCE` package or PL/SQL plug-in provides support for multimedia stored in the local file system external to the database.

```
CREATE OR REPLACE PACKAGE ORDX_FILE_SOURCE AS
  -- functions/procedures
  FUNCTION processCommand(obj     IN OUT NOCOPY ORDSYS.ORDSource,
                          ctx     IN OUT RAW,
                          cmd     IN VARCHAR2,
                          arglist IN VARCHAR2,
                          result  OUT RAW)
           RETURN RAW;
  PROCEDURE import(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                   ctx      IN OUT RAW,
                   mimetype OUT VARCHAR2,
                   format   OUT VARCHAR2);
  PROCEDURE import(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                   ctx      IN OUT RAW,
                   dlob     IN OUT NOCOPY BLOB,
                   mimetype OUT VARCHAR2,
                   format   OUT VARCHAR2);
  PROCEDURE importFrom(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                       ctx      IN OUT RAW,
                       mimetype OUT VARCHAR2,
                       format   OUT VARCHAR2,
                       loc      IN VARCHAR2,
                       name     IN VARCHAR2);
  PROCEDURE importFrom(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                       ctx      IN OUT RAW,
                       dlob     IN OUT NOCOPY BLOB,
                       mimetype OUT VARCHAR2,
                       format   OUT VARCHAR2,
                       loc      IN VARCHAR2,
                       name     IN VARCHAR2);
  PROCEDURE export(obj  IN OUT NOCOPY ORDSYS.ORDSource,
```

```
                  ctx  IN OUT RAW,
                  slob IN OUT NOCOPY BLOB,
                  loc  IN VARCHAR2,
                  name IN VARCHAR2);
  FUNCTION  getContentLength(obj  IN ORDSYS.ORDSource,
                             ctx  IN OUT RAW),
            RETURN INTEGER;
  PRAGMA RESTRICT_REFERENCES(getContentLength, WNDS, WNPS, RNDS, RNPS);
  FUNCTION  getSourceAddress(obj  IN ORDSYS.ORDSource,
                             ctx  IN OUT RAW,
                             userData IN VARCHAR2)
            RETURN VARCHAR2;
  PRAGMA RESTRICT_REFERENCES(getSourceAddress, WNDS, WNPS, RNDS, RNPS);

  FUNCTION open(obj IN OUT NOCOPY ORDSYS.ORDSource,
           userArg IN RAW,
           ctx OUT RAW) RETURN INTEGER;
  FUNCTION close(obj IN OUT NOCOPY ORDSYS.ORDSource, ctx IN OUT RAW)
         RETURN INTEGER;
  FUNCTION trim(obj IN OUT NOCOPY ORDSYS.ORDSource,
                ctx IN OUT RAW,
                newlen IN INTEGER) RETURN INTEGER;
PROCEDURE read(obj     IN OUT NOCOPY ORDSYS.ORDSource,
               ctx      IN OUT RAW,
               startPos IN INTEGER,
               numBytes IN OUT INTEGER,
               buffer   OUT RAW);
PROCEDURE write(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                ctx      IN OUT RAW,
                startPos IN INTEGER,
                numBytes IN OUT INTEGER,
                buffer   OUT RAW);
END ORDX_FILE_SOURCE;
/
```

Table B-1 (page B-3) shows the methods supported in the ORDX_FILE_SOURCE package and the exceptions raised if you call a method that is not supported.

Table B-1 Methods Supported in the ORDPLUGINS.ORDX_FILE_SOURCE Package

Name of Method	Level of Support
processCommand	Not supported - raises exception: METHOD_NOT_SUPPORTED
import	Supported
import	Supported
importFrom	Supported
importFrom	Supported
export	Supported
getContentLength	Supported
getSourceAddress	Supported
open	Supported
close	Supported

Table B-1 (Cont.) Methods Supported in the ORDPLUGINS.ORDX_FILE_SOURCE Package

Name of Method	Level of Support
trim	Not supported - raises exception: METHOD_NOT_SUPPORTED
read	Supported
write	Not supported - raises exception: METHOD_NOT_SUPPORTED

B.1.1.2 ORDPLUGINS.ORDX_HTTP_SOURCE Package

The ORDPLUGINS.ORDX_HTTP_SOURCE package or PL/SQL plug-in provides support for multimedia stored in any HTTP server and accessed through a URL.

```
CREATE OR REPLACE PACKAGE ORDX_HTTP_SOURCE AS
  -- functions/procedures
  FUNCTION processCommand(obj     IN OUT NOCOPY ORDSYS.ORDSource,
                          ctx     IN OUT RAW,
                          cmd     IN VARCHAR2,
                          arglist IN VARCHAR2,
                          result  OUT RAW)
           RETURN RAW;
  PROCEDURE import(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                   ctx      IN OUT RAW,
                   mimetype OUT VARCHAR2,
                   format   OUT VARCHAR2);
  PROCEDURE import(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                   ctx      IN OUT RAW,
                   dlob     IN OUT NOCOPY BLOB,
                   mimetype OUT VARCHAR2,
                   format   OUT VARCHAR2);
  PROCEDURE importFrom(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                       ctx      IN OUT RAW,
                       mimetype OUT VARCHAR2,
                       format   OUT VARCHAR2,
                       loc      IN VARCHAR2,
                       name     IN VARCHAR2);
  PROCEDURE importFrom(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                       ctx      IN OUT RAW,
                       dlob     IN OUT NOCOPY BLOB,
                       mimetype OUT VARCHAR2,
                       format   OUT VARCHAR2,
                       loc      IN VARCHAR2,
                       name     IN VARCHAR2);
  PROCEDURE export(obj  IN OUT NOCOPY ORDSYS.ORDSource,
                   ctx  IN OUT RAW,
                   dlob IN OUT NOCOPY BLOB,
                   loc  IN VARCHAR2,
                   name IN VARCHAR2);
  FUNCTION  getContentLength(obj  IN ORDSYS.ORDSource,
                             ctx  IN OUT RAW)
            RETURN INTEGER;
  PRAGMA RESTRICT_REFERENCES(getContentLength, WNDS, WNPS, RNDS, RNPS, TRUST);
  FUNCTION  getSourceAddress(obj  IN ORDSYS.ORDSource,
                             ctx  IN OUT RAW,
                             userData IN VARCHAR2)
            RETURN VARCHAR2;
  PRAGMA RESTRICT_REFERENCES(getSourceAddress, WNDS, WNPS, RNDS, RNPS);
```

```
  FUNCTION open(obj IN OUT NOCOPY ORDSYS.ORDSource, userArg IN RAW,
           ctx OUT RAW) RETURN INTEGER;
  FUNCTION close(obj IN OUT NOCOPY ORDSYS.ORDSource, ctx IN OUT RAW)
           RETURN INTEGER;
  FUNCTION trim(obj IN OUT NOCOPY ORDSYS.ORDSource,
           ctx IN OUT RAW,
           newlen IN INTEGER) RETURN INTEGER;
  PROCEDURE read(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                 ctx      IN OUT RAW,
                 startPos IN INTEGER,
                 numBytes IN OUT INTEGER,
                 buffer   OUT RAW);
  PROCEDURE write(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                  ctx      IN OUT RAW,
                  startPos IN INTEGER,
                  numBytes IN OUT INTEGER,
                  buffer   OUT RAW);
END ORDX_HTTP_SOURCE;
/
```

Table B-2 (page B-5) shows the methods supported in the ORDX_HTTP_SOURCE package and the exceptions raised if you call a method that is not supported.

Table B-2 Methods Supported in the ORDPLUGINS.ORDX_HTTP_SOURCE Package

Name of Method	Level of Support
processCommand	Not supported - raises exception: METHOD_NOT_SUPPORTED
import	Supported
import	Supported
importFrom	Supported
importFrom	Supported
export	Not supported - raises exception: METHOD_NOT_SUPPORTED
getContentLength	Supported
getSourceAddress	Supported
open	Supported
close	Supported
trim	Not supported - raises exception: METHOD_NOT_SUPPORTED
read	Not supported - raises exception: METHOD_NOT_SUPPORTED
write	Not supported - raises exception: METHOD_NOT_SUPPORTED

B.1.1.3 Extending Oracle Multimedia to Support a New Data Source

Extending Oracle Multimedia to support a new data source consists of these steps:

1. Design your new data source.
2. Implement your new data source and name it, for example, ORDX_MY_SOURCE.SQL.

3. Install your new ORDX_MY_SOURCE.SQL plug-in into the ORDPLUGINS schema.
4. Grant EXECUTE privileges on your new plug-in, for example, ORDX_MY_SOURCE.SQL plug-in to PUBLIC.
5. Set the srctype to my to cause your plug-in to be invoked.

Example B-1 Package Body for Extending Support to a New Data Source

```
CREATE OR REPLACE PACKAGE BODY ORDX_MY_SOURCE
AS
  -- functions/procedures
  FUNCTION processCommand(
                   obj  IN OUT NOCOPY ORDSYS.ORDSource,
                   ctx  IN OUT RAW,
                   cmd  IN VARCHAR2,
                   arglist IN VARCHAR2,
                   result OUT RAW)
  RETURN RAW
  IS
   --Your variables go here.
  BEGIN
  --Your code goes here.
  END processCommand;
  PROCEDURE import( obj  IN OUT NOCOPY ORDSYS.ORDSource,
                   ctx  IN OUT RAW,
                   mimetype OUT VARCHAR2,
                   format   OUT VARCHAR2)
  IS
  --Your variables go here.
  BEGIN
  --Your code goes here.
  END import;
  PROCEDURE import( obj  IN OUT NOCOPY ORDSYS.ORDSource,
                   ctx  IN OUT RAW,
                   dlob IN OUT NOCOPY BLOB,
                   mimetype OUT VARCHAR2,
                   format   OUT VARCHAR2)
  IS
  --Your variables go here.
  BEGIN
  --Your code goes here.
  END import;
  PROCEDURE importFrom( obj      IN OUT NOCOPY ORDSYS.ORDSource,
                        ctx      IN OUT RAW,
                        mimetype OUT VARCHAR2,
                        format   OUT VARCHAR2,
                        loc      IN VARCHAR2,
                        name     IN VARCHAR2)
  IS
  --Your variables go here.
  BEGIN
  --Your code goes here.
  END importFrom;
  PROCEDURE importFrom( obj      IN OUT NOCOPY ORDSYS.ORDSource,
                        ctx      IN OUT RAW,
                        dlob     IN OUT NOCOPY BLOB,
                        mimetype OUT VARCHAR2,
                        format   OUT VARCHAR2,
                        loc      IN VARCHAR2,
                        name     IN VARCHAR2)
```

```
IS
--Your variables go here.
BEGIN
--Your code goes here.
END importFrom;
PROCEDURE export( obj  IN OUT NOCOPY ORDSYS.ORDSource,
                  ctx  IN OUT RAW,
                  slob IN OUT NOCOPY BLOB,
                  loc  IN VARCHAR2,
                  name IN VARCHAR2)
IS
--Your variables go here.
BEGIN
--Your code goes here.
END export;

FUNCTION  getContentLength( obj  IN ORDSYS.ORDSource,
                            ctx  IN OUT RAW)
RETURN INTEGER
IS
--Your variables go here.
BEGIN
--Your code goes here.
END getContentLength;
FUNCTION  getSourceAddress(obj  IN ORDSYS.ORDSource,
                           ctx  IN OUT RAW,
                           userData IN VARCHAR2)
RETURN VARCHAR2
IS
--Your variables go here.
BEGIN
--Your code goes here.
END getSourceAddress;
FUNCTION open(obj IN OUT NOCOPY ORDSYS.ORDSource, userArg IN RAW, ctx OUT RAW)
RETURN INTEGER
IS
--Your variables go here.
BEGIN
--Your code goes here.
END open;
FUNCTION close(obj IN OUT NOCOPY ORDSYS.ORDSource, ctx IN OUT RAW)
RETURN INTEGER
IS
--Your variables go here.
BEGIN
--Your code goes here.
END close;
FUNCTION trim(obj    IN OUT NOCOPY ORDSYS.ORDSource,
                     ctx    IN OUT RAW,
                     newlen IN INTEGER)
RETURN INTEGER
IS
--Your variables go here.
BEGIN
--Your code goes here.
END trim;
PROCEDURE read(obj      IN OUT NOCOPY ORDSYS.ORDSource,
               ctx      IN OUT RAW,
               startPos IN INTEGER,
               numBytes IN OUT INTEGER,
               buffer   OUT RAW)
```

```
  IS
  --Your variables go here.
  BEGIN
  --Your code goes here.
  END read;
  PROCEDURE write(obj      IN OUT NOCOPY ORDSYS.ORDSource,
                  ctx      IN OUT RAW,
                  startPos IN INTEGER,
                  numBytes IN OUT INTEGER,
                  buffer   OUT RAW)
  IS
  --Your variables go here.
  BEGIN
  --Your code goes here.
  END write;
END ORDX_MY_SOURCE;
/
show errors;
```

A package body listing is provided in Example B-1 (page B-6) to assist you in this operation. Add your variables to the places that say "--Your variables go here" and add your code to the places that say "--Your code goes here".

B.2 Supporting Other Media Data Formats

To implement your new ORDAudio, ORDDoc, or ORDVideo data format, you must implement the required interfaces in the `ORDPLUGINS.ORDX_<format>_<media>` package in the `ORDPLUGINS` schema (where `<format>` represents the name of the new audio or video, or other heterogeneous media data format and `<media>` represents the type of media ("AUDIO" or "VIDEO", or "DOC"). Use the `ORDPLUGINS.ORDX_DEFAULT_<media>` package as a guide when you extend support to other audio or video data formats or other heterogeneous media data formats. Use the package body examples in Extending Oracle Multimedia to Support a New Audio Data Format (page B-10), Extending Oracle Multimedia to Support a New ORDDoc Data Format (page B-12), and Extending Oracle Multimedia to Support a New Video Data Format (page B-15) as templates to create the audio or video, or other heterogeneous media data package body, respectively. Then, set the new format parameter in the setFormat( ) call to the appropriate format value to indicate to the ORDAudio, ORDDoc, or ORDVideo object that package `ORDPLUGINS.ORDX_<format>_<media>` is available as a plug-in, and that it must be used for method invocation.

The following subsections describe how to extend Oracle Multimedia to support other data formats:

- Supporting Other ORDAudio Data Formats (page B-8)
- Supporting Other ORDDoc Data Formats (page B-12)
- Supporting Other Video Data Formats (page B-13)
- Supporting Other Image Data Formats (page B-16)

B.2.1 Supporting Other ORDAudio Data Formats

The following subsections describe how to extend ORDAudio to support other data formats:

- ORDPLUGINS.ORDX_DEFAULT_AUDIO Package (page B-9)

- Extending Oracle Multimedia to Support a New Audio Data Format (page B-10)

B.2.1.1 ORDPLUGINS.ORDX_DEFAULT_AUDIO Package

Use the following ORDPLUGINS.ORDX_DEFAULT_AUDIO package provided as a guide in developing your own ORDPLUGINS.ORDX_<format>_AUDIO audio format package. This package sets the mimeType field in the setProperties( ) method with a MIME type value that is dependent on the file format.

```
CREATE OR REPLACE PACKAGE ORDX_DEFAULT_AUDIO
authid current_user
AS
--AUDIO ATTRIBUTES ACCESSORS

PROCEDURE setProperties(ctx IN OUT RAW,
                        obj IN OUT NOCOPY ORDSYS.ORDAudio,
                        setComments IN NUMBER := 0);
FUNCTION checkProperties(ctx IN OUT RAW, obj IN OUT ORDSYS.ORDAudio)
                RETURN NUMBER;
FUNCTION getAttribute(ctx IN OUT RAW,
                      obj IN ORDSYS.ORDAudio,
                      name IN VARCHAR2) RETURN VARCHAR2;
PROCEDURE getAllAttributes(ctx IN OUT RAW,
                           obj IN ORDSYS.ORDAudio,
                           attributes IN OUT NOCOPY CLOB);
--AUDIO PROCESSING METHODS
FUNCTION processCommand(ctx       IN OUT RAW,
                        obj       IN OUT NOCOPY ORDSYS.ORDAudio,
                        cmd       IN VARCHAR2,
                        arguments IN VARHAR2,
                        result    OUT RAW)
         RETURN RAW;

END;
/
```

Table B-3 (page B-9) shows the methods supported in the ORDPLUGINS.ORDX_DEFAULT_AUDIO package and the exceptions raised if you call a method that is not supported.

Table B-3 Methods Supported in the ORDPLUGINS.ORDX_DEFAULT_AUDIO Package

Name of Method	Level of Support
setProperties	Supported; if the source is local, extract attributes from the local data and set the properties, but if the source is NULL, raise an ORDSYS.ORDSourceExceptions.EMPTY_SOURCE exception; if the source is a BFILE, then extract attributes from the BFILE and set the properties; if the source is neither local nor a BFILE, get the media content into a temporary LOB, extract attributes from the data, and set the properties.

Table B-3 (Cont.) Methods Supported in the ORDPLUGINS.ORDX_DEFAULT_AUDIO Package

Name of Method	Level of Support
checkProperties	Supported; if the source is local, extract the attributes from the local data and compare them with the attribute values of the object, but if the source is `NULL`, raise an ORDSYS.ORDSourceExceptions.EMPTY_SOURCE exception; if the source is a BFILE, extract the attributes from the BFILE and compare them with the attribute values of the object; if the source is neither local nor a BFILE, get the media content into a temporary LOB, extract the attributes from the media content and compare them with the attribute values of the object.
getAttribute	Not supported - raises exceptions: METHOD_NOT_SUPPORTED and AUDIO_PLUGIN_EXCEPTION.
getAllAttributes	Supported; if the source is local, get the attributes and return them, but if the source is `NULL`, raise an ORDSYS.ORDSourceExceptions.EMPTY_SOURCE exception; otherwise, if the source is external, raise an ORDSYS.ORDAudioExceptions.LOCAL_DATA_SOURCE_REQUIRED exception.
processCommand	Not supported - raises exceptions: METHOD_NOT_SUPPORTED and AUDIO_PLUGIN_EXCEPTION.

B.2.1.2 Extending Oracle Multimedia to Support a New Audio Data Format

Extending Oracle Multimedia to support a new audio data format consists of the following steps:

1. Design your new audio data format.
   a. To support a new audio data format, implement the required interfaces in the `ORDX_<format>_AUDIO` package in the `ORDPLUGINS` schema (where `<format>` represents the name of the new audio data format). See ORDPLUGINS.ORDX_DEFAULT_AUDIO Package (page B-9) for a complete description of the interfaces for the `ORDX_DEFAULT_AUDIO` package. Use the package body example in Example B-2 (page B-11) as a template to create the audio package body.
   b. Then, set the new format parameter in the setFormat( ) call to the appropriate format value to indicate to the audio object that package `ORDPLUGINS.ORDX_<format>_AUDIO` is available as a plug-in.
2. Implement your new audio data format and name it, for example, `ORDX_MY_AUDIO.SQL`.
3. Install your new `ORDX_MY_AUDIO.SQL` plug-in into the `ORDPLUGINS` schema.
4. Grant EXECUTE privileges on your new plug-in, for example, `ORDX_MY_AUDIO` plug-in, to PUBLIC.
5. In an application, set the format attribute to `my` to cause your plug-in to be invoked.

A package body listing is provided in Example B-2 (page B-11) to assist you in this operation. Add your variables to the places that say "--Your variables go here" and add your code to the places that say "--Your code goes here".

Example B-2 Package Body for Extending Support to a New Audio Data Format

```
CREATE OR REPLACE PACKAGE BODY ORDX_MY_AUDIO
AS
  --AUDIO ATTRIBUTES ACCESSORS
  PROCEDURE setProperties(ctx IN OUT RAW,
                          obj IN OUT NOCOPY ORDSYS.ORDAudio,
                          setComments IN NUMBER :=0)
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
  FUNCTION checkProperties(ctx IN OUT RAW, obj IN OUT ORDSYS.ORDAudio)
  RETURN NUMBER
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
  FUNCTION  getAttribute(ctx IN OUT RAW,
                         obj IN ORDSYS.ORDAudio,
                         name IN VARCHAR2)
  RETURN VARCHAR2
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
  PROCEDURE getAllAttributes(ctx IN OUT RAW,
                             obj IN ORDSYS.ORDAudio,
                             attributes IN OUT NOCOPY CLOB)
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
  -- AUDIO PROCESSING METHODS
  FUNCTION  processCommand(
                                  ctx       IN OUT RAW,
                                  obj       IN OUT NOCOPY ORDSYS.ORDAudio,
                                  cmd       IN VARCHAR2,
                                  arguments IN VARCHAR2,
                                  result    OUT RAW)
  RETURN RAW
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
END;
/
show errors;
```

B.2.2 Supporting Other ORDDoc Data Formats

The following subsections describe how to extend ORDDoc to support other data formats:

- ORDPLUGINS.ORDX_DEFAULT_DOC Package (page B-12)
- Extending Oracle Multimedia to Support a New ORDDoc Data Format (page B-12)

B.2.2.1 ORDPLUGINS.ORDX_DEFAULT_DOC Package

Use the following `ORDPLUGINS.ORDX_DEFAULT_DOC` package provided as a guide in developing your own `ORDPLUGINS.ORDX_<format>_DOC` media format package.

```
CREATE OR REPLACE PACKAGE ORDX_DEFAULT_DOC
authid current_user
AS

PROCEDURE setProperties(ctx IN OUT RAW,
                        obj IN OUT NOCOPY ORDSYS.ORDDoc,
                        setComments IN NUMBER := 0);

END;
/
```

Table B-4 (page B-12) shows the method supported in the `ORDPLUGINS.ORDX_DEFAULT_DOC` package and the exception raised if the source is `NULL`.

Table B-4 Method Supported in the ORDPLUGINS.ORDX_DEFAULT_DOC Package

Name of Method	Level of Support
setProperties	Supported; if the source is local, extract attributes from the local data and set the properties, but if the source is `NULL`, raise an ORDSYS.ORDSourceExceptions.EMPTY_SOURCE exception; if the source is a BFILE, then extract attributes from the BFILE and set the properties; if the source is neither local nor a BFILE, get the media content into a temporary LOB, extract attributes from the data, and set the properties.

B.2.2.2 Extending Oracle Multimedia to Support a New ORDDoc Data Format

Extending Oracle Multimedia to support a new ORDDoc data format consists of the following steps:

1. Design your new media data format.
   a. To support a new media data format, implement the required interfaces in the `ORDX_<format>_DOC` package in the `ORDPLUGINS` schema (where `<format>` represents the name of the new media data format). See ORDPLUGINS.ORDX_DEFAULT_DOC Package (page B-12) for a complete description of the interfaces for the `ORDX_DEFAULT_DOC` package. Use the package body example in Example B-3 (page B-13) as a template to create the package body.

b. Then, set the new format parameter in the setFormat( ) call to the appropriate format value to indicate to the media object that package ORDPLUGINS.ORDX_<format>_DOC is available as a plug-in.

2. Implement your new media data format and name it, for example, ORDX_MY_DOC.SQL.

3. Install your new ORDX_MY_DOC.SQL plug-in into the ORDPLUGINS schema.

4. Grant EXECUTE privileges on your new plug-in, for example, ORDX_MY_DOC plug-in, to PUBLIC.

5. In an application, set the format to my to cause your plug-in to be invoked.

A package body listing is provided in Example B-3 (page B-13) to assist you in this operation. Add your variables to the places that say "--Your variables go here" and add your code to the places that say "--Your code goes here".

Example B-3 Package Body for Extending Support to a New ORDDoc Data Format

```
CREATE OR REPLACE PACKAGE BODY ORDX_MY_DOC
AS
  --DOCUMENT ATTRIBUTES ACCESSORS
  PROCEDURE setProperties(ctx IN OUT RAW,
                          obj IN OUT NOCOPY ORDSYS.ORDDoc,
                          setComments IN NUMBER :=0)
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
END;
/
show errors;
```

B.2.3 Supporting Other Video Data Formats

The following subsections describe how to extend ORDVideo to support other data formats:

- ORDPLUGINS.ORDX_DEFAULT_VIDEO Package (page B-13)
- Extending Oracle Multimedia to Support a New Video Data Format (page B-15)

B.2.3.1 ORDPLUGINS.ORDX_DEFAULT_VIDEO Package

Use the following ORDPLUGINS.ORDX_DEFAULT_VIDEO package provided as a guide in developing your own ORDPLUGINS.ORDX_<format>_VIDEO video format package. This package sets the mimeType field in the setProperties( ) method with a MIME type value that is dependent on the file format.

```
CREATE OR REPLACE PACKAGE ORDX_DEFAULT_VIDEO
authid current_user
AS
--VIDEO ATTRIBUTES ACCESSORS
FUNCTION  getAttribute(ctx IN OUT RAW,
                       obj IN ORDSYS.ORDVideo,
                       name IN VARCHAR2)
          RETURN VARCHAR2;
PROCEDURE setProperties(ctx IN OUT RAW,
                        obj IN OUT NOCOPY ORDSYS.ORDVideo,
```

```
                        setComments IN NUMBER := 0);
FUNCTION checkProperties(ctx IN OUT RAW,obj IN ORDSYS.ORDVideo) RETURN NUMBER;

-- must return name=value; name=value; ...  pairs
PROCEDURE getAllAttributes(ctx IN OUT RAW,
                           obj IN ORDSYS.ORDVideo,
                           attributes IN OUT NOCOPY CLOB);
-- VIDEO PROCESSING METHODS
FUNCTION  processCommand(
                         ctx       IN OUT RAW,
                         obj       IN OUT NOCOPY ORDSYS.ORDVideo,
                         cmd       IN VARCHAR2,
                         arguments IN VARCHAR2,
                         result    OUT RAW)
        RETURN RAW;

END;
/
```

Table B-5 (page B-14) shows the methods supported in the `ORDPLUGINS.ORDX_DEFAULT_VIDEO` package and the exceptions raised if you call a method that is not supported.

Table B-5 Methods Supported in the ORDPLUGINS.ORDX_DEFAULT_VIDEO Package

Name of Method	Level of Support
getAttribute	Not supported - raises exceptions: METHOD_NOT_SUPPORTED and VIDEO_PLUGIN_EXCEPTION
setProperties	Supported; if the source is local, extract attributes from the local data and set the properties, but if the source is `NULL`, raise an ORDSYS.ORDSourceExceptions.EMPTY_SOURCE exception; if the source is a BFILE, then extract attributes from the BFILE and set the properties; if the source is neither local nor a BFILE, get the media content into a temporary LOB, extract attributes from the data, and set the properties.
checkProperties	Supported; if the source is local, extract attributes from the local data and compare them with the attribute values of the object, but if the source is `NULL`, raise an ORDSYS.ORDSourceExceptions.EMPTY_SOURCE exception; if the source is a BFILE, then extract attributes from the BFILE data and compare them with the attribute values of the object; if the source is neither local nor a BFILE, get the media content into a temporary LOB, extract attributes from the media content and compare them with the attribute values of the object.
getAllAttributes	Supported; if the source is local, get the attributes and return them, but if the source is `NULL`, raise an ORDSYS.ORDSourceExceptions.EMPTY_SOURCE exception; otherwise, if the source is external, raise an ORDSYS.ORDVideoExceptions.LOCAL_DATA_SOURCE_REQUIRED exception.
processCommand	Not supported - raises exceptions: METHOD_NOT_SUPPORTED and VIDEO_PLUGIN_EXCEPTION

B.2.3.2 Extending Oracle Multimedia to Support a New Video Data Format

Extending Oracle Multimedia to support a new video data format consists of the following steps:

1. Design your new video data format.

   a. To support a new video data format, implement the required interfaces in the `ORDX_<format>_VIDEO` package in the `ORDPLUGINS` schema (where `<format>` represents the name of the new video data format). See ORDPLUGINS.ORDX_DEFAULT_VIDEO Package (page B-13) for a complete description of the interfaces for the `ORDX_DEFAULT_VIDEO` package. Use the package body example in Example B-4 (page B-15) as a template to create the video package body.

   b. Then, set the new format parameter in the setFormat( ) call to the appropriate format value to indicate to the video object that package `ORDPLUGINS.ORDX_<format>_VIDEO` is available as a plug-in.

2. Implement your new video data format and name it, for example, `ORDX_MY_VIDEO.SQL`.

3. Install your new `ORDX_MY_VIDEO.SQL` plug-in into the `ORDPLUGINS` schema.

4. Grant EXECUTE privileges on your new plug-in, for example, `ORDX_MY_VIDEO` plug-in, to PUBLIC.

5. In an application, set the video format to `my` to cause your plug-in to be invoked.

A package body listing is provided in Example B-4 (page B-15) to assist you in this operation. Add your variables to the places that say "--Your variables go here" and add your code to the places that say "--Your code goes here".

Example B-4 Package Body for Extending Support to a New Video Data Format

```
CREATE OR REPLACE PACKAGE BODY ORDX_MY_VIDEO
AS
  --VIDEO ATTRIBUTES ACCESSORS
  FUNCTION  getAttribute(ctx IN OUT RAW,
                         obj IN ORDSYS.ORDVideo,
                         name IN VARCHAR2)
  RETURN VARCHAR2
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
  PROCEDURE setProperties(ctx IN OUT RAW,
          obj IN OUT NOCOPY ORDSYS.ORDVideo,
          setComments IN NUMBER :=0)
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
  FUNCTION checkProperties(ctx IN OUT RAW, obj IN ORDSYS.ORDVideo) RETURN NUMBER
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
```

```
  END;
  PROCEDURE getAllAttributes(ctx IN OUT RAW,
                             obj IN ORDSYS.ORDVideo,
                             attributes IN OUT NOCOPY CLOB)
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
  -- VIDEO PROCESSING METHODS
  FUNCTION  processCommand(
                                ctx       IN OUT RAW,
                                obj       IN OUT NOCOPY ORDSYS.ORDVideo,
                                cmd       IN VARCHAR2,
                                arguments IN VARCHAR2,
                                result OUT RAW)
  RETURN RAW
  IS
--Your variables go here.
  BEGIN
--Your code goes here.
  END;
END;
/
show errors;
```

B.2.4 Supporting Other Image Data Formats

Oracle Multimedia supports certain other image formats through the setProperties( ) method for foreign images. This method enables other image formats to be recognized by writing the values supplied to the setProperties( ) method for foreign images to the existing ORDImage data attributes.

See Also:

The setProperties( ) for foreign images method in *Oracle Multimedia Reference* for more information, and to determine the type of images that are supported this way

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B.3 Supporting Media Data Processing

Oracle Multimedia allows the audio and video object types to be extended to support the processing of audio and video data, as described in the following subsections:

- Supporting Audio Data Processing (page B-16)
- Supporting Video Data Processing (page B-17)

B.3.1 Supporting Audio Data Processing

To support audio data processing, that is, the passing of an audio processing command and set of arguments to a format plug-in for processing, use the processAudioCommand( ) method. This method is available only for user-defined formats.

See Also:

The processAudioCommand( ) method in *Oracle Multimedia Reference* for a description

B.3.2 Supporting Video Data Processing

To support video data processing, that is, the passing of a command and set of arguments to a format plug-in for processing, use the processVideoCommand( ) method. This method is only available for user-defined formats.

See Also:

The processVideoCommand( ) method in *Oracle Multimedia Reference* for a description

C

Oracle Multimedia Sample Applications

This appendix summarizes the Oracle Multimedia scripts and sample applications, which are written in C, SQL, and PL/SQL.

Most of the Oracle Multimedia scripts and sample applications are available after you install the Oracle Database Examples media, which you can download from the Oracle Technology Network (OTN), in the locations shown in the following table.

Table C-1 Oracle Multimedia Sample Applications in Oracle Database Examples Media

Name	Location
ORDImage OCI C	Linux and UNIX: `<ORACLE_HOME>/ord/img/demo` Windows: `<ORACLE_HOME>\ord\img\demo`
PL/SQL Web Toolkit Photo Album	Linux and UNIX: `<ORACLE_HOME>/ord/http/demo/plsqlwtk` Windows: `<ORACLE_HOME>\ord\http\demo\plsqlwtk`
Code Wizard for the PL/SQL Gateway	Linux and UNIX: `<ORACLE_HOME>/ord/http/demo/plsgwycw` Windows: `<ORACLE_HOME>\ord\http\demo\plsgwycw`

You can download additional sample applications from *Oracle Multimedia* on the Oracle Technology Network Web site.

This appendix includes these sections:

C.1 Oracle Multimedia ORDImage OCI C Sample Application

After installing the Oracle Database Examples media, you can run the Oracle Multimedia ORDImage OCI C sample application to modify images. This sample application is written in C, and uses Oracle Call Interface (OCI) to access the database and process images using Oracle Multimedia.

See Also:

The `README.txt` file in the `demo` directory for more information about this sample application

C.2 Oracle Multimedia PL/SQL Sample Applications

These PL/SQL sample applications are available after installing the Oracle Database Examples media.

Oracle Multimedia PL/SQL Web Toolkit Photo Album Sample Application

The Oracle Multimedia PL/SQL Web Toolkit Photo Album sample application shows how to upload and retrieve media data using the PL/SQL Web Toolkit and PL/SQL Gateway. See Oracle Multimedia PL/SQL Photo Album Sample Application (page 3-1) for more information about installing and using this application.

See Also:

The `README.txt` file in the `demo` directory for requirements and instructions for running this application

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Oracle Multimedia Code Wizard Sample Application for the PL/SQL Gateway

The Oracle Multimedia Code Wizard sample application for the PL/SQL Gateway lets you create PL/SQL procedures for the PL/SQL Gateway to upload and retrieve media data stored in the database using any of the Oracle Multimedia object types. See Oracle Multimedia Code Wizard Sample Application for the PL/SQL Gateway (page 4-1) for more information about installing and using this application.

See Also:

The `README.txt` file in the `demo` directory for requirements and instructions for running this application

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Glossary

audio data

Media data produced by an audio recorder, an audio source, or by program algorithms. Audio recording devices take analog or continuous signals and convert them into digital values with specific audio characteristics.

codecs

Digital compression and decompression schemes.

content metadata

Data that describes the content of image media, such as the name of the photographer, and the date and time when a photograph was taken.

DICOM content

Standalone DICOM Information Objects that are encoded according to the data structure and encoding definitions of PS 3.10-2007 of the DICOM standard (commonly referred to as DICOM Part 10 files). For more information about DICOM Information Objects, see the DICOM standard, which is available worldwide from the NEMA Web site at

`http://medical.nema.org/`

DICOM data

See DICOM content.

embedded metadata

Metadata that is stored with image data in the image file format.

heterogeneous media data

Assorted media data, such as audio data, image data, video data, and other types of media data. The data can have a variety of formats, depending upon the application that generated it.

image data

Media data produced by a document or photograph scanner, a video source, other specialized image capture devices, or by program algorithms. Image capture devices take analog or continuous signals and convert them into digital values on a two-dimensional grid of data points known as pixels. Devices involved in the capture and display of images are under application control.

image interchange format

A well-defined organization and use of image attributes, data, and often compression schemes that enables different applications to create, exchange, and use images. Interchange formats are often stored as disk files.

image metadata format

Standard protocols and techniques used to store image metadata within an image file. Formats include EXIF, IPTC-IIM, and XMP.

lossless compression schemes

Compression schemes that squeeze an image so that when it is decompressed, the resulting image is bit-for-bit identical with the original.

lossy compression schemes

Compression schemes that do not result in an identical image when decompressed, but rather, one in which the changes may be imperceptible to the human eye. Lossy schemes generally provide higher compression than lossless compression schemes.

media data

Data from audio, image, DICOM format medical images and other objects, video, or other heterogeneous media.

metadata

Information about media data, such as object length, compression type, or format.

methods

Procedures that can be performed on objects, such as getContent( ) or setProperties( ).

Oracle *inter*Media

In Oracle Database 11*g* Release 1 (11.1), the name Oracle *inter*Media was changed to Oracle Multimedia.

protocols

Image interchange formats exchanged in a sequential fashion over a network.

technical metadata

Data that describes image media in a technical sense, such as the height and width of an image, in pixels, or the type of compression used to store the image.

video data

Media data produced by a video recorder, a video camera, digitized animation video, other specialized video recording devices, or by program algorithms. Some video recording devices take analog or continuous signals and convert them into digital values with specific video characteristics.

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